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Musician Advantages in Music Perception: An Issue of Motivation, Not Just Ability

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Two experiments examined effects of regulatory fit and music training on performance on one subtest of the Montreal Battery of Evaluation of Amusia (MBEA). Participants made same-different judgments about melody pairs, while either gaining points for correct answers (gains condition) or losing points for incorrect answers (losses condition). In Experiment 1, participants were told that the test was diagnostic of their music ability and then were asked to self-identify as a musician or a nonmusician. In Experiment 2, participants were given either a promotion-focus prime (a performance-based opportunity to gain entry into a raffle) or a prevention-focus prime (a raffle ticket was awarded at the start of the experiment and participants prevented its loss by maintaining a certain level of performance). Consistent with a regulatory fit hypothesis, nonmusicians and promotion-primed participants performed better in the gains condition than the losses condition, while musicians and prevention-primed participants performed better in the losses condition than the gains condition. Experiment 2 additionally revealed that regulatory fit effects were stronger for musicians than nonmusicians. This study demonstrates that regulatory fit impacts performance on the MBEA and highlights the importance of motivational orientation with respect to musician performance advantages in music perception.

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Key words: music training, regulatory focus, regulatory fit, MBEA, motivation

Performance advantages that musicians demonstrate over nonmusicians in music perception assessments are typically attributed to differences in music ability. Supporting this view, a number of neuroanatomical differences between musicians and nonmusicians have been reported, including larger cortical volume in primary motor, premotor, and auditory areas for musicians compared to nonmusicians (Gaser & Schlaug, 2003; Schlaug, Norton, Overy, & Winner, 2005) as well as larger corpus callosum volume (Hyde et al., 2009; Schlaug, Jäncke, Huang, Staiger, & Steinmetz, 1995). Neuroimaging studies have also revealed a number of functional brain differences between musician and nonmusicians; in particular, musicians recruit prefrontal areas involved in working memory to a greater degree than nonmusicians during rhythm learning (Chen, Penhune, & Zatorre, 2008), musicians show decreased motor activation relative to nonmusicians during bimanual tapping (Jäncke, Shah, & Peters, 2000), musicians show greater connectivity between auditory and motor areas than nonmusicians during beat perception (Grahn & Rowe, 2009), and musicians show a more efficient encoding of pitch information than nonmusicians in early stages of auditory processing, including the brainstem (Musacchia, Sams, Skoe, & Kraus, 2007; Strait, Kraus, Skoe, & Ashley, 2009; Wong, Skoe, Russo, Dees, & Kraus, 2007).

Nonetheless, one factor that has been not been systematically considered when interpreting performance differences between musicians and nonmusicians is the role of motivation. Within the field of cognitive psychology, individual differences in motivation are typically treated as a random factor. However, in the past ten years, there has been increased interest in the mechanisms of interaction between motivational and cognitive processes (Maddox & Markman, 2010). Within the music cognition field, individual differences in motivation associated with music training seem like a good candidate to play an important role and make systematic (rather than random) contributions to performance. Informal observations in the lab suggest that some highly trained musicians approach music perception tasks as an opportunity to demonstrate their skill, while others treat the same task as a test that they ought to do well on. Similarly, some nonmusicians appear to approach music perception tasks as an opportunity to meet a challenge, while others approach the same task as a test on which they should not perform well.

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In sum, although there is evidence that musicians perform better than nonmusicians on music perception tests because of their music ability, it is not clear how systematic differences in motivation may contribute to these performance differences. Toward this end, the aim of the current study was to apply a well-established theoretical framework in the motivation literature—namely regulatory focus theory—to begin to consider how differences in musicians' motivational orientation may interact with characteristics of the tasks being performed to affect performance.

Regulatory Focus Theory and the Concept of a Regulatory Fit

The theoretical framework that forms the basis for the current investigation is regulatory focus theory (Higgins, 1997) and the related concept of regulatory fit (Higgins, 2000). Regulatory focus theory distinguishes between two motivational orientations present to varying degrees in all people. People in a promotion focus are motivated to become the person they ideally would like to be (i.e., fulfill their hopes and aspirations), whereas people in a prevention focus are motivated to be the kind of person they feel they ought to be (i.e., fulfill their duties and obligations). Given that both promotion and prevention systems are present in all people, it is possible for situational contingencies to temporarily prime or induce a focus (see, e.g., Förster, Grant, Idson, & Higgins, 2001; Freitas & Higgins, 2002; Higgins, Idson, Freitas, Spiegel, & Molden, 2003).

Two differences between promotion focus and prevention focus systems were of particular relevance for the current study. First, during self-regulation, people in a promotion focus are more concerned with attaining currently unattained goals, whereas people in a prevention focus are more concerned with maintaining currently held states (e.g., Brodscholl, Kober, & Higgins, 2007; Maddox & Markman, 2010). In tasks with built-in incentives, framing the task to emphasize attainment vs. maintenance has been one common way in which promotion and prevention orientations have been primed. For example, participants can be told "you need to attain X number of points to receive the reward" (promotion prime) or "you need to maintain at least X number of points to avoid losing the reward" (prevention prime). The second difference, which derives from the difference in attainment vs. maintenance, is that people in each focus are sensitive to different types of outcome information. A promotion focus activates a mode of processing that focuses the motivational system on the presence or absence of gains in the environment. A prevention focus, conversely, activates a mode of processing that focuses the motivational system on the presence or absence of losses in the environment. Thus, an important idea here is that a promotion focus increases sensitivity to gains and nongains, while a prevention focus increases sensitivity to losses and nonlosses (for reviews, see, e.g., Cesario, Higgins, & Scholer, 2008; Higgins, 2006).

On this view, in any performance situation there is the orientation/regulatory focus of the individual (promotion/prevention) and the type of incentives emphasized by the task (e.g., gains versus losses). Regulatory fit (see Higgins, 2000; Higgins et al., 2003) occurs when task incentives are framed in the manner that is preferred by a person's current orientation—that is, when individuals in a promotion focus perform a task where they gain points for correct answers (a gains incentive condition) or individuals in a prevention focus perform a task where they lose points for incorrect answers (a losses incentive condition). Conversely, individuals with a promotion or prevention focus experiencing losses or gains incentives, respectively, experience a state of regulatory nonfit. When outcomes are described in a way that is preferred by a person's regulatory focus (i.e., regulatory fit), the result is enhanced motivational strength and greater valuation of the outcome. Considerable research has supported this prediction across a wide range of domains (e.g., Cesario & Higgins, 2008; Higgins et al., 2003; Latimer et al., 2008; Spiegel, Grant-Pillow, & Higgins, 2004; Werth & Förster, 2007; for summaries, see Cesario et al., 2008; Higgins, 2000, 2006).

Regulatory Fit and Performance

Regulatory focus theory has recently attracted substantial attention within cognitive science in studies of category learning (Maddox, Baldwin, & Markman, 2006a, 2006b; Maddox & Markman, 2010), standardized test performance (Grimm, Markman, Maddox, and Baldwin, 2009), and cognitive control (Maddox, Filoteo, Glass, & Markman, 2010). In research on category learning, Maddox and colleagues (Grimm, Markman, Maddox, & Baldwin, 2008; Maddox et al., 2006b; Worthy, Markman, & Maddox, 2009) have provided evidence that regulatory fit leads to better performance (relative to regulatory nonfit) on rule-based visual perceptual classification tasks that require cognitive flexibility (i.e., participants need to explore the space of possible rules to arrive at the correct solution).

In research on standardized test performance, Grimm, Markman, Maddox, and Baldwin (2009) considered the possibility that gender differences on math assessments may be partly motivational in origin. Building on the work of Seibt and Förster (2004), they hypothesized that differences in regulatory focus are related to stereotype threat effects; specifically, one reason some women may underperform men on tests of mathematical aptitude is because of a fear of reinforcing a negative stereotype about one's ingroup (stereotype threat), thereby inducing a prevention focus and a regulatory nonfit with the way that standardized tests of math aptitude are typically structured (the goal is to achieve enough correct answers to obtain a high score). To test this possibility, Grimm et al. (2009) had male and female participants complete math GRE-type problems where they either gained points for correct answers or lost points for incorrect answers. Consistent with a regulatory fit hypothesis, they found that females performed worse than males on the math problems in the gains condition (a regulatory nonfit), but conversely performed just as well as the males in the losses condition (a regulatory fit). Moreover, the reduced gender difference in math performance was driven entirely by the female participants.

Finally, in research on neuropsychological assessments of cognitive control, Maddox et al. (2010) considered how creating states of regulatory fit and nonfit might influence the proportion of individuals classified as impaired on the Wisconsin Card Sorting Task (WCST: Heaton, 1981). In the WCST, participants sort cards varying along three dimensions based on a verbal rule known to the experimenter, but not to the participant. Once the participant learns the rule, a new rule is applied without the participant's knowledge and participants must abandon the old rule and shift to the new rule in order to continue to make correct responses. Thus, in general, participants must search for possible rules and also recognize when the current rule no longer applies. Maddox et al. (2010) gave participants a modified WCST that included between-subject regulatory focus (promotion vs. prevention) and task incentive (gains vs. losses) manipulations. Consistent with a regulatory fit hypothesis, individuals in a regulatory fit took fewer trials to learn the second rule and made fewer perseverative responses than individuals in a regulatory nonfit; moreover, fewer people in the regulatory fit condition were classified as impaired on the WCST than those in the regulatory nonfit condition.

In sum, recent research is beginning to show the importance of relating one's current motivational orientation to the current task's incentives, and reveal how regulatory fit or nonfit can impact performance. This article extends this research to a consideration of the role of regulatory fit/nonfit in assessing effects of music training on music perception.

Current Study

Two experiments were conducted. One goal of the experiments was to address the question of whether any perceptual advantages shown by musicians on music perception tests can be eliminated, or at least reduced, by varying task characteristics previously shown to interact with the motivational orientation of the participants. A second related goal was to test a regulatory fit hypothesis in a previously untested domain. As a music perception assessment, we chose to focus on the Montreal Battery of Evaluation of Amusia (MBEA; Peretz, Champod, & Hyde, 2003), which is a widely used diagnostic tool for amusia (i.e., tone deafness) that is also difficult enough to be sensitive to performance differences between musicians and nonmusicians.

In both experiments, participants completed the Interval subtest of the MBEA. The Interval subtest, like the other melodic organization subtests, involves same-different judgments about pairs of novel melodies. The Interval subtest, however, is notably more difficult than the other melodic organization subtests because "different" melodies are created by changing two adjacent pitch intervals (i.e., changing the pitch of one note) while retaining the pitch contour and scale. By using this subtest, we knew from normative data collected in our lab that musician and nonmusician participants would not be performing at ceiling (Henry, Gruschow, & McAuley, 2009). One modification to the Interval subtest that was made for the present investigation was to provide feedback to participants about their performance on each trial. Participants either gained points for correct answers (a gains condition) or lost points for incorrect answers (a losses condition).

Experiment 1 told participants that the test they would be taking was diagnostic of their music ability and they were then were asked to identify themselves as a musician or a nonmusician. Our hypothesis was that after telling participants that the test was diagnostic of their music ability, self-identified musicians would be more concerned with maintenance than attainment, and from a regulatory focus theory perspective would adopt a prevention focus. In terms of regulatory fit, this hypothesis implied that musicians would show greater attention to losses and nonlosses than nonmusicians and thereby perform better when points were lost for incorrect answers (i.e., the losses condition) compared to when points were gained for correct answers (i.e., the gains condition). Conversely, we hypothesized that self-identified nonmusicians (with in essence nothing to lose) would be more focused on attainment than maintenance and from a regulatory focus theory perspective would adopt a promotion focus. In terms of regulatory fit, this hypothesis implied that nonmusicians would show greater attention to gains and nongains than musicians and thereby perform better in the gains condition than in the losses condition. Expressed in terms of a performance comparison between musicians and nonmusician, our general hypothesis was that any musician performance advantage was expected to be smaller when points were gained for correct answers than when points were lost for incorrect responses.

Experiment 2 provided a more direct test of the regulatory fit hypothesis by explicitly priming either a promotion focus or a prevention focus using a raffle ticket manipulation and then having participants complete the same music perception assessment. As in Experiment 1, participants either gained points for correct answers or lost points for incorrect answers, but participants were not told that that the test was diagnostic of music ability and participants were not asked to self-identify as musicians or nonmusicians prior to taking the test. Our hypothesis was that, in line with previous work on regulatory fit/nonfit, promotion-primed participants would experience regulatory fit and perform better in the gains condition than the losses, while prevention-primed participants would perform better in the losses condition than in the gains condition.

Experiment 1

Method

PARTICIPANTS AND DESIGN

Fifty-two individuals (M = 25.3 years, SD = 8.8 years; n = 30, female) with self-reported normal hearing from a large Midwestern university community participated in exchange for course credit or a $5 cash payment. The general design of the study was a 2 (Musicianship: musicians, nonmusicians) × 2 (Task Incentive: gains, losses) between-subjects factorial. Participants were randomly assigned to either a gains incentive condition (musicians, n = 12; nonmusicians, n = 16) or a losses incentive condition (musicians, n = 12; nonmusicians, n = 12).

STIMULI AND EQUIPMENT

Stimuli were a set of melodies from the Interval subtest of the MBEA, which were composed according the rules of Western tonality (Peretz et al., 2003). The number of notes in a melody varied between 7 and 21 with an average duration = 5.1 s. Melodies were presented at a comfortable listening level over Sennheiser HD-280 Pro headphones; stimulus presentation and response collection were controlled by E-Prime software (Psychology Software Tools, Inc.).

PROCEDURE

Participants were administered a number of surveys to rule out the possibility that our musician and nonmusician groups were *a priori* different with respect to a number of self-report measures, including "motivation to do well on the task." Participants initially completed the Regulatory Focus Questionnaire (RFQ: Higgins et al., 2001), followed by the Beck Anxiety Inventory (BAI: Beck, Epstein, Brown, & Steer, 1988) and the Penn State Worry Questionnaire (PSWQ: Meyer, Miller, & Metzger, & Borkovec, 1990). The RFQ was used to assess potential differences between musicians and nonmusicians in chronic regulatory focus. It assesses an individual's history of promotion success and prevention success by asking them to rate how often certain events have happened in their past (e.g., "How often did you obey rules and regulations that were established by your parents," "Not being careful enough has gotten me into trouble at times"). Cronbach's coefficient alphas for promotion and prevention subscales were 0.46 and 0.77, respectively. The BAI and PSWQ were administered because they measure two constructs—anxiety and worry—that have been shown in some previous research to be related to a chronic prevention focus. The BAI asks participants to indicate how much they have been bothered by a variety of symptoms in the last week (e.g., "nervous," "faint, "terrified"); responses range from 0 ("Not at all") to 3 ("Severely, I could barely stand it"). Cronbach's coefficient alpha for the BAI was .84. The PSWQ asks participants to rate how typical of them they consider statements about worrying (e.g., "My worries overwhelm me" and "When I am under pressure I worry a lot"); responses range from 1 ("Not at all typical of me") to 5 ("Very typical of me"). Cronbach's coefficient alpha for the PSWQ was .94.

Participants were next told the following: "We are developing some new tests that we are evaluating across a large group of students and community members. Today, you will be taking a music test. This test is designed to be diagnostic of your music ability." Participants were then asked to indicate whether they were a musician or a nonmusician by pressing the M or N key, respectively. They were then asked to make rating responses to a series of questions. These were in the following order. "How well do you think you will perform on this test?" (1 = "very bad" and 9 = "very good"), "How well do you think you will like the test?" (1 = "not at all" and 9 = "very much"), "How motivated are you to do well on the test?" (1 = "not at all" and 9 = "very much"). Participants were then given the Positive and Negative Affect Schedule (PANAS: Watson, Clark, & Tellegen, 1988), which is a 20-adjective checklist that asks participants to rate the degree to which each adjective on the list describes their *current* emotional state. Response ranged from 1 ("Very slightly, or not at all") to 5 ("Extremely"). The PANAS yields a positive affect (PA) score and a negative affect (NA) score; coefficient alphas for the PA and NA subscales were .86 and .75, respectively.

Following survey completion, participants were administered the music test, which consisted of the Interval subtest of the MBEA. On each of 30 trials, participants heard a pair of melodies and indicated whether the two melodies were the same or different by pressing one of two response-box buttons. Half of the trials were same trials in which the melodies were identical, while the remaining trials were different trials where one of the notes of the melody was altered; for the Interval subtest of the MBEA, the altered note changes adjacent pitch intervals in a three note sequence while preserving the melodic contour and key. Participants received corrective feedback after each response. Correct responses were accompanied by a cash register "cha-ching" sound, and incorrect responses were accompanied by a buzzer sound. To parallel the design of Grimm et al. (2009), participants assigned to the gains incentive condition received two points for each correct answer and zero points for each incorrect answer; the goal was to gain 54 points (i.e., 90% correct). Participants assigned to the losses incentive condition lost three points for incorrect answers, but only one point for correct answers; the goal was to avoid losing more than 36 points (i.e., 90% correct).[1] Throughout the task, a point meter was displayed on the right of the screen that tracked the number of points gained or lost and additionally displayed the goal score.

Finally, participants responded to a series of music-related statements. These appeared in the following order: "I am good at music" (1 = "strongly disagree" and 9 = "strongly agree"), "It is important to me that I am good at music" (1 = "strongly disagree" and 9 = "strongly agree"), "My music ability is important to my identity" (1 = "strongly disagree" and 9 = "strongly agree"). Finally, they completed a posttest questionnaire that asked participants to rate their natural music ability (1 = "very poor" and 6 = "very good"), level of effort (1 = "I did not try at all" and 6 = "I tried my best"), level of attention (1 = "I did not pay attention" and 6 = "I paid full attention"), level of task difficulty (1 = "not difficult at all" and 6 = "very difficult"), and level of task understanding (1 = "I did not understand at all" and 6 = "I understood exactly what to do") on a six-point scale. The entire experiment lasted approximately 30 minutes.

[1] The asymmetry between points gained and lost comes from Maddox et al. (2006b) who found that a gains condition with +2 points for a correct response and 0 points for an incorrect response produced a similar pattern of performance to a losses condition with –3 points for an incorrect response and –1 point for a correct response.

Results

COMPARISON OF SELF-IDENTIFIED MUSICIANS AND NONMUSICIANS ON SELF-REPORT MEASURES

Self-identified musicians and nonmusicians were first compared in their responses to a number of potentially relevant self-report items (see Table 1). For the questions concerning music ability and general interest in music, self-identified musicians reported receiving more years of formal music training ($M = 8.8$ years, $SD = 3.9$ years) than nonmusicians ($M = 3.0$ years, $SD = 1.9$ years), $t(35) = 5.14$,

TABLE 1. Mean Scores (± *SD*) for Self-Report Items for Musicians and Nonmusicians.

	Musicians	Nonmusicians
Pretest questionnaire		
"How well do you think you will perform on this test?"	6.8 (1.3)	6.2 (1.8)
"How well do you think you will like the test?"*	6.6 (1.1)	5.9 (1.5)
"How motivated are you to do well on the test?"	7.5 (1.2)	7.5 (1.2)
"I am good at music."**	7.4 (1.1)	4.9 (1.7)
"It is important for me to be good at music."**	7.0 (1.3)	4.3 (1.9)
"My music ability is important to my identity."**	6.0 (1.9)	3.1 (1.9)
Posttest questionnaire		
Natural music ability**	4.6 (0.8)	3.2 (1.2)
Level of effort	5.5 (0.5)	5.5 (0.5)
Level of attention	5.4 (0.7)	5.5 (0.7)
Level of task difficulty	3.6 (1.3)	3.4 (1.5)
Level of task understanding	5.9 (0.3)	5.8 (0.5)
Survey measure		
RFQ (promotion score)	23.3 (3.1)	23.4 (3.3)
RFQ (prevention score)	16.9 (5.2)	16.7 (3.3)
BAI	10.9 (7.8)	9.0 (6.1)
PSWQ	45.0 (13.7)	44.3 (13.8)
PANAS (PA – positive affect)	29.3 (6.2)	31.2 (7.5)
PANAS (NA – negative affect)	13.2 (4.0)	11.5 (2.1)

Note: Items with an * and ** indicate that the group difference is significant at $p < .05$ and $p < .01$ levels, respectively.

$p < .001$. Ratings for the statement "I am good at music" were significantly higher for musicians ($M = 7.4$, $SD = 1.1$) than for nonmusicians ($M = 4.9$, $SD = 1.7$), $t(50) = 7.42$, $p < .001$; musicians also judged that it was "important to be good at music" to a greater extent than nonmusicians (7.0 ± 1.3 versus 4.3 ± 1.9), $t(50) = 5.86$, $p < .001$. Musicians additionally rated their natural music ability to be higher than nonmusicians (4.6 ± 0.8 versus 3.2 ± 1.2), $t(50) = 5.11$, $p < .001$ and felt that they would like the test more so than nonmusicians (6.6 ± 1.1 versus 5.9 ± 1.5), $t(50) = 2.05$, $p < .05$.

In contrast to the music-related questions, musicians and nonmusicians did not tend to show differences in any of the other measures. There were no musician versus nonmusician differences in their pretest rating of motivation (musicians, $M = 7.5 \pm 1.2$; nonmusicians, $M = 7.5 \pm 1.2$), $t(50) = 0.00$, $p = .99$, in their pretest expectations about how well they thought they would perform on the task (musicians, $M = 6.8 \pm 1.3$; nonmusicians, $M = 6.2 \pm 1.8$), $t(50) = 1.49$, $p = .14$), or in their posttest ratings of effort expended, attention to the task, task difficulty, or task understanding (all p's > .40). Musicians and nonmusicians additionally did not reliably differ in chronic regulatory focus (as assessed by the RFQ), total PSWQ score, total BAI score, or positive affect (PA) and negative affect (NS) scores on the PANAS (all p's > .05).

MBEA PERFORMANCE

Analyses of MBEA performance for the Interval subtest considered three measures: proportion correct and the associated signal detection measures, d' and c. Table 2 summarizes average proportion correct (PC) and additionally reports hit rate and false alarm rate for musicians and nonmusicians assigned to the gains and losses incentive conditions. The signal detection results are illustrated in Figure 1. Signal detection analyses were performed in order to distinguish between effects of Musicianship and Task Incentive on participants' ability to discriminate between same and different melodies and any general tendency to respond either 'same' or 'different' on the task. For the signal detection analysis, a different response to a different trial was coded as a hit and

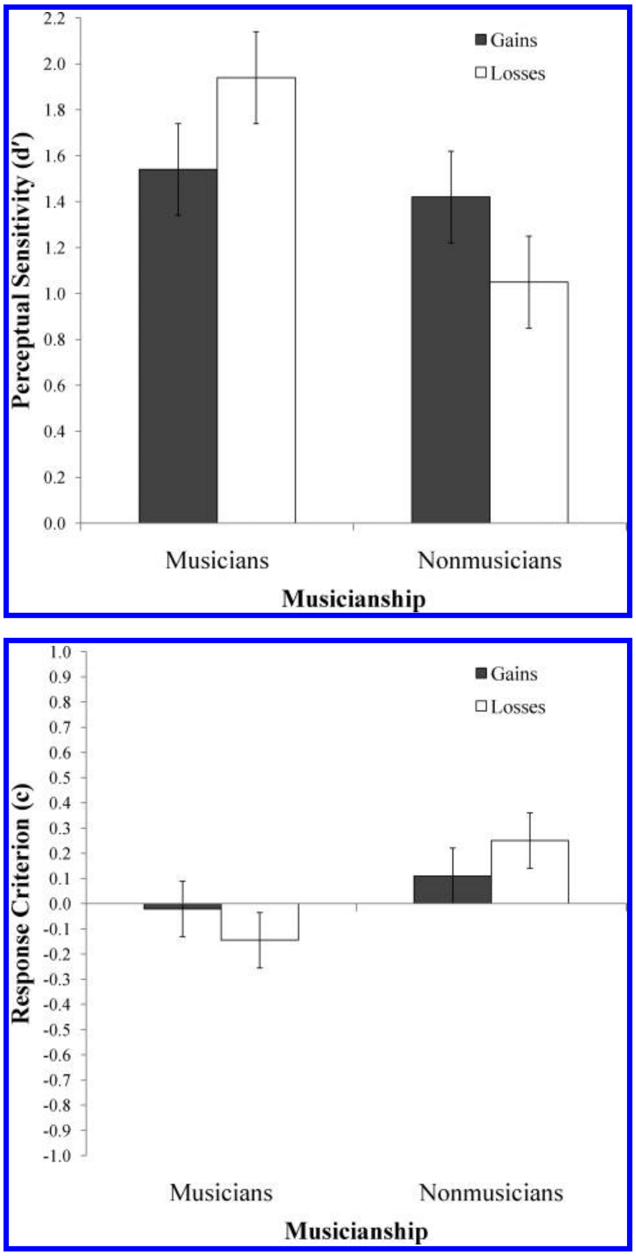

FIGURE 1. Experiment 1. Signal detection measures d' (Panel A) and c (Panel B) for self-identified musicians and nonmusicians assigned to gains and losses incentive conditions.

TABLE 2. Experiment 1: Mean Proportion Correct, Hit Rate, and False Alarm Rate (± *SD*) for Musicians and Nonmusicians in the Gains and Losses Incentive Conditions.

	Gains			Losses		
	PC	HR	FAR	PC	HR	FAR
Musicians	0.76 (0.12)	0.75 (0.21)	0.24 (0.09)	0.80 (0.10)	0.82 (0.16)	0.24 (0.17)
Nonmusicians	0.75 (0.11)	0.70 (0.17)	0.22 (0.08)	0.66 (0.11)	0.59 (0.17)	0.27 (0.20)

a different response to a same trial was coded as a false alarm. Hit and false alarm rates for each participant were then used to calculate the two standard signal detection measures, d' and c (MacMillan & Creelman, 2005). The value of d' measured participants' ability to discriminate between same and different melodies, while the response criterion score, c, measured participants' tendency to respond 'same' or 'different' on the task; $c > 0$ indicated a bias to respond 'same' (a conservative response strategy), while $c < 0$ indicated a bias to respond 'different' (a liberal response strategy).

With respect to overall PC, a 2 (Musicianship) × 2 (Task Incentive) between-subjects ANOVA revealed a main effect of Musicianship, $F(1, 48) = 7.01$, $p < .05$, no main effect of Task Incentive, $F(1, 48) = 0.50$, $p = .48$, but a significant interaction between Musicianship and Task Incentive, $F(1, 48) = 5.02$, $p < .05$. PC scores were generally higher for musicians than for nonmusicians, but the musician versus nonmusician difference in performance was mediated by Task Incentive in the expected direction (Table 3). Melody discrimination was better for musicians than nonmusicians in the losses condition, $t(22) = 3.49$, $p = .002$, but there was no musician advantage in the gains condition, $t(26) = 0.29$, $p = .78$.

The results of the signal detection analyses are summarized in Figure 1. Similar to the ANOVA on PC, the ANOVA on d' revealed a main effect of Musicianship, $F(1, 48) = 6.51$, $p < .05$, no main effect of Task Incentive, $F(1, 48) = 0.004$, $p = .94$, but a marginally significant Musicianship × Task Incentive interaction, $F(1, 48) = 3.81$, $p = .06$. Similar to the PC results, d' scores were higher for musicians than nonmusicians in the losses condition, $t(22) = 3.21$, $p < 0.01$, but the two groups did not differ in the gains condition, $t(26) = 0.45$, $p = .67$. The ANOVA on the response criterion, c, showed a main effect of Musicianship, $F(1, 48) = 5.18$, $p < .05$, but no main effect of Task Incentive, $F(1, 48) = 0.01$, $p = .93$, and no Musicianship × Task Incentive interaction, $F(1, 48) = 1.36$, $p = .25$. Overall, values of c were greater for nonmusicians ($M = 0.17$, $SD = 0.38$) than for musicians ($M = -0.08$, $SD = 0.44$), which means that nonmusicians tended to be more conservative (i.e., respond same more often) than musicians. The lack of a main effect of Task Incentive or a significant interaction between Musicianship and Task Incentive for the response criterion measure showed that whether participants gained points for correct responses or lost points for incorrect responses did not impact any general tendency to respond same or different.

Discussion

Participants completed a melody discrimination task (consisting of same-different melody pairs from the Interval subtest of the MBEA), while either gaining points for correct answers (a gains incentive condition) or losing points for incorrect answers (a losses incentive condition). All participants were told that the test was diagnostic of their music ability and then were asked to identify themselves as either a musician or a nonmusician. Consistent with the hypothesis that musicians would adopt a prevention focus and experience regulatory fit in the losses condition, musicians outperformed nonmusicians in the losses condition, but critically, the two groups did not differ in the gains condition. Conversely, consistent with the hypothesis that nonmusicians would adopt a promotion focus and experience regulatory fit in the gains condition, nonmusicians performed significantly better in the gains condition than in the losses condition. Taken together, musicians and nonmusicians showed opposite effects of the task incentive manipulation. Separate from the effects on melody discrimination performance, nonmusicians also tended to respond 'same' more often than musicians (i.e., in signal detection terms, they had a more conservative response criterion). No differences in the response criterion were observed when comparing gains and losses incentives.

Participants also completed a number of survey measures, which permitted us to assess whether the self-selected

TABLE 3. Experiment 2: Mean Proportion Correct, Hit Rate, and False Alarm Rate (± *SD*) for Musicians and Nonmusicians in the Gains and Losses Incentive Conditions.

	Gains			Losses		
	PC	HR	FAR	PC	HR	FAR
Musicians						
Promotion	0.78 (0.06)	0.82 (0.14)	0.26 (0.12)	0.69 (0.13)	0.68 (0.14)	0.31 (0.19)
Prevention	0.69 (0.12)	0.67 (0.18)	0.28 (0.09)	0.76 (0.07)	0.72 (0.13)	0.20 (0.12)
Nonmusicians						
Promotion	0.71 (0.11)	0.64 (0.14)	0.22 (0.15)	0.67 (0.10)	0.53 (0.19)	0.18 (0.08)
Prevention	0.67 (0.09)	0.53 (0.20)	0.20 (0.07)	0.66 (0.13)	0.56 (0.19)	0.23 (0.09)

musician and nonmusician groups were *a priori* different in ways other than music training that could potentially explain the opposite effects that the task incentive manipulation had on performance. Of particular interest was the RFQ, which assessed *chronic* regulatory focus and was critically administered prior to participants being told that the test was diagnostic of music ability. The similar *chronic* promotion and prevention scores of the two groups support the conclusion that musicians and nonmusicians did not have *a priori* prevention and promotion focus biases, respectively, but rather, that regulatory focus biases were primed by the task and the instructions given to participants. Also ruling out the possibility that anxiety or mood differences between groups may have contributed to the interaction between Musicianship and Task Incentive, musicians and nonmusicians also did not differ in their scores on the Beck Anxiety Inventory, the Penn-State Worry Questionnaire, or in their positive affect and negative affect scores on the PANAS. Musicians and nonmusicians also did not differ in pretest ratings of motivation and expectation to do well on the test or in their posttest ratings of effort expended, attention to the task, task difficulty, and task understanding. Musician and nonmusician groups did, however, differ, as expected, on a number of music-related survey items, including ratings of "I am good at music," "Music is important to my identity," and "Natural music ability."

One issue raised by Experiment 1 is the indirect nature of the evidence supporting the regulatory fit hypothesis. That is, although data are consistent with the hypothesis that when faced with a task that they are told is diagnostic of their music ability, self-identified musicians will show a prevention focus bias, while self-identified nonmusicians will show a promotion-focus bias, it is possible that some other unmeasured characteristic of individuals in Experiment 1 may have been responsible for what we've interpreted to be a regulatory fit effect.

Thus, in order to provide direct evidence for a role of regulatory fit in performance on the MBEA and to provide converging evidence for our interpretation of Experiment 1, a second experiment was conducted in which participants were given either a promotion-focus or a prevention-focus prime using a raffle ticket manipulation. Promotion focus was primed by telling participants that good performance on the task would gain them entry into the raffle, while prevention focus was primed by requiring participants to avoid poor performance on the task in order to maintain raffle entry. Of note, this manipulation was identical to the type of situational regulatory focus manipulation that has been used successfully in previous research (e.g., Maddox et al., 2006b). As in Experiment 1, participants completed the Interval subset of the MBEA while either gaining points for correct answers or losing points for incorrect answers. A regulatory fit hypothesis predicted that promotion-primed participants would perform better in the gains condition than the losses condition, while prevention-primed participants would perform better in the losses condition than in the gains condition.

Experiment 2

Method

PARTICIPANTS AND DESIGN

Seventy-six undergraduate students at a large Midwestern university ($M = 19.3$ years, $SD = 1.6$ years; $n = 64$, female) participated in exchange for credit in an undergraduate psychology course; all self-reported normal hearing. The general design of the study was a 2 (Regulatory Focus: promotion, prevention) × 2 (Task Incentive: gains, losses) between-subjects factorial. Participants were randomly assigned to either a promotion-focus ($n = 38$) or a prevention-focus condition ($n = 38$) and then completed the Interval subtest of the MBEA while either gaining points for correct answers ($n = 38$) or losing points for incorrect answers ($n = 38$). Six additional individuals participated in the experiment, but they were not included in the final sample because they reported a hearing impairment ($n = 2$) or because of a technical problem with the administration of the experiment ($n = 4$).

STIMULI AND EQUIPMENT

Identical to Experiment 1.

PROCEDURE

The key difference between Experiment 2 and Experiment 1 was that, rather than telling participants that the task was diagnostic of music ability and then having participants self-identify as musicians or nonmusicians, we explicitly primed regulatory focus and then after the task was completed obtained information about formal music training. Participants randomly assigned to the promotion-focus condition were told that they would earn a raffle ticket with a 1-in-20 chance of winning a $50 cash prize if they performed well enough on the task. Participants randomly assigned to the prevention focus condition were given a raffle ticket with a 1-in-20 chance of winning a $50 cash prize and told that they would lose their raffle ticket if they failed to perform well enough on the task. All other aspects of the task and procedure were identical to Experiment 1 except participants were not administered the RFQ, PSWQ, and the PANAS personality measures.[2] As in Experiment 1, participants did, however, provide posttest ratings for effort expended, attention to task, task difficulty, task understanding, and natural music ability.

Results

COMPARISON OF PROMOTION- AND PREVENTION-PRIMED PARTICIPANTS ON SELF-REPORT MEASURES

Promotion-primed and prevention-primed participants did not differ in reported years of formal music training (promotion: $M = 3.6$ years, $SD = 4.3$ years; prevention: $M = 4.8$, $SD = 4.2$ years), $p = .22$, or ratings of natural music ability (promotion: $M = 3.38$, $SD = 1.48$; prevention: $M = 3.55$, $SD = 1.41$), $p = .60$. Moreover, there were no differences between promotion- and prevention-primed participants in their posttest ratings of effort expended, attention to the task, task difficulty, or task understanding (all p's $> .34$).

MBEA PERFORMANCE

Analyses of MBEA performance focused on the same five measures as in Experiment 1: proportion correct, hit rate, false alarm rate, and the associated signal detection measures d' and c. In addition, because Experiment 1 provided evidence of an interaction between the musicianship and task incentive manipulations, we performed an approximate median split on years of formal music training in order to include music training as a factor in the analysis. Participants with < 4 years of formal music training were classified as nonmusicians, while participants with ≥ 4 years of formal music training were classified as musicians, yielding roughly equal numbers of musicians ($n = 36$) and nonmusicians ($n = 40$). Table 3 summarizes average proportion correct (PC), hit rate, and false alarm rate for promotion-primed and prevention-primed participants assigned to the gains and losses incentive conditions. Musician and nonmusician data are shown separately. The signal detection results are shown in Figure 2 for d' and Figure 3 for the response criterion c.

With respect to overall PC, a 2 (Regulatory Focus) × 2 (Task Incentives) × 2 (Music Training) between-subjects ANOVA revealed a significant main effect of Music Training, $F(1, 68) = 4.69$, $p < .05$ and a significant Regulatory Focus × Task Incentive interaction, $F(1, 72) = 3.85$, $p = .05$. Consistent with the regulatory fit hypothesis, promotion-primed participants performed better in the gains condition ($M = 0.75$, $SE = 0.03$) than in the losses condition ($M = 0.68$, $SE = 0.02$), while conversely prevention-primed participants performed slightly better in the losses condition ($M = 0.71$, $SE = 0.03$) than in the gains condition ($M = 0.68$, $SE = 0.02$). A comparison of

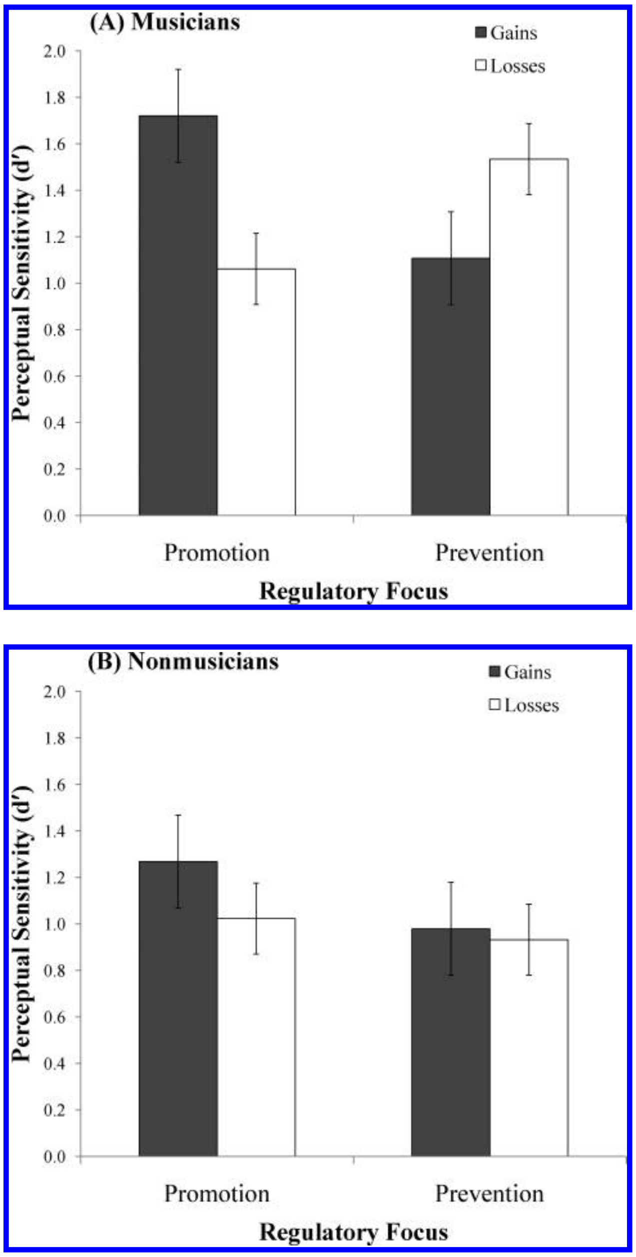

FIGURE 2. Experiment 2. Signal detection measure d' for promotion-primed participants and prevention-primed participants assigned to gains and losses incentive conditions. Participants with ≥ 4 years of formal music training are shown in Panel A, while those with < 4 years of formal music training are shown in Panel B.

[2] Because participants were randomly assigned to conditions rather than relying on their self selection, there is less of a concern that group differences could be due to individual difference characteristics rather than the manipulated regulatory focus prime.

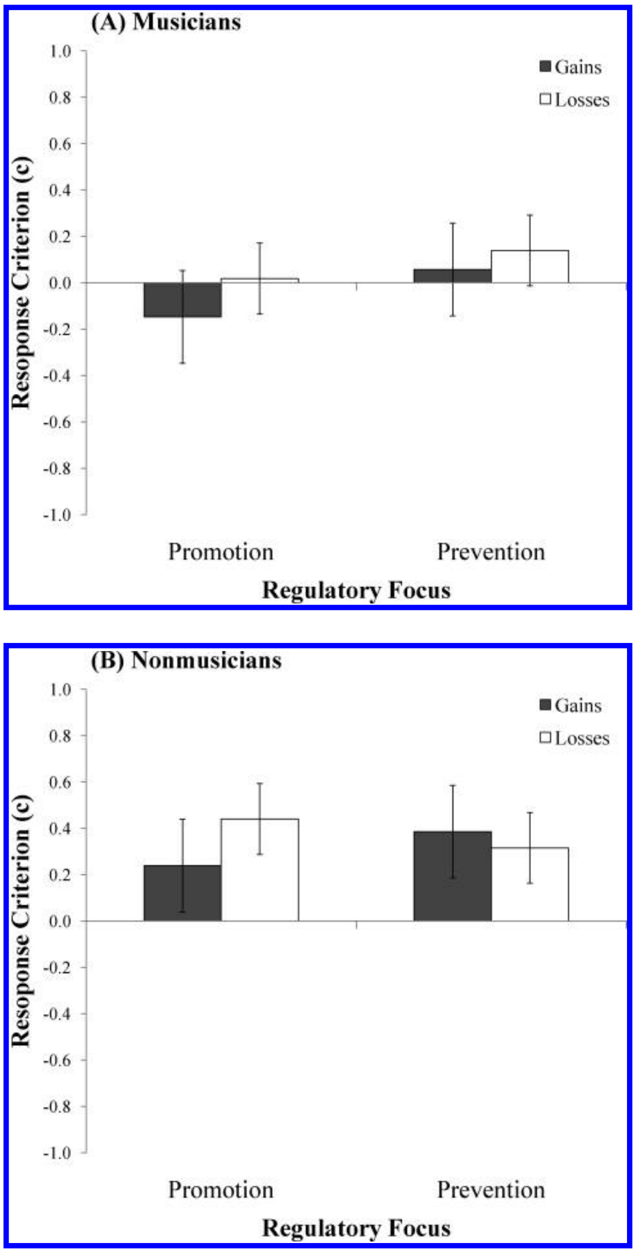

FIGURE 3. Experiment 2. Signal detection measure *c* for promotion-primed participants and prevention-primed participants assigned to gains and losses incentive conditions. Participants with ≥ 4 years of formal music training are shown in Panel A, while those with < 4 years of formal music training are shown in Panel B.

musicians and nonmusicians shows that musicians generally outperformed nonmusicians (0.73 ± 0.02 versus 0.68 ± 0.02). Moreover, regulatory fit effects appeared to be stronger for musicians than for nonmusicians, although none of the interactions with the Music Training factor were significant (all *p*'s > .2).

The signal detection analyses revealed a similar data pattern. A 2 (Regulatory Focus) x 2 (Task Incentive) x 2 (Music Training) between-subjects ANOVA on *d′* scores revealed a marginal main effect of Music Training, $F(1, 68) = 3.8$, $p = .055$, and a significant interaction between Regulatory Focus and Task Incentive, $F(1, 68) = 4.22$, $p < 0.05$. Consistent with the regulatory fit hypothesis and the analysis on PC, values of *d′* were higher for promotion-primed participants in the gains condition (*M* = 1.50, *SE* = 0.16) than in the losses condition (*M* = 1.04, *SE* = 0.15), while prevention-primed participants performed better in the losses condition (*M* = 1.23, *SE* = 0.16) than in the gains condition (*M* = 1.04, *SE* = 0.15). A comparison of *d′* scores for musicians and nonmusicians (Figure 2: Panel A versus Panel B) shows that, as found with PC, values of *d′* were higher for musicians (*M* = 1.36 ± 0.11) than for nonmusicians (*M* = 1.05 ± 0.11) and that regulatory fit effects appeared to be stronger for musicians than nonmusicians, although none of the interactions with Music Training reached significance (all *p*'s > .16).

With respect to the response criterion, *c*, a 2 (Regulatory Focus) × 2 (Task Incentive) × 2 (Music Training) between-subjects ANOVA revealed a main effect of Music Training, $F(1, 68) = 19.3$, $p < .001$, but no other main effects of interactions (all *p*'s > .20). Similar to Experiment 1, nonmusicians (*M* = 0.35, *SD* = 0.30) were overall more conservative in their responding (i.e., they tended to say same more often) than musicians (*M* = 0.03, *SD* = 0.34).

Discussion

To provide a more direct test of the regulatory fit hypothesis in the context of the MBEA, participants explicitly primed with a promotion focus were told that they could earn entry into a raffle to win a cash prize if they performed well on the task or conversely, participants primed with a prevention focus were told that they would lose entry into a raffle that they were given at the start of the experiment unless they avoided poor performance on the task. Thus, participants who were given a promotion-focus prime needed to reach a performance-based criterion in order to obtain a raffle ticket at the end of the experiment, while those given a prevention focus prime had to avoid going below a set performance criterion in order to prevent losing a raffle ticket given to them at the start of the experiment. As in Experiment 1, participants either gained points for correct answers (a gains condition) or lost points for incorrect responses (a losses condition). Consistent with a regulatory fit hypothesis, participants in a regulatory fit (promotion gains or prevention losses) outperformed participants in a regulatory nonfit (promotion losses and prevention gains). One somewhat unexpected finding from Experiment 2 was that regulatory fit effects appeared to be stronger for musicians than nonmusicians. There was also a tendency, as in Experiment 1, for nonmusicians to use a more conservative response criterion than musicians; that is, nonmusicians showed a greater tendency than musicians to say that pairs of melodies were the same.

General Discussion

This article reported two experiments that used regulatory focus theory as a framework to begin to investigate the extent to which individual differences in motivational orientation (i.e., regulatory focus) associated with music training impact performance on assessments of music ability. The assessment we chose to focus on was a representative melody discrimination subtest from the widely used Montreal Battery of Evaluation of Amusia (MBEA) that is sufficiently difficult to be sensitive to musicians/nonmusician differences in performance. Central to the design of Experiment 1 was the statement to all participants that they were taking a test that was diagnostic of music ability. Participants then had to self-identify as a musician or a nonmusician prior to testing and were randomly assigned to either a gains or losses condition, where they received points for correct responses or lost points for incorrect responses, respectively. We hypothesized that telling participants that the test was diagnostic of their music ability would encourage self-selected musicians to adopt a prevention focus and self-selected nonmusicians to adopt a promotion focus. Consistent with this hypothesis and the concept of a regulatory fit, musicians outperformed nonmusicians in the losses condition, but there was no difference between musicians and nonmusicians in the gains conditions. These findings are particularly striking because: (1) other than the incentive manipulation, the tests given to participants were identical and (2) self-identified musicians and nonmusicians did not differ in a number of potentially relevant individual-difference characteristics.

Experiment 2 provided direct evidence that regulatory fit impacts performance on the MBEA and converging evidence that performance differences between musicians and nonmusicians in Experiment 1 were indeed likely due to differences in situational regulatory focus, and not some other unmeasured individual difference characteristic. Instead of telling participants who self-identified as musicians and nonmusicians that they were taking a test that was diagnostic of their music ability, Experiment 2 primed regulatory focus using a raffle ticket manipulation, which has been widely used in previous studies (e.g., Maddox et al., 2006b). Participants then completed the same melody discrimination assessment as in Experiment 1, either gaining points for correct responses or losing points for incorrect responses. Consistent with a regulatory fit hypothesis, promotion-primed participants performed better in the gains condition than in the losses condition, while prevention-primed participants performed better in the losses condition than in the gains condition.

One unexpected result was that regulatory fit effects were somewhat more pronounced for individuals with more music training. A close inspection of the data suggested that this was particularly evident in the prevention focus condition. That is, musicians primed with a prevention focus showed a prevention-fit effect (i.e., prevention focus paired with losses), which was absent in the nonmusicians. One possible reason for this difference between the musicians and nonmusicians in the prevention focus condition is that, in line with the results of Experiment 1, musicians tended to show a prevention focus bias (thereby reinforcing the prevention focus prime), while nonmusicians tended to show a promotion-focus bias (thereby counteracting the prevention focus prime).

The overall pattern of results observed in the present study is similar to that found by Grimm and colleagues in their work varying task incentives (gains versus losses) to eliminate/reverse stereotype threat effects associated with gender differences on performance on a cognitive task. Grimm et al. (2009) considered the possibility that one reason why females may do more poorly than males on tests of math aptitude is that a fear of reinforcing a negative stereotype about one's ingroup (a stereotype threat) induces a prevention focus and that the implied gains reward structure of the task (the goal is to achieve enough correct answers to end with a high score) causes women to experience a regulatory nonfit when taking the test. Supporting this hypothesis, Grimm et al. showed that when females and males are given math GRE-type problems in which they lost points for incorrect answers (i.e., a losses incentive condition), no gender differences were observed on the test. Thus, analogous to the present study, Grimm et al. were able to eliminate a group performance difference by simply manipulating task incentives.

However, there are also important differences between the present study and Grimm et al. (2009). First, in the present study, we are not claiming that musicians experience stereotype threat when taking the MBEA. However, we do think that musicians faced with a straightforward melody comparison task that they are told is diagnostic of their music ability are vested in avoiding poor performance. Thus, analogous to Grimm et al. (2009), musicians show a prevention-focus bias and experience regulatory fit in the losses condition and regulatory nonfit in the gains condition. Second, in the present study, the net effect of varying task incentives (gains versus losses) in the current study was that music training differences were eliminated when musicians were hypothesized to experience regulatory nonfit, whereas in Grimm et al. (2009), gender differences were eliminated when women were hypothesized to experience regulatory fit.

An additional issue that is valuable to consider in comparing the current research with Grimm et al. (2009) is that for stereotype threat effects to be observed, it is important for individuals to identify with the relevant ingroup. Considered in the context of the present research, this highlights a potentially important distinction between self-identifying as a musician and having extensive formal music training. In the present study, self-identified musician and nonmusician participants significantly differed in years of formal music training, but some participants who would be classified as musicians and nonmusicians according to their formal music training self-reported as nonmusicians and musicians, respectively. That is, there is not a perfect correlation between the two measures. This suggests that when assessing the contribution of motivational factors to musician/nonmusician differences in performance, it may turn out to be more important to consider whether individuals consider themselves to be musicians or nonmusicians, and how much they view music as important to their identity, rather than how many years of formal music training they have.

More broadly, the current study contributes to a growing body of empirical and theoretical work at the intersection of motivation and cognition (Grimm et al., 2008, 2009; Maddox et al., 2006a, 2006b; Maddox & Markman, 2010; Markman, Baldwin, & Maddox, 2005, 2007; Markman, Maddox, & Worthy, 2006; Worthy et al., 2009). In a recent series of articles, Maddox, Markman, and colleagues (for a review see Maddox & Markman, 2010) have demonstrated a systematic pattern of interaction between situational regulatory focus and task incentive (feedback) structure in visual perceptual classification tasks. For rule-based perceptual classification tasks in which participants have to learn to classify stimuli according to a simple rule, individuals primed to have a promotion focus learn the rule more quickly with a gains incentive structure than with a losses incentive structure, while individuals primed to have a prevention focus learn the rule more quickly with a losses incentive structure than with a gains incentive structure. Thus, for both types of task incentives, individuals experiencing a regulatory fit outperform individuals in a regulatory nonfit. The explanation given for this effect is that regulatory fit promotes cognitive flexibility and encourages participants to explore the space of rules to solve the task. This type of fit effect differs, however, from that observed with information-integration tasks that require participants to correctly classify stimuli that vary along two dimensions in a manner that cannot be readily described by a rule that can be expressed in words. For information-integration tasks, where cognitive flexibility is a disadvantage, individuals in a regulatory nonfit tend to learn the rule more quickly than individuals in a regulatory fit.

Based on the work of Maddox, Markman, and colleagues (see Maddox & Markman, 2010), it seems likely that a number of task factors may be important when assessing performance differences between musicians and nonmusicians. Of note, the current study tested participants on a task likely to be both familiar for musicians (i.e., making same-different judgments about pairs of short novel melodies) and for which the instructions were unambiguous. In recent research, we've shown that for an unfamiliar perceptual classification task that required learning an initially unknown rule, musicians tend to show a promotion-focus bias and outperform nonmusicians in a gains condition, but not in a losses condition—the opposite to what was observed in the present study (McAuley, Henry, Wedd, Pleskac, & Cesario, 2010). Combining the results of these two studies, our working hypothesis is that for unambiguous tasks that are familiar, musicians will tend to show a prevention focus bias and try to prevent poor performance, whereas for ambiguous tasks that require learning, musicians will tend to show a promotion focus bias and approach the task as an opportunity to demonstrate their musical skill.

Conclusions

The results of the current study provide the first extension of regulatory focus theory to music perception and provide evidence that performance advantages typically associated with music training have the potential to be eliminated, or at least reduced, by considering the fit between an individual's motivational orientation (i.e., regulatory focus) and the feedback characteristics of the task (i.e., whether participants' gained points for correct responses or lost points for incorrect responses). Using a representative subtest of the MBEA, individuals in a regulatory fit were found to outperform individuals in a regulatory nonfit. Effects of regulatory fit appeared to be stronger for individuals with more music training, suggesting that musicians confronted with tasks that assess musical skill may be more susceptible to interactions between regulatory focus and task performance than individuals with less music training. More broadly, this research highlights the need to consider more carefully individual differences in motivational orientation when assessing music perception skills.

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