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The Effect of Music Characteristics on the Novelty and Usefulness of Creative Ideas.

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Title Page

The Effect of Music Characteristics on the Novelty and Usefulness of Creative Ideas.

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

by

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Abstract

THE EFFECT OF MUSIC CHARACTERISTICS ON THE NOVELTY AND USEFULNESS OF CREATIVE IDEAS

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A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

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This study explores the relationship between music and creativity. Prior research has conflicting results with some finding that music does influence creativity and some reporting no relationship and others finding that music is harmful to creativity. All of these studies, however, have largely focused on the presence vs. absence of music without consideration for the characteristics (i.e., musical key, tempo, etc.) that make up the sound we identify as music and their unique effects on us emotionally, physically, and cognitively. This dissertation contends that different characteristics of music influence different components of creativity (i.e., novelty and usefulness) through their effects on executive functions—working memory and inhibitory control. The hypotheses presented in this dissertation were tested in a 2x2 between-subject lab experiment with two different control groups (i.e., nature sounds and no audio) using 436 undergraduate students. The results provide support for the physiological and affective consequences of musical key and tempo. However, measures of creativity were unrelated with the proposed mediating mechanisms, making any conclusions about the effects of music characteristics on creativity difficult to draw. Reasons for this are discussed. It can be said, however, that it does appear that music is not harmful creativity as reported by previous studies. Directions for future research are also discussed.

THE EFFECT OF MUSIC CHARACTERISTICS ON THE NOVELTY AND USEFULNESS OF CREATIVE IDEAS

From labor songs to Muzak, music has been a feature of nearly every type of working environment. With advances in music technology and availability of music stream services, listening to music at work is easier than ever, and is quickly becoming the norm. Employees spend approximately 30% of their working hours listening to music (Haake, 2011). Despite its growing presence, little is known regarding the effects of music on work outcomes. The lack of research on music by organizational scientists is problematic as there is clear and growing interest on the practitioner side. Recently, popular press articles in the *Wall Street Journal* and *Harvard Business Review* debated advantages and disadvantages of music in the workplace. Yet, despite this interest, few scholarly articles on this topic exist, the most rigorous of which was published more than 20 years ago (Oldham, Cummings, Mischel, Schmidtke, & Zhou, 1995). As a result, we have little wisdom to offer as to why and how music may influence performance at work and for which tasks and work activities is music most beneficial or harmful.

One type of performance outcome that has become increasingly valued by organizations is employee creativity. More than ever, organizations depend on their employees to produce novel and useful ideas, products, and solutions to stay competitive in an ever-changing global economy. Employee creativity is a valuable commodity and is generally thought to improve firm performance (Amabile, 1983; 1996; Gong, Zhou, & Chang, 2013). As a consequence, organizations are motivated to find new ways to inspire and motivate employees to develop their creative capacity. One common method is by encouraging employees to listen to music while working. There is an inherent connection between music and creativity. Playing or composing music is largely seen as a creative activity (Gibson, Folley, & Park, 2009) and individuals often

report listening to music to boost their creative thinking (Dunn, 1997). Yet, very little research focusing on the effects of music on creativity exists in either the organizational sciences or other fields that study the effects of music. Further, the evidence as to whether music is beneficial or harmful for creativity is mixed, with some finding evidence to suggest that music is beneficial (Ritter & Fergson, 2017) and others finding that music is detrimental to creativity (Threadgold, Marsh, McLatchie, & Ball, 2019).

Of the few studies that have looked at the effects of music on creativity, none have systematically investigated the effect of different characteristics of music on the different components of creativity (i.e., novelty and usefulness). For instance, Threadgold, Marsh, McLatchie, and Ball (2019) found that listening to background music both with and without lyrics resulted in poor performance on a creativity task. Most existing research on music and creativity have looked at different types of music based on their perceived emotional characteristics (i.e., how happy or sad the music sounds). For instance, Kavanagh (1987) found that participants who listened to "happy" music solved more anagrams than participants who listened to "sad" music. Adaman and Blaney (1995) found that participants who listened to "elated" music performed better on the Alternative Uses Task than participants who listened to "depressing" music. Similarly, Yamada and Nagai (2011) found that participants produced more novel ideas for different names of rice when listening to "happy" music as opposed to participants who did not listen to music. Again, it is unclear as to what constitutes "happy" music. Likewise, Ritter and Ferguson (2017) examined how listening to classical music that differed in mood and arousal influenced convergent and divergent thinking. Drawing on past research on music and emotions, they argued that music influences arousal and valence of participant affect, which influences creativity. They found that subjectively rated "happy" music

(i.e., high arousal and positive valence), relative to silence, was positively associated with overall divergent thinking. Although they suggest that changes in emotions in response to music influences creativity, they do not demonstrate this empirically, nor do they examine any potential mediating mechanisms that may act as an intermediary links between music and creativity.

A small number of studies have examined the influence of objective characteristics (e.g., pitch, volume, musical key, tempo) on creativity. Ilie and Thompson (2011) found pitch, tempo, and volume intensity influenced participant performance on creative insight tasks. Performance was higher for participants who listened to high-pitch music, rather than low-pitch music, and this effect was fully mediated by the perceived emotional valence of the music. Callaghan and Growey (2013) had participants watch video clips to induce a happy or sad mood and then had participants listen to "happy" (major key/fast tempo) or "sad" (minor key/slow tempo) music while completing the Alternative Uses Task. The authors did not find evidence that music alone was associated with higher creative performance. Instead, they found that listening to sad music when in a sad mood enhanced idea generation (i.e., fluency or number of ideas produced).

Common to all these two studies is the notion that music influences creativity through some combination of mood and arousal. None, however, have explicitly linked individual characteristics of music with mood and arousal and, in turn, with the different dimensions of creativity. Indeed, the studies described above have only focused on understanding the role music plays in predicting creative performance behavior (i.e., idea generation) or the ability to be creative (i.e., divergent thinking). These studies have not examined how music influences the quality or *effectiveness* of generated ideas (i.e., the novelty and usefulness of those ideas). At most, previous studies have only examined novelty, if researchers evaluated effectiveness at all. As I will discuss later, this is problematic because it does not accurately reflect the criterion

space of creativity. Thus, the current literature on music and creativity suffers from little to no theoretical discussion linking music to creativity, poorly designed experimental studies with vague construct operationalization, little empirical examination of mediating mechanisms, conflicting findings, and criterion deficiency. In this paper, I propose that certain characteristics of music—namely, musical key and tempo—influence the degree of novelty and usefulness of generated ideas through the self-regulation of attention.

The structure of the paper is as follows: First, after explaining what creativity is and how it is conceptualized and measured, I review the literature on the putative antecedents of creativity. I then introduce the importance of the self-regulation of attention to the creative process and discuss how affect and arousal influence the self-regulation of attention. Next, I introduce the different characteristics of music and describe how music characteristics can influence attention through their immediate physiological and emotional consequences. I then discuss how different types of creative ideas can manifest based on the degree of novelty and usefulness present (e.g., Litchfield, Gibson, & Gibson, 2015), and explain how listening to music with certain characteristics can lead to the generation of these different types of creative ideas (see Figure 1). This then leads to several novel (and hopefully useful) hypotheses. Finally, I describe a proposed study to test these hypotheses.

Insert Figure 1 here

CREATIVITY: WHAT IS IT?

Creativity is typically defined as the generation of novel and appropriate or useful ideas, solutions, or products (Amabile, 1996). Creative ideas can vary in scope ranging from small

modifications or adaptions (i.e., incremental creativity) to radical breakthroughs or departure from existing practices (i.e., radical creativity) (George, 2007; Madjar, Greenberg, & Chen, 2011; Mumford & Gustafson, 1988). Additionally, creativity is distinct from task performance, and represents a separate aspect of performance. Creative tasks are more complex than normal in-role tasks, may exist outside of one's formal duties and responsibilities, and involve different ways of thinking about problems and situations.

Conceptualization of Creativity

Creativity unfolds through a series of stages, each of which is defined by a particular set of behaviors (Lubart, 2001). Although the number of proposed stages varies, two stages—idea generation and idea evaluation/selection—are present in nearly all proposed models of creativity (Amabile, 1996; Lubart, 2001; Montag, Maertz, & Baer, 2012). The goal of these two stages is to end up with an idea, process, procedure, product or service that is both novel and useful or appropriate (Oldham & Cummings, 1996; Woodman, Sawyer, & Griffin, 1993). The generation of ideas requires behaviors such as recalling previously stored categories of information from long-term memory, developing links between categories, and transforming and synthesizing information into new forms to produce potential responses (Ward, Smith, Finke, 1999). Such behaviors and activities are strongly associated with divergent thinking and, by extension, the novelty of ideas (Cropley, 2006; Zeng et al., 2011). During the idea evaluation/selection, individuals judge the utility and appropriateness of the ideas generated as a solution to the problem and then select the best one. This is accomplished by applying a set of criteria or rules to the generated ideas (Rietzschel, Nijstad, & Stroebe, 2010) and by forecasting the implementation of the ideas (Mumford, Lonergan, & Scott, 2002). This stage is strongly

associated with convergent thinking and is predictive of the overall usefulness of creative ideas (Cropley, 2006).

Traditionally, researchers have considered idea generation as synonymous with creativity (e.g., the number of patent applications or number of suggestions) with studies typically measuring creativity in terms of fluency, flexibility, and originality (e.g., Guilford, 1967). However, this conceptualization, as several researchers have pointed out, is problematic (e.g., Montag et al., 2012; Litchfield et al., 2015; Sullivan & Ford, 2010). For one, these dimensions reflect the cognitive processes involved in the initial generation of new ideas (i.e., early cycle capabilities, Mumford, 2001). In other words, the conceptualization of creativity as fluency, flexibility, and originality only captures capabilities associated with the idea generation stage of the creative process, but not those of the idea evaluation/selection stage (i.e., late cycle capabilities, Mumford, 2001).

Drawing upon this criticism of current practices, researchers have advocated that creativity should be conceptualized and measured in terms of novelty and usefulness (Ford & Gioia, 2000; Mumford & Gustafson, 1988; Litchfield et al., 2015; Sullivan & Ford, 2010). *Novelty* refers to the newness, uncommonness, and distance from standard practice of an idea or solution. *Usefulness*, within an organizational context, reflects the feasibility and value of an idea, product, or solution (Ford & Gioia, 2000; Litchfield et al., 2015). For an idea, product, or solution to be evaluated as creative, it must be both novel *and* useful. If either aspect is missing, then the idea or product is not creative (Amabile, 2012; George, 2007). This raises an important question about the relationship between novelty and usefulness, as there is an inherent tension between the two. Namely, there is a perception amongst laypeople that novelty and usefulness are opposite ends of same dimension such that, as the novelty of the idea increases its practicality

decreases and vice versa (Diehl & Stroebe, 1987; Ford & Gioia, 2000; Rietzschel et al., 2010). This perception is further propagated with the use of unidimensional measures of creativity that largely focus on novelty (Sullivan & Ford, 2010). However, a stream of research has demonstrated that novelty and usefulness are conceptually and empirically distinct from one another (Sullivan & Ford, 2010). Indeed, empirical evidence suggests that novelty and usefulness are determined by different antecedents (Auia & Goncalo, 2007; Beersma & De Dreu, 2005; Grant & Berry, 2011; Zhou, Wang, Song, & Wu, 2017) and predict different outcomes (Smith & Yang, 2004).

Antecedents of Creativity

Understanding the antecedents that give rise to creativity has long been of interest to researchers (Shalley, Zhou, & Oldham, 2004). More, however, is known regarding the antecedents of novelty, rather than usefulness, due to how creativity is typically measured (Montag et al., 2012). Organizational research on creativity has focused heavily on identifying the personal and contextual factors that influence creative performance at work, such as leadership (Gong, Huang, & Fahr, 2009; Shalley & Gilson, 2004; Tierney, Farmer, & Graen, 1999; Zhang & Bartol, 2010), work design (e.g., task autonomy, feedback, job complexity, rewards; George & Zhou, 2002; Oldham & Cummings, 1996; Tierney & Farmer, 2002) and organizational and/or team climate (Hunter, Bedell, & Mumford, 2007; Wang & Rode, 2010). Additionally, a wealth of research suggests that personal characteristics such as personality traits (Feist, 1998; George & Zhou, 2001; McCrae, 1987) and cognitive thinking styles (Masten & Caldwell-Colbert, 1987; Tierney, Farmer, & Graen, 1999) influence creativity.

In addition to identifying predictors that are relatively stable in nature, research has also focused on potential antecedents that can fluctuate from moment to moment. In particular,

research has focused on the emotional antecedents of creativity. A large body of research suggests that positive affect facilitates creativity (e.g., Amabile et al., 2005; Baas, De Dreu, & Nijstad, 2008; Davis, 2009; Isen, Daubman, & Nowicki, 1987; Vosburg, 1998a; 1998b). Yet, other research has demonstrated that negative affect can also facilitate creativity (Abele-Brehm, 1992; Akinola & Mendes, 2008; Kaufmann & Vosburg, 2002). To account for these conflicting findings, scholarly work has begun to focus more on the intermediating processes that link affect to creativity. Recent theorizing and empirical evidence suggest that state affect leads to creativity by influencing different cognitive processes (De Dreu, Baas, & Nijstad, 2008; Nijstad, De Dreu, Rietzschel, & Baas, 2010). However, these current theories explain how different affective states influence cognitive processes to influence the novelty *and* usefulness of creative solutions or ideas.

Cognitive Theories of Creativity

The cognitive tuning model (Clore, Schwarz, & Conway, 1994) proposes that activating positive affective states encourages heuristic processing styles and leads individuals to experience their situation as safe to explore novel pathways and possibilities; activating negative affective states encourages analytical processing styles and leads individuals to experience their situation as problematic and threatening. Building on this model, the dual-pathway model of creativity (DPMC) suggests that, depending on one's state affect and level of arousal, individuals utilize two different cognitive pathways (i.e., cognitive flexibility and persistence) to achieve creative outcomes (De Dreu et al., 2008; Nijstad et al., 2010). The DPMC argues that executive functions (i.e., working memory) underlie both the flexibility and persistence pathways. Whether one adopts the flexibility route, persistence route, or a combination of the two depends on how affect and arousal influence working memory capacity. Although the DPMC argues that both

pathways lead to creativity, there are several limitations of the model in its current form. First, the emphasis of the model and subsequent empirical evidence is on the novelty component of creativity (as characterized by flexibility, fluency, and originality)—not the usefulness of these ideas. Second, the original model does not explain how ideas that are both valuable and feasible result from either of these pathways (Sowden, Pringle, & Gabora, 2015). Third, the model subsumes inhibitory control under working memory. Although there is some debate regarding the dimensionality of executive functions, there is evidence to suggest that inhibitory control and working memory are distinct constructs (Diamond, 2013; Miyake et al., 2000). As a consequence, the potential unique effects of inhibitory control in the creative process are not fully known. Finally, although the DPMC suggests that creativity can occur through a combination of the two pathways, it is unclear how this happens. Some have proposed that this requires adjusting the focus of attention based on task demands (Sowden et al., 2015; Vartanian, Martindale, & Matthews, 2009), which, again, implies that both working memory and inhibitory control play a crucial role in the creative process.

Indeed, more recent research on the mood-creativity link has found that attention is the mediating mechanism by which emotions influence creativity (Tidikis et al., 2017). This suggests that the regulation of attention is a critical component of the creative process and requires the engagement of executive function as self-regulatory processes. It is evident that additional theoretical and empirical work is needed to untangle the complex relationship between affect, cognition, and creativity. Adopting the self-regulatory framework that I describe below extends these current theories by clarifying the affect-cognition-creativity relationship and offers a potential explanation as to how changes in momentary states (i.e., affect and arousal) can influence the novelty and usefulness of creative ideas, products, or solutions. Further, this

framework provides a link between music and creative outcomes, which has yet to be addressed in the current literature.

SELF-REGULATION OF ATTENTION: THE ROLE OF AFFECT AND AROUSAL

Self-regulation reflects a fundamental capacity to regulate and control one's emotions, cognitions, and behavior (Vohs & Baumeister, 2004). Although there are various processes by which self-regulation occurs, executive functions are thought to be critical to the self-regulation of attention (e.g., Diamond, 2013; Hofmann, Schmeichel, & Baddeley, 2012). Executive functions are a family of higher-order cognitive processes that are engaged when concentration and active attention are required, or when reliance on automatic or instinctual processes is unwise (Diamond, 2013). *Inhibitory control* is the ability to block competing goals, temptations, and distractions (Baumeister, Bratslavsky, Muraven, & Tice 1998; Diamond, 2013). *Working memory* refers to the ability to maintain and update existing knowledge and information sets as rules, demands, or priorities change (Baddeley, 2012; Engle & Kane, 2003). Working memory is essential for cognitive flexibility and task switching (Blair & Ursache, 2011; Diamond, 2013). Together, these two capabilities are crucial for consolidating information, planning and problem solving, dealing with dangerous or challenging situations, and coordinating thought and action in the pursuit of goal-directed behavior (Banfield et al., 2004; Diamond, 2013; Kaplan & Berman, 2010). In other words, executive functions represent the cognitive mechanism for regulating attention.

A critical human function, and an element of self-regulation, is the control of one's attention. Attention refers to the activation and accessibility of cognitive representations (e.g., information, stimuli, goals; Bosco, Allen, & Singh, 2015). Attention is a limited capacity resource, and our attentional capacity determines the selectivity of task cues—features of the task

at hand and the surrounding environment (Kahneman, 1973). Attentional capacity is similar to the beam of a spotlight—it can be narrowly focused or broadly distributed (Easterbrook, 1959; Wachtel, 1967). When attentional capacity is broad, people focus on a large range of stimuli and are more aware of task-irrelevant information. In contrast, people focus on a small range of stimuli and filter irrelevant stimuli from their awareness when attention is narrow.

Although several factors influence the scope of one's attentional capacity, research has consistently shown that our emotions and level of activation (i.e., arousal) can narrow or expand attentional breadth. The valence of emotions influences attentional breadth such that positive emotions broaden and negative emotions narrow attention (Derryberry & Tucker, 1994; Fredrickson, 2001). Broadening or narrowing of attention due to emotional reactions occurs for several reasons. One is the activation of the neural networks that underlie attention in response to emotional stimuli (Jiang, Scolaro, Bailey, & Chen, 2011). The experience of negative affect triggers the release of stress hormones, such as norepinephrine, that bind to receptors in the right hemisphere, which is responsible for sustained selective attention (Fan, McCandliss, Sommer, Raz, & Posner, 2002; Garavan, Ross, & Stein, 1999). Conversely, the experience of positive affect facilitates the broadening of attention through the associated secretion of dopamine. The executive control system of attention is regulated by activation of dopamine receptors in the anterior cingulate cortex (ACC) and the dorsolateral prefrontal cortex (DLPFC) (Ashby et al., 1999; Bush, Luu, & Posner, 2000). Increased levels of dopamine are associated with greater activation of these regions and subsequent improvements in working memory capabilities (Floresco & Phillips, 2001; Vijayraghavan, Wang, Birnbaum, Williams, & Arnsten, 2007).

Another reason is that emotions provide important signals about the immediate situation and influences how we attend to features within the surrounding environment (Schwartz &

Clore, 1983). Positive emotions signal the absence of a threat; the situation is safe enough that the diffusion of attention does not pose any foreseeable risks (Park & Banaji, 2000; Wegener & Petty, 1994). Negative emotions, in contrast, signal that the situation is threatening or problematic and requires our immediate and focused attention (Fredrickson, 2001; Park & Banaji, 2000).

Likewise, physiological arousal affects the availability of attentional resources towards goal accomplishment. Specifically, attention is broad when arousal is low and narrow when arousal is high (Easterbrook, 1959; Kahneman, 1973). Again, the broadening or narrowing of attention happens in response to how arousal affects the concentration of neurochemicals and their activation on the neural subsystems that underlie attention. At low levels of arousal, levels of key neurotransmitters such as norepinephrine and dopamine are also low, reducing synaptic activity in the frontal lobes (Arnsten & Li, 2005; Blair & Ursache, 2011). As arousal levels increase, levels of these neurochemicals increase, enhancing synaptic activity in the PFC as neural receptors become saturated (Robbins & Arnsten, 2009). As such, higher levels of arousal narrow attention and reduce the range of informational cues that people use from their surroundings (Easterbrook, 1959; Kahneman, 1973). Lower levels of arousal broaden attention and expand the range of stimuli and environmental cues to which people attend.

Attentional breadth manages the influx of task relevant or irrelevant information in our conscious processing (e.g., Conway & Engle, 1994; Conway & Morey, 2006) and the mix of relevant and irrelevant cues influences the effectiveness of working memory and inhibitory control. Narrow attention enables inhibitory control because the range of informational cues is limited to those that are task-related; thus, one can better maintain task-relevant information. Limited attention, however, is counterproductive for working memory capabilities because a

broader array of informational cues is needed to update existing information and make connections between different ideas. With regard to creativity, both types of cognitive self-regulatory processes are needed. To form new ideas, one must be able to make connections between disparate pieces of information, which requires one has awareness of a variety of informational sources. This requires a reliance of working memory capabilities. To select a unique idea that will also be the most appropriate, one must maintain their focus on the end-goal and the criteria that must be met for a potential solution to be considered so (e.g., will it confer value to the organization? Does the organization have the capabilities to implement it?). Indeed, brain imaging studies have revealed that prefrontal cortical activity increases when individuals engage in creativity tasks (Geake & Hansen, 2005; Howard-Jones, Blakemore, Samuel, Summers, & Claxton, 2005), suggesting that executive functions play a critical role in facilitating the creative process.

Thus, to understand how music may impact creativity within the context of executive functions and self-regulation, one needs to understand why and how music influences emotions and physiological arousal, and as a consequence, attention. Recently, Keeler and Cortina (In press) proposed a conceptual model of how music may impact several job performance outcomes. Specifically, the authors proposed that music influences executive functions by affecting attentional breadth. They argue that different characteristics of music (i.e., musical key and tempo) broaden or narrow attention through their individual effects on affect and arousal. It is the resulting breadth of attention, I argue, that fuels executive control over the cognitions and behaviors that lead to creative ideas.

THE EFFECT OF MUSIC CHARACTERISTICS ON ATTENTION MECHANISMS

In their model, Keeler and Cortina (In press) discuss the four objective characteristics of music (musical key, tempo, complexity, and volume) that influence self-regulatory processes. In this paper, I focus on the two characteristics—musical key and tempo—that have the most potential to influence creativity. It is important for the reader to remember that musical characteristics are experienced simultaneously. Hence, although I discuss musical key and tempo and their effects on attention separately for ease of understanding, the hypotheses regarding creativity focus on their combined effects. For readers who want a more in depth explanation of musical theory and terms, I refer them to my website (www.workingtothebeat.com).

Musical Key

Musical key establishes the tonality of a song and, in Western music, is either major or minor. The main distinction between major and minor keys is the distance between the first and third note within a musical scale. In a major scale, the third scale tone is an interval or distance of a major third above the tonic or root of the scale (e.g., four half steps). Examples of songs in a major key include Beyoncé's "Single Ladies," Vivaldi's Violin Concerto in E major No. 1 "Spring," and Beatles' "Here Comes the Sun." In a minor scale, the third scale tone is a minor third above the tonic. The keys for Adele's "Hello," "Habanera" from the opera *Carmen*, and Kanye West's "Stronger," are all minor.

How musical key influences the valence of emotions. Musical key is largely responsible for our emotional responses to music. Research has consistently found that listening to music in a major key elicits a positive emotional response, whereas a minor key elicits a negative emotional response (Hunter, Schellenberg, & Griffith, 2011; Thompson, Schellenberg, & Husain, 2001). For example, Sutton and Lowis (2008) duplicated and digitally altered a Handel sonata that was originally in F major to F minor. Participants listened to both versions

and rated the major key version of the piece as emotionally positive and the minor key version as emotionally negative.

There are several mechanisms by which musical key produces an emotional response. One is through the activation of neural structures and the release of neurochemicals responsible for emotional reactions. The experience of positive and negative emotions corresponds to activation in the left and right hemispheres of the brain, respectively (Davidson, Schwartz, Saron, Bennett, & Goleman, 1979). The experience of positive emotions, such as joy, interest, and happiness is associated with activity in the left frontal region of the PFC. Emotions such as fear, disgust, and sadness corresponds with greater activity in the right frontal regions (Davidson & Irwin, 1999; Harmon-Jones & Sigelman, 2001). Left frontal activation is assumed to underlie positive feelings because of its close relationship with the mesolimbic dopamine (DA) system (Tomarken & Keener, 1989). Increases in dopamine levels are related to increases in positive affect, and mesolimbic dopamine activity mediates cognitive processes controlled by the prefrontal cortex (PFC) (Ashby, Isen, & Turken, 1999). Conversely, the release of stress hormones such as cortisol and norepinephrine are associated with the experience of negative emotions (Hanson, Maas, Meijman, & Godaert, 2000).

Listening to music in a major key enhances left frontal activation and the synthesis of dopamine—positron emission tomography (PET) scans show that music triggers the release of dopamine during peak emotional experiences (Sutoo & Aikyama, 2004). In contrast, listening to music in a minor key generates greater right frontal activation (Schmidt & Tranior, 2001) and activates neural areas responsible for eliciting fear and alarm responses (e.g., the thalamus and amygdala; Pallesen et al., 2005). Activation of these neural regions suppresses the release of

dopamine and increases the release of stress hormones (i.e., adrenaline and cortisol), which prompt aversive responses such as fear, revulsion, etc. (Berger, 2011).

Musical key can also influence emotions through evaluative conditioning (Juslin & Västfjäll, 2008). Conditioning refers to the repeated pairings between an initially neutral conditioned stimulus and an affectively valenced, unconditioned stimulus. After being paired, the conditioned stimulus is then able to elicit the same affective state as the unconditioned stimulus. When musical key is are repeatedly paired with specific emotionally laden stimuli (e.g., major key paired with positive emotional stimuli) this can lead to a conditioned response in listeners (Juslin & Västfjäll, 2008). In other words, we are conditioned to associate major key music with positive emotions and feelings and minor key music with negative emotions. Movies and TV shows frequently use musical key to convey the emotion. For instance, the theme for *Schindler's List* is in a minor key. The theme for the *Indiana Jones* film series is in a major key. This pairing of musical keys with emotionally laden stimuli is also seen in popular music. Most songwriters will use a minor key when writing a song about a painful breakup. Taken as a whole, the extant research suggests that music can influence emotional responses through its key.

Hypothesis 1a: Positive state affect is higher while listening to music in a major key and lower while listening to music in a minor key.

Hypothesis 1b: Negative state affect is higher while listening to music in a minor key and lower while listening to music in a major key.

How musical key influences attention. Musical key impacts the breadth attention by triggering positive or negative affect (e.g., Jefferies, Smilek, Eich, & Enns, 2008). Positive affect broadens the scope of attention, incorporating more features and events from the environment into one's thinking (Fredrickson & Branigan, 2005; Rowe, Hirsh, & Anderson, 2007). Under a

state of positive affect, people demonstrate greater verbal fluency (Phillips, Bull, Adams, & Fraser, 2002), make more novel associations between disparate or unrelated ideas (Isen, Johnson, Mertz, & Robinson, 1985) and exhibit more flexible categorization and thinking (Isen et al., 1987). In contrast, negative affect narrows attention (Derryberry & Tucker, 1994; Gasper & Clore, 2002). People engage in more constrained and analytical thinking when experiencing negative affect (Schwarz & Bless, 1991). Further, negative affect is related to greater anchoring effects, such that one becomes fixated on an idea and cannot see alternative solutions (Lyubomirsky, King, & Diener, 2005), thus compromising cognitive flexibility (Mitchell & Phillips, 2007).

Because major and minor keys elicit different affective responses, I propose that the key of the song to which one is listening influences attentional breadth. Specifically, when listening to music in a major key, this characteristic generates positive emotional response, which increases attentional availability. Conversely, when people listen to music in a minor key, it generates negative emotions, which should narrow attention to limit variety of stimuli.

Hypothesis 2a: Music that is in a major key elicits positive affect and broadens attention.

Hypothesis 2b: Music that is in a minor key elicits negative affect and narrows attention.

Tempo

When we listen to music, we often tap our feet or nod our heads to the beat or pulse of the music. The speed at which we do this is an indication of tempo. *Tempo* is the speed at which a piece of music is played and is measured in beats per minute (BPM). Generally, a song is considered to have a fast tempo if it is about 120 BPM or more. Songs such as the Rolling Stones' "Paint it Black," Drake's "Hotline Bling" and the overture from Rossini's *William Tell* all have tempos faster than 130 BPM. Moderately paced songs, such as the Cyndi Lauper's

"Girls Just Wanna Have Fun," the Bee Gee's "Stayin' Alive," and Beethoven's "Symphony No 7 (*allegretto*)," are about 100 BPM. Songs are categorized as slow if they have a tempo less than 80 BPM. For example, The Eagle's "Desperado," Christina Aguilera's "Beautiful," and Saint-Saens' "Le Cygne (The Swan)" are all slower than 75 BPM.

How tempo influences arousal. The feeling of chills or tingling sensation across the skin while listening to music is an example of physiological arousal. Manifestations of arousal include increased heart rate, higher blood pressure, pupil dilation, and increased skin conductance. Tempo induces arousal through synchronization of neural activity, based on the principle of entrainment (Bernardi, Porta, & Sleight, 2006; Khalfa, Roy, Rainville, Dalla Bella, & Peretz, 2008). Entrainment theory posits that two particles oscillating at a similar frequency will synchronize with each other and will vibrate at the same frequency. Many physiological processes are composed of regular and cyclical vibrations. When a songs tempo is at the same speed as resting heart rate, about 80 BPM, it can act as a synchronizer (Yehuda, 2011). Once in synch, increases or decreases in tempo should have corresponding increases and decreases in arousal. For example, blood pressure, heart rate, and respiratory rate increase while listening to music with fast tempos as opposed to slow tempos (Bernardi et al., 2006; van der Zwaag et al., 2011). Other characteristics, such as musical key, are unrelated to physiological arousal (van der Zwaag et al., 2011). Thus, tempo is the main characteristic of music that affects arousal.

Hypothesis 3: There is a positive relationship between tempo and arousal, such that arousal levels increase as tempo increases.

How tempo influences attention. Tempo influences the availability of attention through changes in arousal (Jefferies et al., 2008). As discussed earlier, changes in arousal broaden or narrow attention (e.g., Easterbrook, 1956). Specifically, attentional breadth increases as arousal

decreases. This suggests that changes in tempo elicit similar changes in attention. Specifically, listening to music that is slow reduces arousal, which in turn broadens attention; a broader range of attention enhances flexibility of thought and the merging of ideas. Listening to fast music increases arousal, which narrows attention; a narrower range of attention reduces the presence of distracting cues and enhances concentration.

Hypothesis 4a: Listening to music with a slow tempo decreases arousal levels, which broadens attention.

Hypothesis 4b: Listening to music that is fast in tempo increases arousal levels, which narrows attention.

CONSEQUENCES OF MUSIC ON CREATIVE OUTCOMES

The potential impact of music on the self-regulation of attention suggests a wide variety of implications for employee creativity. Indeed, prior research has found that attentional scope to be a key mediator of the mood-creativity relationship (Tidikis et al., 2017). Further, self-regulatory processes such as working memory, and to a lesser extent, inhibitory control are theorized to play a key role in the creative process (De Dreu et al., 2008). Prior research, however, has only focused on how the self-regulation of attention influences creative performance behavior, rather than creative outcome effectiveness. Although individuals can generate more or fewer ideas under certain conditions, this is not an indication quality. Not all creative ideas are equal—they vary in their novelty and/or usefulness (Litchfield et al., 2015; Montag et al., 2012). Generating one highly novel and useful idea is clearly more valuable for an organization than generating 10 bad ideas. But because of how creativity is traditionally measured (i.e., number of ideas generated), the person who generated the 10 bad ideas would receive a higher creativity rating than the person who generated the one breakthrough idea.

Recently, Litchfield, Gilson, and Gilson (2015) argued that novelty and usefulness are orthogonal constructs with their own continuum that range from incremental to radical (i.e., low to high novelty) and from foolish to breakthroughs (i.e., low to high usefulness). They proposed that different creative ideas emerge depending on the unique mix of novelty and usefulness: foolish (high novelty/low usefulness), low-hanging fruit (low novelty/high usefulness), breakthroughs (high novelty/high usefulness), and bad ideas likely to stay bad (low novelty/low usefulness). In the section that follow, I argue that the combination of different characteristics of music leads to the generation of ideas that range from the bad (low novelty/low usefulness) to the ground breaking (high novelty/high usefulness) by how these music characteristics influence attention through their immediate impact on state affect and physiological arousal.

Worthless Follies

According to Litchfield et al. (2015), *foolish* ideas are those that are highly novel, but yield little utility because they are not feasible or valuable. For instance, sending internal memos using paper airplanes in order to minimize cyber security threats is novel, but has little practicality or value, and as such would be considered foolish. Given that working memory involves incorporating and updating information and switching between mental sets, and its close association with cognitive flexibility and divergent thinking, this self-regulatory process is the predominate determinant of novelty (e.g., Benedek, Jauk, Sommer, Arendasy, & Neubauer, 2014). As describe earlier, individuals generate more novel ideas under conditions that facilitate cognitive flexibility (e.g., DeDreu et al., 2008). In contrast, inhibitory control involves selective attention and blocking periphery informational cues, and is closely associated with constrained, analytical thinking, which suggests that this process may be the primary predictor of usefulness. Inhibitory control, however, likely diminishes novelty because selective attention precludes

flexible thinking. Thus, when attention is broad such that working memory is facilitated but inhibitory control is impaired, creative ideas were conceptually determined by novelty and very little or if any usefulness. This suggests that characteristics that facilitate or impair these executive functions may influence the degree of novelty or usefulness of generated ideas. Specifically, listening to music that is in a major key and slow in tempo (e.g., John Lennon's "Imagine") should yield ideas that are highly novel but low in usefulness by expanding attentional scope. Music that is in a major key expands attention by inducing positive affect. Further, listening to music with a slow tempo reduces arousal levels, which in turn broadens attention. When listening to music with these characteristics, working memory is maximally facilitated but inhibitory control is impaired. Thus, the cognitive processes needed to evaluate the appropriateness of the idea are not engaged, and as such the construct of creativity is determined solely by novelty. Thus, I propose that listening to music that is in a major key and slow in tempo, should yield creative outcomes that are foolish in nature.

Hypothesis 5: Listening to music that is in major key and has a slow tempo results in more ideas that are high in novelty and low in usefulness by broadening attentional breadth.

Low-Hanging Fruit

In contrast to ideas that are considered too novel, other ideas can be too useful or mundane. Ideas that are highly useful, but low on novelty are termed by Litchfield and colleagues as *low-hanging fruit*. These types of ideas are practical and have the potential to offer value but may not be far removed from what is currently in done. For instance, switching from a human to a robotic assembly line in a manufacturing factory will generate a lot of value and is feasible, and is therefore highly useful, but is low on novelty; this proposal would be considered

low-hanging fruit. Such ideas likely come about from the narrowing of attention because this facilitates inhibitory control and impairs working memory. When attention is narrow such that inhibitory control is facilitated and working memory is impaired, creative ideas were conceptually determined by usefulness and very little or if any novelty. This suggests that characteristics of music that limit attentional breadth (i.e., minor key and fast tempo) enhance the likelihood of generating high practical but very mundane ideas. Music that is minor in key narrows attention by increasing negative affect and fast paced music also narrows attention by increasing arousal. Together, the combination of minor key and fast tempo (e.g., Nirvana's "Smells Like Teen Spirit") narrows attention to the point at which inhibitory control is fully enhanced, but working memory is impaired. In other words, the cognitive processes required to encourage novelty are not engaged. Thus, when listening to music in a minor key and with a fast tempo, the resultant creative ideas were conceptually determined by usefulness and very little or if any novelty.

Hypothesis 6: Listening to music that is in minor key and has a fast tempo results in more ideas that are high in usefulness and low in novelty by narrowing attentional breadth.

Breakthrough Ideas

Ideas that are both highly novel and highly useful are what Litchfield et al label as *breakthroughs*. A clear example is the invention of the Post-it note: its creator, Art Fry, was looking for a solution to his problem of bookmarking his choir hymnal. The Post-it note was quickly recognized as a product that was novel, as well as practical. The generation of an idea or solution that is both novel and useful is a complex task that requires the engagement of higher-level cognitive processes. Executive functions form the foundation of several higher-level cognitive abilities such as planning and problem solving, which are important for successful

performance (Drasgow, 2013). This suggests that working memory and inhibitory control are both crucial for the successful completion of creative problem solving (Diamond, 2013). Specifically, I argue that the generation of breakthrough ideas requires an optimal range of attention to facilitate both working memory and inhibitory control to achieve the simultaneous goal of high novelty and high usefulness. The novelty of an idea depends on the engagement of working memory; one must make connections between seemingly unrelated concepts cognitive categories to generate highly original ideas. Yet, the generation of breakthrough ideas also requires inhibitory control: one must determine the source of the problem and evaluate which possible solutions are the most viable. This implies that attention needs to be broad enough to engage working memory capabilities, but also narrow enough so that individuals ultimately select the appropriate action or solution. Put differently, the production of ideas that are both highly novel and useful requires the complementary functioning of both working memory and inhibitory control. This means that attention can neither be too broad nor too narrow.

With regard to music, the generation of breakthrough ideas should be enhanced when listening to combinations of music that assist *both* inhibitory control and working memory. Specifically, I propose that listening to music that is in a major key and has a fast tempo yields an optimal breadth of attention that enables both self-regulatory processes. Listening to music in a major key elevates feelings of positive affect and broadens attention. This, in turn should enhance the novelty of generated ideas because the broadening of attention facilitates working memory capabilities. Yet, to these ideas need to also be useful, which suggests attention needs to be narrow enough to facilitate inhibitory control without compromising working memory. Listening to a song with a fast tempo counterbalances the effects of key by narrowing attention to enhance inhibitory control. Listening to music with a very slow tempo would impair inhibitory

control, making it difficult for individuals to systematically evaluate multiple alternative solutions and select the best one because of the presence of too many distracting or irrelevant informational cues. Thus, the combination of major key and fast tempo (e.g., Marvin Gaye's version of "Ain't No Mountain High") allows for the optimal breadth of attention needed to facilitate both working memory and inhibitory control; this combination facilitates the active maintenance of task goals, allows for individuals to make connections between different categories, yet enables one to selectively attend to task relevant information and evaluate various possible outcomes. As a consequence, these ideas should be both highly novel and useful.

Hypothesis 7: Listening to music that is in major key and has a fast tempo results in more ideas that are both highly novel and highly useful by facilitating an optimal breadth of attention.

Bad Ideas

Finally, some ideas are just bad. According to Litchfield et al., *bad ideas* are those that are both low in novelty and in usefulness. These ideas do little to extend current practices or may even be antagonistic to other practices and routines and lack originality. Such ideas do not come about through the engagement of engagement of high-order cognitive processes. Put differently, these ideas are the product of simple, automatic thinking. Dual-process theories, in general, suggest that there are two different modes of processing: those that are unconscious, fast, and automatic (i.e., Type 1) and those that are conscious, slow, and deliberative (i.e., Type 2) (Evans, 2008). Executive functions represent Type 2 processes; Type 1 processes, in contrast, are reflexive and tend to yield poorer decisions or ideas (Snowden et al., 2015). Creativity large comes from the engagement of Type 2 processes (although Type 1 processes may supply information to be further explored in Type 2 processes; Evans, 2008). Thus, when executive

functions are not engaged, automatic thinking processes take over. As a consequence, any solutions that are formed utilizing Type 1 processes are likely to be low in both novelty and usefulness. With regard to music, this suggests that any combination of characteristics that does not affect attentional breadth in a way that optimizes inhibitory control and/or working memory, may yield bad ideas. Specifically, I argue that listening to music that is in a minor key and is slow in tempo (e.g., Adele's "Hello") fails to engage executive functions and therefore only facilitates Type 1 processes. Attention under these conditions is too broad to optimize inhibitory control. However, the increase in negative affect (due to minor key) will reduce cognitive flexibility. Further, this combination yields an imbalance between inhibitory control and working memory: Inhibitory control is not optimized to an equal degree as working memory; thus, individuals are more likely to be distracted by irrelevant task demands or stimuli. With this combination of characteristics, executive functions are not engaged, thus increasing a reliance on Type 1 processes. Ideas generated while listening to music with these characteristics will, as a result, be low in novelty and low in usefulness.

Hypothesis 8: Listening to music that is in minor key and has a slow tempo overly broadens attention, which results in the generation of more ideas that are low in novelty and low in usefulness.

METHODS

Power Analysis

A power analysis for each stage of the path model was conducted using G*Power 3.1 (Faul, Erdfelder, Lang, & Buchner, 2007). Cohen (1992) described effect sizes for multiple and multiple partial correlations of 0.02, 0.15, and 0.35 as being small, medium, and large, respectively. Based on pilot data results, the anticipated effect size for the relationship between

musical key and state affect is 0.08 and for the relationship between tempo and arousal is 0.5, which with an $\alpha = 0.05$ and 80% power requires an *N* of approximately 124 and 23, respectively. The anticipated effect size for the relationship for state affect and attention is 0.093, which is consistent with previous literature (e.g., Gable & Harmon-Jones, 2010) and for the relationship of arousal on attention is 0.17, again consistent with prior research (e.g., Tidikis et al., 2017). Thus, assuming a $\alpha = 0.05$ and 80% power, the anticipated *N* for these paths was approximately 100 and 60, respectively. For the effect of attention on creativity, prior research suggests an effect size of 0.03 (Tidikis et al., 2017). Again, assuming a $\alpha = 0.05$ and 80% power, the anticipated *N* was 325.

Participants

Participants were undergraduate business students from a large mid-Atlantic public university. Students were recruited from several large sections of an introductory management course. The lead investigator came to each section to provide a general overview of the study. Participants received class credit for participating in the study. A total of 436 students participated. Participants were mainly White (*n* = 172, 39.4%) and male (*n* = 219, 50.2%). The average participant age was 22.5 with a range of 18 to 56. Most participants were in their second year or more in college (*n* = 271, 62.2%). The sample was evenly split with half of participants being transfer students. The large majority of participants (88.5%) indicated that they listened to music while engaged in some type of activity and tended to listen to music the most at home, then at school, and then at work. The majority of participants (71.3%) indicated that they play an instrument or sing and, of those, more than half (56.0%) had some formal musical training. The average number of years of musical training was 4.87. The most commonly endorsed preferred

genre was rap (*n* = 340, 78.2%), followed by pop (*n* = 275, 63.1%), R&B (*n* = 244, 56%), and rock (*n* = 213, 49%).

Experimental Design and Task

Design. The proposed study will employ an experimental 2x2 between-subjects design with two different control conditions (active vs. passive). Participants in the active control condition listened to nature sounds, whereas the participants in the passive control group did not listen to anything. Measures were collected at multiple times throughout the experiment. The benefits of this type of design allow for stronger causal inferences to be made by reducing several threats to internal validity (Shaughnessy, 2011). Participants were randomly assigned to one of 6 conditions: major key/fast tempo (*n* = 76), major key/slow tempo (*n* = 76), minor key/fast tempo (*n* = 77), minor key/slow tempo (*n* = 73), active control (*n* = 65), or passive control (*n* = 69). Assignment of the participants to condition was done using a random number generator. This study was approved by Institutional Review Board at Virginia Commonwealth University (Protocol # HM20011629).

Task. The task for this experiment was a creative problem-solving task adapted from Baer, Leenders, Oldham, and Vadera (2010). Creativity is domain specific and, as such, what is considered creative in one domain may not be creative in another domain (Ford & Gioia, 2000). This becomes an important issue when selecting an appropriate task to assess creativity. This also implies that some level of expertise in or knowledge of the domain is necessary for both the creator and judge. Thus, the task had participants generate creative (i.e., original and potentially useful) ideas that address two issues related to student life: (1) improving the transition from high school to college for entering students and (2) improving the quality of life for students once they arrived on campus. Participants had 10 minutes to generate ideas for both issues.

Participants were asked to come up with a minimum of two different ideas for each problem. Baer et al. (2010) demonstrated that this task is moderately interesting to participants, which is an important prerequisite for participants to produce creative ideas (Shalley & Oldham, 1997).

Procedure

Experiment manipulation. Upon arriving at the lab, participants were greeted by the experimenter and told to sit in front of a lab computer. The computer was open to a survey accessed through the Qualtrics platform, which the participants used to complete all measures and experimental tasks in the study. The participants were told the purpose of this study is to understand how one's emotional state influences creativity. They were not told that the study is about music so as to avoid any threats to internal validity such as contamination effects, compensatory rivalry, or resentful demoralization (Shadish, Cook, & Campbell, 2002). Participants in all study conditions were told that they would complete several tasks, including one that measures creativity. They were told that they will have their blood pressure taken three times throughout the session and fill out several measures at the end of the study. Participants in the experimental conditions, however, were told that they would be listening to music while completing the task and participants in the active control condition were told they would be listening to nature sounds. Participants then read an informed consent on the computer screen and asked to either select "agree" or "disagree" to participate. If participants decide to not participate or withdraw from the study, the experimenter closed out their session and their responses were permanently deleted.

After signing the informed consent, participants were then fitted with an ambulatory blood pressure monitor—which remained on their non-writing arm for the remainder of the experiment—and practiced using the monitors. Participants were then asked to sit quietly for

two minutes prior to taking their first blood pressure reading. Next the participant will take the SAM to measure subjective arousal and the PANAS and Affect Grid to establish initial state affect. The experimenter then provided an overall roadmap of the study. Instructions for each task were presented on the computer screen.

Next to each computer was an iPod and headphones on which the different experimental conditions and active control condition were presented as different playlists. Prior to participants entering the lab, the researcher ensured that the correct playlist is selected. The playlist was on "shuffle" mode so that the audio selections within a given condition are presented in a random order. The participants were instructed to put the headphone on and start playing the audio for three minutes. Participants were told that they should focus on the audio during this period and that they will be asked questions about the selections later in the session. This is in keeping with prior music research (Adaman & Blaney, 1995). Prior research has found significant changes in mood after exposure to music for as little as 15 seconds to 20 minutes (e.g., Adaman & Blaney, 1995; Ritter & Ferguson, 2017). Three minutes was deemed an acceptable trade-off to give participants enough time to listen to the music or nature sounds but also maintain their interest in the study. This did not occur in the passive control condition. Across all conditions, the volume was kept a constant level (50 dB). For the experimental and active control conditions, the audio played for the entire duration of the experiment until the session was complete.

After listening to the music or nature sound audio for three minutes, participants had their blood pressure taken and then completed the SAM, PANAS and Affect Grid for a second time. The audio was still playing throughout. Participants then completed the attention task. Following the completion of the attention task, participants received on-screen instructions regarding the creativity task. Participants had eight minutes to provide at least two potential solutions or ideas

for each issue. After the time expired, participants reviewed their answers and were asked to select the two most creative ideas for each issue. The procedure for participants in the passive control condition (i.e. no music playing) was the same expect that they did not have the three-minute listening period prior to taking the second wave of affect and physiological measures.

After selecting their final ideas, participants in the experimental and active control conditions were instructed to remove the headphones. In the experimental conditions, participants answered questions about how familiar they were with the music, how distracting was the music, how much did they like the music, and indicate their musical preference. Participants in the active control answered similar questions but the wording of the questions was changed to reflect their attitudes regarding the nature sounds they heard. Participants in the passive control condition only indicated their musical preference. All participants provided basic demographic information, such as age, biological sex, year in college, etc., as well as whether they were a transfer student. Following this, all participants completed the NEO-PI-R subscales for extraversion and openness to experience, as well as measures of creative self-efficacy and trait regulatory focus. After completing these measures, all participants took their blood pressure and completed the SAM, PANAS, and Affect Grid a final time.

Following the completion of the study, participants in all study conditions were debriefed regarding the true purpose of the study. Specifically, participants were told that the real purpose of the study is to understand how music affects creativity and that they were randomly assigned to either an experimental group or to a control group. They were asked not to tell others they may know the true purpose of the study to ensure the integrity of the research. The experiment was one hour in length for which students received extra credit.

Creativity ratings. Employees within the Office of Student Affairs (n = 20) evaluated the novelty and usefulness of each participant's response. The majority of judges were academic advisors (n = 15, 75%) in various departments (i.e., psychology, business, chemistry, etc.). The other five worked in career services (n = 2), student life (n = 2), and in enrollment and recruitment (n = 1). Using employees within the Office of Student Affairs as judges is appropriate as these individuals are experts in issues related to student life and thus can make accurate judgments as to the novelty and feasibility of proposed solutions. The consensual assessment technique (Amabile, 1983) was used to rate creativity. The CAT has been widely used to evaluate creative outcomes, although traditionally it does not differentiate between levels of novelty and usefulness. The CAT procedure requires several subject matter experts (SMEs) to independently rate something (e.g., an idea, a design, etc.) on its level of creativity. This approach typically yields acceptable interrater reliabilities (i.e., .70 to .90; Baer, Kaufman, & Gentile, 2004; Conti, Coon, & Amabile, 1996). The procedure was adapted to assess levels of novelty and usefulness in addition to overall creativity. SMEs were given detailed instructions regarding the conceptual definition of each construct as well as examples of responses that would characterize each scale point (see Appendix D). Ratings took place over the course of two weeks during multiple 90-minute sessions. At the beginning of each session, all raters underwent a brief training session. Because it was not feasible to have every judge rate every participant response, raters were assigned 40 participants to rate. On average, 2.79 SMEs rated each student generated response for novelty, originality, usefulness, feasibility, and creativity on a scale from 1 (*extremely low*) to 6 (*extremely high*).

Measures and Materials

Music. Music was selected based on whether it met certain criteria. First, a song had to be clearly in a major or minor key. Musical pieces that shifted between major and minor (e.g., Beethoven's *Für Elise*) were excluded. Second, selections needed to have a tempo of either less than 80 BPM (i.e., slow) or greater than 120 BPM (i.e., fast). Italian markings are typically used to convey to musicians the speed at which the music should be played. These markings range from *larghissimo* (19 BPM or less) to *prestissimo* (178 BPM or more). The designation used in music composition for 80 BPM is *andante*, which indicates the music is to be played at a moderately slow tempo. The designation for 120 BPM is *allegro*, which indicates the music is to be played at a brisk tempo. Tempo for each selection was established using a metronome. The average tempo for "slow" music selections was 54.5 BPM (SD = 5.72) and ranged from 46 to 65 BPM. The average tempo for "fast" musical selections was 153.8 BPM (SD = 22.44) and ranged from 120 to 202 BPM.

Third, the selections also needed to be instrumental. As such, the majority of the selections were classical, although attempts were made to use instrumental selections from other genres, such as jazz. Prior research examining the effects of music on performance, however, has found that genre has no effect on this relationship (Oldham et al., 1995). These criteria yielded an initial total of 31 songs, with an average of 7.75 songs per condition. The average listening time per condition was 34.5 minutes. Pilot testing (see Appendix B for a full description) further refined the musical selections to a total of 24 songs, with an average of 5 songs per condition. The average listening time per condition was 26.4 minutes (see Appendix A for the final list of songs per condition).

State Affect. I used the Positive Affect Negative Affect Scale (PANAS) and the Affect Grid to assess state affect. The PANAS is a self-evaluation of state positive and negative affect

at a specified time and is one of the most widely used measures of affect in psychology (Watson, Clark, & Tellegen, 1988). The PANAS consists of 30 possible words or phrases that describe different feelings and emotions, including "cheerful," "angry," and "calm." Participants rated their agreement with the emotions on a scale of 1 (*very little or not at all*) to 5 (*extremely*). Cronbach's alpha ranges from 0.86 to 0.89 for PA and from 0.84 to 0.87 for NA, which indicates good internal validity for both dimensions. Test-retest reliabilities are 0.79 for PA and 0.81 for NA, indicating good reliability (Watson et al., 1988). In this study, Cronbach's alpha for positive affect at times 1, 2, and 3 were .89, .93, and .94, respectively. For negative affect, Cronbach's alpha at times 1, 2, and 3 were .82, .81, and .83 respectively.

The Affect Grid is a single item, non-verbal measure of affect and is widely used self-report measure of current affect (Russell, Weiss, & Mendelsohn, 1989). This measure is a 9x9 grid that assesses two dimensions of affect: valence (pleasure-displeasure) and arousal (arousal-sleepiness). The pleasure score, which ranges from 1 to 9, is the number of the column checked, counting from the left. The arousal score, which also ranges from 1 to 9, is the number of the row checked, counting from the bottom (see Appendix C). Participants indicated their current mood by checking one of the squares in the grid.

Physiological Arousal. Subjective and objective measures were used to measure physiological arousal. Blood pressure and pulse rate were collected using the Omron HEM-637 automated monitor; these were the objective measures of physiological arousal used in this study. The monitors provide accurate and valid readings of systolic and diastolic pressure and pulse rate. Blood pressure and pulse rate are largely seen as reliable measures of physiological arousal and these monitors have been used in published literature (Ilies, Dimotakis, & Watson, 2010). The monitors are worn on the participants' wrists. Each monitor has a self-inflating cuff

and is equipped with a mechanism that aids in the correct placement of the device. Following established practice (i.e., Marler, Jacob, Lehoczky, & Shapiro, 1988; see also Ilies et al., 2010), blood pressure readings were considered artifactual if 1) systolic pressure was less than 70 or greater than 250 mmHg, 2) diastolic pressure was less than 45 or greater than 150 mmHg, or 3) the ratio of systolic to diastolic pressure was less than the value obtained from the formula (1.65+[.00125*diastolic value]) or if it was greater than 3. Additionally, any heart rate score that was below 40 beats or above 200 beats was considered artifactual. This resulted in the deletion of 12 blood pressure and heart rate scores in total.

The arousal subscale of the Self-Assessment Manikin (SAM; Bradley & Lang, 1994) was used as a subjective measure of felt arousal. The SAM is a non-verbal pictorial assessment technique that has been widely used to assess self-report affect. The arousal subscale uses a series of graphic abstract characters arranged on a 7-point scale, which spans from a sleepy to a widely awake figure showing an incremental explosion at the center (see Appendix C).

Attention. Attentional breadth was assessed using the global-local processing task (Kimchi & Palmer, 1982). This task has been used to assess attentional breadth in prior creativity research (e.g., Tidikis et al., 2017). In this task, participants were presented with a target image, which they then compare with two comparison images. One comparison figure resembles the target figure in global features (i.e., overall shape is a square); the other is similar to the target figure in local components (i.e., both figures are made up of circles). Whether participants match images based on their global shape or based on their individual components indicates a global or local processing bias, respectfully. Participants were presented with 16 shapes and had eight seconds to make their selection. Selection of the global figure was coded as 1 and the selection of the local figure was coded as 0 for each trial. Responses were summed across the 16 trials to

yield an overall attention score, such that a higher score indicates a global processing bias whereas a lower score indicates a local processing bias.

Creativity. Following Zhou, Wang, Song, and Wu (2017), judges rated the "novelty," "originality," "usefulness," and "feasibility" of each proposed idea using a Likert scale ranging from 1 (*extremely low*) to 6 (*extremely high*). Responses to "novelty" and "originality" were averaged to form an overall novelty index (Cronbach's alpha = 0.82) and responses to "usefulness" and "feasibility" were averaged to form an overall usefulness index (Cronbach's alpha = 0.74). Finally, I averaged their responses to create an overall creativity index (Cronbach's alpha = 0.84).

Prior to aggregating raters' evaluations, I calculated interrater reliability and agreement. To assess agreement, I calculated the mean average deviation ($AD_{M(j)}$) which is widely used index to determine interrater agreement (Burke, Finkelstein, & Dusig, 1999). Burke and Dunlap (2002) suggest that high agreement is obtained when AD values for a 5- and 7-point scales are less than .8 and 1.2, respectively. AD_M values for novelty (0.70), originality (0.76), usefulness (0.62), feasibility (0.77) and creativity (0.58) were below these cutoffs lending support for aggregation of scores across raters. ICC(1) and ICC(2) were calculated to assess rater consensus and rater consistency. ICC(1) is based on a one-way random effects ANOVA and indicates the "proportion of observed variance in ratings that is due to systematic between-target differences compared to the total variance in ratings" (LeBreton & Senter, 2008, p. 822). ICC(2) is an estimate of the consistency of mean ratings given by *K* judges (Bliese, 2000; LeBreton & Senter, 2008). Initial calculations of ICC(1) and ICC(2) were relatively low and inconsistent across rater pairs. To obtain acceptable levels of interrater agreement and consistency, I created composites for novelty, usefulness, and creativity by combining across student responses for each rater set.

Ratings of novelty and originality were combined to form a novelty index and evaluations of usefulness and feasibility were combined to form a usefulness index. After dropping two items each from the novelty and originality scale scores and 16 items each from the usefulness and feasibility scale scores, values for the novelty index (ICC(1) = 0.16, ICC(2) = 0.79), usefulness index (ICC(1) = 0.12, ICC(2) = 0.69) and creativity index (ICC(1) = 0.08, ICC(2) = 0.79) were at acceptable levels and consistent with values reported in prior creativity research (e.g., Zhou et al., 2017).

Controls. Several additional variables were measured in order to rule out alternative explanations. Specifically, I measured how distracting participants perceived the music to be ("how distracting was the music?"), their familiarity with the music selections ("how familiar are you with this music?"), and how much they liked the music ("how much did you like the music?"). Participants will rate their responses on a scale of 1 (*very little or not at all*) to 5 (*extremely*) (see Appendix C for all materials).

Musical preference was also assessed with an open-ended question about what type of music to which the participants prefer to listen. The use of an open-ended question is appropriate in this case as people typically have more than one type of musical preference (Rentfrow, 2012; Rentfrow & Gosling, 2003). Further it is important to control for preference of music as it is strongly correlated to personality (Rentfrow, 2012; Rentfrow & Gosling, 2003). Participants may write down as many genres as they like, and responses were coded to capture this dimension. The volume at which the music was played was set to 50 decibels. The literature indicates that 50 decibels is an appropriate volume level that will not cause the participants discomfort (Thompson et al., 2011).

Demographic information, such as gender, age, and race/ethnicity were asked of the participants. Additionally, several individual difference variables were assessed. Prior research shows that a person's standing on openness to experience is related to creativity; as such the openness subscale of the NEO-PI-R (Costa & McCrae, 1992) was included to control for this trait (Cronbach's alpha = 0.79). Relatedly, other research suggests that extraverts and introverts perform differently on cognitive tasks in the presence of music (Chamorro-Premuzic, Swami, Terrado, & Furnham, 2009; Dobbs, Furnham, & McClelland, 2011; Furnham, & Bradley, 1997). The extraversion subscale of the NEO-PI-R was also controlled for (Cronbach's alpha = .88). Given that the focal mediator is attentional breadth, I also measured trait mindfulness (Cronbach's alpha =.85), as this characteristic implies that certain individuals are better able to influence their attentional control than others (Brown & Ryan, 2003).

Prior research also suggests that creative self-efficacy is related to creativity (Tierney & Farmer, 2002). Participants' creative self-efficacy was controlled for using Tierney and Farmer's (2002) scale (Cronbach's alpha = 0.90). Finally, recent research suggests that trait regulatory focus may influence individual's perceptions regarding novelty (Zhou et al., 2017). As such, participants' trait regulatory focus was also included as a control using Lockwood et al.'s (2002) 18 item measure of promotion (Cronbach's alpha = 0.81) and prevention (Cronbach's alpha = 0.79) regulatory focus.

RESULTS

Descriptives

Table 1 displays the means, SD, and correlations among all study variables. I specified my independent variables by creating *k*-1 dummy coded variables (i.e., major key, minor key, fast, slow, control; Cohen, Cohen, West, & Aiken, 2003) with the passive control as the referent

group (coded zero across all five dummy variables). The correlation matrix reveals that major key was positively related to valence measured by the SAM (r = .11, p = 0.02) and the Affect Grid (r = .11, p = 0.02) at time 2, and, unexpectedly, systolic blood pressure at time 2 (r = .14, p < 0.01). Minor key, however, was unrelated to negative affect or any measure of valence or arousal. As expected, fast tempo had a positive relationship with systolic blood pressure (r = .12, p = 0.01) and subjective arousal as measured by the SAM (r = .27, p < 0.01). Contrary to expectation, fast tempo was also significantly related to measures of affect. Specifically, the results showed a positive relationship between fast tempo and positive affect (r = .14, p < 0.01), the SAM measure of valence (r = .2, p < 0.01), and valence measured by the Affect Grid (r = .24, p < 0.01). Slow tempo was negatively to subjective arousal as measured by the SAM (r = -0.16, p < 0.01) and, unexpectedly, subjective valence measured by the Affect Grid (r = -0.16, p < 0.01). Overall, these results provide partial support for Hypotheses 1 and 3.

As expected, global focused attention demonstrated a negative relationship with negative affect (r = -0.12, p < 0.01) providing some support for Hypothesis 2; however, there was no significant relationship with positive affect, valence, or any measure of arousal. Measures of novelty, usefulness, and creativity are unrelated to any of the predictor and proposed mediating variables. This is surprising given the large body of literature establishing the relationship between positive and negative affect and creativity (Akinola & Mendes, 2008; Baas et al., 2008; Davis, 2009; Isen et al., 1987), as well as attention and creativity (Kasof, 1997; Tidikis et al., 2017). Reasons for this are discussed below.

Preliminary Analyses

As a manipulation check to determine if participants picked up on the emotional content of the music in each condition (e.g., happy, sad, angry, etc.), I conducted a MANCOVA

controlling for baseline positive and negative affect, as well as liking and familiarity. The results show a significant mean difference in evaluations of emotion content across conditions, $F(30, 837) = 10.721$, $p < .001$, Wilks' $\Lambda = .385$, partial $\eta^2 = .27$. When considered separately, all emotional descriptors reached statistical significance. Post hoc comparisons show that the major-fast condition was rated significantly higher for descriptors such as happiness ($M = 3.55$, $SD = 1.03$) relative to all other conditions, as well as joyful ($M = 3.45$, $SD = 1.09$) and energizing ($M = 3.41$, $SD = 1.28$) except compared to the minor-fast condition (joy: $M = 3.05$, $SD = 1.26$; energizing: $M = 3.71$, $SD = 1.29$). The major-slow condition was rated significantly higher for conveying calm ($M = 3.96$, $SD = 1.11$) and relaxation ($M = 3.45$, $SD = 1.09$) relative to the major-fast (calm: $M = 2.88$, $SD = 1.34$; relaxation: $M = 3.01$, $SD = 1.21$) and minor-fast (calm: $M = 2.49$, $SD = 1.32$; relaxation: $M = 2.74$, $SD = 1.39$) conditions but not the minor-slow condition (calm: $M = 3.90$, $SD = 0.95$; relaxation: $M = 3.75$, $SD = 1.01$) nor the active control (calm: $M = 4.02$, $SD = 0.91$; relaxation: $M = 3.95$, $SD = 1.02$). The minor-fast condition was rated significantly higher for conveying anxiety ($M = 2.55$, $SD = 1.30$), anger ($M = 1.61$, $SD = 1.02$), and fear ($M = 1.78$, $SD = 1.02$) relative to all conditions. Further, the minor-fast condition was rated as significantly more energizing relative ($M = 3.71$, $SD = 1.29$) to the two slow tempo conditions. Finally, the minor-slow condition was rated significantly higher for conveying sadness ($M = 2.40$, $SD = 1.26$) and depression ($M = 1.93$, $SD = 1.07$) relative to all conditions. Taken together, these results suggest that participants perceived emotional differences between the music conditions, and this was in keeping with expectations.

To determine if the experimental manipulation was effective in yielding change in affect and arousal, I conducted a number of mean comparisons between conditions with regard to the different measures of arousal and affect. A MANCOVA revealed significant difference in mean

valence and arousal scores across conditions, $F(30, 746) = 1.743$, $p < .001$, Wilks' $\Lambda = .82$, partial $\eta^2 = .06$, after controlling for baseline measures of arousal and affect as well as liking and familiarity. When considered separately, significant mean differences were found for subjective arousal [SAM: $F(3, 25) = 7.54$, $p < 0.001$, partial $\eta^2 = .08$], positive affect [$F(3, 25) = 5.8$, $p = .001$, partial $\eta^2 = .06$], and valence [SAM: $F(3, 25) = 3.58$, $p = .014$, partial $\eta^2 = .04$; Affect Grid: $F(3, 25) = 6.59$, $p < 0.001$, partial $\eta^2 = .07$]. For subjective arousal, post hoc comparisons revealed significant mean differences between the fast music conditions and all other conditions. Specifically, the mean SAM arousal score for both the major-fast ($M = 3.72$, $SD = 1.34$) and the minor-fast ($M = 3.78$, $SD = 1.36$) conditions were significantly greater than the major-slow ($M = 2.96$, $SD = 1.26$), minor-slow ($M = 2.89$, $SD = 1.3$), active control ($M = 2.88$, $SD = 1.49$) and passive control ($M = 3.06$, $SD = 1.38$) conditions. There were no other significant mean differences between the major-fast or the minor-fast conditions.

For subjective valence, post hoc comparisons revealed significant mean difference between all music conditions and the passive control group. Specifically, the mean SAM valence score for the passive control condition ($M = 4.19$, $SD = 0.85$) was significantly smaller than the major-fast ($M = 4.89$, $SD = 0.85$), minor-fast ($M = 4.83$, $SD = 0.97$), major-slow ($M = 4.62$, $SD = 0.78$), minor-slow ($M = 4.62$, $SD = 0.93$), and active control ($M = 4.52$, $SD = 0.82$) conditions. There are no other significant mean differences between music conditions.

For positive affect, post hoc comparisons revealed a significant mean difference between major-fast condition ($M = 3.05$, $SD = 0.85$) and the passive control group ($M = 2.67$, $SD = 0.76$). There were no other significant mean differences between music conditions. For valence measured with the Affect Grid, both the major-fast ($M = 3.72$, $SD = 1.34$) and minor-fast ($M = 3.78$, $SD = 1.36$) conditions was significantly greater than the minor-slow ($M = 4.1$, $SD = 2.07$)

and active control (M = 3.06, SD = 1.38) conditions. There were no other significant mean differences between major-fast or minor-fast conditions.

I also conducted an ANOVA to determine if there were significant differences in attention across conditions. The results showed no significant differences [$F(5, 435) = 0.771$, $p = .571$]. Finally, I conducted ANOVA to determine if there were significant differences in the dependent outcomes (novelty, usefulness, and creativity). Again, the results yielded no significant differences across conditions for neither novelty [$F(5, 435) = 0.245$, $p = .942$], usefulness [$F(5, 434) = 0.706$, $p = .619$] or overall creativity [$F(5, 435) = 0.556$, $p = .734$].

Hypothesis Testing

I tested Hypotheses 1 and 3 with hierarchical regression in SPSS 25. In each analysis, I included baseline measures of each mediator as well as liking and familiarity as controls[1]. Results are shown in Tables 2-5. The results demonstrate that positive affect is significantly related to music in a major key (b = 0.145, SE = .06, p = 0.01) over and above baseline affect and controls [$\Delta F(2, 362) = 3.1$, $p < 0.05$, $\Delta R^2 = 0.004$] and is unrelated to music in a minor key (b = 0.08, SE = .06, p = 0.24). For other measures of affect, major key had a significant positive effect on SAM valence (b = 0.281, SE = .09, $p < 0.01$, $\Delta F(2, 360) = 6.167$, $p < 0.05$, $\Delta R^2 = 0.02$), but not on valence measured with the Affect Grid (b = 0.23, SE = .19, p = 0.22). Further for the SAM, minor key demonstrates a positive effect on valence (b = 0.257, SE = .09, $p < 0.01$). These results provide only partial support for Hypothesis 1. Given the significant correlations between tempo and affect, I also explored whether tempo explains additional variance in affect over and above musical key. Results show that fast tempo explains significant variance in affect across all measures (PA: b = 0.18, SE = .06, $p < 0.01$, $\Delta F(1, 361) = 15.638$, $p < 0.01$, $\Delta R^2 = 0.01$; SAM: b

[1] Perceptions of loudness and distractibility were also originally included but did not have a significant effect on any of the mediating variables. For parsimony, they were not included in subsequent analyses.

= 0.296, *SE* = .08, $p < 0.01$, $\Delta F(1, 359) = 12.444$, $p < 0.05$, $\Delta R^2 = 0.02$, Affect Grid: $b = 0.944$, *SE* = .207, $p < 0.01$, $\Delta F(1, 349) = 20.74$, $p < 0.01$, $\Delta R^2 = 0.04$), over and above musical key.

For objective measures of arousal, fast tempo was significantly related to systolic blood pressure ($b = 0.145$, *SE* = .06, $p = 0.01$), over and above baseline blood pressure and liking and familiarity [$\Delta F(2, 362) = 3.1$, $p < 0.05$, $\Delta R^2 = 0.004$]. Slow tempo was not significantly related to systolic pressure and neither fast nor slow tempo is related to diastolic pressure nor heart rate. Finally, the results show that fast tempo explained significant variance in subjective arousal as measured by the SAM ($b = 0.71$, *SE* = .12, $p < 0.01$, $\Delta F(1, 363) = 35.568$, $p < 0.01$, $\Delta R^2 = 0.06$), but not arousal measured by the Affect Grid ($b = 0.155$, *SE* = .157, $p = 0.325$, $\Delta F(1, 351) = .97$, $p = 0.325$). Slow tempo was unrelated to both subjective measures of arousal. These results provide partial support for Hypothesis 3.

To test Hypotheses 2 and 4, I first ran a hierarchical regression in which I regressed attention onto the affect and arousal mediating variables. In this analysis, I controlled for baseline affect and arousal. The results of this analysis did not show any significant relationships between affect, arousal, and attention, after taking into account baseline affect and arousal (see Tables 6 and 7). Again, this finding is inconsistent with prior research on attention (Derryberry & Tucker, 1994; Gasper & Clore, 2002; Jefferies et al., 2008). Thus, Hypotheses 2 and 4 were not supported. Finally, although correlations between indices of creativity and attention were not significant, I regressed each criterion onto attention while controlling for several individual difference variables. None of these analyses were significant (see Table 8) thus failing to support Hypotheses 5-8. Possible reasons as to why are given below.

DISCUSSION

The purpose of this study was to explore the effects of music on creativity through executive functions. Although prior research has suggested a link between music and creativity (Adaman & Blaney, 1995; Kavanagh, 1987; Ilie & Thompson, 2011; Ritter & Ferguson, 2017), the underlying mechanisms and the development of a theoretical basis for this relationship is lacking. This experiment was intended to clarify this relationship. Unfortunately, the results of this study do not provide such clarity. Here I outline possible explanations as to why these unexpected results were found.

There were several surprising findings, or rather, *lack* of findings from this study. The most surprising was the lack of significant relationships between novelty, usefulness, and creativity overall and attention. Prior research suggests that executive functions are critical for creativity (Baas et al., 2008; Benedek et al., 2012; Benedek et al., 2014; Rominger et al., 2018). Prior research has also found support that attention influences the different stages of the creative process (Kasof, 1997; Tidikis et al., 2017). Several reasons may exist as to why this study did not replicate previous findings. It could be that attentional breadth is not an appropriate proxy of working memory and inhibitory control. This measure was chosen primarily because it has been used in prior research and is not as cognitively intensive as other measures of working memory and inhibitory control (e.g., N-back test, attentional eye blink, Stroop, etc.; Diamond, 2013). Executive functions are complex and encompass a variety of processes (Diamond, 2013). For instance, inhibitory control broadly includes functions such as response inhibition, focused attention, and cognitive inhibition (Blair & Ursache, 2011; Diamond, 2013). Models of working memory are even more complicated with the distinction between its operation in different content domains (i.e., verbal working memory and visual-spatial working memory; Baddeley,

2012). It is likely that attentional breadth is too coarse a measure to adequately capture the complex nature of these functions. This represents a significant limitation of the present study.

Additionally, recent empirical evidence suggests that the relationship between attention and creativity depends on the type of attention measure used (Carruthers, MacLean, & Willis, 2018). Although prior research has used the Navon task (Tidikis et al., 2017), it could be that this task only reflects a particular aspect of one of these executive functions, and this aspect is unnecessary for creativity. An important avenue for future research should be to determine the appropriateness of attentional breadth as an indicator of executive functions and compare it to other known measures of working memory and inhibitory control. Further, prior research on the attention-creativity link has mainly used indicators of divergent and convergent thinking as their measure of creativity (e.g., Carruthers et al., 2018; Tidikis et al., 2017). It could be argued that these studies have established a link between attention and the potential or ability to be creative, but not creative outcome effectiveness (Montag et al., 2012). Thus, a direction for future research should be to clarify the causal chain between attentional breadth and creativity by exploring the role of creative ability as a potential mediating mechanism.

The lack of significant relationship between measures of creativity and established predictors of creativity (i.e., state affect) was also highly surprising and inconsistent with prior literature on mood, cognition, and creativity (Baas et al., 2008; Davis, 2009; De Dreu et al., 2012; Kaufmann & Vosburg, 2002). This suggests that in the context of this study there could be an issue with the measure itself. For one, the task was originally used as a measure of team creativity as opposed to individual creativity. It could be that on their own, students cannot possess the expert knowledge regarding the programs and policies at the university level to sufficiently address this question. Having additional information from other sources would help

address those gaps. Second, it could be that the level of expertise between students and Student Affairs employees is not equivalent. Students likely have greater expertise vis-à-vis daily life on campus relative to academic advisors but are likely novices about university programs and policies. In other words, students are experts about living on campus but are not likely experts about the policies and practices governing student life. Likewise, academic advisors may have trouble considering something as new or creative based on their prior experience and knowledge as to what other universities do. Although the SMEs were repeatedly told to only focus on what is new or novel within the current context (i.e., present day VCU), it was difficult, based on conversations within the rating sessions, for raters to not draw on their past experiences. Indeed, research suggests that prior knowledge may have a negative influence on perceptions of novelty (Haynie, Shapherd, & McMullen, 2009; Moreau, Lehmann, & Markman, 2001).

Another limitation is that raters only evaluated the two most creative ideas for each task as selected by the participant. Although by selecting an idea the participants were completing the full creative process (Mumford et al,) this does reduce the variance of the dependent measure. Further, it may be that students limited their selection to the first or second ideas generated. The serial order effect suggests that ideas become more creative over time (Beaty & Silvia, 2012; see also Baer & Oldham, 2006) such that more common, highly accessible ideas are identified first, allowing for more distal associations and ideas to be identified. Thus, it could be that had raters examined the last responses of participants, we would see more variability in the dependent measure. Relatedly, it could be that different characteristics of music affect the different stages of the creative process. For instance, it could be that listening to music in a major key and slow tempo enhances idea generation but listening to music in a minor key and fast tempo enhances idea selection. Thus, it could be that because participants were listening to one type of music

throughout the study their selection of creative ideas may have been influenced by the music they were listening to (although there were no differences between condition in term of creative responses).

Despite a significant effort to recruit a representative sample of advisors and student life employees from various colleges, this was not possible and represents another serious limitation of the present study. Different colleges and departments implement different practices and policies; thus, some ideas that were deemed novel to certain departments were not considered new to others because it was already in place. Indeed, achieving adequate agreement and reliability amongst raters was difficult, despite efforts to encourage consistency in ratings during sessions. This is consistent with findings from other research comparing agreement in ratings between experts vs. novices: Haller, Courvoisier, and Cropely (2011) found that experts demonstrated lower interrater consistency than novices in new product evaluation.

There could also be differences in perception as to what is considered novel or useful between undergrads and academic advisors. Prior research has found that creators and perceivers differ in their perceptions of creativity and this difference is further compounded between novices and experts (Zhou, Wang, Bavato, Tasselli, & Wu, 2019; Zhou et al., 2017). For instance, novices are more likely to emphasize the novelty of an idea in their evaluations whereas experts focus more on the utility of the idea (Baron & Ensley, 2006). Although the use of experts is considered best practice, care must be exercised when determining the appropriateness of judges (Zhou et al., 2019). Future research should explore new methods to help determine the extent to which judges will converge in their evaluations a priori. For instance, researchers could use propensity score analysis to match raters based on a variety of characteristics that are known to influence perceptions of creativity (e.g., personality traits, creative ability, prior knowledge,

etc.). Further research is needed to understand the match in the level of expertise between respondents and judges and identify the factors that contribute to differences in perceptions of novelty and usefulness between creators and perceivers.

With regard to the effects of music, the results of this study find evidence that key and tempo do influence affective and physiological states; again, however, the relationships were not quite as expected and was not consistent across measures. For instance, the results suggest that tempo is the primary driver of both arousal and affect. Although the relationship between arousal and tempo was as hypothesized, the weak relationship between musical key and affect was unexpected and inconsistent with prior research (DiGiacomo & Kirby, 2006; Husain, Thompson, & Schellenberg, 2002; Mead & Ball, 2007; Sutton & Lowis, 2008; Vuoskoski & Eerola, 2012). It could be that there are other characteristics of music at play that are suppressing these effects. For instance, if the music is highly complex, this would tend to reduce positive affect and enhance negative affect (Blood et al., 1999; Keeler & Cortina, in press). It could also be an influence of pitch intensity. Prior research suggests that higher pitches are more salient than lower pitches (Krumhansl, 2000), however, individuals do not seem to have an innate preference for higher or lower pitches (Wapnick, 1984). Although efforts were made to select music that were comparable to each other in terms of dynamics and complexity, it is not possible to control for every characteristic when using different songs. Indeed, prior research on music and affect has tended to rely on multiple versions of the same song in which key and tempo were changed systematically. This technique allows researchers to control for other characteristics, like complexity, but does sacrifice external validity. Future research is clearly needed to compare the effectiveness of different mood induction techniques using music.

The lack of significant associations between music characteristics and negative affect was also surprising. This finding, however, may be due to participant efforts to respond in a desirable manner. Prior research suggests that individuals are more likely to underreport negative affect because the phrases used in the PANAS to capture negative affect are seen as undesirable (e.g., afraid, irritable, etc.) (Chen, Dai, Spector, & Jex, 1997). The words used to describe positive affect (e.g., proud, interested, etc.), however, are considered to be socially desirable traits. Even though the PANAS was used to capture state affect, it could be that participants were motivated to portray themselves in the best possible light throughout the entire study.

Another possibility for these findings would be a discrepancy between perceived and felt emotions. In other words, it could be that music influences our perceptions of the emotional content of the music, but we do not emulate or internalize these emotions (Eerola, & Vuoskoski, 2013; Gabrielsson, 2001). Although a large body of research has shown that music does influence felt emotions (Krumhansl, 1997; Koelsch, Yves, Müller, & Friederici, 2006; Vuoskoski & Eerola, 2012), others have found that music does not influence emotions (Gabrielsson, 2001; Sloboda & O'Niell, 2001). Gabrielsson (2001) outlined and reviewed the existing literature on the relationship between perceived emotion and felt emotion in music studies. He identified four possible relationships: positive, negative, no systematic relationship, and no relationship. The data presented here suggest a non-systematic relationship. Participants largely agreed on the emotional content of the music and that different combinations of characteristics corresponded to different emotions as anticipated, but the impact on felt emotion was small and inconsistent across measures. This represents an interesting area of future research to better understand the conditions under which music does and does not induce actual emotion.

Finally, there are several other methodological issues that may have influenced the results of this study. One reason could be demand characteristics. Specifically, participants could have known the true purpose of the study prior to participating. Participants could have anticipated that they would feel a certain way in response to listening to music and this could have suppressed emotional reactions to the music. As a precaution, I included an open response question asking participants what they knew or had heard about the study prior to participating. Upon inspection, 8.94% (n = 39) of participants said they knew the study was related to music beforehand. This suggests that demand characteristics was not a widespread issue within the sample. Additionally, participants were blind to the fact that they were randomly assigned to different types of music, ensuring the internal validity of this study (Shadish et al., 2002). Another potential limitation could be low power within each condition. Some of the anticipated effect sizes between music characteristics and outcomes were very small, particularly the relationship between musical key and state affect. Although my power analysis overall suggested a sample size of 325 and I exceeded that by well over 100 participants, it could be that, within each condition, the sample size was too small to detect a key-state affect relationship. The sample size in this study, however, exceeded the sample sizes used in prior research on music and creativity (e.g., Adaman & Blaney, 1995; Ritter & Ferguson, 2017; Threadgold et al., 2019). Indeed, my sample size was much larger than the majority of studies on music characteristics (e.g., Husain et al., 2002; Khalfa et al., 2013; Sutton & Lowis, 2008). Thus, more research is needed to determine the optimal sample size to detect effects of musical key on state affect, in particular when manipulations of key are not present.

In sum, although some studies have suggested that music influences creativity (Adaman & Blaney, 1995; Ritter & Ferguson, 2017) whereas others have suggested music is unrelated to

creativity (cf. Threadgold et al., 2019), there is still a sufficient lack of evidence to draw concrete conclusions for either case. Although these findings do not show people are more creative when listening to music, these findings do show that music does not harm creativity as has been previously reported (Threadgold et al., 2019). This study, however, could be considered as a stepping stone towards further understanding of this relationship. From the results of this experiment, future research can draw upon the lessons learned and improve upon the design and methodology. Further, these findings do not discount the importance to untangle this relationship, but rather highlights the challenges researchers face in doing so.

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Appendix A: Final Music Selections

Song Title	Composer	Condition Number	Tempo	Key
Sonata No. 14 in C-Sharp Minor for Piano, "Moonlight:" Adagio sostenuto	Beethoven	1	62 BPM	C minor
Theme from "Schindler's List"	John Williams	1	56 BPM	D minor
Adagio in G Minor for Strings and Organ, "Albinoni's Adagio"	London Philharmonic Orchestra, David Perry	1	56 BPM	G minor
Sonata No. 8 in C Minor for Piano, Op. 13 "Pathetique": Adagio cantablie	Beethoven	1	48 BPM	C minor
Chamber Symphony, Op. 110a: II. Allegro molto	Shostakovich	2	132 BPM	C minor
Violin Concerto No. 2 in G minor, RV 315, "Summer": III. Presto	Vivaldi	2	146 BPM	G minor
In the Hall of the Mountain King	Grieg	2	150 BPM	E minor
Symphony No. 25 in G minor, K. 183: 1. Allegro con brio	Mozart	2	156 BPM	G minor
Sonata No. 14 in C-sharp minor for Piano, Op. 27, "Moonlight:" Presto agitato	Beethoven	2	166 BPM	C# minor
Flight of the Bumblebee	Rimsky-Korsakov	2	163 BPM	D minor
Overture from Le Nozze di Figaro	Mozart	3	158 BPM	Major
Overture from William Tell	Rossini	3	167 BPM	Major
Tritsch Tratsch – Galopp Polka, Op. 214	Strauss	3	164 BPM	Major
Serenade No. 13 in G Major, K. 525, "Eine Kleine Nachtmusik"	Mozart	3	138 BPM	G Major
Carmen Overture	Bizet	3	128 BPM	G Major
Pomp and Circumstance	Elgar	3	134 BPM	Major
Meet the Flinstones theme	Clark Terry	3	160 BPM	Major
L'Arlesienne Suite	Bizet	4	49 BPM	F Major

Ombra mai fu	George Frideric Handel	4	59 BPM	Major
Well-Tempered Clavier: Prelude No. 1 in C Major	Johann Sebastian Bach	4	61 BPM	C Major
My Romance	Rodgers & Hart	4	54 BPM	C Major
Concerto in A major for Clarinet and Orchestra	Mozart	4	46 BPM	A Major
Concerto in D major for Lute, Two Violins	Vivaldi	4	54 BPM	D Major

Appendix B: Pilot Testing

Manipulation Check of Music

A pilot test was conducted to determine if the music selections influenced participants' perceptions of valence and arousal as anticipated. Pilot testing was also used to further reduce the number of musical selections. Thirty-one undergraduate business students participated in the pilot. Participants were randomly assigned to one of four experimental conditions. Participants were greeted by the experimenter upon entering the lab and instructed to sit in front of a lab computer. Each computer was open to an online survey accessed through the Qualtrics platform. Participants were instructed that they would listening to several selections of music and after each song would be asked to respond to several questionnaires. Participants were told that they should focus on the music, paying particular attention to how each song sounded and how it made them feel. After reading and signing the informed consent, participants rated their current emotional state using the PANAS. After completing this measure, participants were instructed to put on their headphones and begin the experiment. The music was embedded into the survey platform and was presented in a random order for each participant. After each song finished, participants immediately answered several questions regarding its perceived valence, arousal, and emotional content. Valence was assessed using a single item asking participants to indicate how positive or negative the song sounded on a Likert-type scale that ranged from 1 (*extremely negative*) to 7 (*extremely positive*). Arousal was assessed with a single item asking how stimulating or energizing each song was on a Likert-type scale that ranged from 1 (*extremely un-stimulating*) to 7 (*extremely stimulating*). To assess perceived emotion, participants were presented with ten discrete emotions (i.e., happy, sad, anxious, calm, fear, etc) and were as to rate the extent to which each word described the overall feel or emotion of that given song.

Participants recorded their response using a Likert-type scale that ranged from 1 (*very slightly or not at all*) to 5 (*extremely*). Participants also rated the extent to which they liked, disliked, and were familiar with each song, again using a Likert-type scale ranging from 1 (*very slightly or not at all*) to 5 (*extremely*). After listening to all the selections, participants removed the headphones and immediately completed the PANAS for a second time.

Between condition analyses. Post PA and NA scores were compared across conditions using a MANCOVA. There was a marginally significant difference between conditions in post PA and NA scores, after controlling for pre PA and NA scores, $F(6, 48) = 2.087$, $p = .072$, Wilks' $\Lambda = .629$, partial $\eta^2 = .207$. When considered separately, however, the only difference to reach statistical significance was NA [$F(3, 25) = 3.333$, $p = .036$, partial $\eta^2 = .286$], although the difference for PA was approaching significance [$F(3, 25) = 1.938$, $p = .149$, partial $\eta^2 = .189$]. Further, post hoc comparisons revealed significant mean differences between conditions for both PA and NA. Condition 3 (major/fast) had significantly higher mean PA score ($M = 2.82$, $SD = 0.65$) than Condition 1 (minor/slow; $M = 2.5$, $SD = 0.72$) and Condition 2 (minor/fast; $M = 2.29$, $SD = 0.51$). There were no other significant differences between any of the other conditions on PA scores. Condition 3 also had significantly lower mean NA score ($M = 1.17$, $SD = 0.10$) than Condition 1 ($M = 1.36$, $SD = 0.20$), Condition 2 ($M = 1.38$, $SD = 0.20$), and Condition 4 ($M = 1.74$, $SD = 0.51$). There were no other significant differences between any of the other conditions on NA scores.

A MANCOVA revealed significant difference in mean valence and arousal scores across conditions, after controlling for perceptions of liking and familiarity, $F(6, 48) = 7.377$, $p < .001$, Wilks' $\Lambda = .26$, partial $\eta^2 = .49$. When considered separately, there was a statistically significance difference for both valence [$F(3, 24) = 10.888$, $p < .001$, partial $\eta^2 = .576$] and

arousal [$F(3, 24) = 10.448$, $p < .001$, partial $\eta^2 = .566$]. Post hoc comparisons revealed significant mean differences between conditions for both valence and arousal. Condition 3 had significantly a higher mean valence score ($M = 5.91$, $SD = 0.98$) than Condition 1 ($M = 4.25$, $SD = 1.14$), Condition 2 ($M = 4.57$, $SD = 0.67$), and Condition 4 ($M = 4.64$, $SD = 0.52$). There were no other significant mean differences between any of the other conditions on valence. Condition 1 ($M = 4.13$, $SD = 1.19$) and Condition 4 ($M = 4.09$, $SD = 1.18$) both had significantly lower mean arousal scores than Condition 2 ($M = 5.04$, $SD = 1.19$) and Condition 3 ($M = 5.47$, $SD = 0.89$). There were no significant mean differences between Condition 1 and Condition 4 or between Condition 2 and Condition 3.

In sum, these results suggest that the selected music for each condition yields the intended change in state affect. Further, these results show that participants are sensitive to the characteristics that correspond to valence and arousal.

Within condition analyses. Within each condition, paired t-tests were conducted to determine if there was a significant change in participants' positive (PA) and negative (NA) affect scores pre/post and whether there were significant differences between music selections on various subjective characteristics (i.e., valence, arousal, and emotional tone). Condition 1 ($n = 12$) featured six music selections that were minor and slow in tempo ($M = 57.2$, $SD = 5.88$). The average valence rating for this condition was 4.25 ($SD = 1.14$) and the average arousal rating was 4.13 ($SD = 1.19$). A paired-samples t-test revealed a significant difference between pre-PA scores ($M = 3.24$, $SD = 0.58$) and post-PA scores [($M = 2.5$, $SD = 0.72$); $t(11) = 3.65$, $p = 0.004$]. There was no significant change in NA scores [pre: $M = 1.35$, $SD = 0.32$; post: $M = 1.36$, $SD = 0.20$); $t(11) = -0.162$, $p = 0.874$] although there was a slight increase. These results suggest that participants experienced a decrease in their level of PA after listening to the music, but their

level of NA did not change. With the exception of one song, which was rated as more familiar to participants than the other selections, paired t-tests revealed no significant differences between any of the songs in terms of familiarity. With the exception of one song, which was liked more by participants than the other selections, paired t-tests revealed no significant differences between the songs in terms of liking.

Condition 2 (n = 7) featured eight music selections that were minor and fast in tempo (M = 157.8, SD = 23.22). The average valence rating for this condition was 4.57 (SD = 0.67) and the average arousal rating was 5.04 (SD = 1.19). A paired-samples t-test revealed a significant difference between pre-PA scores (M = 3.12, SD = 0.32) and post-PA scores [(M = 2.29, SD = 0.51); t(6)= 3.38, p = 0.015]. There was no significant change in NA scores [pre: M = 1.31, SD = 0.25; post: M = 1.38, SD = 0.20); t(6)= -1.27, p = 0.251] although there was a slight increase. These results suggest that participants experienced a decrease in their level of PA after listening to the music, but their level of NA did not change. With the exception of two songs, which were rated as more familiar to participants than the other selections, paired t-tests revealed no significant differences between any of the songs in terms of familiarity. With the exception of one song, which was liked less by participants than the other selections, paired t-tests revealed no significant differences between the songs in terms of liking.

Condition 3 (n = 5) featured nine music selections that were major and fast in tempo (M = 150.2, SD = 23.84). The average valence rating for this condition was 5.91 (SD = 0.98) and the average arousal rating was 5.47 (SD = 0.89). A paired-samples t-test revealed a significant difference between pre-PA scores (M = 2.64, SD = 0.65) and post-PA scores [(M = 2.82, SD = 0.65); t(4)= -2.76, p = 0.051]. A paired-samples t-test revealed a marginally significant difference between pre-NA scores (M = 1.48, SD = 0.40) and post-NA scores [(M = 1.17, SD =

0.10); t(6)= 2.17, p = 0.096]. These results suggest that participants experienced an increase in their level of PA and a decrease in their level of NA, after listening to the music. There were no differences between any of the songs in terms of familiarity or liking.

Condition 4 (n = 7) featured eight music selections that were major and slow in tempo (M = 52.5, SD = 5.48). The average valence rating for this condition was 4.64 (SD = 0.52) and the average arousal rating was 4.09 (SD = 1.18). A paired-samples t-test found no significant difference between pre-PA scores (M = 2.71, SD = 0.32) and post-PA scores [(M = 2.58, SD = 0.70); t(6)= 0.806, p = 0.451]. A paired-samples t-test revealed a marginally significant difference between pre-NA scores (M = 2.00, SD = 0.54) and post-NA scores [(M = 1.74, SD = 0.51); t(6)= 1.95, p = 0.099]. These results suggest that participants experienced a decrease in their level of NA after listening to the music, but their level of PA did not change. There were no significant differences between the songs in terms of familiarity. With the exception of one song, which was disliked more by participants than the other selections, paired t-tests revealed no significant differences between the songs in terms of liking.

Manipulation Check of Music on Attention

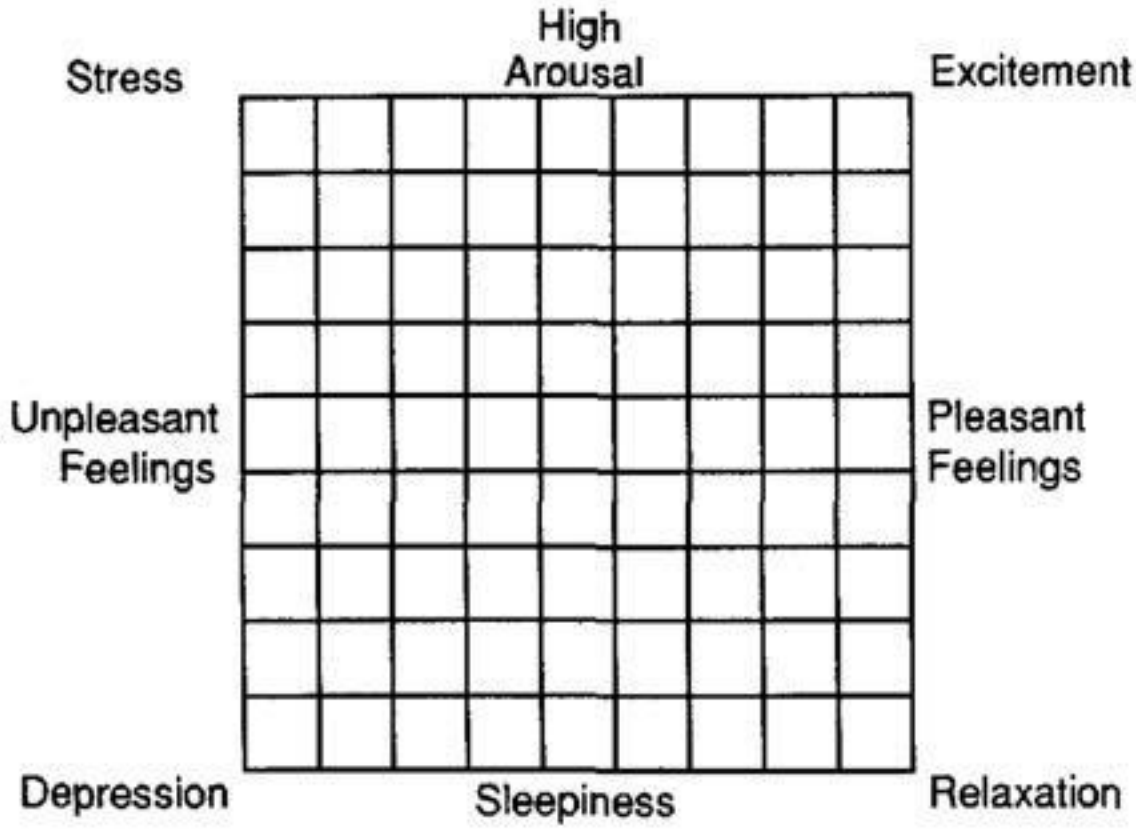
A pilot test of the full experimental study was also conducted to determine if music has the intended effect on attention. The procedures were identical to the full study procedures described in the manuscript. Participants were randomly assigned to one of the four experimental conditions. Dummy coded variables were created to reflect key (major vs. minor) and tempo (fast vs. slow). Results indicate that music key is significantly related to positive affect such that positive affect is higher for participants who listened to music in a major key (β = 0.398, SE = 0.187, $p > 0.05$) even after controlling for baseline affect. Results for negative affect were not significant but suggests a negative relationship between key and negative affect. This implies

that negative affect increases when listening to music in a minor key. For arousal, there were trends in the data to suggest that indicators of arousal increase as tempo increases. Indeed, there was a marginally significant relationship between tempo and pulse rate ($\beta = 5.664$, $SE = 2.751$, $p = 0.055$), even after controlling for baseline pulse rate. Finally, results show a significant correlation between musical key and attention ($r = 0.44$, $p > 0.05$), suggesting that listening to music in major key is associated with broader attentional scope. Taken as whole, trends in these pilot tests appear to be in keeping with the proposed hypotheses of this study.

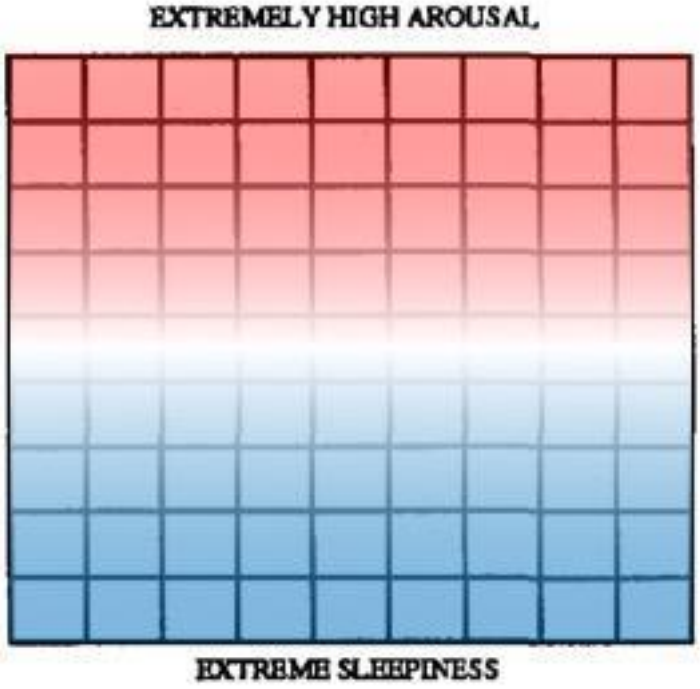
Appendix C: Study Measures

Affect Grid

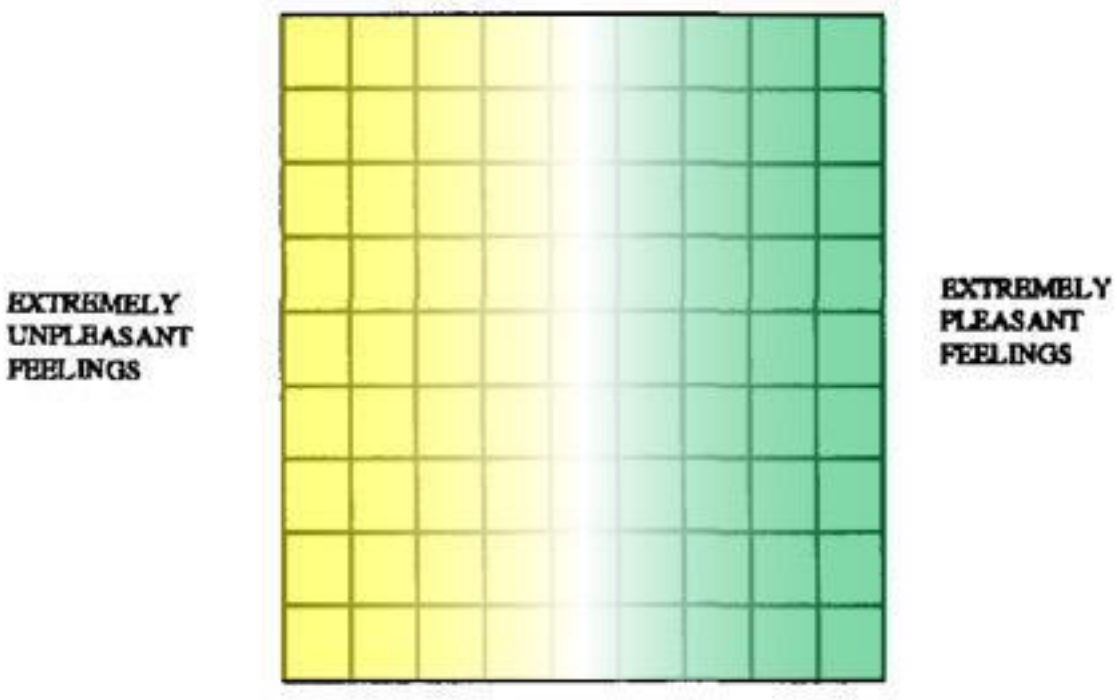
Below is a grid that you can use to indicate your emotional state by selecting a point along two axes. The horizontal axis is the **energy or intensity** of your feelings and the vertical axis is the **pleasantness** of your feelings.



The **horizontal axis** of the grid represents your intensity of your feelings. The **top half** of the grid represents **high energy feelings**. The **bottom half** of the grid represents **low energy feelings.**



The **vertical axis** of the grid represents your valence of your feelings. The **right half** of the grid represents **positive feelings**. The **left half** of the grid represents **negative feelings.**

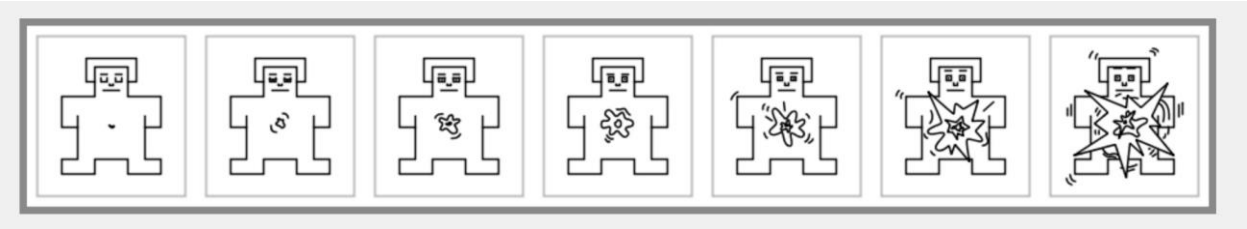


Combined, each square represents different emotional responses (i.e., positive energized feelings such as excitement, low energy negative feelings like sadness)

Self-Assessment Manikin

Arousal subscale

Please indicate which picture best captures your level of arousal or activation at this moment.



PANAS

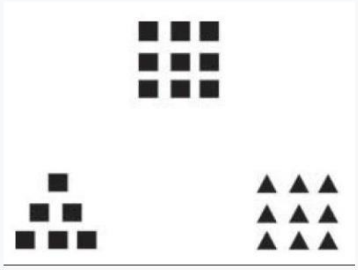
This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way **at this very moment**. Use the following scale to record your answers:

1	2	3	4	5
Very slightly or not at all	A little	Moderately	Quite a bit	Extremely

_____ cheerful	_____ sad	_____ upset	_____ calm	_____ enthusiastic
_____ attentive	_____ afraid	_____ joyful	_____ interested	_____ nervous
_____ happy	_____ excited	_____ irritable	_____ hostile	_____ frightened
_____ relaxed	_____ alert	_____ jittery	_____ tired	_____ determined
_____ at ease	_____ delighted	_____ angry	_____ inspired	_____ downhearted
_____ energetic	_____ fearless	_____ blue	_____ scared	_____ concentrating

Global-Local Processing Task

You will now complete task in which you will be presented with a target figure and two comparison figures, such as in the example below. The target figure is the top center one. The two comparison figures are below it.



You need to select the comparison figure that **you think** best matches the target figure as fast as possible. **There is no wrong or right answer.**

You will be presented with 16 trials. You will have **10 seconds** to make your selection for each trial.

Do you understand what you need to do for this task? If "YES", please proceed to the next page to begin the task. If "NO", please raise your hand to ask the experimenter to clarify the task.

Questions about Music

On a scale from 1 (not at all)-7 (extremely) please answer the following questions:.

1. How familiar are you with this music?
2. How much did you like the music?
3. How much did you dislike the music?
4. How distracting was the music?
5. How well could you concentrate with the music playing?
6. Did the music help you complete the task?
7. How interesting was the creativity task?
8. How difficult or challenging was the creativity task?

Using a scale from 1 (not at all) to 5 (extremely), to what extent does each word describe the overall feel or emotion of the music that you heard? In other words, did the music overall sound happy, angry, sad, etc.

1. Happy
2. Anxious
3. Sad
4. Calm
5. Joyful
6. Fearful
7. Depressed

8. Angry
9. Relaxing
10. Exciting/energizing

Musical Background

1. Please write down as many types or genres of music you like best (i.e. rock, pop, hip-hop, country, techno, jazz, etc.).

2. On average, how many hours per day do you listen to music?

3. In what settings do you typically listen to music? Check all that apply.

Home _____

Work _____

School _____

Other (please specify) _____

4. On average, how many hours per day do you listen to music in the following settings?

Home _____

Work _____

School _____

Other (please specify) _____

5. Do you typically listen to music while doing some task or activity (e.g. work, homework, cleaning, etc.)? Yes/No

5a. If yes, please indicate the type of task(s).

6. Do you play an instrument and/or sing or have ever played an instrument and/or sang in the past? Yes/No

7. Have you ever received musical training (i.e. private lessons, voluntarily taken music classes in school, etc.)? Yes/No

6a. If so, for how many years?

Demographic Information

1. What is your age (in years)?

2. What is your biological sex?

3. What is your race? (White/Caucasian, Hispanic/Latino, Black/African American, Asian/Pacific Islander, Middle Eastern/Arab, Native American, Other)

   3a. If other, "Please specify."

4. What year is this for you at VCU?
   a. First year
   b. Second year
   c. Third year
   d. Fourth year
   e. Fifth year
   f. Sixth year or more

5. Did you transfer to VCU from another college or university?
   a. Yes
   b. No

6. Are you an international student (i.e., not born in the US)?
   a. Yes
   b. No

7. Did you take a break between finishing high school and starting college?
   a. Yes
   b. No

8. Have you returned to college after taking break to work, military service, have children, etc.?
   a. Yes
   b. No

Controls

NEO-RPI

Here are a number of characteristics that may or may not apply to you. Please indicate the extent to which you agree or disagree with that statement. **In general, I...**

<u>Extraversion subscale</u>
1. Feel comfortable around people.
2. Make friends easily.
3. Am skilled in handling social situations
4. Am the life of the party.
5. Know how to captivate people.

6. Have little to say.
7. Keep in the background.
8. Would describe my experiences as somewhat dull.
9. Don't like to draw attention to myself.
10. Don't talk a lot.

Openness subscale

1. Believe in the importance of art.
2. Have a vivid imagination.
3. Tend to vote for liberal political candidates.
4. Carry the conversation to a higher level.
5. Enjoy hearing new ideas.
6. Am not interested in abstract ideas.
7. Do not like art.
8. Avoid philosophical discussions.
9. Do not enjoy going to art museums.
10. Tend to vote for conservative political candidates.

Trait Regulatory Focus

Please indicate how well each statement describes you in general.

1. In general, I am focused on preventing negative events in my life.
2. I am anxious that I will fall short of my responsibilities and obligations.
3. I frequently imagine how I will achieve my hopes and aspirations.
4. I often think about the person I am afraid I might become in the future.
5. I often think about the person I would ideally like to be in the future.
6. I typically focus on the success I hope to achieve in the future.
7. I often worry that I will fail to accomplish my academic goals.
8. I often think about how I will achieve academic success.
9. I often imagine myself experiencing bad things that I fear might happen to me.
10. I frequently think about how I can prevent failures in my life.
11. I am more oriented toward preventing losses than I am toward achieving gains.
12. My major goal in school right now is to achieve my academic ambitions.
13. My major goal in school right now is to avoid becoming an academic failure.
14. I see myself as someone who is primarily striving to reach my “ideal self ”—to fulfill my hopes, wishes, and aspirations.
15. I see myself as someone who is primarily striving to become the self I “ought” to be—to fulfill my duties, responsibilities, and obligations.
16. In general, I am focused on achieving positive outcomes in my life.
17. I often imagine myself experiencing good things that I hope will happen to me.
18. Overall, I am more oriented toward achieving success than preventing failure.

Creative Self-Efficacy

Please indicate how well each statement describes you in general.

1. I feel that I am good at generating novel ideas

2. I believe I can succeed at most any creative endeavor to which I set my mind
3. I have confidence in my ability to solve problems creatively
4. Compared to other people, I can do most tasks very creatively
5. I am confident that I can perform creatively on many different tasks

Trait Mindfulness

Please read each of the following statements carefully and indicate the extent to which you agree/disagree that each of the statements describes you **in general.**

1. I could be experiencing some emotion and not be conscious of it until some time later.
2. I find it difficult to stay focused on what's happening in the present.
3. I tend not to notice feelings of physical tension or discomfort until they really grab my attention.
4. It seems I am "running on automatic," without much awareness of what I'm doing.
5. I rush through activities without being really attentive to them.
6. I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there.
7. I do jobs or tasks automatically, without being aware of what I'm doing.
8. I find myself doing things without paying attention.
9. I find myself preoccupied with the future or the past.
10. I find myself listening to someone with one ear, doing something else at the same time.

Appendix D: SME Rating Material

Instructions

The purpose of this task is to generate novel and useful ideas to address key issues regarding student life. This task consisted of two issues: 1) how to improve the transition between high school and college, and 2) how to improve the quality of student life once on campus.

Construct Definitions

Creativity is the production of novel and useful ideas, products, or solutions to a defined problem (Amabile, 1996). You will be evaluating student responses based on the idea's novelty, originality, usefulness, feasibility, and overall creativity. Below are definitions of each of these sub-dimensions for you to use as a guide when rating:

- **Novelty** refers to how new or unexpected an idea is in the context of present day VCU.
    - This could be something totally different or a new application of an existing idea or activity.
    - Keep in mind that students will not be aware of every activity or program that VCU currently does or has done in the past.
    - Even if the idea is one that is currently in practice or has been by VCU in the past, but it isn't an obvious response that a student would make, that response should be rated higher in novelty.
- **Originality** refers to how unique or distinctive a response is within the sample.
    - You will notice that certain ideas (e.g., more activities, better food, etc.) are more commonly given than others. As a general rule, the more common the idea, the less original it is.
    - The more detail that an individual provides, such as the target, means, and processes by which that activity will be carried out, the *more* original and distinct the idea is.
- **Usefulness** refers to the idea's potential effectiveness, worth, or success in solving the issue at hand.
    - In other words, how likely is it that this idea will help present-day VCU improve the issue or problem?
- **Feasibility** refers to how practical or able an idea is to be implemented.
    - In other words, is it possible for present-day VCU to carry out this idea?

Important Points to Remember!

- When rating each of the sub-dimensions of creativity (i.e., novelty, originality, usefulness, feasibility), focus on the definition of that particular construct and *rate the response irrespective of the other dimensions*. Consider all the dimensions when rating the overall creativity of the response.

- The context of these ideas is present day VCU.
- Remember that just because an idea is very novel, doesn't mean that it is very creative. And just because an idea is very useful doesn't mean that it can't be creative. Creativity is both novelty ***and*** usefulness.
- Be aware that just because a response is *longer*, it doesn't mean that it is more creative.

Rating instructions

1. Before rating, take a moment to skim through the responses of the first 20 or so participants.
2. Go back to the first participant, read the response, and then rate how *novel*, *original*, *useful*, *feasible*, and *creative* the response is using the scale below.
3. Repeat for the rest of your set of participants

1	2	3	4	5	6
Extremely low	Moderately low	A little low	A little high	Moderately high	Extremely high

Codeable vs. Noncodeable responses

If the response is not a coherent idea, not understandable, is off topic, or a response is not provided, leave blank. Examples include:

- "get contract with VCU transtion department and take a long talk about it"
- "take some party"
- "I feel as if High school did not prepare me for college. I think VCU did a great job for my transition from community college to university. I don't have any suggestions."

Some responses may refer to actions taken by other organizations or institutions not related to VCU. For issue 1, a number of responses will suggest ideas that would take place at the high-school level. For example: "Don't hand-hold as much in high school. Make student be more accountable for their work and independent." This response is still codeable but would probably be rated lower in terms of feasibility. Likewise for issue 2, a number of responses will suggest ideas that require action by the city of Richmond: "Add more bus stops around Richmond so students can explore the city outside of campus."

Examples and Rationale for Ratings

Task 1: How can VCU improve the transition from high school to college?

Examples for **novelty**

1. Extremely low:
    - "Making them feel like they are included"
    - *Why*: The University already has several programs and hosts events specifically for this purpose. If the response had more specific details about *how* to make new students feel included, then this would receive a higher rating.
2. Moderately low:
    - "Give them more resources to help them navigate through classes and time management. Many of the kids I talk to have problems navigating blackboard, and many others find themselves exhausted and lacking good study habits."
    - *Why*: The university already has several programs and hosts events specifically for this purpose. If the response had more specific details about *how* to make new students feel included, then this would receive a higher rating.
3. A little low:
    - "I feel like students entering college should have a college student check on them at the end of the week to see how they are adjusting."
    - *Why:* The university already has a student ambassador program, but this is a little different from current practice by specifying a mandatory check-in and having it occur during the first week of the semester.
4. A little high:
    - "Give tours of the campus and let them "shadow" a student for the day."
    - *Why:* A few participants provide a similar idea of campus tours, so this idea isn't too unique but the fact that they mention shadowing a student makes this different from similar ideas.
5. Moderately high:
    - "Find what major works best for the through the STRONG test if they are undecided"
    - *Why*: This idea is new in that it provides a different application of a product that VCU currently uses. The Strong Inventory is used by career services to help student identify possible career trajectories, but not necessarily used for helping undecided students to pick a major.
6. Extremely high:
    - "Involve the freshman in a transition program that focuses on life skills such as finance, banking, cooking, cleaning, communicating, time management, individuality, etc."

- *Why*: This idea is different or new to what VCU currently does, in particular because it targets the idea towards new students (i.e., freshman), is specific in the types of skills to enhance, and suggests that it would a separate program from normal academic coursework.

Examples for **originality**

1. Extremely low:
    - "More events or activities"
    - *Why*: Not very unique. If they had been more specific about types of activities then it would receive a higher score.
2. Moderately low:
    - "Do better easing them into the coursework load."
    - *Why:* A few participants provide a similar response is given by a number of participants and does not provide
3. A little low:
    - "Assign student mentors in high school to give them better insight on the college experience"
    - *Why*: Several participants provide a similar idea of mentorship, so this idea isn't very unique, but the fact that they mention assigning mentors starting in high school makes this a little different from similar ideas.
4. A little high:
    - "Give tours of the campus and let them "shadow" a student for the day."
    - *Why:* A few participants provide a similar idea of campus tours, so this idea isn't too unique but the fact that they mention shadowing a student makes this different from similar ideas.
5. Moderately high:
    - "Show the new students that it's okay to ask for help, have people wear t-shirts letting new students know they're approachable when they need help/advice about the university."
    - *Why:* Although the university has a students ambassadors program and a welcome week for incoming students, very few participants provided a similar response. Further, this answer provides some specifics about how the idea would be implemented. This makes is moderately original.
6. Extremely high:
    - "Meaningful campus news, an opt-in email list written by students for students with actual relevant information"
    - "Have college professors evaluate local public school/private high school seniors' papers and work to and give advice to classes about what to improve about their work and what the expectations are for college"

- *Why:* Both of these ideas are highly original because no other participant gave a similar idea and the details given in each makes them more unique.

Examples for **Usefulness** (i.e., the idea's potential effectiveness or success in solving the issue)

1. Extremely low:
    - "Give out free t-shirt to all high school student entering college."
    - *Why*: This idea will probably not be effecting in improving the transition from high school to college.
2. Moderately low:
    - "More activities to help them enter the college life."
    - *Why*: VCU already has many programs and activities in place to make students feel included and adjust to college life, so it isn't clear how having more activities would be effective in solving the issue over and above what is currently done. If the idea had given more detail about the specific kinds of activities then it would be more useful.
3. A little low:
    - "Have all of them take a test of what their strength and weaknesses are in—with respect to academics (i.e., writing, math, etc.)."
    - *Why*: Most introductory courses have placements tests to determine which course level a student should take, so it isn't clear how this idea would be more effective than current practice. Further, the response doesn't explain how the test results would be used to help students entering college. If it had given more detail about how VCU could use these results to ease the transition, then it would be more useful.
4. A little high:
    - "Making them feel like they are included"
    - *Why*: Although this idea is useful and would effective at improving the transition from high school to college, it doesn't provide any detail or explanation as to how VCU would make new students feel included. Thus, this response doesn't provide an idea that is more effective than what is current practice at VCU.
5. Moderately high:
    - "Assign student mentors in high school to give them better insight on the college experience"
    - *Why*: This idea would be very effective at improving the transition from high school to college, because it would give high school students an idea of what to expect. It would also provide the new student a contact so that they would come into the university already knowing someone and building their social network.
6. Extremely high:
    - "Give tours of the campus and let them "shadow" a student for the day."

- *Why*: This idea would be highly effective at improving the transition from high school to college, because it would give new students a very good realistic preview of what to expect attending college at VCU.

Examples for **Feasibility**

1. Extremely low:
    - "Don't hand hold as much in high school. Make student be more accountable for their work and independent."
    - *Why*: This idea is specific to what should be done in high school and it is not possible for the university to control how all high schools in the state and across the country teach and prepare students for college.
2. Moderately low:
    - "Assign student mentors in high school to give them better insight on the college experience"
    - *Why*: This idea would be difficult for VCU to implement because it would require a lot of coordination and planning pair high school students with VCU students. It's also not possible to know who may or may not apply for VCU, or even come to VCU once accepted.
3. A little low:
    - "Have college professors evaluate local public school/private high school seniors' papers and work to and give advice to classes about what to improve about their work and what the expectations are for college"
    - *Why:* This idea would be a little challenging for VCU to implement because it would need to get faculty to agree to grade more assignments and to go to different high schools to give advice. It would also require a lot of coordination with local high schools.
4. A little high:
    - "I feel like that high school students entering college should have a college student check on them at the end of the week to see how they are adjusting"
    - *Why:* This idea is little bit feasible as VCU already has a student ambassador program and thus has the resources and coordinating mechanisms in place to carry this out. However, the scale of this idea would be difficult to execute efficiently.
5. Moderately high:
    - "Show the new students that it's okay to ask for help, have people wear t-shirts letting new students know they're approachable when they need help/advice about the university."
    - *Why:* Again, VCU already has the resources in place to carry this out and it wouldn't be too difficult to execute this idea.
6. Extremely high:
    - "Give tours of the campus and let them "shadow" a student for the day."

- *Why*: VCU already gives tours, and thus has the capabilities to do this, and it would be easy to get a few current students to volunteer to be shadowed by new students for a day.

Examples for **Creativity**

1. Extremely low:
    - "More events or activities"
    - *Why:* This answer is not novel or original, and is only slightly useful and practical for VCU to implement. Thus, this idea is very low in creativity.
2. Moderately low:
    - "Making them feel like they are included"
    - *Why*: This answer is not very novel or original. Although feasible, it doesn't offer much utility in addressing the issue. Thus, it is fairly low in creativity.
3. A little low:
    - "Give them more resources to help them navigate through classes and time management. Many of the kids I talk to have problems navigating blackboard, and many others find themselves exhausted and lacking good study habits."
    - *Why:* This idea has a lot of utility and is practical for VCU to implement, however, it's not very novel novel and original. Thus, this idea is a little low in creativity.
4. A little high:
    - "Give tours of the campus and let them "shadow" a student for the day."
    - *Why:* This idea is very useful and feasible for VCU to implement, but it's only a little novel and original, so it is only a little high in creativity.
5. Moderately high:
    - "Assign student mentors in high school to give them better insight on the college experience"
    - *Why*: This idea moderately creative because it is fairly novel and original, plus it is also very useful and would effective at improving the transition for new students. However, it would be difficult to implement so this is why it is only moderately creative.
6. Extremely high:
    - "Have students sit in on a "mock lecture classroom" during their orientation. This way, students can first hand experience what a class will be like, and what materials and amount of study hours are required."
    - *Why*: This idea is new or different from what is currently done and has the potential to be effective in improving the transition from high school to college and is possible to implement.

Table 1

Descriptives and Correlations Among Focal Variables

Variables	Mean	SD	N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 Major Key	-	-	152	1																
2 Minor Key	-	-	150	-.530**	1															
3 Fast Tempo	-	-	152	.229**	.246**	1														
4 Slow Tempo	-	-	150	.248**	.215**	-.527**	1													
5 Control	-	-	134	-.306**	-.303**	-.308**	-.300**	1												
6 Systolic Pressure T2	114.93	16.22	430	.140**	-0.02	.120*	-0.003	-0.026	1											
7 Diastolic Pressure T2	71.52	11.47	430	0.09	-0.016	0.086	-0.015	0.006	.818**	1										
8 Heart Rate T2	77.17	12.76	436	0.065	-0.048	-0.029	0.053	-0.091	0.057	.162**	1									
9 Arousal T2 (SAM)	3.23	1.40	436	0.059	0.061	.274**	-.155**	-.105*	0.076	0.08	-0.015	1								
10 Valence T2 (SAM)	4.62	0.89	434	.111*	0.087	.199**	0.001	-0.049	0.028	0.011	-0.076	.361**	1							
11 Positive Affect T2	2.85	0.79	436	0.075	-0.011	.140**	-0.078	0.012	0.01	0.001	-0.071	.284**	.603**	1						
12 Negative Affect T2	1.47	0.43	436	-0.047	-0.025	-0.054	-0.024	-0.074	-0.02	-0.006	0.069	0.013	-.319**	-0.067	1					
13 Arousal T2 (Grid)	6.53	1.84	422	0.068	0.014	0.029	0.054	0.07	0.012	-0.003	-0.02	0.056	.500**	.484**	-.457**	1				
14 Valence T2 (Grid)	4.78	1.92	422	.111*	-0.021	.242**	-.150**	-.102*	0.04	0.059	0.001	.399**	.307**	.332**	-0.036	-0.049	1			
15 Global Attention	11.40	4.22	436	-0.072	0.042	-0.023	-0.007	0.012	-0.004	-0.027	-0.046	-0.023	0.068	0.033	-.121*	0.086	-0.016	1		
16 Novelty	2.91	0.71	436	0.032	-0.015	-0.019	0.036	-0.033	-0.026	-0.013	0.016	0.073	0.032	0.042	-0.024	-0.04	0.009	0.076	1	
17 Usefulness	3.70	0.61	435	0.046	-0.014	0.042	-0.009	-0.047	-0.037	-0.036	0.087	-0.009	0.019	-0.026	-0.093	-0.007	0.015	-0.062	0.032	1
18 Creativity	3.19	0.49	436	0.06	-0.021	0.016	0.024	-0.058	-0.045	-0.036	0.064	0.058	0.044	0.029	-0.079	-0.03	0.027	0.036	.833**	.566**

* $p < 0.05$ level (2-tailed).

** $p < 0.01$ level (2-tailed).

Table 2

Effect of Musical Key on State Affect

	Positive Affect			Negative Affect			Affect Grid: Valence			SAM: Valence		
Variables	*B*	b	*SE*	*B*	b	*SE*	*B*	b	*SE*	*B*	b	*SE*
Controls												
Positive affect baseline	0.74**	0.88**	0.04	-	-	-	-	-	-	-	-	-
Negative affect baseline	-	-	-	0.72**	0.62**	0.04	-	-	-	-	-	-
Valence (Affect Grid) baseline	-	-	-	-	-	-	0.5**	0.52**	0.05	-	-	-
Valence (SAM) baseline	-	-	-	-	-	-	-	-	-	0.58**	.56**	0.04
Liking	0.19**	0.1**	0.02	-0.09*	-0.03*	0.01	0.01	0.01	0.07	.16**	0.1**	0.03
Familiarity	0.09**	0.06**	0.02	-0.04	-0.02	0.02	0.13*	0.21*	0.09	.12*	0.09*	0.04
Predictors												
Major key	0.09*	0.14*	0.06	-0.02	-0.02	0.04	0.08	0.31	0.24	.15**	0.28**	0.10
Minor key	0.05	0.08	0.06	-0.001	-0.001	0.04	0.05	0.19	0.24	.15**	0.27**	0.10
R2		0.005			0			0.004			0.02**	
F change		F(2, 296) = 2.49			F(2, 296) = 0.11			F(2, 296) = 0.83			F(2, 296) = 5.41	
Model Summary												
Intercept		-0.39**	0.14		0.63**	0.09		1.4**	0.46		1.24**	0.23
		R2 = .681			R2 = .52			R2 = .29			R2 = .44	
		F(5, 296) = 126.41**			F(5, 296) = 63.89**			F(5, 296) = 22.12**			F(5, 296) = 48.51**	

**$p < 0.01$.

*$p < 0.05$.

+$p < 0.1$.

Table 3
Effect of Musical Key on Objective and Subjective Arousal

	Systolic			Diastolic			Heart Rate			SAM: Arousal			Affect Grid: Arousal		
Variables	*B*	b	*SE*	*B*	b	*SE*	*B*	b	*SE*	*B*	b	*SE*	*B*	b	*SE*
Controls															
Systolic BP baseline	0.75**	0.73**	0.04	-	-	-	-	-	-	-	-	-	-	-	-
Diastolic BP baseline	-	-	-	0.77**	0.73**	0.04	-	-	-	-	-	-	-	-	-
Heart Rate	-	-	-	-	-	-	.89**	.84**	0.03	-	-	-	-	-	-
Arousal (SAM) baseline	-	-	-	-	-	-	-	-	-	0.59**	0.59**	0.05	-	-	-
Arousal (Affect Grid) baseline	-	-	-	-	-	-	-	-	-	-	-	-	0.60**	0.58**	0.04
Liking	-0.09	-1.03	0.45	-0.04	-0.29	0.31	0.00	0.001	0.25	0.04	0.04	0.05	0.17**	0.21**	0.06
Familiarity	0.05	0.73	0.56	0.07	0.63	0.38	0.04	0.40	0.31	0.08	0.09	0.06	0.03	0.05	0.08
Predictors															
Major key	0.11**	3.81	1.53	0.01	0.35	1.06	-0.03	-0.69	0.84	.15**	.43**	0.16	0.08	0.30	0.21
Minor key	0.06	2.20	1.53	0.04	0.86	1.06	-0.06	-1.55	0.84	.11*	0.34*	0.16	0.06	0.25	0.21
R2		0.01*			0.001			0.002			.02*			0.005	
F change		F(2, 290) = 3.12			F(2, 290) = 0.34			F(2, 296) = 1.71			F(2, 296) = 3.89			F(2, 284) = 1.19	
Model Summary															
Intercept		-0.39**	0.14		18.83**	3.06		9.65**	2.44		0.65	0.30		1.72**	0.41
		R2 = .681			R2 = .60			R2 = .79			R2 = .37			R2 = .42	
		F(5, 296) = 81.28**			F(5, 296) = 87.98**			F(5, 295) = 224.52**			F(5, 296) = 34.8**			F(5, 289) = 41.53**	

**$p < 0.01$.
*$p < 0.05$.
+$p < 0.1$.

Table 4
Effect of Tempo on State Affect

	Positive Affect			Negative Affect			Affect Grid: Valence			SAM: Valence		
Variables	*B*	b	*SE*	*B*	b	*SE*	*B*	b	*SE*	*B*	b	*SE*
Controls												
Positive affect baseline	0.74**	0.88**	0.04	-	-	-	-	-	-	-	-	-
Negative affect baseline	-	-	-	0.72**	0.62**	0.04	-	-	-	-	-	-
Valence (Affect Grid) baseline	-	-	-	-	-	-	0.49**	0.51**	0.05	-	-	-
Valence (SAM) baseline	-	-	-	-	-	-	-	-	-	0.58**	.56**	0.04
Liking	0.22**	0.12**	0.02	-0.1*	-0.03*	0.01	0.06	0.07	0.07	.19**	0.11**	0.03
Familiarity	0.05	0.03	0.03	-0.03	-0.01	0.02	0.06	0.10	0.09	0.07	0.05	0.04
Predictors												
Fast tempo	.12**	0.2**	0.06	-0.04	-0.03	0.04	.17**	0.67**	0.24	.21**	0.39**	0.10
Slow tempo	0.01	0.01	0.07	0.01	0.01	0.04	-0.04	-0.17	0.24	0.08	0.16	0.10
R2		.01**			0.001			0.03**			0.03**	
F change		F(2, 296) = 6.04			F(2, 296) = 0.45			F(2, 296) = 6.58			F(2, 296) = 8.67	
Model Summary												
Intercept		-0.39**	0.14		0.63**	0.09		1.45**	0.45		1.23**	0.23
		R2 = .69			R2 = .52			R2 = .30			R2 = .46	
		F(5, 296) = 130.79**			F(5, 296) = 64.17**			F(5, 296) = 25.3**			F(5, 296) = 50.8**	

**$p < 0.01$.
*$p < 0.05$.
+$p < 0.1$.

Table 5
Effect of Tempo on Objective and Subjective Arousal

	Systolic			Diastolic			Heart Rate			SAM: Arousal			Affect Grid: Arousal		
Variables	*B*	b	*SE*	*B*	b	*SE*	*B*	b	*SE*	*B*	b	*SE*	*B*	b	*SE*
Controls															
Systolic BP baseline	0.75**	0.74**	0.04	-	-	-	-	-	-	-	-	-	-	-	-
Diastolic BP baseline	-	-	-	0.77**	0.73**	0.04	-	-	-	-	-	-	-	-	-
Heart Rate	-	-	-	-	-	-	0.89**	0.84**	0.03	-	-	-	-	-	-
Arousal (SAM) baseline	-	-	-	-	-	-	-	-	-	0.56**	0.57**	0.05	-	-	-
Arousal (Affect Grid) baseline	-	-	-	-	-	-	-	-	-	-	-	-	0.60**	0.58**	0.04
Liking	-0.09*	-0.96*	0.46	-0.03	-0.26	0.32	-0.002	-0.01	0.26	0.10	0.09	0.05	0.17**	0.21**	0.06
Familiarity	0.05	0.66	0.60	0.06	0.56	0.41	0.04	0.40	0.33	-0.004	-0.01	0.06	0.04	0.05	0.08
Predictors															
Fast tempo	0.1*	3.29*	1.54	0.03	0.77	1.06	-0.04	-1.15	0.85	.25**	0.72	0.16	0.07	0.27	0.21
Slow tempo	0.07	2.34	1.58	0.01	0.32	1.09	-0.04	-0.97	0.85	0.004	0.01	0.16	0.08	0.30	0.21
R2		0.01+			0.001			0.001			0.05**			0.005	
F change		F(2, 290) = 2.4			F(2, 290) = 0.27			F(2, 296) = 1.06			F(2, 290) = 13.31			F(2, 290) = 1.25	
Model Summary															
Intercept		31.1**	4.96		19.05**	3.04		9.5**	2.45		.73**	0.29		1.71**	0.41
		R2 = .58			R2 = .60			R2 = .79			R2 = .41			R2 = .42	
		F(5, 295) = 80.61**			F(5, 295) = 87.9**			F(5, 295) = 223.29**			F(5, 295) = 40.63**			F(5, 295) = 41.57**	

**$p < 0.01$.
*$p < 0.05$.
+$p < 0.1$.

Table 6

Effect of State Affect on Attention

	Attention		
Variables	*B*	b	*SE*
Controls			
Positive affect baseline	0.03	0.17	0.58
Negative affect baseline	-0.13+	-1.08+	0.64
Valence (Affect Grid) baseline	0.03	0.08	0.13
Valence (SAM) baseline	-0.05	-0.21	0.35
Predictors			
Positive affect	0.00	0.01	0.53
Negative affect	-0.03	-0.25	0.72
Valence (Affect Grid)	-0.05	-0.10	0.14
Valence (SAM)	0.06	0.27	0.38
R2		0.003	
F change		F(4, 410) = .314	
Model Summary			
Intercept		12.79**	1.75
		R2 = .02	
		F(4, 410) = 1.27	

**$p < 0.01$.

*$p < 0.05$.

+$p < 0.1$.

Table 7
Effect of Objective and Subjective Arousal on Attention

	Attention		
Variables	*B*	b	*SE*
Controls			
Systolic BP baseline	-0.18	-0.05	0.02
Diastolic BP baseline	0.05	0.02	0.03
Heart Rate baseline	0.08	0.03	0.03
Arousal (SAM) baseline	-0.01	-0.03	0.19
Arousal (Affect Grid) baseline	0.14*	0.31*	0.14
Predictors			
Systolic BP	0.14	0.04	0.03
Diastolic BP	-0.06	-0.02	0.04
Heart Rate	-0.11	-0.04	0.04
Arousal (SAM)	-0.03	-0.09	0.19
Arousal (Affect Grid)	0.002	0.004	0.14
R2		0.009	
F change		F(5, 405) = .734	
Model Summary			
Intercept		12.02**	2.14
		R2 = .03	
		F(10, 405) = 1.47	

**$p < 0.01$.
*$p < 0.05$.
+$p < 0.1$.

Table 8

Effect of Attention on Novelty, Usefulness, and Creativity

	Novelty			Usefulness			Creativity		
Variables	*B*	b	*SE*	*B*	b	*SE*	*B*	b	*SE*
Controls									
Extraversion	0.01	0.01	0.04	-0.02	-0.01	0.03	-0.003	-0.001	0.03
Openness	0.11*	.08*	0.04	0.16**	0.11**	0.04	.19**	0.1	0.03
Mindfulness	-0.04	-0.02	0.04	0.04	0.02	0.03	-0.002	-0.001	0.03
CSE	0.00	0.00	0.04	-0.11*	-0.06*	0.06	-0.05	-0.02	0.02
Promotion focus	-0.01	-0.01	0.05	-0.01	-0.01	0.05	0.001	0.001	0.04
Prevention focus	0.04	0.03	0.04	0.07	0.04	0.03	0.08	0.04	0.03
Predictors									
Attention	0.07	0.01	0.01	-0.07	-0.01	0.01	0.03	0.004	0.01
R2		0.005			0.004			0.001	
F change		F(1, 427) = 2.36			F(1, 426) = 1.97			F(1, 427) = 0.4	
Model Summary									
Intercept		2.29**	0.40		3.37**	0.34		2.54**	0.27
		R2 = .02			R2 = .04			R2 = .04	
		F(7, 434) = 1.31			F(7, 433) = 2.48*			F(7, 434) = 2.74	

**$p < 0.01$.

*$p < 0.05$.

+$p < 0.1$.

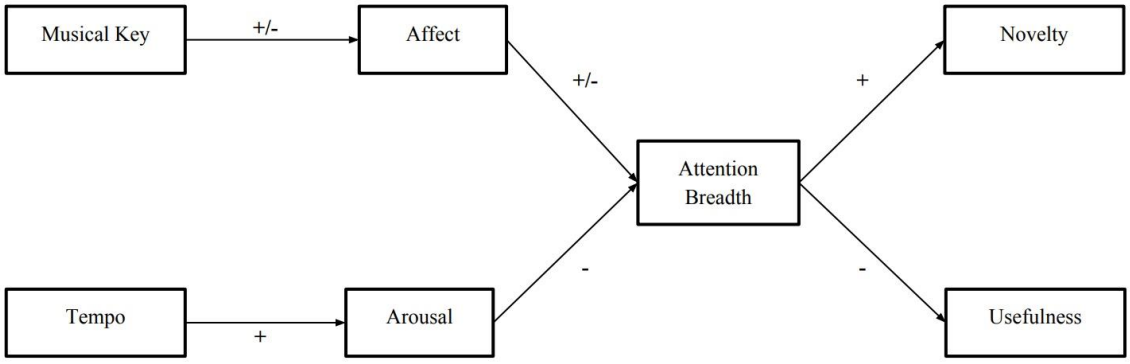


Figure 1. Conceptual Model of Music Characteristics on the Dimensions of Creativity

Vita

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