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CARDIOVASCULAR CHANGES IN ANGER UP-REGULATION DURING GOAL PURSUIT

By

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Abstract

Cardiovascular Changes in Anger Up-Regulation during Goal Pursuit

David B. Rompilla Jr.

People will choose anger-inducing stimuli when pursuing confrontation goals, which indicates an intention to up-regulate anger. The physiological concomitants of these actions, however, are not clearly understood. The current study was aimed to gain insight into this phenomenon by assessing changes in heart rate variability (HRV) when listening to music selected to facilitate goal pursuit. Sixty-seven students prepared to negotiate solutions to current student-parking issues. Participants were given a negotiation goal (confrontation, collaboration, or control) and then chose an emotion-inducing song (angry, happy, or neutral) to listen to in preparation for negotiation. After listening to the song, participants wrote a goal-driven message to the Director of Parking. Primary analyses revealed no significant differences between goal groups. However, group differences revealed through exploratory analyses suggest that music with a more polarized valence (i.e., angry and happy music) may demand more attentional resources, which interferes with emotion regulation processes during goal pursuit.

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Chapter One:

Introduction

Emotion regulation research has predominantly been focused on how emotion is regulated (e.g., what are the strategies people use to regulate emotion?). However, there has been a recent shift towards examining why people regulate emotions (Gross, 2014; Mauss & Tamir, 2014). The most recognized reason for regulating emotion is to increase pleasure and decrease pain (i.e., for hedonic reasons). Thus, emotion regulation research is often conducted based on the assumption that people want to regulate to increase pleasant emotions or decrease unpleasant emotions (Larsen, 2000). Although this assumption may be true in most instances, a growing body of literature provides evidence against the idea that maximizing pleasure and minimizing pain is always the goal of emotion regulation (Tamir, 2015). This literature contends that there are situations in which people choose to increase/up-regulate unpleasant emotions, such as anger, fear, or sadness, in order to achieve performance-related/instrumental goals, and that people who engage in this type of instrumental regulation tend to have better psychological health (Kim, Ford, Mauss, & Tamir, 2015; Tamir, 2015).

When regulating emotion for instrumental purposes, the goal is not to feel emotion for immediate pleasure. Instead, feelings of unpleasant emotions are increased because such feelings can enhance performance and, therefore, increase the likelihood of achieving longer-term goals (e.g., anger increasing an athlete's performance, which leads to winning a game and/or a more successful athletic career). The current study was aimed to investigate if the usefulness of anger in confrontation situations influences participants' regulation of anger. Furthermore, the study examined physiological

concomitants of selecting and implementing emotion-inducing music (angry, happy, and neutral music) to achieve instrumental goals.

The Process Model of Emotion Regulation

The process model of emotion regulation is aimed to explain how emotions are generated and regulated (see Figure 1; Gross, 2015). Although typically explained in preventing or attenuating negative emotions, it can also be applied to the up-regulation of negative emotions. According to the model, emotion generation starts with a personally relevant situation and attention deployment towards an aspect of the situation. The aspect attended to is then appraised, which leads to the generation of an emotional response. For instance, a person trying to get to work on time may appraise traffic negatively, leading to feelings of anger, along with co-occurring behavioral (e.g., cursing at other drivers) and physiological responses (e.g., increased skin conductance). Once an emotional response occurs, a new situation is created and the process starts over. Therefore, this situation-attention-appraisal-response cycle can lead to a change in emotion intensity as time passes.

Certain emotion regulation strategies can be implemented at each point in the emotion generation process (Gross, 2015). Situation selection can be implemented before a situation occurs. Therefore, if the emotion goal is higher anger, individuals may choose to experience anger-inducing situations. Once an individual is in a situation, they can alter the environmental aspects of the situation to increase their ability to achieve an emotion goal (e.g., turning on the lights to make a movie less scary). Attentional deployment can also be used to direct attention towards or away from emotion-inducing aspects of a situation. For example, if anger is the emotion goal of a football player,

attention may be directed towards negative aspects of the opposing team (e.g., their arrogant behavior). Cognitive change can be implemented to alter the way a situation is appraised. For instance, football players may appraise every action of the opposing team in a more negative light to increase feelings of anger before a game. After a situation is appraised, an emotion response is generated. Therefore, at this point in the emotion generation process, only the response to the emotion can be modulated (i.e., through suppressing or faking expressions of an emotion).

Central Nervous System and Emotion Regulation

Research suggests that cognitive control processes, such as attentional deployment (i.e., distraction) and cognitive change (i.e., reappraisal), can effectively alter environmental appraisals (Ochsner & Gross, 2014). This is shown through activation patterns associated with the interaction between emotion generation and emotion regulation. When an appraisal of the environment is formed, the appraisal is held in the medial prefrontal cortex (mPFC). In a non-emotional state, the mPFC is tonically inhibiting the amygdala (i.e., the brain region associated with feelings of negative emotions, such as anger, fear, anxiety, etc.) and keeping negative emotions from being felt. The degree of amygdala inhibition depends on the appraisal being held by the mPFC. For example, if an aspect of a situation is appraised as a threat, the brake will be taken off the amygdala (i.e., GABA release, which inhibits the amygdala, is decreased), which leads to increased amygdala activity and, therefore, increased negative emotion.

If an emotion regulation goal is formed, the anterior cingulate cortex (ACC) becomes active to monitor conflicts between one's current and goal emotion state (Ochsner & Gross, 2014). Once a mismatch is identified, the lateral prefrontal cortex

(lPFC) becomes engaged in cognitive control processes aimed to alter one's current state to better fit the goal emotion state. Successfully altering a current emotion state occurs through replacing or changing the original environmental appraisal held in the mPFC. When distraction strategies are employed, activation in the ACC and lPFC increase, along with the mPFC. Therefore, if a distraction is attentionally demanding enough, appraisals relevant to the distraction (e.g., focusing on fun activity to distract from negative emotion) will replace appraisals of the emotion-inducing situation in the mPFC, which leads to decreased amygdala activity. The same prefrontal cortex (i.e., both lPFC and mPFC; PFC) and ACC patterns of activation occur during cognitive reappraisal, while amygdala activity is altered based on the direction of the reappraisal (Oschner et al., 2004). For instance, if a situation is thought of more negatively than it was originally appraised, PFC activity will increase, while amygdala activation activity will also increase.

In contrast to distraction and reappraisal, expressive suppression, which is a response-focused strategy that only involves inhibiting outward expression of emotion, does not lead to activation of the PFC and ACC (Eysenck & Keane, 2010, p. 579-581). Additionally, amygdala activity increases over time with the use of expressive suppression, along with the later onset of PFC activation. This suggests that expressive suppression does not involve the necessary cognitive/PFC activation to stop emotion generation of a negative emotion. Therefore, to successfully alter amygdala activation to achieve an emotion goal, antecedent-focused strategies (i.e., strategies that occur before the emotion is generated) may need to be employed.

More preventative antecedent-focused strategies, such as situation selection and modification, can be used to select or change aspects of a situation that are likely to encourage an emotion goal state. One way of changing a situation is through listening to music. Research suggests that certain ways of listening to music can produce activation patterns similar to those found in successful emotion regulation (Moore, 2013). lPFC activation, leading to decreased amygdala activation, occurs when listening to preferable or familiar music. Additionally, music that is happy activates the anterior cingulate cortex and mPFC, which then leads to decreased amygdala activation. Minor, dissonant, or negative music is found to then show the opposite activation patterns, leading to increased amygdala activity. However, some studies suggest that passive situation selection of music can only intensify emotion states that are already felt, and that music alone is not enough to change an emotion state (Chin & Rickard, 2014; Karreman, Laceulle, Hanser, & Vingerhoets, 2017; Leipold & Loepthien, 2015). For instance, those who engage in successful emotion regulation through music have a tendency to listen to music in ways that engage attentional resources (i.e., thinking about the structure of the music), or they tend to engage in reappraisal processes while listening (Chin & Rickard, 2014; Leipold & Loepthien, 2015). Therefore, the exact role and effectiveness of music in the emotion regulatory process is unclear, and the role of lPFC activity may still be essential when implementing situational strategies to achieve emotion goals.

Cardiovascular System and Emotion Regulation

Emotion regulatory processes occurring in the PFC can be indirectly assessed through cardiovascular changes (Thayer & Lane, 2009; Silvani, Calandra-Buonaura, Dampneyand, & Cortelli, 2016). According to the model of neurovisceral integration,

inhibitory pathways, which originate in the mPFC (i.e., where environmental appraisals are held), are directed through the amygdala and other subcortical structures. This inhibitory pathway results in activation of the parasympathetic nervous system, specifically the vagus nerve. Essentially, the vagus nerve acts as a brake on the heart by attenuating cardiac output to adaptively adjust to environmental demands (Beauchaine, 2015; Friedman, 2007; Thayer & Lane, 2009). Without vagal control, the heart would naturally beat at a pace of around 100 beats per minute. However, vagal control of the heart allows for resting heart rate levels to remain around 70 beats per minute, which conserves energy. Additionally, vagal effects on the heart occur rapidly (i.e., in less than 1 second), allowing for quick adjustments to adaptively allocate cardiovascular resources based on PFC activity.

The sympathetic nervous system works in opposition to the parasympathetic nervous system, and its effects on the heart occur at a slower pace (i.e., take over 5 seconds to occur; Shaffer, McCraty, & Zerr, 2014). In contrast to the parasympathetic nervous system, which is responsible for rest and recovery processes, the role of the sympathetic nervous system is to prepare the body to endure strenuous survival periods that involve fighting or escaping a threat. Thus, when a situation is appraised as a significant threat by the mPFC (e.g., loud roommates threatening a students ability to study), the amygdala becomes activated, which leads to the vagal brake being taken off of the heart, along with activation of the sympathetic nervous system. If the vagus nerve activity remains withdrawn, the sympathetic nervous system—which affects the heart's activity at a slower rate—predominantly influences cardiovascular activity, which leads to a faster, more rigid heart rate. Thus, for negative emotions, such as fear and anger, less

vagal control is an indicator of emotional disinhibition, while greater vagal control (i.e., greater parasympathetic influence) is an indicator of emotional inhibition (Thayer & Lane, 2009; Stemmler, 2004).

Heart rate variability (HRV), which refers to the variability in beat-to-beat changes, is often used to measure vagally mediated/parasympathetic influence on the cardiovascular system. Different measures of vagally mediated HRV (frequency domain and time domain measures) are used to parse out HRV changes that are mediated by other systems (e.g., the sympathetic nervous system; Shaffer et al., 2014). For instance, high frequency HRV (HF HRV) is obtained through power spectral density analysis, which splits electrocardiography (ECG) signals into cardiac rhythms (very low frequency, low frequency, high frequency). Vagally mediated HRV is represented by high frequency rhythms (i.e., 0.15 - 0.40 Hz) associated with respiration (i.e., respiratory sinus arrhythmia). Respiratory sinus arrhythmia is characterized by heart rate slowing during expiration, which is due to vagal control, and heart rate speeding up during inspiration, which is due to vagal withdrawal. HF HRV is a measure of the frequency and magnitude of this respiratory rhythm in a given time period. Therefore, more respiratory sinus arrhythmia/HF HRV indicates more frequent and longer time periods in which the heart is under vagal control. In addition to frequency domain measures, time domain measures, such as root mean square of successive differences (RMSSD), measure variation between heartbeats adjacent to one another. Only vagally mediated/parasympathetic effects can occur fast enough to influence differences in the distance between successive heartbeats. Therefore, greater RMSSD, or variation in

successive beats over a certain period, represents greater vagal control (Shaffer et al., 2014).

Studies often use frequency and time domain measures of resting/baseline HRV as a trait-type measure, and such studies often find that high resting HRV is indicative of having a strong ability to control emotions (Appelhans & Luecken, 2006; Thayer, Ahs, Fredrikson, Sollers, & Wager, 2012). In addition, changes in time and frequency domain measures have been used to demonstrate the effectiveness of reappraisal and distraction in comparison to suppression and rumination.as a trait-type measure. For instance, when using reappraisal and distraction to down-regulate responses to anger-inducing stimuli, HRV tends to decrease less in comparison to when expressive suppression or rumination is used (Denson, Grisham, & Moulds, 2011; Fabiansson, Denson, Moulds, Grisham, & Schira, 2012; Ray, Wilhelm, & Gross, 2008). Because greater amygdala inhibition is theorized to lead to smaller decreases in vagal control/HRV and less anger, this research is consistent with neurobiological evidence that supports the effectiveness of reappraisal and distraction (Ochsner & Gross, 2014; Thayer & Lane, 2009). Therefore, measures of HRV are closely tied to activity occurring in the brain (i.e., PFC and amygdala) during the implementation of regulation strategies.

The Function of Anger

Emotion regulation research, such as the anger studies presented above, is often conducted with the aim of understanding effective ways to limit anger and its negative effects. However, anger may serve a specific function, making it useful if felt in certain contexts. According to the functionalist approach, which is a theory aimed to explain emotional development, emotions have distinct, basic functions, which remain the same

throughout life (Barrett & Campos, 1987). Similar to the process model of emotion regulation, this approach describes that emotions are generated when aspects of an environment are appraised as relevant to one's ability to adaptively function in that environment. Emotions are then characterized as specific action tendencies and physiological reactions aimed to motivate and prepare the body to alter the environment in one's favor. Whether an aspect of the environment is significant enough to lead to such action tendencies and physiological reactions depends on goals that are tied to certain emotions.

According to this functional approach (Barrett & Campos, 1987), anger generation involves learned goals (i.e., rather than innate survival goals, such as avoiding bodily harm) that form based on personal motives and desires (e.g., wanting to be a good student). Anger is felt when there is an obstacle blocking an obtainable goal. For example, a teacher giving an unfair test, which results in a failing grade, is likely to lead to anger because the teacher is interfering with the student's goal to be viewed as a good student. In this example, it is necessary to learn through socialization that good students get good grades to be able to evaluate the situation as relevant to one's goals. Therefore, this demonstrates the idea that goals relevant to anger tend to be learned and change based on the social aspects of the environment (e.g., what makes a student good?).

When a goal achievement is blocked, anger prepares the body for movement towards eliminating the obstacle (Barrett & Campos, 1987). The physiological components of anger involve strong activations of the sympathetic nervous system, vagal withdrawal (i.e., low HRV), high blood pressure, and strong cardiac output to support muscular strength (Stemmler, 2004; Kreibig, 2010). Thus, when anger is felt, action

tendencies are to physically attack obstacles that are in the way of a goal, and these physiological responses occur to support the activation of motor neurons when anger is felt (Stemmler, 2004). According to the functional perspective, this type of action tendency is then useful to obtain particularly difficult goals or to establish dominance.

Consistent with the idea that emotions are associated with specific action tendencies, Gray's (1990) biopsychological theory of personality argues that emotional action tendencies are often driven by basic approach or avoidance systems. The approach system becomes activated when a reward is presented, while the avoidance system becomes activated when a punishment is presented. The activation of approach or avoidance systems is then accompanied by emotions in order to promote approach or avoidance behaviors towards a reward or away from a punishment. Experimental studies often find that anger encourages approach-oriented behavior (Carver, 2004; Carver & Harmon-Jones, 2009; Harmon-Jones, Gable, & Peterson, 2010). For instance, Carver (2004) used a scale that measured participants' tendency to use the behavioral approach system (BAS) and behavioral inhibition system (BIS). More use of the BAS was an indicator that an individual was more likely to engage in approach-oriented behavior, while more use of the BIS was an indicator that an individual was more likely to engage in avoidance-oriented behavior. Approach-oriented and avoidance-oriented participants were then led to believe they could earn a reward (i.e., extra research participation credits) if they were to perform at a certain level during the experimental task. Achieving this performance level was then made impossible, and all participants experienced gradual failure. The results showed that approach-oriented participants felt more intense anger as they began to recognize that they were failing to achieve the goal, which

suggests that approach motivation is an important aspect of anger. The authors concluded that anger is likely generated when there is perceived inadequate movement towards a goal that is still obtainable. Therefore, anger promotes increased engagement to continue actions towards the goal.

Biopsychological evidence has also connected anger to approach motivation. Research suggests that left frontal cortical activity is associated with emotions that promote approach behavior, while right frontal cortical activity is associated with emotions that promote avoidance (Davidson, Ekman, Saron, Senulis, & Friesen, 1990). Harmon-Jones et al. (2010) then reported that left frontal cortical activity increases when anger is felt. Additionally, Brenner, Beauchaine, and Sylvers (2005) conducted a study in which participants were rewarded monetarily for every correct response given during a basic task (i.e., pressing a correct number key). Participants then were able to see their monetary rewards accumulate as the study progressed. During frustrative non-reward trials, rewards unexpectedly stopped being given for correct responses. The researchers found that participants' HRV decreased for both frustrative non-reward trials and reward trials. In addition, higher BAS reward responsiveness (i.e., a subscale of BAS specific to one's sensitivity to reward) was correlated with higher decreases in HRV during frustrative non-reward trials. Consistent with Carver (2004), when the task unexpectedly led to inadequate movement toward a goal (i.e., the goal of accumulating as much money as possible), participants who had more sensitive BAS systems likely felt frustrated by non-reward, leading to decreased HRV. Therefore, this suggests that anger is closely tied to the BAS system and physiological responses that support approach behaviors.

Anger and Confrontation Performance

Approach-oriented action tendencies and physiological concomitants of anger may have value in certain situations. Tamir, Mitchell, and Gross (2008) demonstrated the confrontation-enhancing potential of anger by having participants listen to different types of music (angry, exciting, or neutral) before playing a violent video game, where their goal was to shoot and kill as many enemies as possible. They found that participants who listened to the anger-inducing music reported more feelings of anger and successfully killed more enemies than participants who listened to exciting or neutral music. Therefore, anger enhanced participants' confrontation performance, while other feelings (i.e., arousal) did not.

Although Tamir et al.'s (2008) findings showed the performance enhancing utility of anger in confrontation, the confrontation situation used in their study was unrealistic and inapplicable to real-world confrontation (i.e., most people do not have to kill large numbers of people in everyday life). To address this issue, Tamir and Ford (2012) examined the usefulness of anger in the social context of negotiations. Negotiations are situations that involve a dispute between two or more parties over resources, and research on negotiations has shown that anger expression helps individuals elicit more concessions from other parties involved in a negotiation (Van Kleef, De Dreu, & Manstead, 2004; Sinaceur & Tiedens, 2006; Tamir & Ford, 2012). Tamir and Ford (2012) have demonstrated this through two studies where college students role-played as a landlord who had to negotiate with a tenant who failed to pay rent on time. Participants in each study were given different goals for the negotiation. One group was given a confrontation goal and was instructed to confront the tenant by getting their payments as quickly as

possible. Another group was given a collaboration goal and was instructed to maintain a good relationship with the tenant, while reaching a fair payment agreement. A third group (control) that was only included in Study 1 was given no goal.

In Tamir and Ford's (2012) first study, participants across all goal conditions were randomly assigned to either listen to anger-inducing, happiness-inducing, or neutral music before leaving a voice-recorded message to the tenant. Objective raters then listened to the voice messages and assessed participants' successful confrontation and collaboration. Successful confrontation was assessed by the likelihood that the message would cause a tenant to feel a sense of urgency to make his/her payments. For example, the raters were asked how likely the tenant would be to pay the rent back quickly. Successful collaboration was assessed by the degree that the message promoted a healthy relationship with the tenant. For example, the raters were asked how likely the tenant would be to collaborate with the landlord on a payment plan. The results showed that those who listened to anger-inducing music before leaving the voice message reported higher levels of anger and had higher successful confrontation ratings in comparison to those who listened to happiness-inducing or neutral music, suggesting that anger enhanced participants' confrontation performance in comparison to other emotions (Tamir & Ford, 2012). In addition, those given a confrontation goal had higher successful confrontation ratings, while those given a collaboration goal had higher successful collaboration ratings. Therefore, participants' goals also impacted how they addressed the tenant.

In the second study conducted by Tamir and Ford (2012), participants instead chose what music they wanted to listen to before an in-person negotiation task. Before

the negotiation task, participants listened to 20 s clips of songs that were anger inducing, happiness inducing, or neutral and then selected three of the songs to listen to at full length before the negotiation. The average emotional tone of the three selected songs was then calculated. After listening to the chosen songs, successful confrontation was assessed through a task where participants had to negotiate a payment plan with another student who role-played as the tenant (Tamir & Ford, 2012). All participants were first given a payment chart that assigned point values to varying payment plans specific to their assigned role. For the participants role-playing as the landlord, payment plans that resulted in more gain for the landlord were worth more points. For the participants role-playing as the tenant, payment plans that resulted in more gain for the tenant were worth more points. Successful confrontation was then based on the final payment plan that the landlord and tenant agreed upon. Therefore, a landlord who achieved an agreement associated with more points successfully confronted the tenant.

Consistent with the findings of the first study of Tamir et al. (2008), the results showed that participants who chose to listen to music that was primarily anger inducing felt more anger and gained more points during the negotiation (Tamir & Ford, 2012). Therefore, anger was again shown to enhance participants' confrontation performance in comparison to other feelings. In addition, participants in the confrontation goal condition chose more anger-inducing music in comparison to the collaboration condition, which suggested that participants wanted to up-regulate anger before confrontation.

Preference for Anger Based on Goals

As described above, participants in the second study conducted by Tamir and Ford (2012) tended to prefer anger-inducing music when they were given a

confrontational goal. This was also found to be true for a variety of additional stimuli examined in Tamir et al. (2008) and Tamir and Ford (2012). Before the main procedure of each study, participants rated their preference for different emotion-inducing stimuli that they would want to experience before the games/negotiation tasks, such as videos, memory recall, and music. Specifically in Tamir and Ford (2012), this preference-rating aspect of the study occurred after goal assignment (i.e., to confrontation or collaboration goals), and only participants in the second study actually experienced their preferred stimuli before the negotiation. In all cases within these studies, participants who were anticipating confrontation or assigned to a confrontation goal preferred anger-inducing stimuli. Therefore, these findings suggest that participants wanted to up-regulate feelings of anger before confrontation, possibly because they expected the feelings of anger to increase their performance.

Expected Usefulness of Anger Based on Goals

In order to provide evidence that participants expected anger to increase their performance, Tamir and Ford (2012) also evaluated the expected usefulness of emotions in the negotiation. Therefore, before the negotiation tasks and after goal assignment, participants were given a list of emotions and rated how successful they expected to be during the negotiation if each emotion was felt. The results then showed that participants in the confrontation condition expected anger to be more useful than those in collaboration or control (i.e., no goal) conditions. In addition, the expected usefulness of anger was found to mediate the relationship between the participants' goal and their preference. In other words, participants in the confrontation condition expected anger to be useful during the negotiation, which lead to a preference for anger-inducing stimuli.

These results suggest that participants given a confrontation goal sought to up-regulate feelings of anger before the negotiation to improve confrontation performance (i.e., for instrumental reasons).

Limitations of Anger Up-Regulation Research

Although the conclusion of Tamir and Ford's (2012) research is logical, their study presented some methodological concerns. For instance, first asking participants to rate the expected success of anger may have influenced participants' subsequent self-reported anger. In other words, if participants rated that they expected anger to be useful during the negotiation, they may have felt inclined to report greater feelings of anger to meet their own expectations, even if they truly were not feeling higher levels of anger. In a way, self-reported anger for those who expected anger to be useful may reflect a more complex form of demand characteristics, where participants behave based on the experimenter's expectation that beliefs will be consistent with actual feelings. In other words, once participants rated that they expected anger to be useful, they may have been inclined to provide evidence to the experimenter that they were following those beliefs (i.e., by self-reporting higher anger).

This idea is similar to conclusions drawn from cognitive dissonance theory paradigms (Festinger & Carlsmith, 1959). In a classic study involving the induced-compliance paradigm, participants given low incentive or high incentive ($1 or $20) had to persuade a confederate that a boring task was enjoyable. After, participants rated how much they actually enjoyed the study. The researchers found that participants given low incentive to lie ($1) tended to report that the boring study was more enjoyable in comparison to those given high incentive ($20) and a control group. The authors

concluded that, in the low incentive group, the behavior of saying the experiment was enjoyable dictated subsequent reported feelings, while actual feelings were likely much different than what was reported. Therefore, in Tamir and Ford (2012), similar dissonance between behavior (i.e., rating an emotion as being highly useful) and subsequent reported feelings (i.e., not really feeling any angrier after music) may have led participants who expected anger to be useful to self-report higher levels of anger, which possibly contradicted what they actually felt or even wanted to feel.

In addition to possible dissonance issues and as stated previously, emotion regulation through music may be dependent on cognitive processes, and it is unclear whether music itself can be used to up-regulate anger (Chin & Rickard, 2014; Karreman et al., 2017; Leipold & Loepthien, 2015). Although the music selection in the confrontation group may be evidence of intentions to up-regulate anger in Tamir and Ford's (2012) study, the emotion-enhancing potential of the music alone may not be enough to increase anger beyond self-report (i.e., physiological changes associated with higher anger). In addition, it may have been difficult for students to appraise the landlord-tenant situation as anger inducing because students may not have been able to relate to the situation (i.e., it was unlikely that any students had experience as a landlord). Therefore, the ecological validity of the landlord-tenant paradigm is also questionable.

The Current Study

The current study was aimed to gain better insight into the phenomenon in Tamir and Ford (2012) by assessing changes in vagally mediated HRV (i.e., HF HRV and RMSSD) when listening to music selected to facilitate goal pursuit. Using a methodology adapted from Tamir and Ford's study, participants were given a negotiation goal

(confrontation, collaboration, or no goal) and then chose an emotion-inducing song (angry, happy, or neutral) to listen to in preparation for negotiation. After listening to the song, participants aimed to achieve their goal through writing a goal-driven message, similar to the voice-recorded message in Tamir and Ford, Study 1. HRV was then recorded throughout the study to assess emotion regulation processes that may occur during goal pursuit and how listening to selected music may interact with these processes (e.g., by possibly enhancing them). The inclusion of HRV was also aimed to address issues with the validity of self-reported anger in Tamir and Ford (2012). Therefore, HRV measures were used as possible support for self-report and song-choice indicators of emotion regulation. Together, the current study included physiological (HRV), preference (song selection), and experiential (self-report anger) measures of emotion regulation, in addition to a measure where participants explicitly stated if they engaged in different types of emotion regulation (e.g., anger up-regulation). Therefore, a more thorough investigation of the mechanisms underlying anger up-regulation during goal pursuit was provided.

Another goal of the current study was to improve upon the ecological validity of Tamir and Ford's (2012) methodology through the use of a manipulation tailored to a sample of Towson University students. To encourage genuine feelings of anger, the tenant-landlord paradigm was replaced with a paradigm aimed to reflect prevalent parking problems at Towson University. A large portion of participants (86.57%) indicated that parking was a significant campus issue. Based on anecdotal data, student commuter parking spaces on Towson University’s campus often fill up quickly, causing students who arrive to campus on time to be late for class because they are spending

lengthy amounts of time finding parking spaces. This often causes students much frustration because there seems to be an excess of faculty parking spaces. In the current study, students role-played as a Student Government Association member preparing to negotiate solutions to current student-parking issues. The negotiation task then involved writing a goal-driven message to the Director of Parking, which students were deceived into thinking would be edited and sent to the Director of Parking. Therefore, the use of a more personally relevant, realistic situation was aimed to encourage students to regulate emotion in ways that were authentic and representative of how they would regulate emotion in similar real-life scenarios. Using a situation that, anecdotally, seemed to anger students was also speculated to encourage stronger emotional engagement (i.e., greater feelings of anger) during the study.

Through the use of the negotiation scenario involving the Director of Parking, the current study assessed differences in HRV (i.e., HF HRV and RMSSD), self-reported anger, music preference, and expected success of anger between participants given a confrontation, collaboration, or neutral goal for the negotiation. Hypothesis 1 was that the confrontation condition would show larger decreases in HRV from baseline to music listening and baseline to writing in comparison to the collaboration and control groups. Hypotheses 2-4 were the same hypotheses supported in Tamir and Ford (2012). Hypothesis 2 was that the confrontation group would show larger increases in self-reported anger from baseline to music listening and from baseline to during writing in comparison to the collaboration and control conditions. Hypothesis 3 was that the confrontation condition would choose more anger-inducing music in comparison to the collaboration and control condition. Hypothesis 4 was that the confrontation condition

would expect anger to be more useful during the negotiation. Hypothesis 5 was that expected success of anger would mediate the relationship between Goal Condition and decreased HRV while listening to selected music, which would provide physiological evidence in support of Tamir and Ford's expectancy-value approach to anger up-regulation.

Chapter Two:

Method

The independent variable in the current study was Goal Condition (Confrontation, Collaboration, Control). The main dependent variables included HRV (i.e., HF HRV and RMSSD), self-reported anger, music preference (Anger, Happy, Neutral), and the expected success of anger. Therefore, the Affect Self-Report (i.e., self-reported anger) and Expected Success of Emotions questionnaire were used to directly examine the hypotheses. Along with anger, self-reported happiness and expected success of happiness were also examined to determine if a similar pattern of hypothesized results for anger would occur for happiness in pursuit of the collaboration goal. Expected Emotion Felt from Music Questionnaire, Heart Rate (HR), Explicit Emotion Regulation Assessment, Success of Goal Pursuit, Demand Characteristics, and Reason for Song Choice were included as secondary measures to further evaluate the hypotheses. Expected Success of Emotions and Expected Emotion Felt from Music were adapted from Tamir and Ford (2012), while the Affect Self-Report was adapted from Stephens, Christie, and Friedman (2010) and followed suggestions of Stemmler, Aue, and Wacker (2007). Demographics and Health History Questionnaire, the Emotion Regulation Questionnaire, Alexithymia Questionnaire, BIS/BAS Scale, and Aggression Questionnaire were also completed, but were not of included in analyses run. Pre-ejection period (PEP), which is a cardiac measure of the sympathetic nervous system, was also recorded but not yet analyzed.

Participants

Sixty-nine students were recruited from Towson University's Research Pool website. One participant did not follow instructions during the study, which resulted in

unusable data. Physiological recording files of a second participant were corrupted and lost. The final sample size was 67 (48 women; M_{age} = 19.58). Students received three research credits for participation in the study. Students with a history of cardiovascular or neurological disease, students with a pacemaker, and students who smoke were instructed not to sign up for the study. On the research pool website, students were also instructed to refrain from alcohol use for 24 hours before participation, caffeine use for 6 hours before participation, and eating or engaging in vigorous exercise 2 hours before participation.

Materials

Baseline Images. Images rated as neutral on valence and low on arousal were selected from the International Affect Picture System (Lang, Bradley, & Cuthbert, 2001) for the baseline slideshow.

Music. This study involved two angry, two happy, and two neutral songs taken from Study 2 of Tamir and Ford (2012). The angry songs were "Refuse/Resist" by Apocalyptica and "Curse of the Werewolf - Finale" by Benjamin Frankel. The happy songs were "Opening Theme" from the soundtrack of "The Triplets de Belleville" and "Estudiante" by Emile Waldteufel. The neutral songs were "Indecision" by Yo Yo Ma and "Aerial Boundaries" by Michael Hedges. These songs have been shown to induce their target emotion (Tamir and Ford, 2012), and evidence was provided suggesting that these songs were expected to induce their target emotion in the current study (see the Expected Emotion Felt from Music section of the results). Each full song was received from Tamir and Ford (i.e., the exact song files used in their study) and was already cut to 2 min in length. Similarly, 20 s clips of each song used in the music selection task were received from Tamir and Ford as separate song files.

Questionnaires

Affect Self-Report. This questionnaire was used to assess participants' baseline anger and happiness levels and their anger and happiness measures after music listening, after writing the goal-driven message, and after recovery (see Appendix A). Participants reported on a Likert scale of 1-7 (1 = Not at All, 4 = Moderately Accurate, 7 = Very Accurate) how accurately certain affect terms associated with anger and happiness described how they were currently feeling. Following suggestions of Stemmler et al. (2007), anger scores were calculated by taking the average rating of 4 different anger terms (Angry, Mad, Annoyed, Stirred up; Cronbach's Alpha = .78), while happiness scores were calculated by taking the average rating of 4 different happiness terms (Happy, Cheerful, Merry, Content; Cronbach's Alpha = .81). Other affect terms (e.g., fear, sadness) were included to mask target emotions. Participants were also asked at the end of the Affect Self-Report to report the intensity of their emotional experience on a Likert scale of 1-7 (1 = Not Intense at All, 4 = Moderately Intense, 7 = Extremely Intense). However, intensity measures were not included in the analysis.

Expected Success of Emotions. This questionnaire was adapted from Tamir and Ford (2012) and was used to assess participants' expected performance during a negotiation with the Director of Parking based on the hypothetical experience of different emotions (see Appendix B). Participants were asked to what extent they should feel X emotion to be successful in negotiating with the Director of Parking. Expected successes of anger and happiness scores were calculated with the 4 anger (Angry, Mad, Annoyed, Stirred up) and happiness (Happy, Cheerful, Merry, Content) terms used in the Affect Self-Report. Other affect terms (e.g., fear, sadness) were included to mask target

emotions. Participants rated on a Likert scale of 1-7 (1 = Not at all, 4 = Moderately, 7 = Extremely) the expected negotiation success of each emotion.

Expected Emotion Felt From Music. This questionnaire assessed whether participants expected the angry songs to increase anger, the happiness songs to increase happiness, and the neutral songs to have less of an impact on emotional states (Appendix C). After completing the primary procedural components of the study, participants rated on a Likert scale of 1-7 (1 = Not at all, 4 = Moderately, 7 = Extremely) the degree to which they would expect to feel a list of emotions if they were to listen to each song at full length. Similar to the Expected Success of Emotions Questionnaire, expected anger and happiness scores were calculated with the 4 anger (Angry, Mad, Annoyed, Stirred up) and happiness (Happy, Cheerful, Merry, Content) terms used in the Affect Self Report. Participants' liking of each song was assessed using a Likert scale of 1-7 ("How much do you agree with the state: I like the song (*insert song name*);" 1 = Strongly Disagree, 4 = Neutral, 7 = Strongly Agree). However, liking ratings were not included in the analysis.

Success of Goal Pursuit. To assess successful confrontation and collaboration of written messages, 4 objective raters read the message of each participant and answered a series of questions (see Appendix D). Three questions were used to assess successful confrontation of messages, including how likely the Director of Parking at Towson University would be to add parking spaces as quickly as possible, how likely the Director of Parking at Towson University would be to feel urgency to satisfy students, and how likely the Director of Parking would be convinced that the parking situation is negatively impacting students. Two questions were used to assess successful collaboration,

including how likely the Director of Parking at Towson University would be to collaborate with the student on a plan to make parking on campus better, and how likely the director of parking at Towson University would be to find the student agreeable. Four raters respond to each question on a Likert scale of 1-5 (1 = Extremely Unlikely, 2 = Unlikely, 3 = Neutral, 4 = Likely, 5 = Extremely Likely).

Explicit Emotion Regulation. At the end of the study, participants were asked 4 questions to assess explicit up/down-regulation of both anger and happiness (Appendix E). Participants were asked if they increased happiness and anger before writing the goal-driven message (i.e., prior to goal pursuit), along with other emotions that were included to mask target emotions. Participants were then asked if they decreased happiness and anger before writing the goal-driven message. Participants responded to these questions by answering, "Yes," "No," or "Not Sure/Don't remember," and emotion words were presented in a random order.

Demand Characteristics. Participants were asked to select the song that they thought the experimenter expected them to choose. Songs for this question were presented in a random order.

Reason for Song Selection. After the study, participants were asked to give their reason for their song choice. This question was open-ended. An objective rater identified the occurrence of themes in responses and rated whether each participant's response fit a given theme.

Additional Surveys. A Demographics and Health History Questionnaire, the Emotion Regulation Questionnaire (Gross & John, 2003), Alexithymia Questionnaire (Rieffe, Oosterveld, & Terwogt, 2006), BIS/BAS Scale (Carver & White, 1994), and

Aggression Questionnaire (Buss & Perry, 1992) were included at either the beginning or end of the procedure. More details of these measures are included in Appendix F.

Physiological Recording Equipment

Physiological variables were recorded through electrocardiography (ECG) and impedance cardiography (ICG). To capture the ECG signal, CONMED disposable, pre-gelled stress-testing spot electrodes were placed in a modified lead II configuration on the thorax. Specifically, one electrode was placed on the left side of the ribcage, and another was placed under the collarbone on the right side. In addition, a 4-lead configuration was used to capture ICG. Two spot electrodes were placed on the lower back, and two were placed on the back of the neck. Placement followed the standard recommendations of Sherwood, Dolan, and Light (1990).

ECG signals were transmitted to an ECG100C amplifier and ICG signals to an EBI100C amplifier (BIOPAC Systems Inc, Goleta, CA). The ECG and ICG signals were interfaced through an MP150 data acquisition system. Data derived from all electrophysiological signals was received by the Biopac Acqknowledge v4.4 software program, which was running on a computer in a separate room (BIOPAC Systems, Inc, Goleta, CA). All raw signals were digitized at 1,000 Hz. Signals were analyzed for any artifacts using the Biopac Acqnowledge 4.4 and Kubios HRV Analysis Software.

Data Reduction

HR and inter-beat intervals (IBIs) were extracted from the ECG signal, and HRV measures were then calculated from the IBIs. Spectral frequency bands were calculated via autoregressive techniques to assess parasympathetic influence on the heart (Task Force, 1996). Specifically, the high-frequency (HF-HRV) component of the waveform

(0.15-0.40 Hz) was of interest because it represents parasympathetic activity on the heart. HRV was also assessed using RMSSD (Penttila et al., 2001).

Procedure

The procedure combined components of the two studies in Tamir and Ford (2012). Table 1 compares the procedure of the current study to both studies conducted by Tamir and Ford (2012). In addition, Figure 2 provides an overview of the step-by-step procedure of the current study. Appendix G includes the word-for-word instructions/script of the current study.

Once arriving to the lab, an experimenter greeted participants, had them have a seat in the testing area, and asked them to sign an informed consent form. After signing the consent form, a general statement regarding the scope of tasks in the study and the purpose of the physiological recording equipment was briefly explained (See Appendix G). The experimenter verbally informed participants that the study involved a negotiation task and a memory task. Participants were deceived into thinking that one of the tasks they would be completing was a memory task. This was following suggestions of Tamir and Ford (2012), who masked the music selection task as a memory task in order to prevent demand characteristics, which were then not shown to impact their study.

After asking if the participant had any questions, an experimenter of the same sex hooked the participant up to physiological recording equipment. Once the recording equipment was set up, participants completed the Beginning Survey (see Figure 2), which was a Qualtrics survey that included secondary questionnaires (i.e., questionnaires not included in the analysis), such as the Demographics and Health History Questionnaire, the Emotion Regulation Questionnaire, and Alexithymia Questionnaire.

After completing the Beginning Survey, the experimenter set up the main portion of the study and began this portion of the study by verbally explaining more details of the negotiation task (See Appendix G). Specifically, participants were told they would be role-playing as a Student Government Association member who was about to partake in a face-to-face negotiation with the Director of Parking. Participants were informed that they would be asked to write a goal-driven message to the Director of Parking, which they were deceived into thinking would be compiled with other student messages and taken to the Director, and were given a preview of their negotiation goal for the message, although the context of this goal was not yet provided (see Appendix G).

The written goal-driven message was designed to be similar to Tamir and Ford (2012), Study 1, where participants left voice-recorded messages for the tenant (i.e., the person being confronted or collaborated with). Research suggests that control and affection goals are more commonly pursued through texting than phone calls (Jin & Park, 2010). Control goals are synonymous to confrontation goals aimed to influence others, while affection goals are synonymous to collaboration goals aimed to build relationships. Based on these findings, people for various reasons (e.g., texting is more indirect and allows more time to gather thoughts) may be more comfortable pursuing goals through text, rather than voice call. Therefore, a means of goal pursuit more similar to texting (i.e., written text) was instead included to facilitate comfort when pursuing confrontation or collaboration goals.

After these final instructions, participants moved on to the main portion of the procedure, which took place via the stimulus presentation program, E-Prime. First, participants watched a 5 min slideshow of neutral images obtained from the International

Affective Picture System, while baseline physiological measures were recorded. After the slideshow, participants reported their baseline emotion states via the Affect Self-Report (see Appendix A). Once the slideshow was completed, more specific instructions were given regarding the negotiation task (i.e., the context of the task). Through these instructions, participants were told that they, as a Student Government Association member, would be negotiating with the Director of Parking at Towson University regarding student parking on campus. More details of parking issues on campus were then explained (see Appendix G). After this explanation of the negotiation task, participants were informed of the memory task (i.e., the music selection task), which was completed prior to the negotiation task. Participants were told that the memory task involved choosing emotional music clips to listen to or choosing emotional events to recall before the negotiation task. After being given information regarding the memory task, participants were instructed on their specific goal of the negotiation (See Appendix G for specific wording).

After receiving further task information and information regarding their goal, participants began the music selection task. During the music selection task, participants listened to six 20 s clips of songs (i.e., two angry, two happy, two neutral) in a random order, and then were asked to select one song to listen to at full length before the negotiation. Next, participants rated emotions that they would expect to lead to a successful negotiation with the Director of Parking (see Expected Success of Emotions Questionnaire, Appendix B). Once completed, participants listened to their chosen song for approximately 2 minutes. After listening, participants filled out the Affect Self-Report for a second time.

Next, participants were told that they would have 6 minutes to handwrite a message to the Director of Parking. This time period was determined based on pilot testing, and seemed to allow enough time for participants to form a moderately lengthy and complete message that was, on average, approximately one paragraph long. The confrontation and collaboration groups were also reminded to keep their goal in mind while writing their message. Once the 6 minutes expired, the participants filled out the Affect Self-Report for a third time. They then watched the 5-minute IAPs slideshow again, which served as a recovery period. After this recovery period, participants filled out the Affect Self-Report for a final time. Participants then listened to each of the 20 s music clips again, and rated the emotions that they would expect to feel if they were to listen to each song at full length (see Expected Emotion Felt From Music Questionnaire, Appendix C). After, participants were instructed to complete the Ending Survey.

The Ending Survey first asked participants to choose the song that they thought the experimenter expected them to select (see Demand Characteristics). Participants were then asked why they selected their chosen song (see Reason for Song Selection) and whether they explicitly attempted to up/down-regulate anger or happiness before writing (see Explicit Emotion Regulation; Appendix E). A few additional assessments (i.e., questionnaires not included in the analysis), such as the Aggression Questionnaire and BIS/BAS Scale, were completed, which led to the conclusion of the study. Once finished, participants were debriefed and detached from physiological equipment. After data collection, 4 objective raters assessed successful confrontation and collaboration (see Success of Goal Pursuit, Appendix D). One of the raters was also used to evaluate the frequency of themes identified in participants' reasons for song selection.

Chapter Three:

Results

To test Hypothesis 1, one-way between-subjects (Goal Condition) ANOVAs were run on HRV change scores from baseline to music listening and from baseline to during writing the message to the Director of Parking (i.e., for both HF HRV and RMSSD). To test Hypothesis 2, one-way between-subjects ANOVAs were run on self-report change scores from baseline to music listening and self-report change scores from baseline to during writing the message. To test Hypothesis 3, a two-way chi-square test of independence on music preference was run. This test indicated if certain goal groups were more likely to choose certain music (i.e., angry, happy, neutral). To test Hypothesis 4, a one-way between-subjects ANOVA was run on the expected success of anger. To test Hypothesis 5, a series of multiple regressions were run in order to attempt to produce a mediation model involving HRV (i.e., during music listening) similar to the mediation model found in Tamir and Ford (2012). Patterns of results found for RMSSD supported all findings for HF HRV. Therefore, only HF HRV was reported.

HRV Change

Data was first log transformed. Change scores were calculated by subtracting HF HRV during baseline from the HF HRV during the 2 min music listening period (Music HF HRV - Baseline HF HRV) and during the first 2 min of writing the message (Writing HF HRV - Baseline HF HRV). Therefore, negative HF HRV change scores indicated a decrease in HF HRV during music or writing, while positive HF HRV change scores indicated an increase in HF HRV during music or writing.

A one-way between-subjects ANOVA run on HF HRV change scores from baseline to music listening revealed no significant main effect of Goal Group**,** $F(2, 64) = 0.55$, $p = .582$, $\eta^2_p = .02$ [90% CI: .00, .08], power = .14. In addition, a one-way between-subjects ANOVA run on HF HRV change scores from baseline to writing the message to the Director of parking revealed no significant main effect of Goal Group**,** $F(2, 64) = 0.73$, $p = .487$, $\eta^2_p = .02$ [90% CI: .00, .09], power = .17.

Self-Reported Anger

Change scores were calculated by subtracting reported anger calculations after baseline from reported anger calculations after the 2 min music listening period (Music Self-reported Anger - Baseline Self-reported Anger) and after the first 2 min of writing the message (Writing Self-reported Anger - Baseline Self-reported Anger). Therefore, negative anger change scores indicated a decrease in anger after music or writing, while positive anger change scores indicated an increase in anger after music or writing.

A one-way between-subjects ANOVA run on anger change scores from baseline to after music listening revealed no significant main effect of Goal Group**,** $F(2, 64) = 1.82$, $p = .170$, $\eta^2_p = .05$ [90% CI: .00, .14], power = .37. In addition, a one-way between-subjects ANOVA run on anger change scores from baseline to after writing the message revealed no significant main effect of Goal Group**,** $F(2, 64) = 1.48$, $p = .236$, $\eta^2_p = .04$ [90% CI: .00, .14], power = .30.

Music Preference

A two-way chi-square was run to determine if goal groups preferred music of a certain valence (angry, happy, neutral). This test indicated no relationship between Goal Group and Emotion of Selected Song, $\chi^2(2) = 2.73$, $p = .603$, $V = .14$ [95% CI: -.06, .34].

Assumptions of this test were also violated, as three cells had an expected count of less than five.

Expected Success of Anger

A one-way between subjects ANOVA revealed no significant main effect of Goal Group, $F(2, 64) = 1.20$, $p = .310$, $\eta^2_p = .04$ [90% CI: .00, .12], power = .25. Although not significant, the confrontation group ($M = 2.97$, $SD = 1.65$) had the highest mean expected success of anger in comparison to the collaboration group ($M = 2.61$, $SD = 1.64$) and control group ($M = 2.27$, $SD = 1.24$).

Expected Success Mediation Analysis

A simple linear regression run with Goal Group as the predictor and HF HRV during music as the outcome was not significant, $t(65) = 1.34$, $p = .190$. A simple linear regression run with Expected Success of Anger as the predictor and HF HRV as the outcome during music was also not significant, $t(65) = -0.72$, $p = .473$. Further steps in the regression model were not run because both simple linear regressions were not significant.

Exploratory Findings

Cardiovascular measures. Although the original analysis revealed no significant effects for HRV changes between the goal groups (confrontation, collaboration, control), the one-way ANOVA tests run on HRV were limiting in the sense that they did not examine the influence of selected music on one's cardiovascular state. In addition, these tests did not examine if certain music interacts with the pursuit of specific goals to stimulate unique cardiovascular changes.

A 3 (Goal Group: Confrontation, Collaboration, Control) x 3 (Emotion of Song Choice: Angry, Happy, Neutral) x 2 (Time: Change during Music, Change during Writing) repeated-measures ANOVA were conducted on both measures of HRV to further explore the influence of selected music. These tests encompassed the original one-way ANOVAs run on HRV measures in the primary analysis, while providing further insight into the underlying HRV change relevant to Tamir and Ford's (2012) paradigm. This analysis is also nearly identical to Tamir and Ford's analysis run on self-reported anger (see Tamir & Ford, 2012, pp. 813). Specifically, Tamir and Ford ran a 2 (Goal Group: Confrontation, Collaboration) x 3 (Emotion of Song Choice) x 2 (Time: Baseline, After Music) analysis and found a significant Time x Emotion of Song Selection interaction effect indicating that anger increased over time (i.e., from baseline to after music) for those who selected angry music. Thus, it was speculated that similar song-selection interaction effects could occur with HRV change in the current study.

In addition, 3 (Goal Group) x 3 (Emotion of Song Choice) x 2 (Time) repeated-measures ANOVAs represented a Person x Environment x Environment (P x E x E) factor design, which is a common design used to compare variables, such as gender, that cannot be manipulated with environmental variables that can be manipulated (Goodwin & Goodwin, 2016, pp. 190-195, 238-250). The person variable in the P x E x E factorial design of the current study is song preference (i.e., Emotion of Song Choice). Thus, music preference is a quality that participants possessed before entering the study. It is logical to question whether this variable (Emotion of Song Choice) was distinguishable from Goal Group because Goal Group was expected to influence Emotion of Song Choice. Therefore, these two variables were expected to be highly correlated. However,

as indicated by the above two-way chi-square analyses, Goal Group did not influence Emotion of Song Choice, which makes it clear that these two variables are independent of each other. Further Spearman's correlation analyses revealed that Goal Group and Emotion of Song Choice were not related, (r_s = .02, N = 67, p = .85), which further demonstrates the separation between these two variables. Because variables were distinct, 3 (Goal Group) x 3 (Emotion of Song Choice) x 2 (Time) repeated-measures ANOVAs were validated and run.

HF HRV. A 3 (Goal Group: Confrontation, Collaboration, Control) x 3 (Emotion of Song Choice: Angry, Happy, Neutral) x 2 (Time: Change during Music, Change during Writing) repeated-measures ANOVA was run on HRV change from baseline. The ANOVA revealed no significant main effects for Goal Group, $F(2, 58) = 0.36$, p = .701, η^2_p = .01 [90% CI: .00, .07], power = .11; Emotion of Song Choice, $F(2, 58) = 0.02$, p = .980, η^2_p = .00 [90% CI: .00, .06], power = .05; or Time, $F(1, 58) = 0.17$, p = .713, η^2_p = .00 [90% CI: .00, .00], power = .07. Therefore, HF HRV change from baseline in the confrontation group (M = -0.07, SD = 0.27, N = 23) was not significantly different in comparison to the collaboration group (M = -0.04, SD = 0.35, N = 22) and control group (M = -0.14, SD = 0.55, N = 22). HF HRV change from baseline for participants who selected neutral (M = -0.11, SD = 0.29, N = 20), happy (M = -0.07, SD = 0.27, N = 38), or angry music (M = -0.09, SD = 0.43, N = 9) was also not significantly different. HF HRV change from baseline to music (M = -0.03, SD = 0.28, N = 67) and baseline to writing (M = -0.14, SD = 0.33, N = 67) across groups and song selections was not significantly different. However, there were four significant interaction effects.

A Time x Goal Group interaction effect was found, $F(2, 58) = 3.60$, $p = .034$, $\eta^2_p = .11$ [90% CI: .00, .23], power = .64. However, simple effects dependent *t*-tests revealed no significant differences between HF HRV during music and during writing for all goal groups; confrontation, $t(22) = 1.83$, $p = .080$, $d = 0.38$ [95% CI: -0.08, 0.85], collaboration, $t(21) = 1.80$, $p = .090$, $d = 0.38$ [95% CI: -0.09, 0.86], control, $t(21) = 1.34$, $p = .190$, $d = 0.29$ [95% CI: -0.19, 0.76]. A Time x Emotion of Song Choice interaction effect was also found, $F(2, 58) = 5.09$, $p = .009$, $\eta^2_p = .15$ [90% CI: .02, .27], power = .80. Simple effects dependent *t*-tests revealed that participants who selected happy music showed a greater decrease in HF HRV from music to writing, $t(37) = 4.21$, $p < .001$, $d = 0.68$ [95% CI: 0.32, 1.05]. There was no significant changes between HF HRV during music and during writing for participants who selected angry music, $t(8) = -.45$, $p = .670$, $d = -0.15$ [95% CI: -0.51, 0.21], or neutral music, $t(19) = 1.38$, $p = .180$, $d = 0.31$ [95% CI: -0.19, 0.81].

A Goal Group x Emotion of Song Choice was also found, $F(4, 58) = 4.40$, $p = .004$, $\eta^2_p = .23$ [90% CI: .05, .34], power = .92, along with a significant Time x Goal Group x Emotion of Song Choice interaction effect, $F(4, 58) = 5.73$, $p = .001$, $\eta^2_p = .28$ [90% CI: .09, .39], power = .97. To investigate these interaction effects further, the data file was split by Emotion of Song Choice (Angry, Happy, Neutral), and simple effects 3 (Goal Group: Confrontation, Collaboration, Neutral) x 2 (Time: Music, Writing) repeated-measures ANOVAs were run.

*Neutral music selection***.** For participants who chose neutral music, follow-up repeated-measures ANOVA revealed that there was a significant main effect of Goal Group, $F(2, 17) = 11.88$, $p = .001$, $\eta^2_p = .58$ [90% CI: .24, .70], power = .98 (see Figure

3). Tukey post hoc tests revealed that HF HRV in the collaboration group (Music: *M* = 0.21, *SD* = 0.13, Writing: *M* = 0.10, *SD* = 0.28; *N* = 5) increased significantly more in comparison to the confrontation (Music: *M* = -0.22, *SD* = 0.37, Writing: *M* = -0.34, *SD* = 0.19; *N* = 8) and control groups (Music: *M* = -0.06, *SD* = 0.13, Writing: *M* = -0.15, *SD* = 0.22; *N* = 7) during both music and writing. The confrontation and control groups were not significantly different and both showed decreases in HF HRV from baseline, while the collaboration group showed increases in HF HRV.

There was no significant main effect of Time, $F(1, 17) = 1.61$, $p = .222$, $\eta^2_p = .09$ [90% CI: .00, .31], power = .22, and no significant Time x Goal Group interaction effect, $F(2, 17) = 0.01$, $p = .986$, $\eta^2_p = .00$ [90% CI: .00, .02], power = .05.

*Happy music selection***.** For participants who chose happy music, follow-up repeated-measures ANOVA revealed that there was a significant main effect of Time, $F(1, 35) = 20.02$, $p < .001$, $\eta^2_p = .36$ [90% CI: .15, .52], power = .99, which was qualified by a Time x Goal Group interaction, $F(2, 35) = 4.12$, $p = .025$, $\eta^2_p = .19$ [90% CI: .01, .34], power = .69. Simple effects dependent *t*-test revealed that, when happy music was selected, participants in the confrontation group, $t(12) = 2.57$, $p = .024$, $d = 0.71$ [95% CI: 0.10, 1.33], and control group, $t(12) = 4.57$, $p = .001$, $d = 1.27$, [95% CI: 0.65, 1.89], showed significantly greater decreases in HF HRV during writing in comparison to during music (see Figure 4). In other words, the HF HRV of happy music selectors in these groups (confrontation and control) decreased between music and writing. In contrast, when happy music was selected in the collaboration group, participants' HF HRV did not significantly change between music and writing, $t(11) = 0.80$, $p = .441$, $d = 0.23$, [95% CI: -0.41, 0.87]. These findings related to happy music selection represent the

three-way interaction effect (Time x Goal Group x Emotion of Song Choice) revealed by the original 3 (Goal Group) x 3 (Emotion of Song Choice) x 2 (Time) repeated-measures ANOVA. Time x Goal Group and Time x Emotion of Song Choice interaction effects found by the original ANOVA were then qualified by this three-way interaction effect.

The repeated-measures ANOVA specific to happy music selection also revealed a significant main effect of Goal Group, $F(2, 35) = 3.60$, $p = .038$, $\eta^2_p = .17$ [90% CI: .01, .32], power = .63 (see Figure 4). Tukey post hoc tests indicated that the HF HRV of participants in the control group (Music: $M = -0.04$, $SD = 0.18$, Writing: $M = -0.34$, $SD = 0.24$; $N = 13$) decreased significantly more during music and writing in comparison to the confrontation group (Music: $M = 0.12$, $SD = 0.17$, Writing: $M = -0.01$, $SD = 0.23$; $N = 13$). HF HRV of the collaboration group (Music: $M = -0.04$, $SD = 0.28$, Writing: $M = -0.10$, $SD = 0.40$; $N = 12$) was not significantly different than the confrontation and control groups.

*Angry music selection***.** For participants who chose angry music, follow-up repeated-measures ANOVA were not run due to the low number of participants who chose angry music ($N = 9$). Therefore, cardiovascular patterns related to angry music could not be analyzed in this research.

***HR*.** Change scores were calculated by subtracting HR during baseline from the HR during the 2 min music listening period (Music HR - Baseline HR) and during the first 2 min of writing the message (Writing HR - Baseline HR). Therefore, negative HR change scores indicated a decrease in HR during music or writing, while positive HR change scores indicated an increase in HR during music or writing.

A 3 (Goal Group: Confrontation, Collaboration, Control) x 3 (Emotion of Song Choice: Angry, Happy, Neutral) x 2 (Time: Change during Music, Change during Writing) repeated-measures ANOVA was run on HR change from baseline. There was no significant effect of Goal Group, $F(2, 58) = 0.34$, $p = ..711$, $\eta^2_p = .01$ [90% CI: .00, .06], power = .10, or Emotion of Song Choice $F(2, 58) = 1.48$, $p = .236$, $\eta^2_p = .05$ [90% CI: .00, .14], power = .30. Therefore, HR change from baseline in the confrontation group ($M = 0.74$, $SD = 4.36$, $N = 23$) was not significantly different in comparison to the collaboration group ($M = 1.18$, $SD = 4.92$, $N = 22$) and control group ($M = 1.36$, $SD = 5.58$, $N = 22$). HR change from baseline for participants who selected neutral ($M = 1.52$, $SD = 4.28$, $N = 20$), happy ($M = 1.32$, $SD = 5.41$, $N = 38$), or angry music ($M = -0.87$, $SD = 3.64$, $N = 9$) was also not significantly different. There was also no significant Goal Group x Emotion of Song Choice interaction effects, $F(4, 58) = 1.27$, $p = .294$, $\eta^2_p = .08$ [90% CI: .00, .15], power = .37.

A significant effect of Time was found, $F(1, 58) = 7.10$, $p = .010$, $\eta^2_p = .11$ [90% CI: .02, .24], power = .75, indicating that participants had a significantly higher HR during writing ($M = 2.34$, $SD = 5.58$, $N = 67$) than during music ($M = -0.17$, $SD = 4.24$, $N = 67$). This main effect of Time was qualified by a significant Time x Goal Group x Emotion of Song Choice interaction effect, $F(4, 58) = 5.61$, $p = .001$, $\eta^2_p = .28$ [90% CI: .09, .38], power = .97. To investigate this interaction effect further, the data file was split by Emotion of Song Choice (Angry, Happy, Neutral), and 3 (Goal Group: Confrontation, Collaboration, Neutral) x 2 (Time: Music, Writing) follow-up repeated-measures ANOVAs were run.

*Neutral music selection***.** For participants who chose neutral music, follow-up repeated-measures ANOVA revealed that there was a significant main effect of Time, $F(1, 17) = 9.19$, $p = .008$, $\eta^2_p = .35$ [90% CI: .06, .55], power = .82. As shown in Figure 5, participants' HR significantly increased between music ($M = 0.07.$, $SD = 3.88$) and writing ($M = 2.97.$, $SD = 4.68$). There was no significant effect of Goal Group, $F(2, 17) = 0.68$, $p = .522$, $\eta^2_p = .07$ [90% CI: .00, .24], power = .15, and no significant Time x Goal Group interaction effect, $F(2, 17) = 0.65$, $p = .534$, $\eta^2_p = .07$ [90% CI: .00, .24], power = 14. However, as shown in Figure 5, changes in HR over time were seemingly different for the goal groups. Simple effects dependent *t*-test were run to analyze group differences within the main effect of time. These tests revealed that, when neutral music was selected, HR in the confrontation group significantly increased from music to writing, $t(7) = -3.36$, $p = .012$, $d = -1.19$ [95% CI: -1.98, -0.40]. HR in the collaboration group, $t(4) = -1.76$, $p = .154$, $d = -0.24$ [95% CI: -1.24, 0.76], and control group, $t(6) = -0.94$, $p = .384$, $d = -0.17$ [95% CI: -1.01, 0.67] did not significantly change from music to writing.

*Happy music selection***.** For participants who chose happy music, follow-up repeated-measures ANOVA revealed that there was a significant main effect of Time, $F(1, 35) = 21.41$, $p < .001$, $\eta^2_p = .38$ [90% CI: .17, .53], power = .99, which was qualified by a significant Time x Goal Group interaction, $F(2, 35) = 4.75$, $p = .015$, $\eta^2_p = .21$ [90% CI: .03, .37], power = .76. Simple effects dependent *t*-tests revealed that, when happy music was selected, the HR of participants in the control group was significantly higher during writing in comparison to during music, $t(12) = -5.17$, $p < .001$, $d = -1.43$, [95% CI: -2.05, -0.81] (see Figure 6). In contrast, when happy music was selected in the collaboration group, $t(11) = -0.86$, $p = .411$, $d = -0.25$, [95% CI: -0.89, 0.40], and

confrontation group, $t(12) = -2.11$, $p = .056$, $d = -0.59$, [95% CI: -1.20, 0.03], participants' HR did not significantly change between music and writing. However, the HR of participants in the confrontation group was closer to resembling the control group. No significant main effect of Goal Group was found, $F(2, 35) = 1.02$, $p = .37$, $\eta^2_p = .06$ [90% CI: .00, .17], power = .21.

Angry music selection. Similar to HF HRV, follow-up repeated-measures ANOVA were not run due to the low number of participants who chose angry music ($N = 9$).

Affect Self-Report. Similar to the exploratory HRV analysis, a 3 (Goal Group: Confrontation, Collaboration, Control) x 3 (Emotion of Song Choice: Angry, Happy, Neutral) x 2 (Time: Change during Music, Change during Writing) repeated-measures ANOVA was conducted to further explore the influence of selected music on changes in reported anger. These tests were almost identical to self-report analyses run by Tamir and Ford (2012). In addition to anger, happiness change scores were also analyzed using the same repeated-measures ANOVA.

Anger. A 3 (Goal Group: Confrontation, Collaboration, Control) x 3 (Emotion of Song Choice: Angry, Happy, Neutral) x 2 (Time: Change during Music, Change during Writing) repeated-measures ANOVA was run on calculated anger scores. The ANOVA revealed a significant main effect of Time, $F(1, 58) = 27.22$, $p < .001$, $\eta^2_p = .32$ [90% CI: .16, .45], power = .99. Reported anger was higher after writing ($M = 2.88$, $SD = 1.65$) than after music ($M = 1.53$, $SD = 0.82$) across all groups and song selections. There was no significant Time x Goal Group, $F(2, 58) = 0.21$, $p = .813$, $\eta^2_p = .01$ [90% CI: .00, .05], power = .08, Time x Emotion of Song Choice interaction effect, $F(2, 58) = 0.849$, $p =$

.433, η^2_p = .03 [90% CI: .00, .11], power = .19, or Time x Goal Group x Emotion of Song Choice interaction effect, $F(4, 58) = .428$, $p = .788$, η^2_p = .03 [90% CI: .00, .06], power = .14. There was also no significant main effect of Goal Group, $F(2, 58) = 1.44$, $p = .245$, η^2_p = .05 [90% CI: .00, .14], power = .30, Emotion of Song Choice, $F(2, 58) = 0.10$, $p = .909$, η^2_p = .00 [90% CI: .00, .04], power = .06, or Goal Group x Emotion of Song Choice interaction effect, $F(4, 58) = 0.46$, $p = .765$, η^2_p = .03 [90% CI: .00, .06], power = .15.

Happiness. A 3 (Goal Group: Confrontation, Collaboration, Control) x 3 (Emotion of Song Choice: Angry, Happy, Neutral) x 2 (Time: Change during Music, Change during Writing) repeated-measures ANOVA was run on calculated mean happiness scores. The ANOVA revealed a significant main effect of Time, $F(1, 58) = 18.89$, $p < .001$, η^2_p = .25 [90% CI: .10, .38], power = .99. Reported happiness was higher after music ($M = 4.26$, $SD = 1.42$) than after writing ($M = 3.16$, $SD = 1.38$) across all groups and song selections. A significant main effect of Emotion of Song Choice was also found, $F(2, 58) = 3.22$, $p = .047$, η^2_p = .10 [90% CI: .00, .21], power = .59. However, Tukey post hoc tests reveal no significant differences between any groups.

The ANOVA revealed no significant Time x Goal Group, $F(2, 58) = 0.44$, $p = .644$, η^2_p = .02 [90% CI: .00, .07], power = .12, Time x Emotion of Song Choice, $F(2, 58) = 2.97$, $p = .059$, η^2_p = .09 [90% CI: .00, .20], power = .56, or Time x Goal Group x Emotion of Song Choice interaction effects, $F(4, 58) = 0.92$, $p = .457$, η^2_p = .06 [90% CI: .00, .12], power = .28. There was also no significant main effect of Goal Group, $F(2, 58) = 0.74$, $p = .481$, η^2_p = .03 [90% CI: .00, .10], power = .17, or Goal Group x Emotion of Song Choice interaction effect, $F(4, 58) = 1.00$, $p = .417$, η^2_p = .06 [90% CI: .00, .13], power = .30.

Expected Emotion Felt From Music. A one-way repeated-measures ANOVA was run on expected mean anger scores of each music pair (i.e., mean of two angry songs, mean of two happy songs, and mean of two neutral songs). Mauchly's test revealed that the assumption of sphericity was violated, Mauchly's $W(2) = 0.43$, $p < .001$. Greenhouse-Geisser corrections were then reported. The ANOVA revealed a significant main effect of the expected emotion of each song pair, $F(1.27, 85.28) = 78.26$, $p < .001$, $\eta^2_p = .54$ [90% CI: .41, .62], power = 1.00. Bonferroni post hoc tests revealed that angry music ($M = 3.04$, $SD = 1.35$) was expected to induce significantly more anger in comparison the happy music ($M = 1.50$, $SD = 0.63$) and neutral music ($M = 1.60$, $SD = 0.67$). The expected anger of happy and neutral music was not significantly different.

A one-way repeated-measures ANOVA was also run on expected mean happy scores of each music pair. The ANOVA revealed a significant main effect of the expected emotion of each song pair, $F(2, 134) = 120.43$, $p < .001$, $\eta^2_p = .64$ [90% CI: .56, .70], power = 1.00. Bonferroni post hoc tests revealed that happy music ($M = 4.82$, $SD = 1.28$) was expected to induce significantly more happiness in comparison to angry music ($M = 2.25$, $SD = 1.15$) and neutral music ($M = 3.37$, $SD = 1.17$). Neutral music was also expected to induce greater happiness in comparison to angry music.

These results indicated that songs were expected to induce their target emotion. Therefore, angry music was expected to induce the most anger, happy music was expected to induce the most happiness, and neutral music was expected to induce emotion that was less polarized.

Explicit Emotion Regulation. To examine a possible relationship between song selection and intentions to regulate anger or happiness, two-way chi-square tests were run

to determine if song selections of certain valances (Angry, Happy, Neutral) could predict whether a person reported explicit attempts to up-regulate or down-regulate anger and/or happiness before writing their goal-driven message. Participants responded to whether they explicitly increased anger by selecting yes, no, or not sure. To ensure a greater expected count in each cell, participants that answered no and not sure were combined into one group (i.e., no or not sure). Thus, one group represented participants who explicitly recognized and remembered their emotion regulation goal (i.e., those who answered "Yes"), while a second group did not (i.e., those who answered "No" or "Not Sure").

Anger up-regulation. A two-way chi-square indicated an overall relationship between Emotion by Song Choice and reported attempts to increase anger. However, the expected count of those who both chose angry songs and attempted to up-regulate anger was less than five (expected count = 2.63), which made this test invalid. Further chi-square tests excluding angry song selectors indicated that participants who chose a neutral song (47.43%) were significantly more likely to report intentions to up-regulate anger in comparison to participants who chose happy songs (16.20%), $\chi^2(1) = 6.21$, $p = .013$, $OR = 4.65$ [95% CI: 1.33, 16.31], and all assumptions were met for this test.

Anger down-regulation. A two-way chi-square indicated an overall relationship between Emotion by Song Choice and reported attempts to down-regulate anger. However, the expected count of those who both chose angry songs and attempted to down-regulate anger was less than five (expected count = 3.50), which made this test invalid. Further chi-square tests indicated that participants who chose a neutral song (17.39%) were significantly less likely to report intentions to down-regulate anger in

comparison to participants who chose happy songs (82.61%), $\chi^2(1) = 4.76$, $p = .029$, $OR = 0.25$ [95% CI: 0.70, 0.91], and all assumptions were met for this test.

***Happiness up-regulation*.** A two-way chi-square indicated no relationship between Emotion by Song Choice and reported attempts to increase happiness, $\chi^2(2) = 1.639$, $p = .44$, $V = .16$ [95% CI: -0.04, 0.36].

***Happiness down-regulation*.** A two-way chi-square indicated an overall relationship between Emotion by Song Choice and reported attempts to down-regulate happiness. The expected count of those who both chose angry songs and attempted to down-regulate happiness was less than five (expected count = 1.50), which made this test invalid. Further chi-square tests indicated that participants who chose a neutral song (70.00%) were significantly more likely to report intentions to down-regulate happiness in comparison to participants who chose happy songs (30.00%), $\chi^2(1) = 7.43$, $p = .006$, $OR = 7.00$ [95% CI: 1.53, 31.84]. However, the expected count of those who both chose neutral songs and attempted to down-regulate happiness was still less than five (expected count = 3.33).

Success of Goal Pursuit. Inter-rater reliability was poor across raters for the confrontation questions (Cronbachs Alpha = 0.38, 0.26, 0.51; Cohen's Kappa = .03, .04, .07). Therefore, these questions were excluded from the analysis. One of the collaboration items (likelihood of finding the student agreeable) also had questionable reliability (Cronbach's Alpha = 0.68; Cohen's Kappa = .10) and was excluded from the analysis. The second collaboration item (likelihood of collaborating with the student on a plan to make parking on campus better) reach an acceptable reliability (Cronbach's Alpha

= 0.70; Cohen's Kappa = .11) and, therefore, was the only item that was included in the analysis.

A 2 (Goal Group: Confrontation, Collaboration, Control) x 2 (Emotion of Song Choice: Angry, Happy, Neutral) between-subjects ANOVA was run on the collaboration item to examine successful collaboration. The ANOVA revealed a significant main effect of Goal Group, $F(2, 58) = 4.00$, $p = .024$, $\eta^2_p = .12$ [90% CI: .00, .24], power = .69. As shown in Figure 7, Tukey post hoc tests indicated that participants in the collaboration group were more successful at collaboration ($M = 3.70$, $SD = 0.83$, $N = 22$) in comparison to the confrontation group ($M = 3.08$, $SD = 0.64$, $N = 23$) and control group ($M = 3.14$, $SD = 0.84$, $N = 22$).

There was no significant main effect of Emotion of Song Choice, $F(2, 58) = 0.50$, $p = .610$, $\eta^2_p = .02$ [90% CI: .00, .08], power = .13, and no significant Goal Group x Emotion of Song Choice interaction effect, $F(4, 58) = 1.90$, $p = .123$, $\eta^2_p = .12$ [90% CI: .00, .20], power = .54.

Demand Characteristics. Most participants guessed that the experimenter expected them to choose one of the angry songs (58.94%). Percentages of those who guessed happy (20.59%) and neutral (23.53%) songs were about the same. Two-way chi-square indicated no relationship between Goal Groups regarding what song they thought they were supposed to choose, $\chi 2(4) = 2.08$, $p = .72$, $V = .13$ [95% CI: -0.07, 0.33].

Reasons for Song Selection. Two major themes stood out in the open-ended responses of why participants selected certain music. A majority of participants (60.00%) indicated that they chose songs for calming reasons ("Because I like to relax myself and think before writing something and that song was relaxing."). Over half of participants

(53.85%) also indicated that they chose songs that facilitated thinking in some way (e.g., "It got me thinking and helped me formulate my thoughts.").

Chapter Four:

Discussion

The hypotheses of the current study were not supported by primary analyses. HRV in the confrontation group did not decrease more during music or writing in comparison to the collaboration and control groups. The confrontation group also did not show greater increases in reported anger after music or after writing, and the confrontation group did not select more angry songs. The confrontation group did not expect anger to be more useful in comparison to the other groups, and the mediation model was not produced because effects were not significant.

The lack of findings in the central analyses may have been the result of poor power and a small sample size. Therefore, if more participants were included, significant effects may have been found. It is also possible that participants across groups did not find anger to be useful for the negotiation task (i.e., writing the message). Therefore, based on Tamir and Ford's (2012) value-expectancy approach, participants did not choose angry music because they did not expect anger to be useful, which resulted in no HRV or self-reported anger differences between groups. However, results discovered through the exploratory analyses extend beyond the value-expectancy approach, while bringing to the surface important considerations when using music selection to facilitate goal pursuit. Because of this, much of the discussion was devoted to integrating and explaining the exploratory results.

Exploratory Findings

Cardiovascular measures. Before delving into findings related to cardiovascular measures, it is important to point out that 3 (Goal Group) x 3 (Emotion of Song

Selection) x 2 (Time) ANOVAs run included small cell sizes (N = 9 for those who selected angry music). In addition, interaction effects were only correlation because of the inclusion of the person variable, Emotion of Song Selection (Goodwin & Goodwin, 2016, pp. 190-195, 238-250). However, despite these limitations, convincing cardiovascular patterns were revealed that bring to the surface many interesting points of discussion regarding Tamir and Ford's (2012) paradigm. Thus, the inclusion of the exploratory findings was necessary, but these findings were not conclusive or causal, and need to be considered with caution.

Findings of the exploratory analyses indicated that emotion of song selection mediated the cardiovascular change that co-occurred with the pursuit of different goals. The hypothesized decrease in HRV in the confrontation group was then partially supported when participants selected neutral and happy music, but not when angry music was selected. When participants selected neutral songs, HRV most closely resembled the hypothesized pattern of results. Therefore, participants pursuing a confrontation goal showed greater decreases in HRV during both music and writing in comparison to participants pursuing a collaboration goal, who instead showed increases in HRV during music and writing (See Figure 3). Those pursuing no goal (i.e., possibly a lesser confrontation goal), again, showed similar changes in HRV as participants pursuing a confrontation goal. Additionally, HR of participants who selected neutral music only increased between music and writing in the confrontation group (see Figure 5), which further supports that cardiovascular change was goal-consistent for those who selected neutral music.

The hypothesized pattern of results appearing most clearly with neutral song selection suggests that, when less engaging music was selected (i.e., neutral music), participants pursuing confrontation and collaboration goals were better able to regulate their emotions to fit their goal both before and during writing. Music with a more polarized valence (i.e., angry and happy music) may then demand more attentional resources, which interferes with emotion regulation processes. This idea is consistent with findings of the current study showing that happy music selectors did not show goal-consistent HRV, and also research supporting the distracting nature of happy music (Saarikallio & Erkkila, 2007). In addition, happiness and anger are emotions that are associated with higher arousal (Russell, 1980), and music with higher arousal has been shown to impair working memory processes and narrow attentional resources (Jones, 2003). Therefore, the low-arousing nature of the neutral music may have interfered least with cognitive processes necessary for emotion regulation, which is why goal-consistent patterns of HRV results were most strongly prevalent in participants that chose neutral songs.

When happy music was selected, the confrontation group showed a greater decrease in HRV between music and writing in comparison to the collaboration group. However, this HRV decrease in the confrontation group occurred later than expected and did not occur during music listening (i.e., as indicated in Figures 4 by positive change scores in the confrontation group during music). Research suggests that happy music facilitates distraction strategies aimed to take attention off anger-inducing thoughts (Saarikallio & Erkkila, 2007). Individuals who use happy music as an emotion regulation strategy often describe happy music as attentionally demanding and something that fills

up mental space that may otherwise be occupied by negative thoughts. This suggests that HRV increases in the confrontation group while listening to happy music indicate that participants were initially distracted from anger-inducing thoughts relevant to the negotiation task (e.g., negative aspects of parking to include in the message to the Director of Parking). While writing, the confrontation group was not distracted by happy music anymore, and attentional resources were able to be redirected towards anger-inducing thoughts and feelings regarding the parking situation, which may have led to the significant decrease in HRV from music. In contrast, participants pursuing a collaboration goal did not need to instate anger-inducing thoughts to achieve the collaboration goal, which explains why HRV did not significantly decrease between music and writing in this group.

HR changes provided some additional evidence in support of HRV findings relevant to participants who chose happy music. As discussed previously, increased HR can be indicative of greater parasympathetic nervous system withdrawal and sympathetic nervous system activation (Thayer & Lane, 2009; Stemmler, 2004). For participants who selected happy music, HR of participants in the control group (i.e., a lesser confrontation goal) was significantly higher during writing in comparison to during music. The HR of participants pursing a confrontation goal resembled this pattern, although changes between music and writing were not significant. Participants pursuing a collaboration goal showed no indication of similar patterns forming (i.e., error bars in Figure 6 for HR during music and writing are overlapping to a great degree in the collaboration group). Consistent with HRV findings, those in the confrontation group also showed decreased HR from baseline to music. Therefore, together, HR findings provide further evidence

that, while listening to happy music, those pursuing confrontation goals were distracted from anger-inducing thoughts relevant to goal pursuit, and such thoughts were then instated while writing the message. HR findings also provide further evidence that those given no goal were pursuing confrontation goals, as the control and confrontation groups showed similar HR patterns.

For cardiovascular patterns associated with both neutral and happy music selection, the control group showed the same pattern of results as the confrontation group, which does not support the hypotheses. This suggests that the control group represented a lesser confrontation group in the current study, which is why this group tended to show similar cardiovascular patterns as the confrontation group. The control group in Tamir and Ford (2012), Study 1, also showed patterns of self-report results that were consistent with their confrontation group, which may be why the researchers decided not to include a control group in Study 2. In the current study, the control group was indirectly given the broad goal of influencing the Director of Parking to make significant changes to benefit students, which could have been interpreted as confrontational in nature (see Appendix G). As evidenced through HRV patterns, this likely led participants in the control group to pursue confrontation goals, even though participants in this group were not explicitly instructed to pursue such goals (i.e., to convince the Director of Parking to add more student parking immediately).

Unlike neutral and happy song selections, HRV patterns were no able to be examined for those who selected angry music because not enough participants chose angry songs. However, if more participants were collected, it is likely that no meaningful HRV patterns would form for angry music selections. Research suggests that emotion

induced through unfamiliar angry music with no lyrics can occur in multiple ways that are more indirect, which could lead to a large amount of variation in HRV responses to angry music between participants (Scherer & Zentner, 2001). First, research argues that music with qualities similar to vocal expressions of fear (e.g., high-pitched, dissonant, and sudden musical components) increase emotion at a core/implicit level, while music that tends to be associated with anger often involves these qualities (Sharman & Dingle, 2015). In addition, the song "Curse of the Werewolf - Finale" in the current study was perceived as anger inducing, while this song was created for the soundtrack of the horror film titled "The Curse of the Werewolf" (i.e., likely was created to encourage feelings of fear during the film). Therefore, it is possible that qualities within the anger-inducing songs used led to cardiovascular changes related to both fear and anger, which have similar cardiovascular response patterns (Stemmler, 2004).

Additionally, research suggests that anger is induced through listening to aversive/disliked music that interferes with thinking (Scherer & Zentner, 2001). Because angry songs were selected so rarely in the current study and were also indicated as being selected less in comparison to other music (i.e., happy music) in Tamir and Ford's (2012) research, it is possible that cardiovascular patterns indicative of a state of annoyance (i.e., a type of anger) could have been induced. However, it is important to note that this state of annoyance represents anger deriving directly from the music, which calls attention to the question of whether anger deriving from aversive musical components would be represented at the cardiovascular level in the same way as anger deriving from thoughts about the parking situation. This variability in how angry music may have been perceived and used could then lead to a lack of consistent cardiovascular patterns developing

between goal groups who chose this type of music. At most, it would be expected that HRV patterns associated with angry song selections would be similar to HRV patterns associated with happy music because anger and happiness have similar levels of arousal.

Although there were no significant effects in HRV change for those who selected angry music, HR for the control group was found to decrease between music and writing. However, changes in HR alone provide limited evidence of sympathetic and parasympathetic control. Therefore, these results were difficult to interpret. It is also important to note that cardiovascular findings related to anger may be unique to the limited amount of participants who selected angry songs ($N = 9$). If more participants would have selected more angry songs in the current study, clear cardiovascular patterns between groups may have emerged, possibly similar to those found with happy music selection (i.e., music with similar arousal levels; Jones, 2003).

Self-Report and Song-Selection measures. Despite cardiovascular evidence suggesting that goal-consistent emotion regulation did occur, the confrontation group did not show greater increases in self-reported anger. Research has shown that self-report measures of emotion are often minimally correlated with measures of the peripheral nervous system (Friedman, Stephens, & Thayer, 2013). This suggests that participants have a limited ability to interpret how they are feeling throughout the course of a study. Because a majority of participants in the current study assumed that the experimenter expected them to select angry songs, participants may have been under the impression that they were being tested on how well they could limit their anger. Participants may have then been inclined to ignore any increases in anger throughout the study, even when engaging in thought processes that up-regulate anger (e.g., attention towards negative

aspects of parking). Therefore, this could explain why HRV indicators of increased anger occurred in the confrontation group, while self-report measures did not indicate such increases in anger.

Similar to self-reported anger findings, the confrontation group did not choose more angry music. Participants in general tended not to select angry music, while none of the goal groups showed a greater preference for certain types of music (angry, happy, neutral). Research conducted on tennis players' emotional preparation for a tennis match indicated that players primarily chose to listen to music that they liked and music that fit their goal level of arousal before a match (Bishop, Karageorghis, & Loizou, 2007). Therefore, this suggests that song choice in the current study was better explained by liking and arousal preference, rather than valence of a song being consistent with a goal (i.e., angry music being consistent with confrontation goals or happy music being consistent with collaboration goals).

A large portion of participants in the current study indicated that they chose music that was expected to induce calmness and facilitate thoughts. To give a better sense of what calming and thought-provoking reasons for song selection meant, below is a participant's reason for song selection that includes both themes:

> Because it reminded me of the music I've played before. It's very calming and helped me clear my mind a little.

Consistent with these calming and thought-facilitating reasons for music selection, research suggests that music is often used to facilitate imagery and reappraisal processes aimed to regulate emotion, especially when thinking is necessary to solve an emotional issue or conflict (Saarikallio & Erkkila, 2007). Because more arousing songs (i.e., happy

and angry songs) inhibit working memory and engage attentional resources necessary for imagery and reappraisal processes, it is likely that neutral songs were chosen most often for thought-facilitating reasons (Jones, 2003; Saarikallio & Erkkila, 2007). This idea was conveyed well through a participant's reason given for a neutral song selection:

> The song made me think. It made me wonder about perhaps what was going through the Directors head. It made me clearly see where I wanted to go with the conversion because it was neither angry or happy. It was something I couldn't explain really. It helped remind me the best way of convincing the director to increase parking.

This proposition that neutral music best facilitated a clear mind and provided a sufficient amount of attentional resources was then supported by cardiovascular patterns suggesting that goal-consistent regulation/goal-consistent thought processes occurred most frequently when neutral music was selected.

Research cited previously regarding the distracting nature of happy music suggests that individuals are aware of the attentional resources that certain music demands (e.g., happy music), and this quality of music is considered when selecting music to regulate emotion (Saarikallio & Erkkila, 2007). In addition, research suggests that arousing music (i.e., happy and angry music) loosens emotion regulatory control (Scherer & Zentner, 2001). This could explain why participants in the current study who selected neutral music were most likely to report explicit attempts to up-regulate anger and down-regulate happiness. Therefore, it is possible that participants who chose neutral music wanted regulatory control to facilitate goal-consistent, anger-inducing thoughts in preparation for the negotiation. These findings may have then occurred because such

participants were aware of the attentionally demanding nature of the arousing songs and the lack of regulatory control through thinking that such songs allow (Jones, 2003; Saarikallio & Erkkila, 2007; Scherer & Zentner, 2001).

In addition to infrequent selections of angry music, the confrontation group did not expect anger to be more useful than other groups, and expected success of anger did not mediate HRV changes. In the negotiation scenario and writing task of the current study, perceived thought-inhibiting aspects of anger may have influenced the degree to which participants' expected anger to be useful. It is commonly believed that anger encourages irrational thinking (Fischer, Manstead, Evers, Timmers, & Valk, 2004), despite evidence suggesting that this assumption may not be true (Shields, Moons, Tewell, & Yonelinas, 2016). In comparison to Tamir and Ford (2012), participants in the current study were likely more motivated to come up with ideas to influence the Director of Parking because participants were able to relate to campus parking issue (i.e., likely making it possible for them to form strong opinions on how to fix such issues) and because they were told their message had real-life significance (i.e., the message would be communicated to the Director of Parking). Therefore, if participants believed anger would inhibit their ability to write a convincing/rational message, they may have rated anger as being less useful. This could have also subsequently led to lower self-reported anger for cognitive dissonance reasons, as explained previously (i.e., expected success ratings may influence participants to report feeling in ways that are consistent with what is expected to be successful, despite actual emotion felt).

Past Research Comparison and Future Directions

The current findings as a whole question the practicality of Tamir and Ford's (2012) conclusions. It is possible that music with a more polarized valance, even when the valence is consistent with a goal (i.e., angry music to increase anger), may not effectively lead to goal-consistent cardiovascular change (i.e., cardiovascular change indicating greater anger). Choosing an angry song to pursue a confrontation goal may be more representative of a commitment to act more confrontational during a subsequent negotiation task and a commitment to report higher feelings of anger, even if such emotions are not really felt. Therefore, more genuine anger up-regulation to pursue a confrontation goal may occur under less attentionally demanding conditions where cognitive control processes (i.e., attention allocation towards negative aspects of a situation or reappraisal of aspects in a more negative light) are facilitated.

These conclusions are consistent with research suggesting that cognitive control processes are essential when up/down-regulating emotion through music (Chin & Rickard, 2014; Leipold & Loepthien, 2015). The results of the current study also support the use of music with a polarized valance as a distraction technique that may draw attentional resources away from negative thought processes. However, because the songs used in this study were likely unfamiliar/not popular music, participants were likely slower to habituate to the music, possibly enhancing its distracting potential. Therefore, future research exploring emotion regulation through selection of music could examine whether familiarity of a song mediates the relationship between music and emotion regulation through distraction.

In addition, the current findings suggest that neutral music facilitated one's ability to engage in emotion regulation processes. Music has been shown to enhance participants' ability to perform other cognitive processes, such as spatial reasoning (Toukhsati & Richarch, 2012). However, these effects only occur when music is listened to *before* a spatial reasoning task, while music listening hinders spatial reasoning *during* a task. Therefore, music may interfere with emotion regulation processes similarly, even when listening to a song with a goal-consistent valence (i.e., song that would be expected to increase a certain emotion). Future research on emotion-consistent goal pursuit through music should explore the cognitive mechanisms underlying HRV changes and whether neutral music does facilitate emotion regulatory processes. This could be done through a similar study as the current study that includes a music-selection control group that does not listen to selected music during goal pursuit. This would then reveal if neutral music facilitates thinking or simply interferes less with emotion regulatory processes than music with a more polarized valance.

It would also be interesting to also directly contrast participants' ability to engage in anger up-regulation through cognitive reappraisal or attentional deployment processes when listening to certain types of music (i.e., angry, happy, neutral) or no music. For example, Participants could be instructed to reappraise a situation more negatively while listening to angry music, while others could be instructed to reappraise the situation more negatively while listening to nothing. Measuring HRV changes in such a study, along with routine self-report measures, could directly test theories formed from the pattern of HRV results found in exploratory analyses of the current study. Having participants report specific songs they would listen to when trying to increase anger levels and then

analyzing those songs could also provide much more insight into music choices when pursing confrontation goals.

Limitations

The most significant limitation was that sample sizes of music selection groups (i.e., those that chose angry, happy, or neutral music) could not be controlled. This led to uneven amounts of participants who selected happy, neutral, or angry music, which was especially detrimental to the ability to analyze data for the small number of participants who selected angry music. Therefore, the results indicated in the exploratory analyses need to be considered with caution. In addition, this limitation may be unavoidable when trying to uncover unique effects relevant to emotion regulation through music selection. The only way to make music-selection group sizes equal may be to cut participants from selection groups with an overflow of participants after a minimum number of participants in each song-selection group is met. Thus, experimental designs tailored to testing the effects of music through assignment to different music conditions (e.g., angry, happy, neutral) could better assess the effects of music on goal pursuit. Despite this limitation, effect size and power values for differences in HRV changes between goal groups were very large (e.g., $\eta^2_p = .58$, power = .98 for HF HRV) when neutral music was selected. This suggests the possible strength of goal-consistent cardiovascular change under neutral listening conditions in comparison to other music conditions, which is a result that should be taken into high regard by future research using similar paradigms.

Another notable limitation of the current study was difficulties in assessing successful confrontation and collaboration, which led to a lack of evidence indicating that emotion-consistent goal pursuit led to confrontation or collaboration success. This was

more of an issue for confrontation goals, as evidence was provided that those pursuing collaboration goals were more successful on one of the collaboration items. Rater questions used for confrontation may have been too objective and not as clearly connected to confrontation success in the negotiation task (i.e., the written message). For instance, a very persuasive writer taking a collaborative approach could have just as much of a chance to, for example, convince the director of parking to add more spaces quickly as an individual taking a more confrontational and aggressive approach to writing. Therefore, the actual success of confrontation behavior in the current study was unclear. It is possible that the motivational nature of anger may be useful in this confrontation situation, while anger behaviors may not. In other words, anger may be useful in the sense that it could encourage more passionate and emotionally convincing writing that is, however, still controlled and logical sounding. Rater questions could possibly be refined to better evaluate this aspect of successful confrontation. Or, at most, more direct rater questions (e.g., how effectively did this participant confront the Director of Parking?) could be used to serve as more of a manipulation check to determine whether participants in the confrontation group showed evidence of attempts to achieve a confrontation goal through the written message.

A lack of self-report evidence of anger increases in the confrontation group also limits the interpretation of the cardiovascular findings, as it can only be speculated that these changes were due to anger-inducing thoughts. However, as stated previously, a larger sample size may lead to self-report differences between goal groups. It is also unclear whether cardiovascular changes that occurred due to negative thinking/preparation for the message were emotion regulation of wanting to increase

anger to complete the writing task or emotion generation of anger resulting from being required to complete the writing task. Therefore, as proposed above, methods that manipulate emotion regulation processes (e.g., reappraisal) and make sure participants are engaging in such processes may be better suited to study the effects of music on goal-pursuit.

Conclusion

In conclusion, emotion regulation through the selection of emotion-inducing stimuli likely requires more than just passive experience of the stimuli (e.g., more than just listening to angry music). It may be essential for a selected stimulus to facilitate cognitive control processes/thoughts that effectively enhance or diminish an emotional state. Such information could be useful for those trying to enhance anger for instrumental reasons. For instance, professional athletes needing to engage in high-contact actions may choose to listen to music that provokes more negative thinking before a game, rather than music that simply has a negative valence. Although far from conclusive, evidence provided in the current study also opens the door to many interesting considerations for future research involving the use of song-selection paradigms to represent up-regulation of an emotion state. Future research on this topic should consider the thought-interfering or facilitating nature of the emotion-inducing stimuli being selected. Methods tailored to cognitive control processes involved in emotion regulation may provide a much greater understanding of this type of emotion regulation and its adaptive use.

Table 1. Study Comparison Chart.

	Tamir & Ford (2012): Study 1	Thesis	Tamir & Ford (2012): Study 2
Initial Instructions	Participants were told that the study was aimed to examine the link between memory and negotiation skills. Participants were told that they would first complete a memory task (i.e., which was actually the video/memory recall selection task) and then complete a negotiation task. Regarding the negotiation task, participants were informed that they would play the role of a landlord and another participant would play a tenant who had not paid rent in 2 months.	Participants will be told that the study is aimed to examine the link between memory and negotiation skills. Participants were told that they will first complete a memory task (i.e., which will actually be the music selection task) and then complete a negotiation task. Regarding the negotiation task, participants were informed that they would role-play as an Student Government Association member in a negotiation with the director of parking at Towson University. Participants were also deceived into thinking that they would write a message that the Director would read.	*Participants were told that the study was aimed to examine the link between memory and negotiation skills. Participants were told that they would first complete a memory task (i.e., which was actually the music selection task) and then complete a negotiation task. Regarding the negotiation task, they were informed that they would play the role of a landlord and another participant would play a tenant who had not paid rent in 2 months.
Initial Measures	Participants provided demographic information and rated their current emotional experiences.	Participants provided demographic information and rated their current emotional experiences (Affect Self-Report 1)	Participants provided demographic information and rated their current emotional experiences.
Pre-Goal Assignment Instructions	Participants were told that the memory task involved choosing certain emotional film clips to watch or emotional events to recall from their past before the negotiation task.	Participants were told that the memory task would either involve choosing emotional music clips to listen to or choosing emotional events to recall before the negotiation task.	* Participants were told that the memory task would either involve choosing emotional music clips to listen to or choosing emotional events to recall before the negotiation task.
Goal Assignment	- Participants in the confrontation condition were told their goal was to get the tenant to pay the rent immediately. - Participants in the collaboration condition were told their goal was to cultivate a healthy long-term relationship with the tenant. - Participants in the unprompted condition were not given specific instructions.	- The confrontation condition was told that their goal was to convince the director of parking to add more student spaces as quickly as possible. - The collaboration condition was told to reach an agreement that was reasonable for both students and the director of parking. - The control condition was given no goal.	*- Participants in the confrontation condition were told their goal was to get their tenant to pay rent quickly. - Participants in the collaboration condition were told their goal was to reach a fair agreement. - No control group was included

Pre-Selection Deception	None at this point. (See Music Listening for when deception occurred)	All participants were told that they were assigned to listen to music.	*All participants were told that they were assigned to listen to music.
Music/ Stimulus Selection	Participants read descriptions of memories and film clips. They rated their preferences for the events they would want to recall and film clips they would want to watch before the negotiation.	Participants listened to 20 s excerpts of six music clips (two angry, two happy, two neutral) and select 1 clip to listen to before the negotiation.	* Participants listened to 20 s excerpts of angry, happy, or sad music clips and selected 3 clips to listen to before the negotiation.
Expected Success of Emotions	Participants rated the extent that certain emotions would lead to success during the negotiation	Participants rated the extent that certain emotions would lead to success during the negotiation	Participants rated the extent that certain emotions would lead to success during the negotiation
Music Listening	All participants were told that they were in the control group and were assigned to music conditions (angry, happy, neutral) They then listened to 5 mins of two songs.	Participants listened to the song they selected for 2 min. - Physiological data was recorded	* Participants listened to approximately 8 mins of the three songs they chose.
Post-Music Measures	Self-report emotional state	Self-report emotional state	Self-report emotional state
Negotiation Task	* Participants left a 2 min voice message for the tenant.	Participants will hand-write a message to the director of parking for 2 min. - Physiological data was recorded	Participants in person negotiated with another participant role-playing as the tenant
Objective Rater Questions	* Based on the 2 min voice message… *Confrontation*: If you were the tenant, how likely would you be to… 1. Pay the rent quickly? 2. Borrow money from family or friends? 3. Get a loan to pay the rent? *Collaboration*: If you were the tenant, how likely would you be to… 1. Stay in the apartment? 2. Recommend the landlord to other potential tenants? 3. Collaborate with the landlord on a payment plan?	Based on the written message… *Confrontation*: If you were in control of parking at Towson, how likely would you be to… 1. Take the necessary action to add more parking for students quickly? 2. Feel urgency to add a sufficient amount of parking spaces to satisfy students? 3. Feel as though the current parking situation is negatively impacting students to a great degree? *Collaboration*: If you were in control of parking at Towson, how likely would you be to… 1. Collaborate with the student on a plan to make parking on campus better? 2. Find the student agreeable?	No Rater. Performance was based on amount of money earned back from the tenant. (More money = successful confrontation)

* = The study that most closely resembles the current study for the specific step

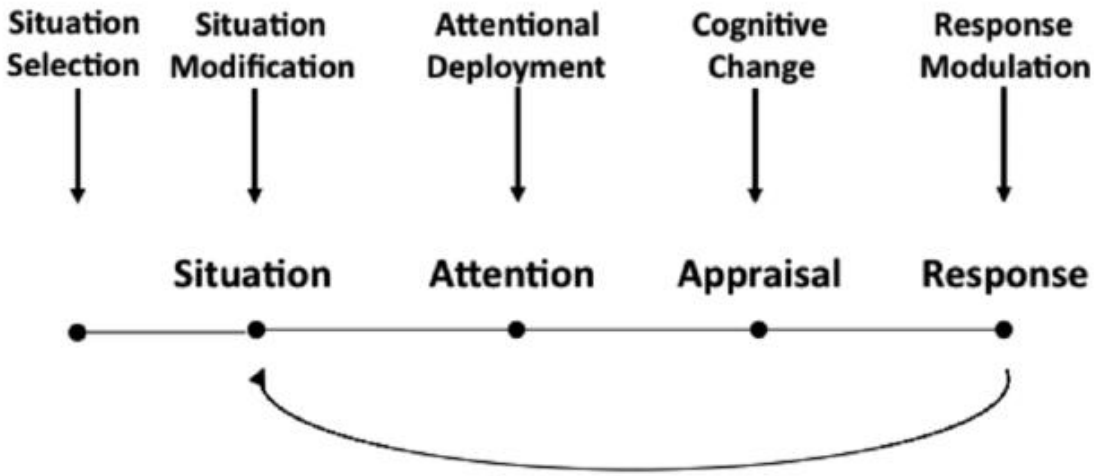

Figure 1. This figure shows the process model of emotion regulation (Gross, 2015). Emotion generation involves situation selection, attention, appraisal, and response components of the model, while emotion regulation involves situation selection, situation modification, attentional deployment, cognitive change, and response modulation components of the model. Emotion regulation components represent strategies that can be used to alter the emotion generation process at a given step.

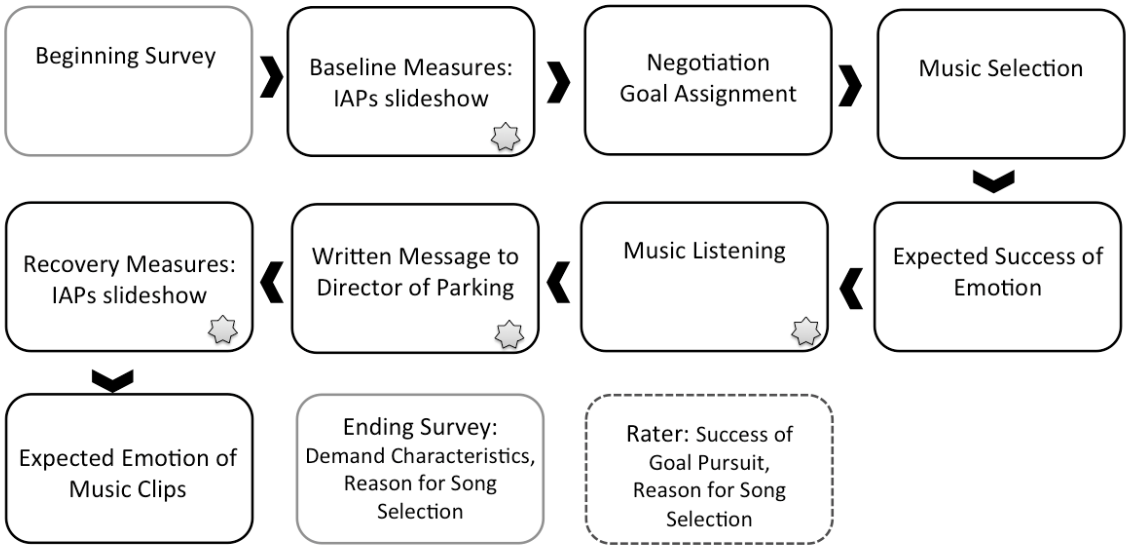

Figure 2. This figure shows the step-by-step procedure of the current study. Grey/silver stars represent physiological recording periods of interest (i.e., periods where HRV was analyzed). Participants also filled out the Affect Self-Report at the end of every step with a grey/silver star. Grey boxes with solid lines were steps that involved Qualtrics, while black boxes involved E-prime scripts. The grey box with dotted lines (i.e., the rater step) indicates a step that was conducted after data collection.

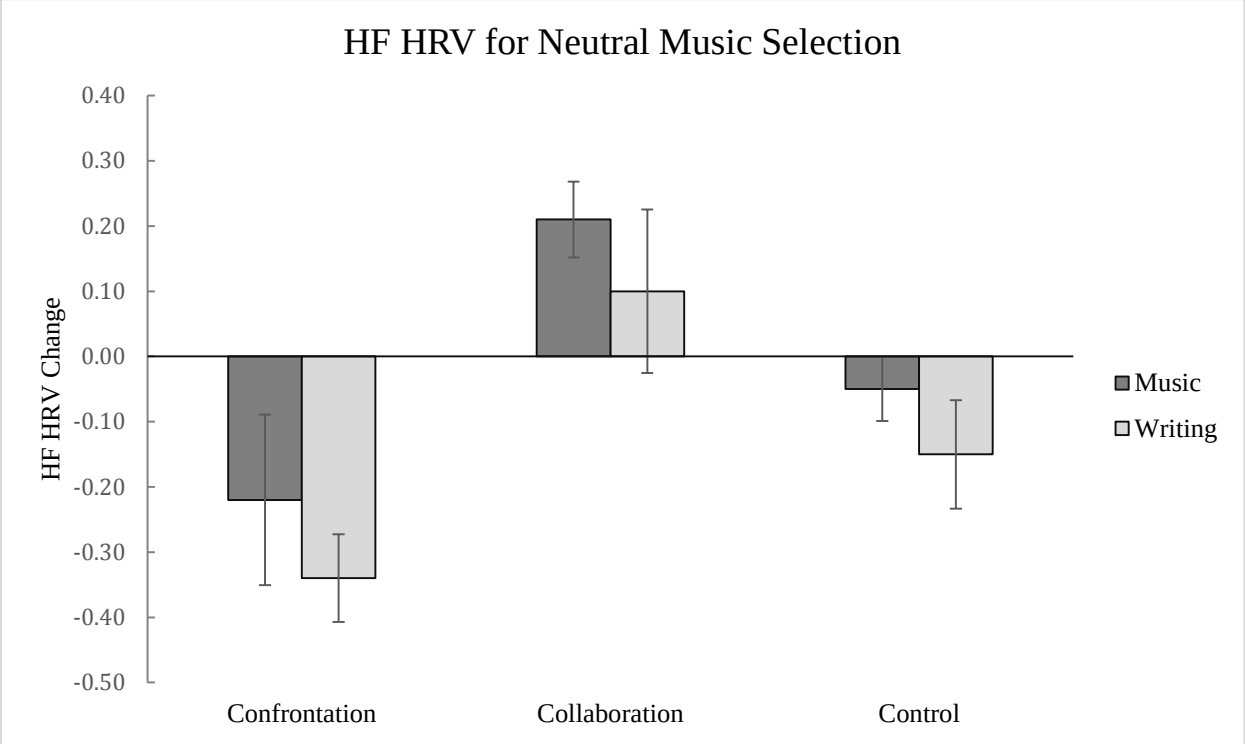

Figure 3. This figure shows differences in HF HRV for participants who selected neutral music. The x-axis represents participants' baseline HF HRV, and bars represent participants' deviation from baseline HRV states during music and writing. Change scores were calculated so bars going up indicate an increase in HF HRV from baseline, while bars going down indicate a decrease in HF HRV from baseline. HF HRV in the confrontation and control groups was significant lower during music and writing in comparison to the collaboration group. In addition, HF HRV decreased in the confrontation and control groups, while HF HRV increased in the collaboration group. The standard error bars represent an estimate of the extent mean HF HRV change from baseline of each goal group deviated from the average HF HRV change within a time period (i.e., music or writing).

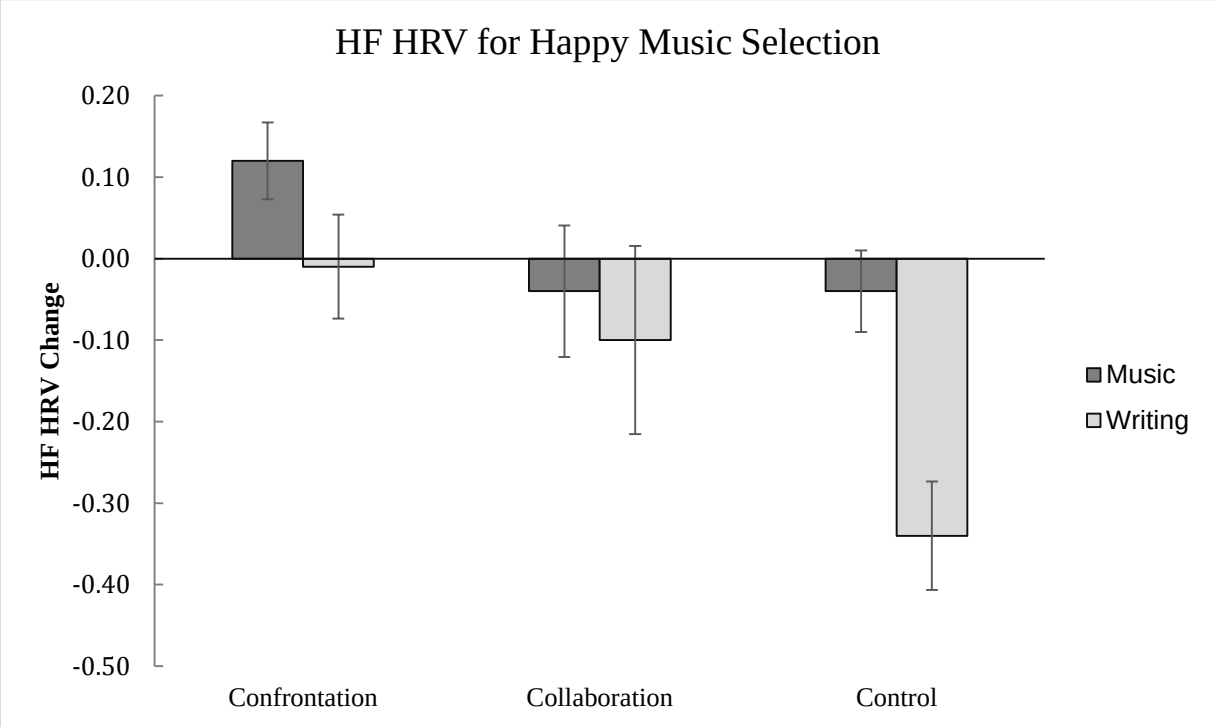

Figure 4. This figure shows differences in HF HRV for participants who selected happy music. The x-axis represents participants' baseline HF HRV, and bars represent participants' deviation from baseline HRV states during music and writing. Change scores were calculated so bars going up indicate an increase in HF HRV from baseline, while bars going down indicate a decrease in HF HRV from baseline. Participants in the confrontation group and control group showed significant decreases in HF HRV between music and writing, while no significant changes HF HRV over time occurred in the collaboration group. In addition, HF HRV in the confrontation group was significantly higher during both music and writing in comparison to the control group. The standard error bars represent an estimate of the extent mean HF HRV change from baseline of each goal group deviated from the average HF HRV change within a time period (i.e., music or writing).

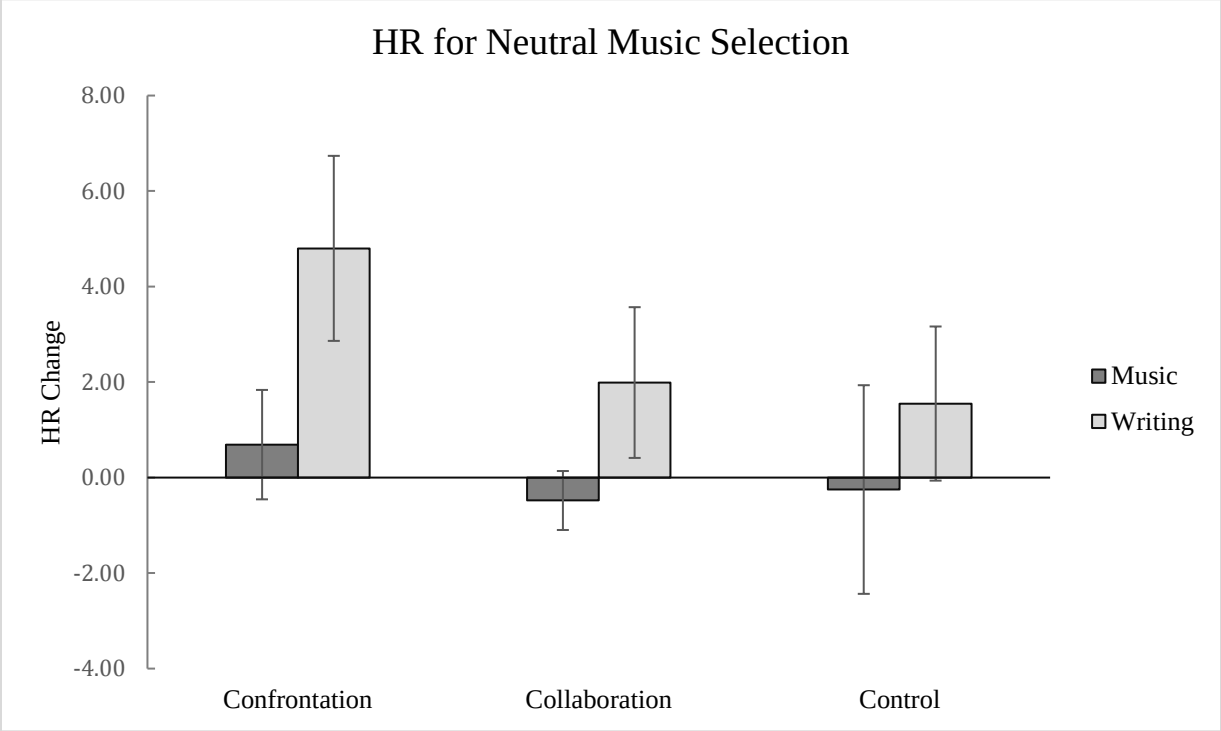

Figure 5. This figure shows differences in HR for participants who selected neutral music. The x-axis represents participants' baseline HR, and bars represent participants' deviation from baseline HR states during music and writing. Change scores were calculated so bars going up indicate an increase in HR from baseline, while bars going down indicate a decrease in HR from baseline. The HR of participants in the confrontation group was significantly higher during writing in comparison to during music. Participants' HR did not significantly change between music and writing for the collaboration or control group. However, the HR of participants in the collaboration group was closer to resembling the control group. The standard error bars represent an estimate of the extent mean HR change from baseline of each goal group deviated from the average HR change within a time period (i.e., music or writing).

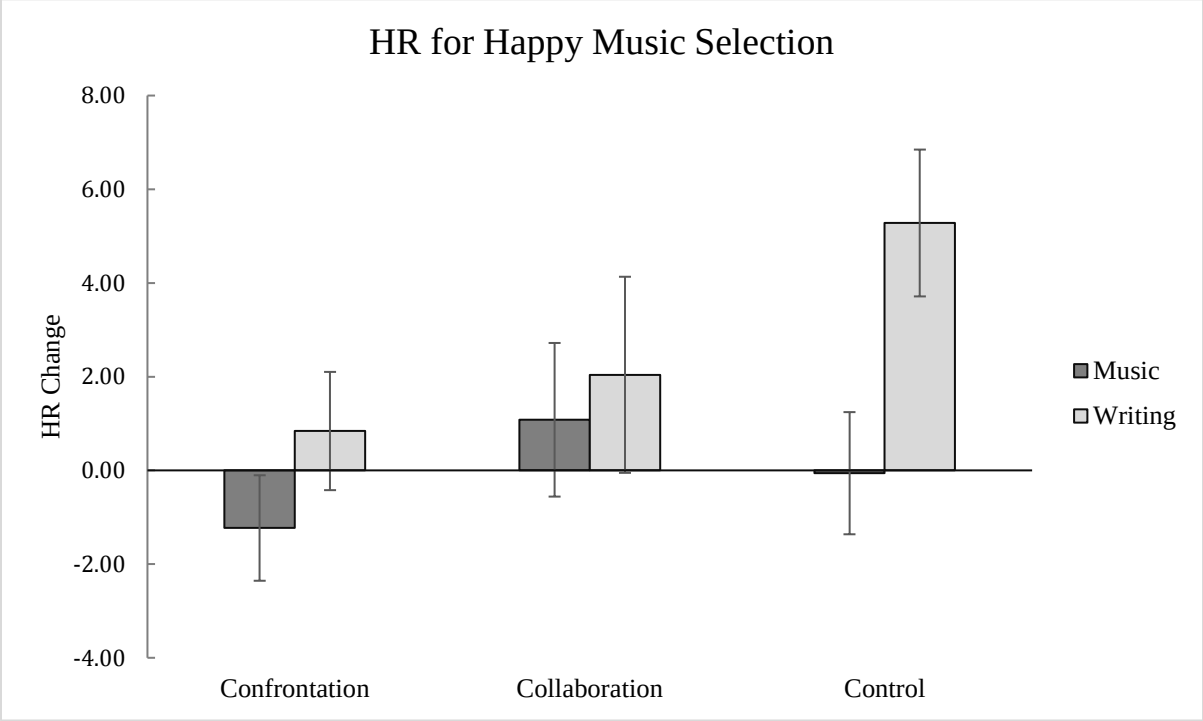

Figure 6. This figure shows differences in HR for participants who selected happy music. The x-axis represents participants' baseline HR, and bars represent participants' deviation from baseline HR states during music and writing. Change scores were calculated so bars going up indicate an increase in HR from baseline, while bars going down indicate a decrease in HR from baseline. The HR of participants in the control group was significantly higher during writing in comparison to during music. When happy music was selected in the collaboration group and confrontation group, participants' HR did not significantly change between music and writing. The HR of participants in the confrontation group was closer to resembling the control group. The standard error bars represent an estimate of the extent mean HR change from baseline of each goal group deviated from the average HR change within a time period (i.e., music or writing).

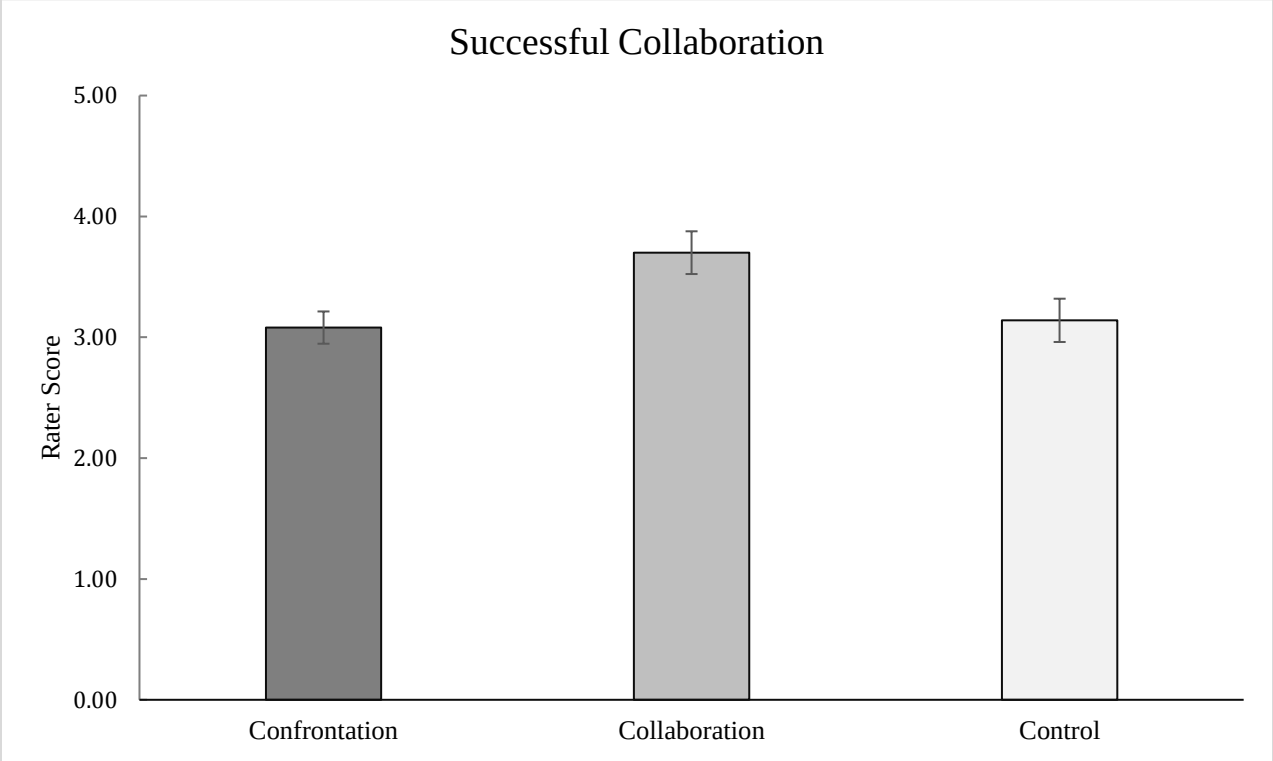

Figure 7. This figure shows the differences between the goal groups' successful collaboration scores. Therefore, higher rater scores indicate that, after reading the students message, there would be a greater likelihood that the Director of Parking would collaborate with the student on a plan to make parking on campus better. The standard error bars represent an estimate of the extent means of goal group's collaboration success deviated from the average collaboration success.

Appendix A

Affect Self-Report.

The following slides will present to you 21 different feeling/emotion words. Please respond by typing a number, 1 (Not at All) through 7 (Very Accurately), in the black box to indicate how accurately the word describes how you are currently feeling.

A scale will be provided that will help you gauge what each response, 1-7, represents. Emotion/feeling words will be presented one at a time. After entering a number in the black box, you will press ENTER to bring up the next word.

Please take your time and make sure to enter a single number into the black box before pressing ENTER. You can use BACKSPACE to delete numbers that you may have accidently entered.

Press SPACEBAR to continue >>

How accurately does the word below describe how you are currently feeling?

Cheerful
Angry
Indifferent
Sad
Anxious
Pleasant
Excited
Happy
Mad
Casual
Negative
Scared
Unconcerned
Merry
Positive
Annoyed
Neutral
Content
Stressed
Stirred up
Unpleasant

Scale: 1 = Not at All, 4 = Moderately Accurate, 7 = Very Accurate; Rate the intensity of what you are feeling as a whole: (1 = Not Intense, 4 = Moderately Intense, 7 = Extremely intense)

Appendix B

Expected Success of Emotion.

For the next set of questions, you will be asked how much certain feelings/emotions would help you successfully achieve your goal in the negotiation with the director of parking.

A scale will be provided that will help you gauge what each response, 1-7, represents. Emotion/feeling words will be presented one at a time. After entering a number in the black box, you will press ENTER to bring up the next word.

Press SPACEBAR to continue >>

To be successful in negotiating with the director of parking, to what extent would you want to feel…

Tired
Cheerful
Angry
Indifferent
Sad
Anxious
Pleasant
Excited
Hungry
Happy
Mad
Casual
Negative
Scared
Unconcerned
Merry
Positive
Annoyed
Neutral
Content
Stressed
Stirred up
Unpleasant
Sick

Scale: 1 = Not at All, 4 = Moderately, 7 = Extremely

Appendix C

Expected Emotion Felt from Music.

You are now going to listen to each song clip a second time. After listening to a clip, a slide will present to you 18 different feeling/emotion words. You will be asked to rate on a scale of 1 (Not at all) to 7 (Extremely) if you would expect the song to make you feel the specified feeling/emotion.

You will also be asked to rate how much you like each song.

A scale will be provided that will help you gauge what each response, 1-7, represents. Emotion/feeling words will be presented one at a time. After entering a number in the black box, you will press ENTER to bring up the next word.

Press SPACEBAR to continue >>

(Song Clip Plays for 20 s)

To what extent would you expect this song to make you feel…

Cheerful
Angry
Indifferent
Sad
Anxious
Pleasant
Excited
Happy
Mad
Casual
Negative
Scared
Unconcerned
Merry
Positive
Annoyed
Neutral
Content
Stressed
Stirred up
Unpleasant

Scale: 1 = Not at All, 4 = Moderately, 7 = Extremely

Respond to the following statement using the scale below: I like the song "(*Name of song clip*)"; Scale: (1 = Strongly Disagree, 2 = Disagree, 3 = Somewhat Disagree, 4 = Neutral, 5 = Somewhat Agree 6 = Agree, 7 = Strongly Agree)

Appendix D

Rater Questionnaire.

For the following questions, you will be asked to imagine that you are the director of parking at Towson University. Do not respond to the questions based on your role as a student or based on any personal opinions you have regarding parking on campus. Make sure to think about how the messages would be viewed from the perspective of the individual in charge of parking on campus.

If you were in control of parking at Towson, how likely would you be to…

1. Take the necessary action to add more parking for students quickly?

1	2	3	4	5
Extremely unlikely	Unlikely	Neutral	Likely	Extremely likely

2. Feel urgency to add a sufficient amount of parking spaces to satisfy students?

1	2	3	4	5
Extremely unlikely	Unlikely	Neutral	Likely	Extremely likely

3. Feel as though the current parking situation is negatively impacting students to a great degree?

1	2	3	4	5
Extremely unlikely	Unlikely	Neutral	Likely	Extremely likely

4. Collaborate with the student on a plan to make parking on campus better?

1	2	3	4	5
Extremely unlikely	Unlikely	Neutral	Likely	Extremely likely

5. Find the student agreeable?

1	2	3	4	5
Extremely unlikely	Unlikely	Neutral	Likely	Extremely likely

Appendix E

Explicit Emotion Regulation.

1. Respond to the following statement as it pertains to each of the emotions listed below: Before writing the message to the director of parking, I actively tried to INCREASE feelings of...

Anger
Happiness
Sadness
Fear
Other

Yes, No, Not Sure/Don't Remember
(Emotion words were presented in a random order)

2. Respond to the following statement as it pertains to each of the emotions listed below: Before writing the message to the director of parking, I actively tried to DECREASE feelings of...

Anger
Happiness
Sadness
Fear
Other

Yes, No, Not Sure/Don't Remember
(Emotion words were presented in a random order)

Appendix F

1) Demographics and Health History Questionnaire: Include questions regarding prototypical demographic information, such as gender, race, and college major. Health history questions were used to assess possible factors that could impact physiological recording (e.g., history of cardiovascular disease). Of importance to the current study, participants were asked various questions regarding their use of parking on campus (e.g., if they commute to Towson University). Additionally, participants were asked various questions assessing whether they followed the pre-study guidelines (e.g., not drinking 24 hr before the study).

2) Emotion Regulation Questionnaire (Gross & John, 2003): Used to assess the degree to which participants tend to use cognitive reappraisal or expressive suppression strategies to regulate their emotions.

3) Alexithymia Questionnaire (Rieffe, Oosterveld, & Terwogt, 2006): Used to assess participants' ability to recognize the emotions they are experiencing.

4) BIS/BAS Scale (Carver & White, 1994): collects information regarding the sensitivity of participants' aversive (BIS; behavioral inhibition system) and appetitive (BAS; behavioral activation system) motivational systems that drive behavior.

5) The Aggression Questionnaire (Buss & Perry, 1992): Used to assess participant's levels of trait anger.

Appendix G

Initial Verbal Instructions:

"The following tasks in this study will examine the link between memory and negotiation skills. We will ask you to engage in a memory task, so we can assess your memory skills. Then, we will ask you to role-play as a Student Government Association member in a negotiation with the director of parking on campus, so that we can assess your negotiation skills.

The negotiation task will specifically involve writing a message to the director of parking at Towson. For this part of the study, we will compile your message with the messages of other participants and bring them to the director of parking to try to influence real change to campus.

(*Emphasize this instruction*) Although the negotiation task will not involve any face-to-face negotiation, go through the tasks in this study imagining that you are anticipating a face-to-face negotiation with the director of parking.

Before starting the memory and negotiation tasks, you will watch a 5 min picture slideshow. Please be as still as you can and please refrain from using your cell phone throughout the study."

Script 1: Task Familiarity/Goal Assignment Instruction Slides 1-6 (immediately follows baseline slideshow):

Note: Slides 1-4 are the same across conditions. Parts of Slides 5 and 6 vary based on Confrontation, Collaboration, or Neutral goals. Each variation of Slides 5 and 6 are below. Additionally, underlined text represents text that is only in the goal conditions/Text that specifically refers to following a goal.

1. The next six slides will provide you with some more background on the negotiation task, which is the central task in this study. These slides will also provide information on the memory task, which will be completed first.

While reading the following slides, imagine that you are a Student Government Association member who is about to have a face-to-face negotiation with the director of parking at Towson University. The negotiation will be regarding student parking spaces on campus.

(1) Press SPACEBAR to continue >>

2. The director of parking at Towson University (the person you will negotiate with) has control over all parking changes that occur on campus.

Student Government Association members at Towson University (the role you are imagining yourself in) have the power to influence the director of parking and other Towson administration to make significant changes to campus. For instance, members of the Student Government Association have successfully pushed Towson administration to add solar panels to campus despite many Towson administration not supporting the addition.

Therefore, as a member of the Student Government Association, you have the power to influence the director of parking to make significant changes to parking.

(2) Press SPACEBAR to continue >>

3. Many students generally have issues with parking on campus. Student parking spaces on Towson University's campus often fill up quickly, causing students who arrive to campus on time to be late for class because they are spending lengthy amounts of time finding parking spaces. This often causes students a lot of frustration because not enough student spaces are available, while many spaces that are labeled for faculty parking are often left unfilled.

According to recent survey data, a majority of students on campus would like to see changes to parking. On the other hand, faculty members do not want parking to be altered on campus and are constantly pushing the director of parking to not make changes. The director of parking agrees with faculty members that parking changes are not necessary.

As a member of the Student Government Association, you must negotiate with the director of parking on campus in order to influence his decisions to better accommodate students.

(3) Press SPACEBAR to continue >>

4. Before you negotiate with the director of parking, you will either be assigned to recall an event from your past or listen to music.

We will give you the opportunity to indicate what type of memory you would like to recall or what type of music you would like to listen to before the negotiation. Because people tend to have much better memories for emotional events or music, many of the events or music you will choose from will vary by emotional tone.

Once you tell us what you prefer, you will either recall your selected type of memory for 2 minutes or listen to your selected song for 2 minutes before the negotiation.

(4) Press SPACEBAR to continue >>

5.

Confrontation.

As a reminder, you are a Student Government Association member who is anticipating a negotiation with the director of parking on campus.

As a Student Government Association member representing students, it is your goal to convince the director of parking to add more student spaces immediately! Students need this problem resolved now.

Do not feel held back during the negotiation. Remember, you are in a position of power and can choose to assert your stance however you want. With that said, achieving your goal is the most important aspect of the negotiation, so always keep your goal in mind.

On the next slide, you will be assigned to either memory recall or music selection.

(5) Press SPACEBAR to continue >>

Collaboration.

As a reminder, you are a Student Government Association member who is anticipating a negotiation with the director of parking on campus.

As a Student Government Association member representing students, it is your goal to reach a decision that is reasonable to both the students and the director of parking. It would be difficult for the director of parking to satisfy all students' wishes.

Do not feel held back during the negotiation. Remember, you are in a position of power and can choose to assert your stance however you want. With that said, achieving your goal is the most important aspect of the negotiation, so always keep your goal in mind.

On the next slide, you will be assigned to either memory recall or music selection.

(5) Press SPACEBAR to continue >>

Neutral.

As a reminder, you are a Student Government Association member who is anticipating a negotiation with the director of parking on campus.

Do not feel held back during the negotiation. Remember, you are in a position of power and can choose to assert your stance however you want.

On the next slide, you will be assigned to either memory recall or music selection.

(5) Press SPACEBAR to continue >>

6.

Confrontation.

You have been assigned to listen to music before the negotiation. You will first listen to 6 song clips. You will then select one song to listen to at full length before the negotiation.

The title of the song will be displayed as each clip plays. Therefore, please try to use the names to help you remember the song you would like to select. You can use the scrap paper and pencil next to you to help you remember the song that you want to select.

Remember, as a Student Government Association member, you will negotiate with the director of parking later in the study. *Keep in mind that it is your goal to convince the director of parking to add more student spaces immediately! Students need this problem resolved now.*

(6) Press SPACEBAR to begin playing the song clips.

Collaboration.

You have been assigned to listen to music before the negotiation. You will first listen to 6 song clips. You will then select one song to listen to at full length before the negotiation.

The title of the song will be displayed as each clip plays. Therefore, please try to use the names to help you remember the song you would like to select. You can use the scrap paper and pencil next to you to help you remember the song that you want to select.

Remember, as a Student Government Association member, you will negotiate with the director of parking later in the study. *Keep in mind that it is your goal to reach a decision that is reasonable to both the students and the director of parking. It would be difficult for the director of parking to satisfy all students' wishes.*

(6) Press SPACEBAR to begin playing the song clips.

Neutral.

You have been assigned to listen to music before the negotiation. You will first listen to 6 song clips. You will then select one song to listen to at full length before the negotiation.

The title of the song will be displayed as each clip plays. Therefore, please try to use the names to help you remember the song you would like to select. You can use the scrap paper and pencil next to you to help you remember the song that you want to select.

Remember, as a Student Government Association member, you will negotiate with the director of parking later in the study.

(6) Press SPACEBAR to begin playing the song clips.

Script 2: Negotiation and Writing Task Instruction Slides 1 and 2 (immediately follows listening to selected song for 2 mins)

Note: Slide 1 is the same for all conditions. Slide 2 will vary based on Confrontation, Collaboration, or Neutral goals. Each variation of Slide 2 is below. Additionally, underlined text represents text that is only in the goal conditions/Text that specifically refers to following a goal.

1. Using the notepad in front of you, your negotiation task will be to write a message to the director of parking regarding student parking issues on campus.

You will have 6 minutes to write your message. When the 6 minutes is up, you will hear a woman's voice say "stop writing." After you hear this voice, look up at the screen and continue with the next part of the study.

Press SPACEBAR for further instruction >>

2.

Confrontation.

Through this message, it is your goal to convince the director of parking to add more student spaces immediately! Students need this problem resolved now.

Remember, your message will be compiled with other participants' messages and brought to the director of parking, and the director of parking will be told that the messages were written by Student Government Association members. Therefore, you have the power to influence the director of parking through your message.

Think about what you want to write to <u>achieve your goal</u> and then press SPACEBAR to begin. Please write as legibly as possible.

Press SPACEBAR to continue >>

Collaboration.

Through this message, it is your goal to reach a decision that is reasonable to both the students and the director of parking. It would be difficult for the director of parking to satisfy all students' wishes.

Remember, your message will be compiled with other participants' messages and brought to the director of parking, and the director of parking will be told that the messages were

written by Student Government Association members. Therefore, you have the power to influence the director of parking through your message.

Think about what you want to write to achieve your goal and then press SPACEBAR to begin. Please write as legibly as possible.

Press SPACEBAR to continue >>

Neutral.

Remember, your message will be compiled with other participants' messages and brought to the director of parking, and the director of parking will be told that the messages were written by Student Government Association members. Therefore, you have the power to influence the director of parking through your message.

Think about what you want to write and then press SPACEBAR to begin. Please write as legibly as possible.

Press SPACEBAR to continue >>

Appendix H

Date: April 25th, 2017

Office of Sponsored Programs and Research

Towson University
8000 York Road
Towson, MD 21252-0001

t. 410 704-2236
f. 410 704-4494

NOTICE OF APPROVAL

TO: David Rompilla ***DEPT:*** Psychology

PROJECT TITLE: *Hold the Brake: The Concomitance of Anger Up-Regulation and Changes in HRV*

SPONSORING AGENCY: None

APPROVAL NUMBER: 1612011426

The Institutional Review Board for the Protection of Human Participants has approved the project described above. Approval was based on the descriptive material and procedures you submitted for review. Should any changes be made in your procedures, or if you should encounter any new risks, reactions, injuries, or deaths of persons as participants, you should notify the Board.

A consent form [✓] is required of each participant [ ] is not

Assent [ ] is required of each participant [ ] is not

This protocol was first approved on December 13th, 2016.
This research will be reviewed every year from the date of first approval.

Elizabeth Katz, Chair
Towson University Institutional Review Board, IRB

References

Office of Sponsored
Programs and Research

Towson University
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APPROVAL NUMBER 1612011426

MEMORANDUM

TO: David Rompilla

FROM: Institutional Review Board for the Protection of Human Participants, Elizabeth Katz, Chair

DATE: April 25th, 2017

RE: Approval of Research Involving the Use of Human Participants, Approval Number

Thank you for submitting an Application for Approval of Research Involving the Use of Human Participants to the Institutional Review Board for the Protection of Human Participants (IRB) at Towson University. The IRB hereby approves your propo sal titled:

Hold the Brake: The Concomitance of Anger Up-Regulation and Changes in HRV

Please note that this appro val is granted on the condition that you provide the IRB with the following informat ion and/or documentation:

N/A

If you should encounter any new risks, reactions, or injuries while conducting your research, please notify the IRB. Should your research extend beyond one year in durat ion, or should there be substantive changes in your research proto col, you will need to submit anoth er application for approval at that time.

We wish you every success in your research project. If you have any questions, please call me at (410) 704-2236.

cc: *Jared Joseph McGinley*

Appelhans, B. M., & Luecken, L. J. (2006). Heart rate variability as an index of regulated emotional responding. *Review of General Psychology*, *10*(3), 229.

Barrett, K. C., Campos, J. J. (1987) Perspectives on emotional development II: A functionalist approach to emotions. Campos, J. J., Osofsky, J. D. (Eds), *Handbook of infant development, 2nd ed.* (pp. 555-578). Oxford, England: John Wiley & Sons.

Beauchaine, T. P. (2015). Respiratory sinus arrhythmia: A transdiagnostic biomarker of emotion dysregulation and psychopathology. *Current opinion in psychology*, *3*(1), 43-47.

Bishop, D. T., Karageorghis, C. I., & Loizou, G. (2007). A grounded theory of young tennis players' use of music to manipulate emotional state. *Journal of Sport and Exercise Psychology*, *29*(5), 584-607.

Brenner, S. L., Beauchaine, T. P., & Sylvers, P. D. (2005). A comparison of psychophysiological and self- report measures of BAS and BIS activation. *Psychophysiology*, *42*(1), 108-115.

Buss, A. H., & Perry, M. (1992). The aggression questionnaire. *Journal of Personality and Social Psychology*, *63*(3), 452.

Carver, C. S., & Harmon-Jones, E. (2009). Anger is an approach-related affect: Evidence and implications. *Psychological Bulletin*, *135*(2), 183.

Chin, T. C., & Rickard, N. S. (2014). Emotion regulation strategy mediates both positive and negative relationships between music uses and well-being. *Psychology of Music*, *42*(5), 692-713.

Davidson, R. J., Ekman, P., Saron, C. D., Senulis, J. A., & Friesen, W. V. (1990). Approach-withdrawal and cerebral asymmetry: Emotional expression and brain physiology I. *Journal of personality and social psychology*, *58*(2), 330.

Denson, T. F., Grisham, J. R., & Moulds, M. L. (2011). Cognitive reappraisal increases heart rate variability in response to an anger provocation. *Motivation and Emotion, 35*(1), 14-22. doi: 10.1007/s11031-011-9201-5

Eysenck, M. W. & Keane, M. T. (2010). *Cognitive psychology: A student's handbook.* New York, NY: Psychology Press.

Fabiansson, E. C., Denson, T. F., Moulds, M. L., Grisham, J. R., & Schira, M. M. (2012). Don't look back in anger: Neural correlates of reappraisal, analytical rumination, and angry rumination during recall of an anger-inducing autobiographical memory. *NeuroImage, 59*(3), 2974-2981. doi: 10.1016/j.neuroimage.2011.09.078

Fischer, A. H., Manstead, A. S.R., Evers, C., Timmers, M., & Valk, G. (2004). Motives and norms underlying emotion regulation. In P. Philip & R. S. Feldman (Eds.), *The Regulation of Emotion* (pp. 187-212). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Festinger, L., & Carlsmith, J. M. (1959). Cognitive consequences of forced compliance. *The Journal of Abnormal and Social Psychology*, *58*(2), 203.

Friedman, B. H. (2007). An autonomic flexibility-neurovisceral integration model of anxiety and cardiac vagal tone. *Biological Psychology*, *74*(2), 185-199.

Friedman, B. H., Stephens, C. L., & Thayer, J. F. (2014). Redundancy analysis of autonomic and self-reported, responses to induced emotions. *Biological Psychology*, *98*(1), 19-28.

Goodwin, K. A., Goodwin, C. J. (2016). *Research in psychology: Methods and design, 8th edition*. Hoboken, NJ: John Wiley & Sons, Inc.

Gray, J. A. (1990). Brain systems that mediate both emotion and cognition. *Cognition and Emotion, 4*(1), 269-288.

Gross, J. J. (2014). Emotion regulation: Conceptual and empirical foundations. In J. J. Gross (Ed.), *Handbook of Emotion Regulation* (pp. 3-22). New York, NY: The Guilford Press.

Gross, J. J. (2015). Emotion regulation: Current status and future prospects. *Psychological Inquiry*, *26*(1), 1-26.

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology*, *85*(2), 348.

Harmon-Jones, E., Gable, P. A., & Peterson, C. K. (2010). The role of asymmetric frontal cortical activity in emotion-related phenomena: A review and update. *Biological Psychology*, *84*(3), 451-462.

Karreman, A., Laceulle, O. M., Hanser, W. E., & Vingerhoets, A. J. (2017). Effects of emotion regulation strategies on music-elicited emotions: An experimental study explaining individual differences. *Personality and Individual Differences*, *114*(1), 36-41.

Jones, M. V. (2003). Controlling emotions in sport. *The Sport Psychologist*, *17*(4), 471-486.

Jin, B., & Park, N. (2010). In-person contact begets calling and texting: Interpersonal motives for cell phone use, face-to-face interaction, and loneliness. *Cyberpsychology, Behavior, and Social Networking*, *13*(6), 611-618.

Kim, M. Y., Ford, B. Q., Mauss, I., & Tamir, M. (2015). Knowing when to seek anger: Psychological health and context-sensitive emotional preferences. *Cognition and Emotion*, *29*(6), 1126-1136.

Kreibig, S. D. (2010). Autonomic nervous system activity in emotion: A review. *Biological Psychology*, *84*(3), 394-421.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (2005). International Affective Picture System (IAPS): Affective ratings of pictures and instruction manual. Technical Report no. A-6, University of Florida, Gainesville, FL.

Larsen, R. J. (2000). Toward a science of mood regulation. *Psychological Inquiry*, *11*(3), 129-141.

Leipold, B., & Loepthien, T. (2015). Music reception and emotional regulation in adolescence and adulthood. *Musicae Scientiae*, *19*(1), 111-128.

Mauss, I. B., & Tamir, M. (2014). Emotion goals: How their content, structure, and operation shape emotion regulation. In J. J. Gross (Ed.), *Handbook of Emotion Regulation* (pp. 361-375). New York, NY: The Guilford Press.

Moore, K. S. (2013). A systematic review on the neural effects of music on emotion regulation: Implications for music therapy practice. *Journal of Music Therapy*, *50*(3), 198-242.

Ochsner, K. N., & Gross, J. J. (2014). The neural bases of emotion and emotion regulation: A valuation perspective. In J. J. Gross (Ed.), *Handbook of Emotion Regulation* (pp. 23-42). New York, NY: The Guilford Press.

Ochsner, K. N., Ray, R. D., Cooper, J. C., Robertson, E. R., Chopra, S., Gabrieli, J. D., & Gross, J. J. (2004). For better or for worse: neural systems supporting the cognitive down-and up-regulation of negative emotion. *Neuroimage*, *23*(2), 483-499.

Penttila, J., Helminen, A., Jartti, T., Kuusela, T., Huikuri, H. V., Tulppo, M. P., ... & Scheinin, H. (2001). Time domain, geometrical and frequency domain analysis of cardiac vagal outflow: effects of various respiratory patterns. *Clinical Physiology*, *21*(3), 365-376.

Ray, R. D., Wilhelm, F. H., & Gross, J. J. (2008). All in the mind's eye? Anger rumination and reappraisal. *Journal of Personality and Social Psychology*, *94*(1), 133-145. doi: 10.1037/0022-3514.94.1.133

Rieffe, C., Oosterveld, P., & Terwogt, M. M. (2006). An alexithymia questionnaire for children: Factorial and concurrent validation results. *Personality and Individual Differences*, *40*(1), 123-133.

Russell, J. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology*, *39*(1), 1161-1178.

Saarikallio, S., & Erkkilä, J. (2007). The role of music in adolescents' mood regulation. *Psychology of Music*, *35*(1), 88-109.

Scherer, K. R., & Zentner, M. R. (2001). Emotional effects of music: Production rules. *Music and Emotion: Theory and Research*, 361-392.

Shaffer, F., McCraty, R., & Zerr, C. L. (2014). A healthy heart is not a metronome: an integrative review of the heart's anatomy and heart rate variability. *Frontiers in Psychology*, *5*, 1040.

Sharman, L., & Dingle, G. A. (2015). Extreme metal music and anger processing. *Frontiers in Human Neuroscience*, *9*, 272.

Sherwood, A., Dolan, C. A., & Light, K. C. (1990). Hemodynamics of blood pressure responses during active and passive coping. *Psychophysiology*, *27*(6), 656-668.

Shields, G. S., Moons, W. G., Tewell, C. A., & Yonelinas, A. P. (2016). The effect of negative affect on cognition: Anxiety, not anger, impairs executive function. *Emotion*, *16*(6), 792.

Silvani, A., Calandra-Buonaura, G., Dampney, R. A., & Cortelli, P. (2016). Brain–heart interactions: physiology and clinical implications. *Philosophical Transactions of The Royal Society A*, *374*, 20150181, doi: http://dx.doi.org/10.1098/rsta.2015.0181.

Sinaceur, M., & Tiedens, L. Z. (2006). Get mad and get more than even: When and why anger expression is effective in negotiations. *Journal of Experimental Social Psychology*, *42*(3), 314-322.

Stephens, C. L., Christie, I. C., & Friedman, B. H. (2010). Autonomic specificity of basic emotions: Evidence from pattern classification and cluster analysis. *Biological Psychology*, *84*(3), 463-473.

Stemmler, G., (2004). Physiological processes during emotion. In P. Philip & R. S. Feldman (Eds.), *The Regulation of Emotion* (pp. 33-70). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Stemmler, G., Aue, T., & Wacker, J. (2007). Anger and fear: Separable effects of emotion and motivational direction on somatovisceral responses. *International Journal of Psychophysiology, 66*(2), 141-153.

Tamir, M. (2015). Why do people regulate their emotions? A taxonomy of motives in emotion regulation. *Personality and Social Psychology Review.* Advance online publication. doi:10.1177/1088868315586325

Tamir, M., & Ford, B. Q. (2012). When feeling bad is expected to be good: Emotion regulation and outcome expectancies in social conflicts. *Emotion, 12*(4), 807.

Tamir, M., Mitchell, C., & Gross, J. (2008). Hedonic and instrumental motives in anger regulation. *Psychological Science, 19*(4), 324-328.

Task Force of the European Society of Cardiology, & Task Force of the European Society of Cardiology (1996). The North American Society of Pacing and Electrophysiology. Heart rate variability: Standards of measurement, physiological interpretation and clinical use. *Circulation, 93*(5), 1043-1065.

Thayer, J. F., Ahs, F., Fredrikson, M., Sollers, J. J., & Wager, T. D. (2012). A meta-analysis of heart rate variability and neuroimaging studies: implications for heart rate variability as a marker of stress and health. *Neuroscience & Biobehavioral Reviews, 36*(2), 747-756.

Thayer, J. F., & Lane, R. D. (2009). Claude Bernard and the heart-brain connection: Further elaboration of a model of neurovisceral integration. *Neuroscience & Biobehavioral Reviews, 33*(2), 81-88.

Toukhsati, S. R., & Rickard N. S. (2012). The Mozart effect: An opportunity to examine the cognitive neuroscience of music listening. In N. S. Rickard & K. McFerran (Eds.), *Lifelong engagement with music* (pp. 183-208). Australia: Nova Science.

Updegraff, J. A., Gable, S. L., & Taylor, S. E. (2004). What makes experiences satisfying? The interaction of approach-avoidance motivations and emotions in well-being. *Journal of Personality and Social Psychology*, *86*(3), 496.

Van Kleef, G. A., De Dreu, C. K., & Manstead, A. S. (2004). The interpersonal effects of anger and happiness in negotiations. *Journal of Personality and Social Psychology*, *86*(1), 57.

David B. Rompilla Jr.

[redacted]

Education

Current	**M.A., Experimental Psychology**, Towson University GPA: 3.877 Master's Thesis: *Hold the Brake: The Concomitance of Anger Up-Regulation and Changes in HRV* Thesis Advisor: Dr. Jared McGinley Committee: Dr. Justin Buckingham, Dr. Sandra Llera, Dr. Jacqueline Leventon
May 2015	**B.A., Psychology**, *cum laude,* Bloomsburg University **B.A., Communication Studies** Overall GPA: 3.67 Psychology GPA: 3.855 Undergraduate Thesis: *What Would You Do? An Analysis of Situational Ethics in First-Year Students* Advisor: Dr. Jennifer Johnson

Academic Honors

2014-Current	Psi Chi, The International Honors Society in Psychology
2010-15	Dean's List, Bloomsburg University

Research Interests

Emotional Regulation; Emotion; Biopsychology; Physiological Psychology; Approach/Avoidance Goal Orientation; Motivation

Research Experience

2016-Current	Towson University, Emotion Science Lab, *Graduate Lab Instructor*
2015	Behavioral Health Research Institute, Lackawanna – Susquehanna Counties Intellectual Disabilities program, *ResearchAssistant*
2014	Central Columbia High School, Counseling, *Intern/Research Assistant*
2013-14	Bloomsburg University Psychology Department, GoodWork Program, *Research Assistant*

Physiological Hardware and Software

Proficient with Biopac 150 and Biopac Acqknowledge analysis software used for measuring and analyzing electrodermal activity, respiration, electrocardiography, and impedance cardiography; Kubios HRV 2.2 software

Additional Software

Proficient with SPSS statistical software; E-Prime; NeuroInvestigations Virtual Navigation Software Morris water task v. 1.2; Microsoft Word, Excel, and PowerPoint

Conferences

Rompilla Jr., D. & McGinley, J.J. (submitted). *Cardiovascular changes in emotion up-regulation during goal pursuit*. Poster submitted for the 57th Annual Meeting for the Society for Psychophysiological Research, Vienna, Austria.

Rompilla Jr., D., Johnson, J. A., & Duncan, M. K. (2014). *What Would You Do? An Analysis of Situational Ethics in First-Year Students*. Poster presented at the annual meeting of the Eastern Psychological Association, Boston, MA, March 13-16, 2013.

Other Research Presentations

Rompilla Jr., D., Sagan, O., Katana, F., McGriff, B., Wesner, E. & McGinley, J.J. (April, 2017). *Hold the vagal brake: The concomitance of anger up-regulation and cardiovascular changes*. Poster presented at Towson University's Student Research & Creative Inquiry Forum, Towson, MD.

Rompilla Jr., D. (2015). *The Analysis of Shared Music Interests and Romantic Relationship Communication.* Poster presented at the College of Liberal Arts Celebration of Scholarship Day, Bloomsburg University, April, 2015.

Rompilla Jr., D. Johnson, J. A., & Duncan, M. K. (2014). *What Would You Do? An Analysis of Situational Ethics in First-Year Students*. Poster presented at the College of Liberal Arts Celebration of Scholarship Day, Bloomsburg University, April, 2014.

Teaching and Mentoring Experience

2017	*Graduate Teaching Assistant*, Towson University, Physiological Psychology
2015	School Counseling Practicum at Central Columbia High School, Bloomsburg University, *Counseling Intern/Research Assistant*

2013 SHARE tutoring program, Bloomsburg University, *Tutor*

Teaching Interests

Psychology of Emotion; Biopsychology; Intro to Psychology; Research Methods; Introductory Statistics

Grants & Awards

2014 Travel Grant, Bloomsburg University ($525)

Membership in Professional Organizations

2016-Current Association for Psychological Science (APS)
2013-2015 Eastern Psychological Association (EPA)