EFFECT OF DIFFERING INTENSITIES OF EXERCISE ON AFFECT AND ENJOYMENT

BY

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THESIS

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ABSTRACT

The benefits of exercise are well-known and well-documented, yet adherence to exercise regimens is low. There is an intuitive connection between exercise enjoyment and increasing adherence to exercise programs. Exercise intensity may influence affect and enjoyment during exercise, which may help in prescribing exercise programs and increasing adherence rates. **Purpose:** To examine the intensity-affect relationship and its influence on exercise enjoyment. **Methods:** Participants (N=22; 12 females, 10 males; M age = 21.82 ±2.81 yrs) exercised at two different intensities [below ventilatory threshold (bVT), above ventilatory threshold (aVT)]. Heart rate (HR; Polar monitor) was assessed throughout each condition; affect was assessed pre-, immediately post-, 10-min post-, and 20-min post-exercise; enjoyment (PACES) was assessed immediately post-exercise; and Rating of Perceived Exertion (RPE) was assessed during exercise with Feeling Scale (FS) and Felt Arousal Scale (FAS) responses assessed before, during, and after exercise. **Results:** Self-reported enjoyment was not significantly different between the two conditions (p= .223). Some differences in affect were seen pre-to post-exercise, with increases in Energy and reductions in Tiredness and Calmness following exercise regardless of intensity condition. Tension increased following the aVT condition relative to the bVT condition. During exercise, aVT resulted in a reduction in affective valence compared to the bVT condition, which resulted in a steady increase in valence. Finally, there were no significant correlations between the affect measured during exercise and self-reported enjoyment. **Conclusions:** The findings are consistent with previous exercise intensity-affect research and extend that research by further examining the link between affect and enjoyment. Although enjoyment was not different between the two intensity conditions as expected, the results are discussed with respect to the affect-enjoyment-exercise adherence link.

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TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION 1

CHAPTER 2: LITERATURE REVIEW 2

CHAPTER 3: RESEARCH METHODS 10

CHAPTER 4: RESULTS 15

CHAPTER 5: DISCUSSION 26

REFERENCES 31

APPENDIX A: PARTICIPANT RECRUITMENT FLYER 35

APPENDIX B: INFORMED CONSENT DOCUMENT 36

APPENDIX C: HEALTH AND PHYSICAL ACTIVITY HISTORY INVENTORY 38

CHAPTER 1

INTRODUCTION

Previous research has shown that intensity of exercise is related to non-adherence and dropout (Ekkekakis, Hall, & Petruzzello, 2008). One reason for this relationship may be the effect exercise intensity has on affect and enjoyment. There is an intuitive connection between exercise enjoyment and increasing adherence to exercise programs; that is, people are more likely to continue to participate in programs that they enjoy. Determining intensities that are enjoyable may help in exercise prescription and increasing adherence rates.

One possibility for mediating the relationship between exercise intensity and adherence is how much pleasure the individual experiences during the exercise. It has been suspected that, in order to maintain exercise behavior, exercise must not just be pleasant, but pleasant enough "to compete successfully with other pleasurable options available to the exerciser" (Morgan, 1977, p. 244). Pollock proposed a hypothetical causal chain linking exercise intensity to affect and, ultimately, to adherence: "People participate in programs they enjoy. The lower-intensity effort makes the programs more enjoyable" (1978, p. 59).

The purpose of this experiment was to investigate the intensity-affect relationship. The focus was to examine the link between exercise intensity and affective responses, as well as the intensity participants would find more enjoyable. The intensity-affect relationship may be helpful in predicting adherence rates.

CHAPTER 2

LITERATURE REVIEW

2.1 PHYSICAL INACTIVITY

Physical inactivity is a complex public health problem (Ekkekakis, Hall, & Petruzzello, 2008), and is associated with an increased risk for a number of diseases (US Department of Health and Human Services, 1996). Even though the benefits of exercise are well-known and well-documented, more than half of adults in the United States still do not meet the physical activity recommendations (CDC, 2003). The final results from the Healthy People 2000 program showed that “the proportion of the population reporting physical activity has remained essentially unchanged, and progress is very limited” (p. 29). In addition to many people being inactive in general, approximately 50% of those who do decide to start an exercise program drop out within the first few months (Dishman & Buckworth, 1997).

2.2 INTENSITY-AFFECT-ADHERENCE CAUSAL CHAIN

Many researchers have attempted to investigate the reasons for low adherence and high drop out rates. One approach examines motivational properties and the effects of exercise “dose,” such as frequency and intensity (Ekkekakis, Hall, & Petruzzello, 2008). Previous research has shown that intensity of exercise, more so than frequency, is related to non-adherence and dropout (Perri, Anton, & Durning, 2002). Pollock (1978) proposed the intensity-affect-adherence causal chain suggesting that lower intensity exercise is more enjoyable, which in turn leads to higher adherence rates; that is, people are going to continue to participate in programs that they find enjoyable.

Although this causal chain was proposed almost 30 years ago, the idea is still used today. The Healthy People 2010 program stated, "each person should recognize that starting out slowly with an activity that is enjoyable…is central to the adoption and maintenance of physical activity behavior" (p. 22-24). In other words, if the exercise provides a pleasurable experience, people are more likely to continue engaging in that behavior.

Evidence is beginning to accumulate in support of this linkage. For example, Kanning and Schlicht (2010) used ecological momentary assessment to demonstrate that participation in leisure time physical activity, which was typically of low to moderate intensity, was associated with greater ratings of positive valence, energetic arousal, and calmness than sedentary activities. Hyde, Conroy, Pincus, and Ram (2011) also found that free time physical activity was associated with pleasant-activated feelings. Perhaps this increase in mood associated with physical activity is related to enjoyment of the activity and could lead to greater physical activity participation. Rhodes and de Bruijn (2010) found that habit is a moderator of physical activity, and suggested that perhaps it is easier to form a habit for performing moderate physical activity than vigorous physical activity.

Williams et al. (2008) examined the relationship between acute affective responses during a moderate-intensity exercise stimulus and future adherence to an exercise program. Participants were 37 sedentary adults who were enrolled in a randomized controlled physical activity promotion trial. Each subject participated in an acute, moderate-intensity exercise bout. They reported their basic affective responses (i.e., feel good versus bad) both prior to and during exercise. After the acute exercise bout, participants were encouraged to participate in regular exercise (at least 30 minutes per day on most days of the week) as a result of their enrollment in the physical activity promotion trial. The participants' physical activity levels were then assessed both 6 and 12 months later. Williams et al. (2008) found that those who reported more positive affect in response to the acute bout of moderate-intensity exercise reported more minutes of physical activity both 6 and 12 months later. This supports the hypothesis that if an activity elicits positive affect, people are more likely to continue to engage in that same activity. Although this study did not directly examine the intensity-affect relationship, it has important implications for how exercise that elicits positive affect may predict adherence rates. However, this study looked more at the affect-adherence link of the chain.

The idea that exercise intensity influences affective responses and these affective responses will influence enjoyment and thus adherence seems simple, and the causal chain seems plausible. However, few studies have examined this chain in its entirety. One explanation is that the first link of the chain, the intensity-affect link, is still being investigated. The evidence examining this link has been somewhat mixed. For example, most of the studies that were reviewed by Ekkekakis and Petruzzello (1999) did not show evidence supporting intensity's influence on affect.

A more recent review by Ekkekakis, Parfitt, and Petruzzello (2011) examining studies published from 1999-2009 showed that recent studies, which examine affect because of the influence it may have on adherence, have shown a more definitive link between intensity and affect. The studies reviewed by Ekkekakis et al. (2011) found that activities at intensities below the ventilatory threshold, lactate threshold, and/or onset of blood lactate accumulation had no negative impact on affect and sometimes even improved affect. However, affect declined when physical activity was performed at intensities above these metabolic landmarks. Exercise at maximal intensity results in negative affective valence. Upon termination of exercise, affect rebounds as the "dose-response effects that occur during exercise tend to dissipate rather rapidly"

(Ekkekakis et al., 2011, p. 657). Ekkekakis et al. concluded that it is necessary to consider affect when prescribing exercise, as “a prescription may well be effective and safe but, if very few want to follow it, then its public-health relevance becomes questionable” (2011, p. 665).

2.3 INTENSITY-AFFECT LINK

Studies have examined the intensity-affect link in a variety of populations. Ekkekakis, Lind, and Vazou (2009) targeted middle aged women of varying weights. Normal weight, overweight, and obese women participated in an incremental treadmill test to volitional exhaustion. Measures of affect [via the Feeling Scale (Hardy & Rejeski, 1989)] were taken before exercise, every minute during exercise, and post exercise. As expected, Feeling Scale scores decreased with increasing intensity, and obese women reported feeling significantly worse than the overweight and normal weight women. Felt Arousal Scale (Svebak & Murgatroyd, 1985) scores also increased throughout exercise in all three groups.

Ekkekakis et al. (2009) also found changes in energy, tiredness, tension, and calmness from pre- to post-exercise as measured by the Activation Deactivation Adjective Check List (Thayer, 1986). The AD ACL was administered upon arrival at the laboratory, immediately after termination of exercise, after a 5 minute cool down, and at minutes 10 and 20 during a 20 minute recovery period. Energy increased from pre- to immediately post-exercise in normal weight and overweight individuals, returning to pre-exercise levels within the first 10 minutes of recovery, but did not change in obese individuals. Tiredness decreased in all three groups from pre- to immediately post-exercise. Although tiredness did increase during recovery, it did not increase back to baseline levels. While there was no significant difference in tension from pre- to immediately post-exercise, it did decrease throughout cool down and the first 10 minutes of recovery, remaining below baseline levels at the end of the recovery period. While calmness decreased from pre- to immediately post-exercise, levels of calmness rebounded back to pre-exercise levels throughout the cool down and during the first 10 minutes of recovery. These data suggest that the exercise had a positive influence on energy, tiredness, and tension.

Sheppard and Parfitt (2008) examined the intensity-affect relationship in young adolescents. After completing a graded exercise test to determine ventilatory threshold (VT), participants completed 15 minutes of exercise below VT, above VT, and at a self-selected intensity. Affect was measured using the Feeling Scale 5 minutes before, immediately before, every 5 minutes during, immediately after, and at 5, 10, 15, and 30 minutes post exercise. Participants felt significantly worse during the above VT exercise than during the below VT and self-selected intensities, which did not differ significantly in intensity (i.e., participants self-selected an intensity that was below their VT).

Parfitt, Rose, and Burgess (2006) studied the affective responses to varying intensities of exercise in sedentary adult males. Participants exercised above lactate threshold, below lactate threshold, and at a self-selected intensity. Participants typically selected an intensity that was harder (i.e., more physiologically demanding) than the below lactate intensity. Affect was measured using the Feeling Scale and Felt Arousal Scale before, during and after exercise. Ratings of perceived exertion (RPE) were also recorded throughout exercise. While RPE increased throughout the above lactate threshold and self-selected intensities, it remained constant in the below lactate threshold condition. While FS increased from pre- to post-exercise in all conditions, FS ratings decreased throughout the above lactate threshold exercise and then rebounded upon termination of the activity. Participants experienced an increase in felt arousal from pre-exercise to 10 minutes post-exercise in all conditions. These data suggest that while pre- to post-exercise affective responses may be similar regardless of intensity, people feel worse during exercise above lactate threshold.

Kilpatrick, Kraemer, Bartholomew, Acevedo, and Jarreau (2007) explain that it is intensity, not total work, which influences affective responses to exercise. They conducted a study in which the participants, who were undergraduates that were slightly overweight and had below average fitness levels, participated in a long bout of exercise below VT and a short bout of exercise above VT. Duration was controlled such that total work was equal for each exercise session. While affect did not change during the long moderate bout of physical activity, participants felt worse during the short bout of high intensity exercise than they did before and after exercise. These data suggest that even if workload is kept constant, exercise above VT is more aversive in nature than exercise below VT. Thus, people may be more likely to adhere to long bouts of moderate intensity exercise rather than short bouts of high intensity exercise.

Ekkekakis, Hall, and Petruzzello (2005) composed a review summarizing studies that examined the intensity-affect relationship. After reanalyzing the data from numerous studies, they proposed a new type of dose-response model that is based on the three-domains of physical activity intensity. The first is the broad range of “moderate” intensity, which includes intensities below the lactate threshold. Physical activity performed within this range of moderate intensity shows a trend towards homogenously positive affective changes. The second domain is the range of “heavy” intensity, ranging from the lactate threshold to the “highest work rate at which blood lactate can be stabilized” (Ekkekakis et al., 2005, p. 487). Affective responses to physical activity within this range shows sizable variability between individuals, with some people reporting pleasure while others report displeasure. The third and final domain is the domain of “severe” intensity, which ranges from the maximal lactate steady state to maximal exercise capacity. Within this domain, affective changes to physical activity tend to be homogenously negative.

Ekkekakis et al. (2005) also pointed out two methodological problems with the studies that have investigated the intensity-affect link. The first is that measurements of affect are generally only assessed before and after exercise. However, assessment of affect *during* exercise may be important in understanding the intensity-affect relationship. The second downfall in the methodology of previous studies is that there is no consistency in determining exercise intensities. For example, some studies use percentage of maximal heart rate to determine intensity, while others use percentage of maximal oxygen consumption (VO_2max), and still others use ratings of perceived exertion. There is no consistency in how intensities are determined, which may be a reason for the mixed results seen in this line of research.

The present experiment investigated the intensity-affect relationship, and used methodology in order to overcome these obstacles. Affect was measured during exercise, in addition to pre- and post-exercise. Previous work has shown a decrease in pleasure during exercise with increasing exercise intensity (Ekkekakis, Hall, & Petruzzello, 2008), so assessing affect during exercise may provide a more complete picture of affective responses. Exercise intensity will be determined based on the ventilatory threshold (VT), similar to Ekkekakis et al. (2008). The relative methods of determining exercise intensity (i.e., percentages of maximum heart rate or aerobic capacity) suffer from shortcomings, and according to some experts, are no longer justifiable (Whipp, 1996). Using the VT may overcome these shortcomings because exercising at intensities above the VT elicits a cascade of physiological events that change the internal environment and “challenge the maintenance of homeostasis” (Ekkekakis et al., 2008). Changes in homeostasis are closely related to affect (Cabanac, 2006), which is why the VT was used in order to determine exercise intensity in the present study. The present study also assessed enjoyment following each exercise intensity.

The present study had several hypotheses. First it was hypothesized that the above ventilatory threshold (aVT) condition, because of its generally aversive nature, would result in less enjoyment than the below ventilatory threshold (bVT) condition. Second, it was hypothesized that exercise intensity would not influence pre-post affect responses, that is, affective responses following exercise in both conditions would be similar. Finally, it was hypothesized that exercise intensity would influence affective responses during exercise. Consistent with previous research (Ekkekakis et al., 2008), it was predicted that affect would become progressively less positive/more negative during exercise at an intensity that exceeded the VT.

CHAPTER 3

RESEARCH METHODS

Participants

Participants were college age residents of the Champaign-Urbana area (N = 22; 10 male, 12 female) recruited from flyers placed on campus bulletin boards (see Appendix A). One female participant did not complete the above ventilatory threshold condition due to a lack of availability. The average age of the overall sample was 21.82 ±2.81 yrs (females: 21.58±3.15 yrs; males: 22.10±2.47 yrs), average height was 172.14±10.13 cm (females: 165.53 ±7.80 cm; males: 180.09 ±6.04 cm), average weight was 70.00 ±12.87 kg (females: 62.29 ±11.14 kg; males: 79.24 ±7.82 kg), average VO_{2max} was 48.73 ±9.16 $ml \cdot kg^{-1} \cdot min^{-1}$(females: 41.88 ±5.07 $ml \cdot kg^{-1} \cdot min^{-1}$; males: 55.98 ±7.41 $ml \cdot kg^{-1} \cdot min^{-1}$), and average ventilatory threshold (VT) was 2.77±.98 $L \cdot min^{-1}$ (females: 2.07±.65 $L \cdot min^{-1}$; males: 3.62±.50 $L \cdot min^{-1}$).

Measures of Affect and Enjoyment

The Feeling Scale (FS; Hardy & Rejeski, 1989), the Felt Arousal Scale (FAS; Svebak & Murgatroyd, 1985), the Activation Deactivation Adjective Check List (AD ACL; Thayer, 1986), and the 6-20 Rating of Perceived Exertion (RPE; Borg, 1998) scale were used to assess affect. The Physical Activity Enjoyment Scale (PACES; Kendzierski & DiCarlo, 1991) was also used in order to assess enjoyment. The FS was used to measure affective valence. The FS is an 11-point, single-item, bipolar measure of pleasure-displeasure, which is commonly used for the assessment of affective responses during exercise (Ekkekakis & Petruzzello, 1999). The scale ranges from +5 to -5, with anchors provided at zero (Neutral) and at all odd integers, ranging from ‘Very Good’ (+5) to ‘Very Bad’ (-5). The FAS was used to measure perceived activation during the exercise bouts. The FAS is a 6-point, single-item measure, ranging from 1 (Low Arousal) to 6 (High Arousal). The FAS is strongly correlated with valid single-item measures used to assess activation.   The AD ACL is a 20-item measure, with five items comprising each of four subscales: Energy, Tiredness, Calmness, and Tension. Each item is rated on a 4-point rating scale (definitely feel=4, feel slightly=3, cannot decide=2, definitely do not feel=1; Thayer, 1986). The Rating of Perceived Exertion (RPE) is a 15-point scale for assessing perceived effort during exercise that ranges from 6 (no exertion at all) to 20 (maximal exertion). Finally, the PACES is bipolar scale with 18 statements that anchor the ends of a 7-point response scale where participants choose the number that most closely corresponds to the way they feel at the moment about the physical activity they have been doing [e.g., “I enjoy it (1) .... I hate it (7)”; “I dislike it (1) …. I like it (7)”]. Scores on the PACES range from 18 to 126. Kendzierski and DeCarlo (1991) demonstrated that the PACES was valid and had acceptable internal consistencies in two separate studies (Cronbach’s alphas = 0.93 in both). PACES scores in the present study ranged from 79 to 123 (*M* = 108.67) in the below VT intensity condition and 85 to121 (*M* = 104.95) in the above VT intensity condition.

Procedure

Each participant came to the Exercise Psychophysiology Laboratory (ExPPL) on three separate occasions. At the first meeting, participants read and signed an informed consent document approved by the University’s Institutional Review Board (see Appendix B). The participants then completed the Physical Activity Readiness Questionnaire (PAR-Q; Thomas, Reading, & Shephard, 1992) and the Health and Physical Activity History Inventory (see Appendix C) in order to determine if they met the inclusion criteria. Upon meeting inclusion criteria, the participants then continued with the first session of the experiment. During this session, participants completed the Preference for and Tolerance of Exercise Intensity Questionnaire (PRETIE-Q; Ekkekakis, Hall & Petruzzello, 2005) to be used as a general self-report measure. The participants then performed a graded exercise test in order to determine their maximal aerobic capacity and ventilatory threshold. These tests were conducted in the Freer Teaching Laboratory.

After having the test procedures explained, the participants were fitted with a Polar heart rate monitor (model Vantage XL, Polar Electro, Finland) which allowed for continuous assessment of heart rate during the testing. Participants were also fitted with a noseclip and a mouthpiece connected to a metabolic cart. Oxygen uptake was measured continuously with expired gases sampled and data recorded every 15 seconds using open-circuit spirometry (Parvomedics TrueOne 2400, Sandy, UT, USA). The metabolic cart was calibrated prior to each test using gases of known concentrations as per manufacture specifications. The testing protocol was as follows: participants were seated for 3 minutes so that resting expired gases could be collected and analyzed to ensure the proper functioning of the various components of the metabolic cart. This was followed by 2 minutes of jogging/running at 0% grade on a motor-driven treadmill to allow adequate warm. After the warm-up period, grade was increased to 2% and speed was increased to the speed that the participant had self-selected. Every 2 minutes the grade was increased by 2% until the participant reached the point of volitional exhaustion. Participants then cooled down by walking at the speed of their choice and 0% grade. Affect [using the Feeling Scale (FS)] and perceived exertion [using the Rating of Perceived Exertion (RPE) scale] were assessed during every stage of the test.

After completing the graded exercise test, two exercise intensities were calculated that were used in the following two lab sessions. Both intensity conditions were determined relative to the ventilatory threshold (VT). The VT was determined from the metabolic data by examining the expired carbon dioxide and the oxygen consumed during the exercise test. The threshold is defined by a nonlinear increase in expired carbon dioxide relative to the consumed oxygen. For the remaining two sessions, one intensity was 20% below the VT (below VT condition), and the other intensity was 10% above the VT (above VT condition). The order of intensities was randomized for each participant.

Each experimental trial began with the participant completing the pre-exercise self-report measures, which consisted of the Feeling Scale (FS), Felt Arousal Scale (FAS), and the Activation Deactivation Adjective Check List (AD ACL). Each participant was then fitted with a Polar heart rate monitor and stepped onto the treadmill. The participants then performed a 5-minute warm-up at a self-selected walking speed and 0% grade. Speed was increased to 3.5 miles per hour during the last minute of the warm-up if they were not already at that pace. During the last 15 seconds of the warm up, the participants were asked to rate RPE, FS, and FAS. The speed and grade were then increased to the intensity assigned for that day (either above VT or below VT). They exercised at that intensity for 15 minutes and were asked to rate their RPE, FS, and FAS during the last 15 seconds of minutes 3, 6, 9, 12, and 15. After 15 minutes, the subjects were then given a 5-minute cool down at the speed and grade of their choice. During the last 15 seconds of the cool down, participants were then asked to rate their RPE, FS, and FAS again.

After completing the exercise bout, the participants remained on the treadmill and completed the post-exercise AD ACL (to assess how they felt) and the Physical Activity

Enjoyment Scale (PACES; measure of enjoyment). They then were asked to sit for 20 minutes, completing the FS, FAS, and AD ACL both 10 and 20 minutes post-exercise.

Data Analysis

Data analysis was conducted using SPSS 12.0.1 for Windows. Data were initially inspected for any unusual data points, with corrections made as needed. Analysis of differences in enjoyment between the two intensity conditions was done with a *t*-test. All other analyses of pre- to post-exercise changes in affect and pre-, during, and post-exercise changes were conducted with multivariate analyses of variance (MANOVA), with repeated measures analyses of variance (RM-ANOVA) used for follow-up analyses. RM-ANOVAs used the Huynh-Feldt epsilon correction to protect against violations of the sphericity assumption.

CHAPTER 4

RESULTS

It was hypothesized that exercise at an intensity above the ventilatory threshold (VT) would result in less enjoyment of the exercise, less pleasant affect during the exercise, and no real difference in affect compared pre- to post-exercise. To test this first hypothesis, a *t*-test was used to compare self-reported enjoyment of the two exercise intensities. The below VT (bVT) condition resulted in reported enjoyment of 108.05±11.16 (*M*±*SD*) while the above VT (aVT) condition resulted in reported enjoyment of 104.75±11.56 (*M*±*SD*) [$t(19)=1.26259$, $p= .223$; Cohen's $d=0.29$]. Thus, in this study, intensity did not influence self-reported enjoyment.

Examination of the pre- to post-affective responses (Energy, Tiredness, Calmness, Tension) were initially done with an Intensity Condition (2: bVT, aVT) x Time (4: pre, post-0, post-10, post-20) multivariate analysis of variance (MANOVA). Neither the Condition x Time interaction nor the Condition main effect were significant ($p_s > .14$), but there was a significant Time main effect [Wilks $\lambda= .032$, $F(12, 9)= 22.34$, $p< .001$, partial $\eta^2= .968$]. This was followed up with a series of repeated measures [Condition (2: bVT, aVT) x Time (4: pre, post-0, post-10, post-20)] ANOVAs for each of the individual affective subscales of the AD ACL (i.e., Energy, Tiredness, Tension, and Calmness). Significant Time effects (all $p_s \leq .01$) were seen for all four measures. The nature of these time effects can be seen in Figures 1 and 2, with means (±*SD*) collapsed across Intensity Condition shown in Tables 1 and 2. For Energy (see Figure 1, top panel), a significant Condition [$F(1, 20)=5.18$, $p= .034$, partial $\eta^2= .206$] and Time main effect [$F(1.94, 38.79)=26.41$, $p< .001$, partial $\eta^2= .569$; H-F $\varepsilon=.647$] were seen, but the Condition x Time interaction was not significant ($p> .88$).

Regarding the Time main effect (see Table 1), Energy was significantly increased immediately post-exercise (*M* difference= 6.57, $p < .001$, d=2.73) compared to pre-exercise and the immediate post-exercise Energy was significantly greater than post-10 (*M* difference= 3.83, $p < .001$, d=-1.50) and post-20 minutes (*M* difference= 4.60, $p < .001$, d=1.61). Also, Energy at post-10 was marginally greater than Energy pre-exercise (*M* difference= 2.74, p= .057, d=0.91). Energy at post-20 was not different from post-10 or pre-exercise ($p_s > .18$).

Table 1. Mean (±*SD*) affective responses before and after exercise along with effect sizes (Cohen's *d*), collapsed across intensity conditions, for Energy and Tiredness.

Measure	Time	*M*	*SD*	*d*
Energy	Pre	10.50	3.02	
	Post-0	17.07	1.79	2.73
	Post-10	13.24	2.97	0.91
	Post-20	12.48	3.24	0.63
Tiredness	Pre	11.26	3.49	
	Post-0	7.07	2.08	-1.50
	Post-10	8.26	2.68	-0.97
	Post-20	9.17	2.93	-0.65

Note: Effect size (*d*) calculated as $(M_{pre} - M_{post})/(SD_{pooled})$. Higher scores for Energy reflect greater Energy (better); higher scores for Tiredness reflect greater Tiredness (worse).

For Tiredness, neither the Condition main effect nor Condition x Time interaction was significant ($p_s > .22$; see Figure 1, bottom panel). However, the Time main effect was significant [$F(2.09,41.83)=10.98$, $p < .001$, partial η^2= .354; H-F ε=.697. Tiredness was significantly decreased immediately post-exercise (*M* difference= 4.19, $p < .001$, d=-1.50) compared to pre-exercise and the immediate post-exercise Tiredness was significantly less than post-20 (*M* difference= 2.10, p= .007, d=0.84). Tiredness post-10 was significantly lower than both pre-exercise (*M* difference= 3.00, p= .004, d=-0.97) and post-20 minutes (*M* difference= 0.91, p= .001, d=-0.32). Also, Tiredness at immediately-post was marginally lower than Tiredness post-10 (*M* difference= 1.19, p= .062, d=-0.50; see Table 1).

Table 2. Mean (±*SD*) affective responses before and after exercise, collapsed across intensity conditions, for Calmness and Tension.

Measure	Time	*M*	*SD*	*d*
Calmness	Pre	12.83	2.37	
	Post-0	8.14	2.26	-2.03
	Post-10	12.43	2.54	-0.16
	Post-20	13.55	2.81	0.28
Tension	Pre	6.93	2.34	
	Post-0	8.07	2.41	-0.48
	Post-10	6.60	1.87	0.16
	Post-20	6.12	2.38	0.31

Note: Effect size (*d*) calculated as $(M_{pre} – M_{post})/(SD_{pooled})$. Higher scores for Calmness reflect greater Calmness (better); higher scores for Tension reflect greater Tension (worse).

For Calmness, neither the Condition main effect nor Condition x Time interaction was significant (p_s> .64). However, the Time main effect was significant [F(2.97,59.34)=28.02, p< .001, partial η^2= .583; H-F ε=.989 (see Table 2). Calmness was significantly decreased immediately post-exercise (*M* difference= 4.69, p< .001, d=-2.03) compared to pre-exercise and the immediate post-exercise Calmness was significantly less than post-10 (*M* difference= 4.29,

$p < .001$, d=-1.79) and post-20 (M difference= 5.41, $p < .001$, d=-2.13). Calmness post-10 was significantly lower than post-20 minutes (M difference= 1.12, p= .023, d=0.42) (see Figure 2, top panel).

For Tension, neither the Condition main effect nor Condition x Time interaction was significant ($p_s > .07$). However, the Time main effect was significant [$F(1.622,32.431)=5.72$, p= .011, partial η^2= .222; H-F ε=.541 (see Table 2). Tension pre-exercise was significantly greater than tension post-20 (M difference= .81, p= .022, d=0.31). Tension was significantly greater immediately post exercise compared to post-10 (M difference= 1.48, p= .014, d=0.69) and post-20 (M difference= 1.95, p= .009, d=0.81). Tension post-10 was significantly greater than post-20 (M difference= .476, p= .045, d=0.23).

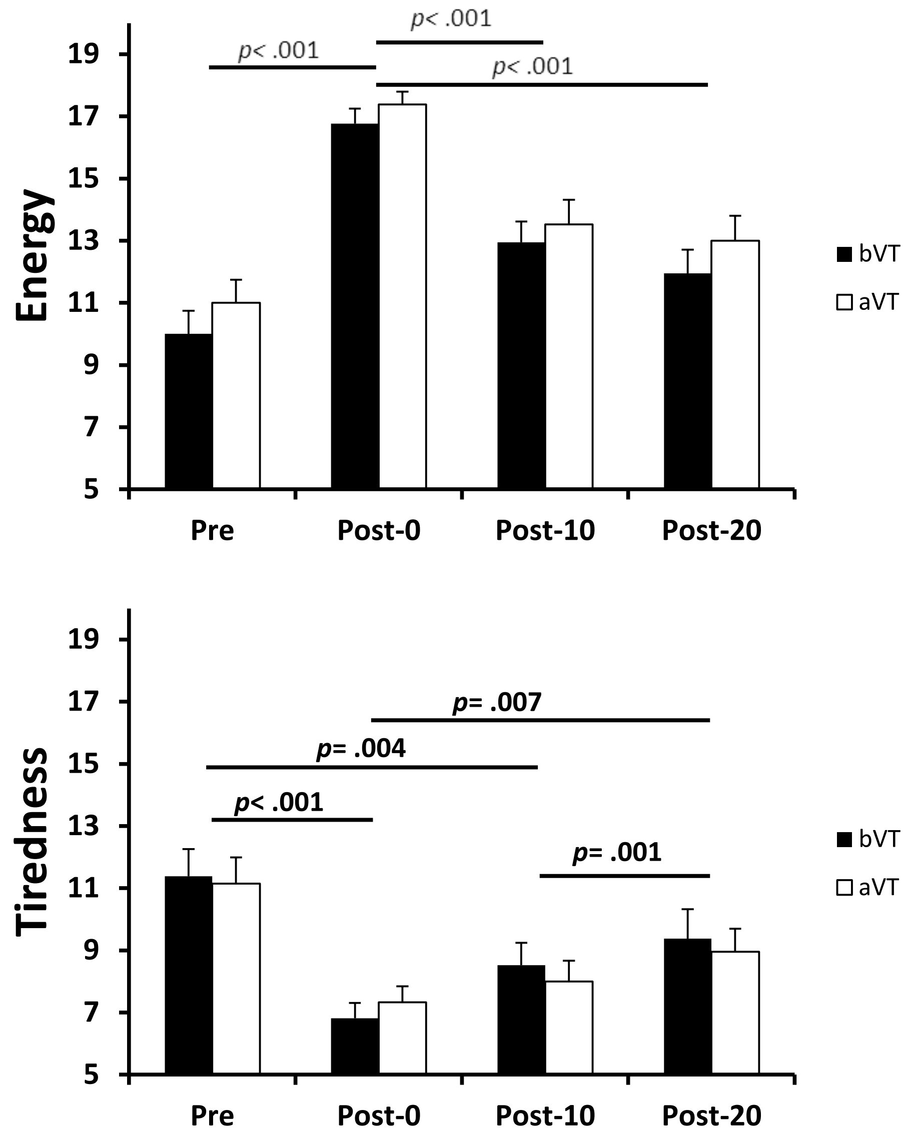

Figure 1. AD ACL scores for Energy (*top*) and Tiredness (*bottom*) subscales pre- and post-exercise in the two intensity conditions.

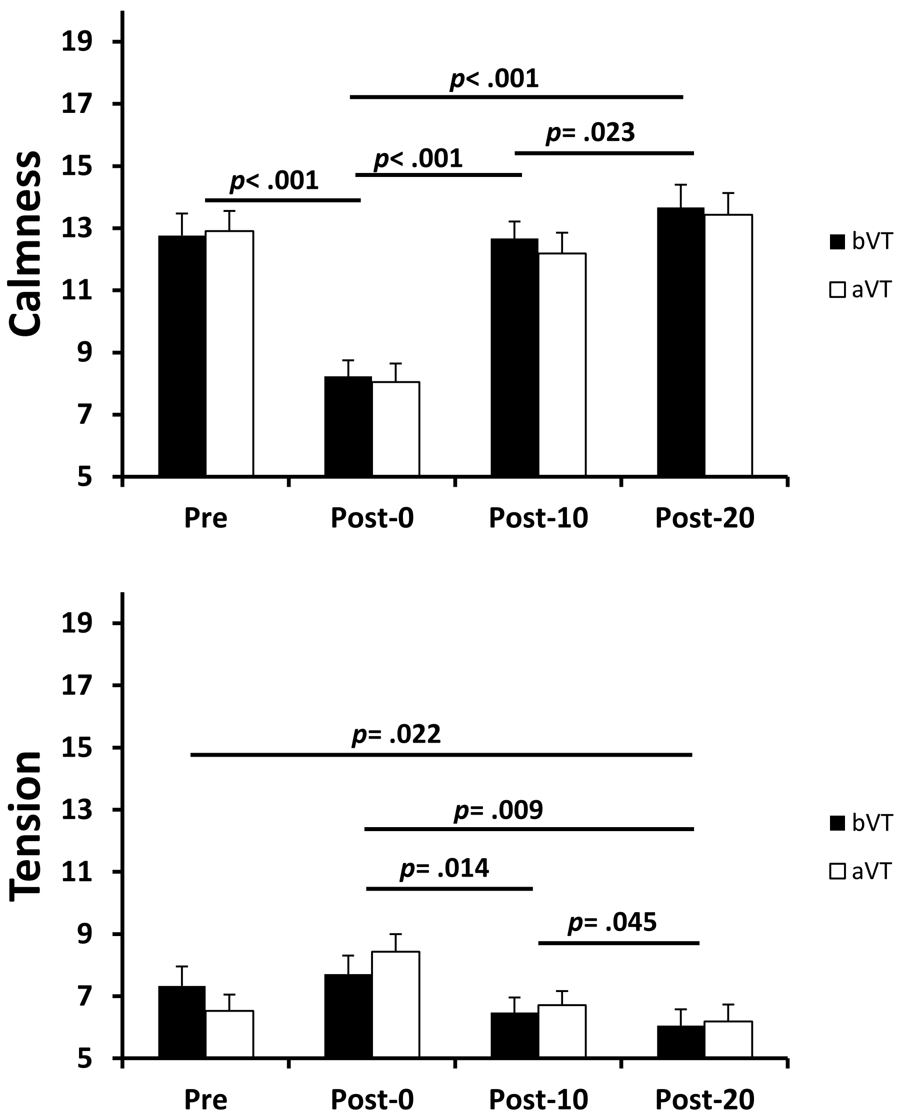

Figure 2. AD ACL scores for Calmness (*top*) and Tension (*bottom*) subscales pre- and post-exercise in the two intensity conditions.

Not surprisingly, perceptions of effort (RPE) were significantly higher in the aVT condition from the 8th minute to the end of the exercise bout than in the bVT condition [$F(3.67, 73.31)=22.96$, $p< .001$, partial $\eta^2= .534$, H-F $\varepsilon =.611$] (see Figure 3). For the Felt Arousal Scale, only the time main effect [$F(3.742, 74.838)=30.119$, $p<.001$, partial $\eta^2= .601$, H-F $\varepsilon =.416$] was significant. (see Figure 4). Finally, for the Feeling Scale, the Condition [$F(1, 20)=21.697$, $p<.001$, partial $\eta^2= .52$, H-F $\varepsilon =1.0$] and Time main effects [$F(3.746, 74.926)=11.47$, $p<.001$, partial $\eta^2= .364$, H-F $\varepsilon =.416$] were significant, but these were superseded by the significant Condition x Time interaction [$F(5.084, 101.681)=13.597$, $p<.001$, partial $\eta^2= .405$, H-F $\varepsilon =.565$]. As seen in Figure 5, affect declined significantly during the aVT condition [$F(3.92, 78.37)=14.89$, $p< .001$, H-F $\varepsilon =.435$] whereas it remained steady and even increased slightly but significantly during the bVT condition [$F(3.17, 66.54)=5.45$, $p= .002$, H-F $\varepsilon =.352$]. It is worth pointing out that from the 20th min of exercise to the cool-down period in the aVT condition, there was a dramatic shift in affect in a positive direction.

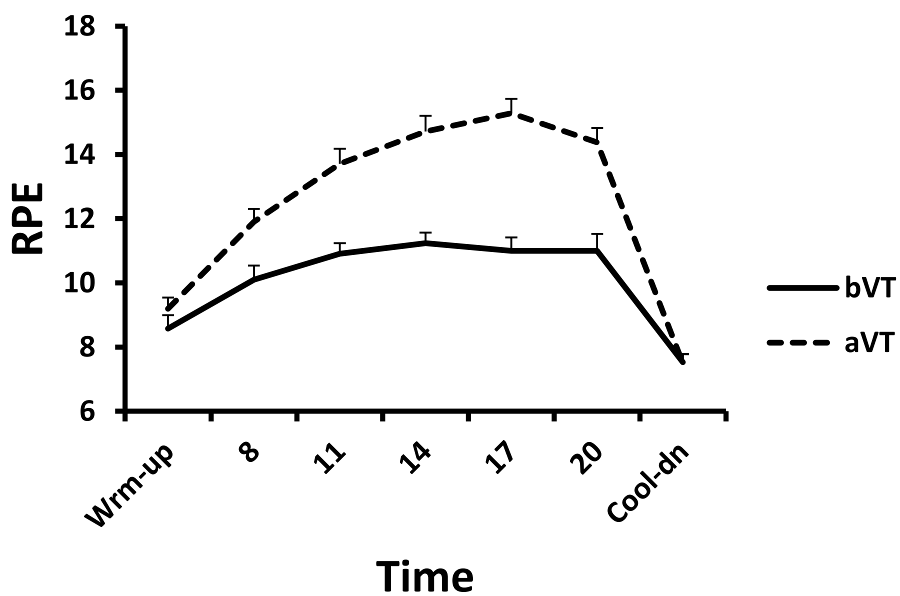

Figure 3. Ratings of Perceived Exertion during exercise in the two intensity conditions.

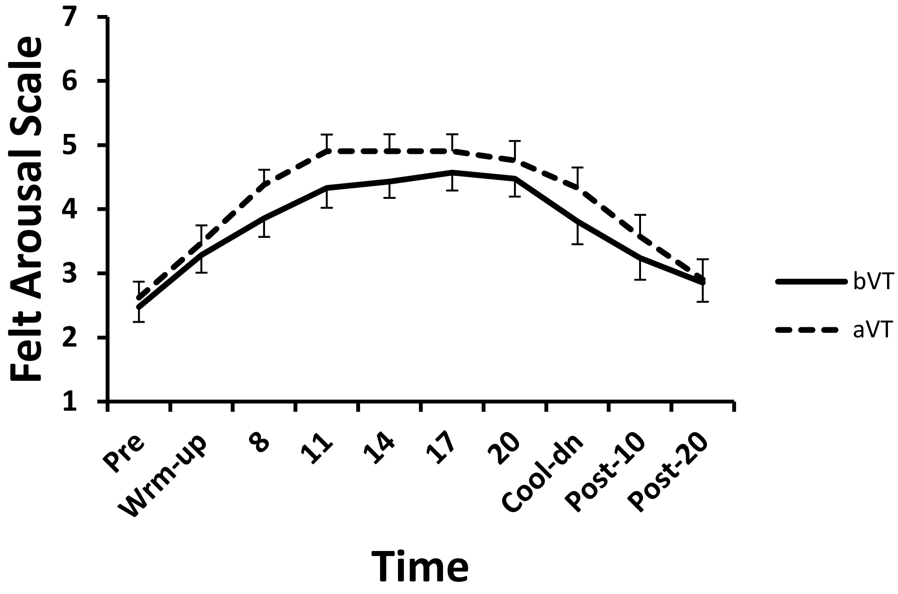

Figure 4. Ratings of arousal during exercise in the two intensity conditions using the Felt Arousal Scale.

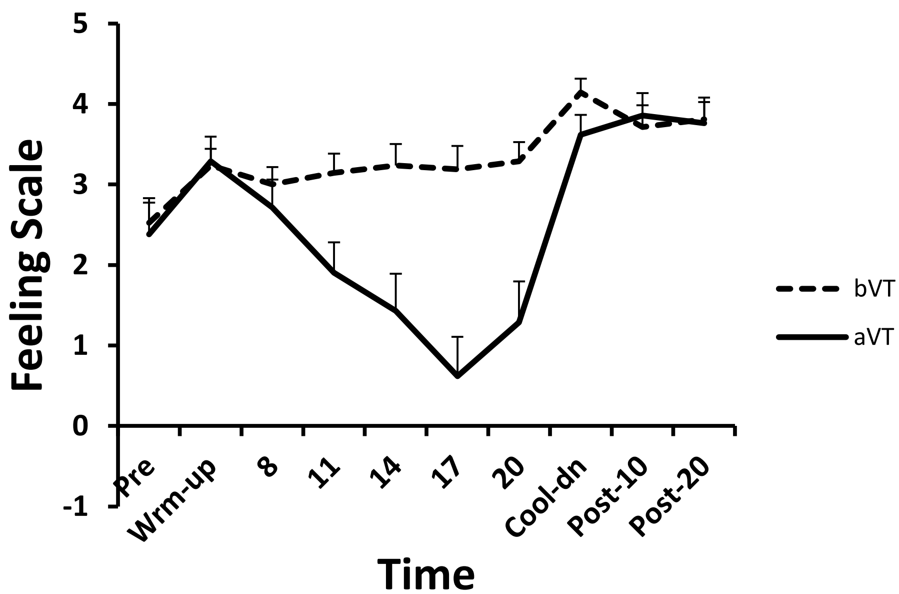

Figure 5. Affective responses during exercise in the tow intensity conditions using the Feeling Scale.

Using the dimensional approach to examining affective responses during the two intensity conditions (see Ekkekakis & Petruzzello, 2002), Figure 6 depicts the combination of affective valence and activation responses. As can be clearly seen, affect during the bVT condition changes from pleasant, unactivated affect before exercise to a more activated, pleasant affect at the end of exercise, with a decrease in activation during the cool-down and recovery periods. In the aVT condition, affect again began in an unactivated, pleasant state prior to exercise, but increased in activation and decreased in valence (i.e., shifted to the left) during the exercise. In the aVT condition, subjects were still technically in a pleasant activated affective state at the end of the exercise bout, but this was distinctly different from the affect experienced during the bVT condition.

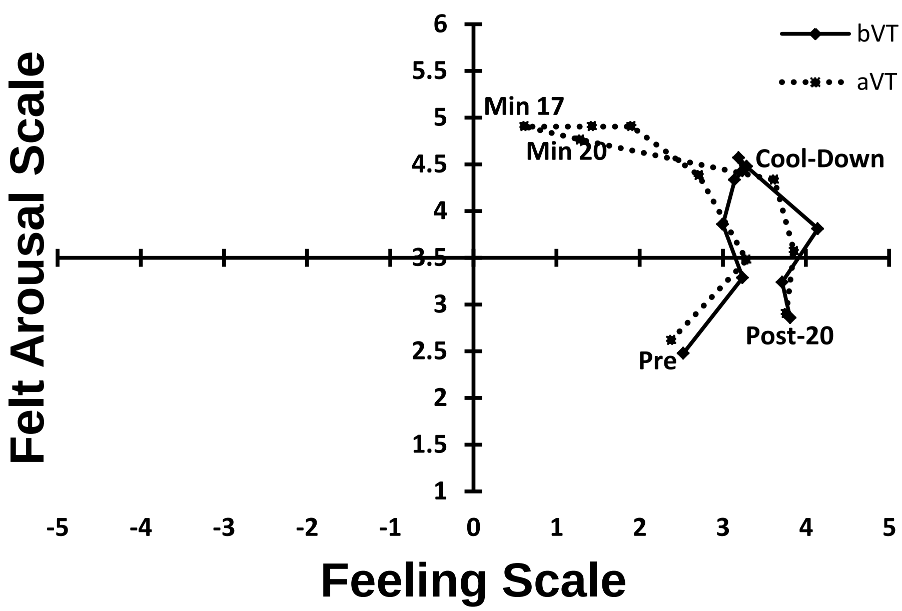

Figure 6. Dimensional approach depiction of the dimensions of valence (FS) and activation (FAS) during the two intensity conditions.

Finally, there were no significant correlations between affect experienced during exercise in either intensity condition and self-reported enjoyment following the exercise. There were also no relationships between RPE measured at the various time points during exercise in either condition and enjoyment.

Table 3. Individual differences in affective responses, based on Feeling Scale scores, from Pre-exercise to various times during exercise in the two intensity conditions.

				bVT		
Time During Exercise *(min)*		8	11	14	17	20
Increased Affect	*n*	10	11	12	11	12
	(%)	(45%)	(50%)	(55%)	(50%)	(55%)
	*M*Δ	1.50	1.73	1.83	2.00	1.83
	SD	1.38	1.19	1.40	1.41	1.40
Unchanged Affect	*n*	7	6	4	5	4
	(%)	(32%)	(27%)	(18%)	(23%)	(18%)
Decreased Affect	*n*	5	5	6	6	6
	(%)	(23%)	(23%)	(27%)	(27%)	(27%)
	*M*Δ	-1.80	-2.00	-1.83	-2.00	-2.00
	SD	1.30	1.22	1.17	1.10	1.83
				aVT		
Time During Exercise *(min)*		8	11	14	17	20
Increased Affect	*n*	8	6	7	4	8
	(%)	(36%)	(29%)	(33%)	(19%)	(38%)
	*M*Δ	1.75	1.50	1.29	1.25	1.50
	SD	0.89	0.84	0.49	0.50	0.93
Unchanged Affect	*n*	9	6	4	1	3
	(%)	(41%)	(29%)	(19%)	(5%)	(14%)
Decreased Affect	*n*	5	9	10	16	10
	(%)	(23%)	(43%)	(48%)	(76%)	(48%)
	*M*Δ	-1.40	-2.11	-2.90	-2.63	-3.50
	SD	0.89	1.27	1.29	2.06	2.12

Note: increased affect reflects an increase in valence (i.e., more positive) from pre- to during exercise; decreased affect reflects a decrease in valence (i.e., more negative) from pre- to during exercise.

In keeping with previous research utilizing the dimensional approach to studying affective responses to exercise, inter-individual variability was examined by assessing the change in FS responses from pre-exercise to the various time points during exercise. Table 3 shows the number (and percentage) of participants who increased, decreased or remained unchanged in FS across time along with the average FS unit change (and standard deviation). It also shows this information for both the bVT (top half of table) and aVT (bottom half of table) intensity conditions. For the bVT condition, the vast majority of participants either had increased affect (45-55%) or had no change in affect (18-32%) during exercise compared to pre-exercise affect. Only 23-27% of the participants experienced a decline in affect, and this was more pronounced (in terms of number of participants) from minute 14 to minute 20. For the aVT condition, a rather interesting pattern emerged. In terms of increased affect, the percentage of participants experiencing increased affect steadily decline from minute 8 to minute 17 (36% to 19%). The percentage of participants who showed no change in affect also decline over the same time frame (41% to 5%). Finally, the percentage of participants who showed a decrease in affect steadily increased from minute 8 to minute 17 (23% to 76%) with the mean units of FS change being -1.40 to -2.63.

In the aVT condition, unlike the bVT condition, the tendency was for less consistency in affective responding as the exercise bout progressed. In the bVT condition, the number of participants reporting increased, decreased, and unchanged affect stayed relatively constant over the course of the exercise bout. In the aVT condition, on the other hand, the number of participants reporting improved and unchanged affect decreased, whereas the number reporting decreased affect increased, particular up to minute 17 of the exercise bout.

CHAPTER 5

DISCUSSION

Previous research has shown that intensity of exercise is related to non-adherence and dropout (Ekkekakis, Hall, & Petruzzello, 2008). One reason for this relationship may be the effect exercise intensity has on affect and enjoyment. There is an intuitive connection between exercise enjoyment and increasing adherence to exercise programs; that is, people are likely to continue to participate in programs that they enjoy. Determining intensities that are enjoyable may help in exercise prescription and increasing adherence rates.

It was hypothesized that the aVT condition, because of its generally aversive nature (i.e., progressively increasing lactate), would result in less enjoyment than the bVT condition. The results from this experiment do not support this hypothesis, despite the physiological events that take place at a higher intensity of exercise. Suprathreshold intensities are usually associated with a cascade of physiological events (e.g., lactate production, cardiovascular changes, respiratory changes) that disrupt homeostasis. However, participants experienced a rebound in affect between minutes 17 and 20 of exercise in the aVT condition as they knew the exercise bout was almost complete. In addition, affect continued to increase (i.e., become more pleasant) during the 5 minute cool down period. This recovery in affect may have caused participants to rate the activity as more enjoyable. Coupled with the time delay in rating enjoyment, these factors could help explain why enjoyment was not different between the two distinct intensity conditions.

It is also possible that participants experienced a sense of accomplishment upon completion of the aVT exercise bout, while the bVT exercise may have been considered boring or too easy. Research by Rose and Parfitt (2007; 2010) is useful in helping to explain why people feel the way they do during different intensities of exercise. Rose and Parfitt (2007) asked participants why they felt the way they did after they had finished exercising. While participants deemed exercise above lactate threshold too difficult, exercise below lactate threshold was too easy and seemed pointless. Rose and Parfitt also explain that the outcomes that would be received from exercise influenced affect, as “individuals were concerned with whether or not they were gaining benefits and achieving health and fitness gains from the exercise” (p. 300). Rose and Parfitt (2010) conducted a follow up study which asked people why they felt the way they did during exercise at VT and at a self-selected intensity. Their findings supported the idea that “individuals evaluate the longer term health and fitness benefits that exercise can provide to generate an affective response” (p. 8). Perhaps these same thoughts that influenced participants’ Feeling Scale ratings influenced how much they enjoyed the activity. Thus, it is possible that enjoyment was statistically the same for the aVT and bVT conditions because while the aVT condition was difficult, participants may have felt they were accomplishing something. On the other hand, the bVT condition may have been too boring. Additionally, perhaps because of the rebound in affect from minute 17 of exercise to the end of cool down, participants reported similar levels of enjoyment for both intensities of exercise.

Disturbances in homeostasis are closely associated with affect (Cabanac, 2006). Indeed, affect during the 2 conditions was markedly different, with affect during aVT showing a progressive decline during the exercise until the last minute of exercise, then showing a rebound during the active cool-down period. This is consistent with previous research (Ekkekakis et al., 2008). The bVT condition showed steady positive affect throughout exercise with a slight increase in affect towards the end. Furthermore, the aVT condition was chosen to produce a change in blood lactate accumulation and a transition from aerobic to anaerobic metabolism. Particularly because the participants in this study were already active, the bVT condition was in a range where steady-state was achievable and represented no threat to survival. Thus, the affective response corresponding to a workload achievable with primarily aerobic metabolism, if an evolved psychological mechanism as hypothesized (Ekkekakis, 2003), would be positive because it would signify adaptations to physical activity and not threat (Hall, Ekkekakis & Petruzzello, 2002). However, the aVT condition was in a range where steady-state was less likely to be achieved and perhaps began to represent a threat to survival. As such, this could explain the declining affective valence during the aVT condition. The individual difference analysis is also consistent with this interpretation. There was more relative heterogeneity in affective responses in the bVT condition, whereas the aVT condition was characterized by relative homogeneity in affective responses, particularly as the bout progressed.

Although affect during exercise (as measured by FS) did not predict exercise enjoyment, responses for affect during the exercise were different in both conditions. Raedeke (2007) distinguished between feelings in general and feelings toward exercise by suggesting that affect only represents general feelings. If this is true and enjoyment of exercise is not a direct consequence of affect during exercise, then it would be apparent that properties of the exercise stimulus and cognitive factors such as evaluation of the experience and its importance would aid in determining level of enjoyment. The dual-mode model (Ekkekakis, 2003) suggests that at different levels of intensity, there is an expected change in the interaction between two primary factors when determining affective responses. Namely, cognitive evaluative factors (e.g., the value of exercise, self-efficacy or other self-perceptions, mastery component of the experience) and interoceptive cues have more or less influence on affective responses depending on characteristics of the stimulus (e.g., intensity, duration, mode). According to this model, intensity is a spectrum upon which affective responses show patterns of the interaction between the two factors. Relatively lower intensities (below the anaerobic threshold) are expected to result in generally positive affective responses with low variability between subjects, and to be only somewhat influenced by cognitive factors. At more vigorous intensities, particularly those near or above the level of anaerobic threshold, like the aVT condition in this study, affective responses are expected to show greater variability between and within subjects, with some individuals showing positive and some showing negative responses (Ekkekakis, 2003). These more vigorous intensities are also expected to be more strongly influenced by cognitive factors. Those intensities that exceed the anaerobic threshold (i.e., high) are expected to again show more homogeneous affective responses, where almost all participants show negative responses. These high intensities are also strongly influenced by interoceptive cues (e.g., lactate levels) whereas cognitive factors have little influence. Examination of Figure 5 shows that for the bVT condition, variability in FS responses is much smaller than for the FS responses in the aVT condition.

Assessing affect throughout the exercise bouts was important in revealing differences between the two conditions since both conditions displayed similar pre- to post-exercise affective responses. Recall that the AD ACL responses were essentially not different between the two conditions when examined before and following exercise, thus not revealing any intensity influences. The differences between the two conditions occurred during exercise, with the aVT condition resulting in a significant decline in affect. If only examining affect pre- to post-exercise, no changes would have been seen. How one feels during exercise may have an affect on enjoyment. For example, if an individual feels better (more positive affect) during exercise, they may enjoy the activity more and be more likely to continue it in the future. It is important to note that during the last 15 seconds of exercise in the aVT condition, subjects reported feeling better even though they were still exercising at the same intensity. This may be due to the fact that participants knew the exercise was almost over, perhaps being the reason for the more positive affective response.

Not surprisingly, perceptions of effort were significantly higher in the aVT condition from the 6th minute to the end of the exercise bout than in the bVT condition. Exercising at a higher intensity resulted in perceptions of having to work harder. Participants also displayed higher arousal during the aVT condition as well, which was not surprising. Although he found no relationship between perceived exertion and enjoyment in college students, Raedeke (2007) found that active participants from a corporate fitness sample enjoyed their exercise stimulus more when they reported higher perceived exertion (RPE). This was not the case in the present study.

Results also indicated that affect during exercise did not significantly predict enjoyment. As suggested by Raedeke (2007), enjoyment is not a simple response to exercise, but includes feelings related to the exercise stimulus and reflects feelings about exercise (e.g., value of exercise, mastery components of the experience). Clearly work remains to be done to more fully understand the relationship between affect experienced as a result of differing levels of exercise intensity, the enjoyment of that exercise, and the link to exercise adherence. It remains possible that, even if the affect during exercise does not impact enjoyment per se, it might still be predictive of longer-term adherence to an exercise program (Williams et al., 2008). Although this was not the purpose of the present study, it could be an important follow-up for future work examining the exercise-affect-adherence link.

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APPENDIX A

PARTICIPANT RECRUITMENT FLYER

looking for volunteers

ARE YOU BETWEEN THE AGES OF 18 & 30?

ARE YOU INTERESTED IN PARTICIPATING IN A STUDY EXAMINING THE MIND/BODY EFFECTS OF EXERCISE?

BENEFITS of PARTICIPATION:

- Learn your aerobic capacity
- Contribute to the understanding of exercise benefits on the mind & body

PLEASE CONTACT:
Annie Nekoliczak
anekoli2@illinois.edu

EXERCISE PSYCHOPHYSIOLOGY LABORATORY
DEPARTMENT OF KINESIOLOGY · UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

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APPENDIX B
INFORMED CONSENT DOCUMENT

"Examination of the effect of differing intensities of exercise on affect and enjoyment."

I understand that I am being invited to volunteer to participate in a research study designed to examine physiological and psychological responses to single bouts of aerobic exercise. This research study is being conducted by Ms. Anne Nekoliczak, Ms. Tina Mattila and Dr. Steven J. Petruzzello, all with the Department of Kinesiology and Community Health at the University of Illinois at Urbana-Champaign.

As a participant in the study, I will be asked to visit the Exercise Psychophysiology Laboratory and/or the Freer Teaching Laboratory a total of three times. Before any exercise participation, I will be asked to complete some questionnaires, some to determine whether I qualify to participate (e.g., exercise and health history) and some to assess my general feelings regarding exercise. If I qualify, during my first session I will perform a graded (incremental) exercise test on a treadmill for the assessment of my maximal aerobic capacity. The workload of the treadmill (primarily the incline that I will jog/run at) will be increased every two minutes until I am no longer able to continue running. The second and third visits will involve having me exercise for 15 minutes on a treadmill at an exercise intensity (speed, incline) that is assigned to me based on the results of my exercise test; the intensities will be different on each day. Before, during and after each exercise bout I will complete several questionnaires designed to assess how I feel at that time.

I understand that as a result of participation in this study I may possibly experience some muscles soreness or fatigue during and/or following the exercise session, but this effect should not last more than a couple of days. This will be minimized by stretching before and after the exercise and by engaging in a warm-up at the beginning of the exercise and cooling down after the exercise is cmompleted. Furthermore, I understand there is a small risk of having a heart attack or experiencing sudden death during or after the exercise sessions, as there is with almost any exercise that I may do. Staff present during any testing will be CPR and First Aid certified

I understand that the total duration of each session will be approximately 60 minutes (perhaps a little less, perhaps a little more). Furthermore, I understand that I have the right to ask questions about the procedures to be followed, and that I may withdraw my consent at any time without prejudice. If I so wish, I will receive the educational benefit of a description of why the study was conducted and what the expected findings were, as well as the actual findings upon the completion of the analyses. I have been assured that all the information obtained from this project will remain strictly confidential and will be used exclusively for the purposes of this research study.

I understand that I will receive no monetary compensation for my participation. In addition, in the unlikely event of any injury during this research project, the University of Illinois offers no reimbursement, compensation, or free medical treatment, except as required by law.

I understand that I will have access to information about my fitness level as assessed by a maximal oxygen consumption test. I will also be provided with information that may give me some insight into my own preferences for exercise. The results of this study will be used to help researchers better understand the relationship between exercise intensity and exercise enjoyment. This relationship may be involved in adherence to physical activity programs and thus provide researchers with important information for exercise intervention design.

I understand the results from this study may be used in a thesis, may be presented at scientific conferences, and may be published in the scientific literature. Furthermore, I understand that results from this study will be presented in such a manner that I will not be identified.

If I have additional questions concerning my rights as a research study participant, I can contact Dr. Steven J. Petruzzello (231 Louise Freer Hall, 906 S. Goodwin Avenue, Urbana IL 61801, MC-052, 217-244-7325, petruzze@illinois.edu), Ms. Annie Nekoliczak (357 Louise Freer Hall, 906 S. Goodwin Avenue, Urbana IL 61801, 217-244-3988, anekoli2@illinois.edu), or Ms. Tina Mattila (357 Louise Freer Hall, 906 S. Goodwin Avenue, Urbana IL 61801, 217-244-3988, tmattila27@gmail.com). I can also direct questions about my rights to The University of Illinois at Urbana-Champaign Institutional Review Board (528 East Green Street, Suite 203, Champaign, IL 61820, MC-419; 217-333-2670). I may call the IRB collect if I live outside the local calling area. It has also been explained to me that I will be given a copy of this consent form for my records.

I have read the above statements and I have been fully advised of the procedures to be used in this project. I verify that I am over eighteen (18) years of age, I understand the responsibilities involved, and I hereby assume them voluntarily.

______________________________ ______________
Signature Date

APPENDIX C

Health and Physical Activity History Inventory

Age: _______ Gender: M / F Height: ________ Weight: _______

Cardiovascular Disease Symptoms
Indicate the symptoms that you have experienced by checking ☐ **Yes** or ☐ **No**

1. Pain or discomfort in the chest, neck, jaw, arms or other areas that may be related to poor circulation ☐ Yes ☐ No
2. Heartbeats or palpitations that feel more frequent or forceful than usual or feeling that your heart is beating very rapidly ☐ Yes ☐ No
3. Unusual dizziness or fainting ☐ Yes ☐ No
4. Shortness of breath while lying flat or a sudden difficulty in breathing which wakes you up while you are sleeping ☐ Yes ☐ No
5. Ankle swelling unrelated to injury ☐ Yes ☐ No
6. Shortness of breath at rest or with mild exertion (like walking 2 blocks) ☐ Yes ☐ No
7. Feeling lame or pain in your legs brought on by walking ☐ Yes ☐ No
8. A known heart murmur ☐ Yes ☐ No
9. Unusual fatigue with usual activities ☐ Yes ☐ No

Recent Health Disturbances

10. Have you had any recent illness? ☐ Yes ☐ No
    If you answered **Yes** for question 10 please explain.

11. Have you recently been hospitalized? ☐ Yes ☐ No
    If you answered **Yes** for question 11 please explain.

12. Have you recently had any surgical procedures? ☐ Yes ☐ No
If you answered **Yes** for question 12 please explain.

13. Have you recently received antibiotics or a vaccination? ☐ Yes ☐ No
If you answered **Yes** to question 13 please explain.

14. Have you recently taken any anti-inflammatory drugs (besides aspirin)? ☐ Yes ☐ No
If you answered **Yes** to question 14 please explain.

Other Habits

15. How many cups of regular coffee do you have daily?
____

16. How many caffeinated soft drinks do you have daily?
____

17. How many cups of tea do you have daily?
____

18. How many cans of beer do you have weekly?
____

19. How many glasses of wine do you have weekly?
____

20. How many ounces of liquor do you have weekly?
____

21. How many cigarettes do you smoke daily?
____

22. How many cigars or pipes do you smoke daily?
____

23. If you are an ex smoker, how many years since you quit?
____

24. How often would you rate your stress level as high?
- ☐ Occasionally
- ☐ Frequently
- ☐ Constantly

25. Do you wear dentures? ☐ Yes ☐ No

26. Do you wear glasses? ☐ Yes ☐ No

27. Do you wear contact lenses? ☐ Yes ☐ No

28. Do you take vitamins? ☐ Yes ☐ No

If you answered **Yes** to question 28, what type?

29. In your previous job, did you regularly handle or breathe chemicals? ☐ Yes ☐ No

If you answered **Yes** for question 29, please explain.

Family History

30. Has any **male** in your immediate family had a heart attack or sudden death before the age of 55? ☐ Yes ☐ No

31. Has any **female** in your immediate family had a heart attack or sudden death before the age of 65? ☐ Yes ☐ No

32. Do you have family history of heart disease? ☐ Yes ☐ No

33. Do you have family history of lung disease? ☐ Yes ☐ No

34. Do you have family history of diabetes? ☐ Yes ☐ No

35. Do you have family history of strokes? ☐ Yes ☐ No

36. Please list anything else you feel we should know about you and your current/past health:

Exercise History

37. In the last 6 months, how many days per week (on average) have you engaged in some form of moderate to strenuous exercise for 30 minutes or more?

0 1 2 3 4 5 6 7

Exercise Habits

38. Do you exercise vigorously on a regular basis? YES [ ] NO [ ]
If yes, answer a. through e.

a. What type(s) of activity do you engage in?
________________________________ ________________________________
___

b. How many days per week on average? _________ days

c. How long do you exercise, on average, per session? _________ minutes

d. Using the scale below, indicate how hard you exercise, on average (circle the appropriate value)

0	½	1	2	3	4	5	6	7	8	9	10	•
Not at All	Very, very light	Very Light	Light	Moderate	Somewhat Hard	Hard		Very Hard			Very, very Hard	Maximal

e. How long have you been doing the exercise(s) you described in a – d above? ________ yrs ________ months

39. Do you frequently lift moderately heavy objects as part of your daily activities? ☐ Yes ☐ No

40. Do you frequently climb stairs as part of your daily activities? ☐ Yes ☐ No

41. Do you regularly engage in informal physical activities? ☐ Yes ☐ No

If you checked **Yes** for question 41, please circle all that apply:

Gardening Housework Walking a pet Other (specify below)