Psycho-Physiological Effects of Television Viewing During Exercise

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DEDICATION

This dissertation is dedicated to my loving wife Dana.

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ABSTRACT

Purpose: To examine the effects of television (TV) viewing on psychological and physiological variables during a moderate-intensity exercise bout. **Methods**: 28 insufficiently active adults participated in this study. Each participant performed three separate 30-minute walking bouts on a motorized treadmill. The bouts were separated by 48 hours and the majority of participants completed all bouts within three weeks. During each bout, participants watched a program they selected (self-selected TV condition), a British Broadcasting Corporation (BBC) nature program the investigators selected (standardized TV condition), and one bout involved no TV viewing (no TV condition). Variables measured during exercise were: heart rate (HR), perceived exertion (RPE), affect (FS), and arousal (FAS). The physical activity enjoyment scale (PACES), subjective exercise experience scale (SEES), and three VAS were administered at the end of each bout. Repeated measures ANOVAs were performed on all variables and additional analyses were conducted to assess the potential mediators of exercise enjoyment (e.g., exercise motivation types). **Results:** Participants rated enjoyment of exercise higher during both self-selected TV and standardized TV conditions (97.1 ± 15.2 and 92.7 ± 15.2) compared to the No TV condition (77.5 ± 13.4, $p < 0.001$). Participants reported more positive affect during the self-selected TV condition compared to the no TV control condition (3.49 ± 0.17 vs. 2.7 ± 0.3, $p=0.025$). They reported liking the self-selected program more (84.3 ± 2.1 vs. 67.2 ± 4.3, $p=0.001$) than the standardized program. Nonetheless, the two types of TV programs resulted in similar levels of attentional focus on TV viewing (self: 81.2 ± 19.7 and standardized: 79.1 ± 14.2, $p > 0.05$) and dissociation from walking, (no TV: 72.6 ± 5.6 vs. self: 38.1 ± 6.7 and standardized: 33.2 ±3.9, $p=0.002$) compared to the no TV condition. **Conclusion:** The findings indicate that TV viewing, regardless of whether the

programming is self-selected or standardized, resulted in greater enjoyment of exercise. This may have occurred because TV viewing caused the participants to focus their attention more on the TV program, and less on the physiological demands of the exercise bout itself.

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CHAPTER I

INTRODUCTION

Determinants of Physical Activity

Habitual physical activity (PA) is associated with a reduced likelihood of developing chronic diseases, such as obesity (57), type 2 diabetes (44), cardiovascular disease (93), and some cancers (56, 61). Current PA guidelines call for US adults to obtain at least 150 min (min) per week (min/wk) of moderate PA, 75 min/wk of vigorous PA, or a combination of the two (103). However, according to the Centers for Disease Control and Prevention (CDC) only 1 in 2 adults are currently meeting the 2008 aerobic PA guidelines, and only 1 in 5 are meeting the aerobic and muscle strengthening guidelines (12). With so few Americans meeting the PA guidelines focus needs to be directed at the determinants of PA, and developing effective means of overcoming any perceived barriers to PA.

Previous studies have examined the various determinants/barriers of PA (22, 87). A more recent review by Trost, et al. (102) examined an additional 38 studies that included previously underrepresented populations such as minorities, middle- and older-aged adults, and the disabled. Despite the common belief that knowledge of the health benefits of habitual PA is an important determinant, Trost, et al. discovered that "knowledge related to health and PA" was not associated with PA levels. Thus, it would appear that along with the continued energy spent educating the public on the health benefits of PA, it is perhaps even more critical to find new ways of targeting other determinants of PA.

Trost, et al. (102) organized the determinants of PA into six categories: (1) Demographic and biological factors, (2) psychological, cognitive, and emotional factors, (3) behavioral attributes and skills, (4) social and cultural factors, (5) physical environment factors and (6) PA characteristics. Trost, et al. [10] reported that psychological, cognitive, and emotional factors such as expected benefits, intention to exercise, self-efficacy, and self motivation, are strongly

associated with PA levels. In addition, there is documented research on the role of affective variables, such as enjoyment, on PA levels and adherence (30, 83, 117). Trost, et al. (102) stated that enjoyment of exercise showed a "repeatedly documented positive association with PA" which suggests that enjoyment could be a very strong predictor of PA behaviors (4, 58).

Motivation and Enjoyment

Exercise and PA behaviors can be intrinsically or extrinsically motivated (86). Intrinsic behaviors are often driven by experiences and feelings of competence, interest, and enjoyment (18, 72, 81) whereas extrinsically motivated behaviors are driven by rewards that are separate from the activity. Examples of extrinsic motivators are verbal praise(17), financial incentives, (67, 96) or other tangible rewards(17). Intrinsic motivators, not driven by reliance on extrinsic outcomes, typically yield greater adherence to a behavior (18). A concern when relying on extrinsic motivators is that they may diminish an individual's intrinsic motivation. In fact, research in the field of motivation has shown that introducing extrinsic motivators (such as money or gifts) often leads to a decrease an individual's intrinsic motivation (10, 16, 17). Intrinsic and extrinsic motivations are not mutually exclusive, as a person's interest in exercise and sport may be driven by both. However, the degree to which one is driven intrinsically or extrinsically is often specific to the activity (34).

Frederick and Ryan (34) surveyed 376 adults about the types of PA they engage in regularly. They classified the activities into sports and exercise/fitness categories. Then, utilizing the Motivation for Physical Activities and Measure (MPAM) the authors examined the differences between the two types of activities on the three separate motivators: (1) enjoyment, (2)

competence, and (3) body-related. Enjoyment and competence were found to be the primary intrinsic motivators whereas body-related motivation was considered to be an extrinsic motivator. Results showed that enjoyment and competence were positively associated with hours per week of participation in sport activities, perceived competence, and overall satisfaction. Thus the authors concluded that when a person is intrinsically motivated to exercises they are more likely to feel energized, confident, and satisfied, compared to when a person is driven to exercise based on extrinsic motivators (34).

Brawley and Vallerand (7) posit that while people may use extrinsic motivators as the impetus to begin an exercise program, these extrinsic motivators eventually lead to reduced adherence and PA levels, due mainly to diminished feelings of enjoyment. This view was echoed by the work of Wankel (106), who argues that intrinsic motivation is the key factor in exercise adherence. Enjoyment of PA is driven by intrinsic motives and this enjoyment will often result in increased adherence of PA, increased positive feelings, and a reduction in overall stress (106, 110).

But how does one define enjoyment of exercise? One of the earliest studies to investigate this was by Scanlan & Simmons (89), who in a 1992 study defined enjoyment as a "positive response" that includes feelings of "pleasure, liking, and fun." Leonard Wankel (104-111) has done significant work on the effects of enjoyment on youth sport participation and exercise adherence; he defines enjoyment as a positive emotion, a positive affective state (108).

Enjoyment and Physical Activity

Enjoyment has previously been cited as an important determinant of increasing PA adherence (19, 116). Hedonic motivation theory holds that individuals tend to engage in activities

that they find pleasurable and avoid those they do not find pleasurable or that might result in pain or discomfort (40). If individuals are able to associate an activity with a pleasurable response, then they are likely to repeat that activity. A reported lack of enjoyment in type of activity as well as exercise intensity is a barrier to adoption and adherence/maintenance of exercise (1, 20).

A study by Salmon, et al. found a link between enjoyment of exercise and participation in moderate-to-vigorous PA (88). The authors reported that in a population-based mail survey of 1,332 adults, those respondents who reported a high enjoyment and preference for PA were more likely to report high levels of PA. Specifically, individuals who reported high levels of enjoyment while walking were three times more likely to walk at least 2.5 hours per week. Conversely, those who reported high levels of enjoyment for sedentary activities were 30% less likely to participate in moderate intensity activity and 40% less likely to participate in vigorous intensity activity.

In 1979, Perrin (1) was one of the first to establish this connection between enjoyment and PA. Perrin surveyed Ontario residents to examine the amount and type of PA engaged in by the residents in the region, their reasons for activity/inactivity, and related attitudinal factors. The survey was conducted by telephone with 769 randomly selected residents. Ninety-two percent of their participants ranked enjoyment as the most important factor for participating in exercise. The authors found that enjoyment was ranked ahead of even health and weight control as an important determinant of PA participation, affirming the findings by Trost, et al (102).

Different factors have been shown to influence the enjoyment of an exercise session. These factors include exercising in front of mirrors (13, 53), exercising indoors vs. outdoors, (32, 64, 74) and exercising in a group setting versus exercising alone (78). In terms of broadcasting media, researchers have studied how music influences both psychological and physiological responses to

exercise (50, 51). A comprehensive review by Karageorghis, et al. (50, 51) concluded that listening to music increases enjoyment of exercise. Factors such as tempo, volume, and genre of music influence enjoyment of exercise. There is additional qualitative work based on interviews (75) and nationwide surveys (76) reporting that music may positively influence adherence to exercise and gym attendance.

Television/Physical Activity/Enjoyment

According to the American Time Use Survey, (55) the most prominent leisure time activity among US adults is television (TV) watching, with the average US adult watching approximately 20 hours of television per week (55). Meanwhile, the average adult spends only 30 minutes per day participating in sports, exercise, and recreation (55). Currently, there are only a few studies that have examined repurposing this typically sedentary activity (television viewing) and transforming it into dynamic activity (94, 95).

A study by Steeves, et al. (94) sought to determine the efficacy of a 6-month RCT comparing television commercial stepping program vs. a 30-min per day walking program among sedentary and overweight adults. Fifty-eight participants were recruited for the study. The authors found that both groups significantly increased their daily steps [4611 ± 1553 steps/d vs. 7605 ± 2471 steps/d (Television Commercial Stepping); 4909 ± 1335 steps/d vs. 7865 ± 1939 steps/d (Walking); $P < 0.05$] with no significant difference between groups. The authors concluded that both programs produced favorable changes among the participants in daily steps and thus PA can be performed during television viewing and that it is a feasible alternative to traditional PA activities among inactive adults. This study, by Steeves, et al.,(94) highlights that exercise during

television viewing is an alternative to other types of PA programs.

While Steeves, et al. examined repurposing a sedentary behavior into an active one, the authors did not examine what, if any, effect the TV viewing had on the participants' enjoyment of exercise. TV viewing is a popular activity (as evidenced by the amount of time the average adult spends watching TV per week). But does exercising while watching TV affect the enjoyment of exercise? Wilkerson, et al. (115) sought to answer this question by examining the effect of TV viewing during 30 minutes of cycle ergometer exercise on enjoyment among a group of college-age students. The students watched a BBC Nature program that was selected by the investigators to be "neutral," so as to reduce possible gender, racial, and religious biases. Using the Physical Activity and Enjoyment Scale (PACES) to assess their subjects' enjoyment levels (54), the authors found that the students reported higher levels of enjoyment when exercising while watching a television (87±19) nature program compared to exercising without watching television (79±16) ($p=0.016$).

Statement of the Problem

Lack of time, access, and motivation are cited as barriers that prevent people from being physically (102). However, behavior change strategies that target these perceived barriers, such as wearable activity monitors, financial incentives, and counseling have struggled to produce lasting behavior change. Therefore, new and novel approaches to increasing PA are urgently needed. One of the areas that needs greater research is try to alter the levels of enjoyment experienced during exercise (59). Hedonic motivation theory holds that the more enjoyable an exercise task is, the more positively mood is impacted post-exercise (70, 78). Studies utilizing television to alter

enjoyment of exercise are lacking and very few of these studies have measured exercise enjoyment using a validated tool, such as the PACES (54).

Statement of the Purpose

The purpose of this study was to build upon the existing literature and examine the effect of TV viewing (self-selected and standardized) on both psychological and physiological variables during a moderate intensity exercise session. Enjoyment of exercise has been correlated to PA, therefore the study will determine if TV viewing, specifically self-selected viewing, will increase participants' enjoyment levels during a moderate (40-60% HRR) walking bout using a validated tool to assess enjoyment (PACES).

Significance of the Study

If TV viewing leads to an increase in exercise enjoyment, this can inform future interventions aimed at increasing people's levels of PA. Use of an attentional focus scale will elucidate whether individuals are focused on TV or the exercise itself, and this will help establish whether TV leads to disassociation from exercise cues. A significant increase in enjoyment levels and positive affect among insufficiently active individuals could lead to interventions designed to test the feasibility of transforming a sedentary activity (TV viewing) into an active one. A plausible hypothesis is that viewing TV while exercising would lead to increased long-term PA adherence.

CHAPTER II

REVIEW OF LITERATURE

Theoretical Framework

Physical inactivity is a major public health problem in the US (12). According to the CDC only 1 out of every 2 adults is currently meeting the 2008 aerobic PA (12). Because of this, an immense amount of research has focused on increasing PA levels. PA research has often been grounded in one or more behavior theoretical frameworks. These frameworks often focus on cognitive, behavioral or environmental factors (2, 41, 43).

One such theoretical framework is hedonic motivation theory (HMT). HMT has been applied to eating behaviors (15, 71), as well as exercise behaviors (28). HMT, derived from learning theory, (40, 45, 120) states that individuals will engage in activity they find pleasurable and avoid those they do not find pleasurable. Specifically, it focuses on affective responses to an activity and their likelihood of predicting future behaviors. A study by Kahneman, et al. (46) showed that affective responses might play a significant role in determining future behaviors and whether certain behaviors will be repeated.

Relevant Constructs and Measurement Techniques

When using HMT to examine the PA behavior change literature, it's imperative to distinguish between "affect" and "enjoyment." Affect is defined by Ekkekakis and Petruzzello as the most "basic or elementary characteristic component of valenced responses (26, 113). This is a term that characterizes the subjective experience of any valence (pleasant or unpleasant) response and includes the concepts of emotions and moods (84). Positive affective response experienced during exercise may result in greater "enjoyment" of the exercise session, thus producing a positive memory of the exercise experience. Enjoyment has been defined as "pleasure, liking, and

fun"(89) and "a positive emotion or affective state" (104). Affect is different from moods and emotions (such as enjoyment) in that it lacks a cognitive appraisal of a situation. Measuring an emotion, such as enjoyment, requires an individual to cognitively appraise the situation or stimulus to determine their level of enjoyment. Both affect and enjoyment have shown to have a positive relationship with PA and exercise adherence, yet they are two separate constructs (26).

Enjoyment of exercise can be assessed in various ways. Some researchers have used interviews (1, 92) whereas others developed unique visual analogue scales (VAS)(37). In the sport psychology and exercise literature, a growing number of studies are employing the Physical Activity and Enjoyment Scale (PACES) to assess their subjects' enjoyment of exercise (74). The PACES is a validated tool that consists of 18 items that are rated on a 7-point Likert scale with opposite descriptions at each end of the scale (1=I enjoy it or It makes me depressed, 7=I hate it or It makes me happy). The scale assesses how much an individual enjoys PA in general. The scale can be modified so that it can be administered immediately following an exercise bout, in order to discern the extent to which an individual enjoyed that specific exercise bout, rather than PA "in general." The 18 items are modified into the past tense and participants are instructed to rate how they felt about the exercise bout they just performed (1=I enjoyed it or It made me depressed, 7=I hated it or It made me happy).

Affect is often assessed using the Feeling Scale (FS) (38). This scale is used as a measure of valence during an exercise bout. Participants respond to the question, "How do you feel right now?" by using an 11-point Likert-type scale from −5 (very bad) to +5 (very good). The FS is a valid measure of exercise-related affect (38).

Relationship Between Affect, Enjoyment and Physical Activity

While both affect and enjoyment have shown to have a positive relationship with PA and exercise adherence, they are two separate constructs (26). For instance, a study by Williams, et al. reported that positive affect experienced during an aerobic exercise class predicted PA participation 6 and 12 months later (116). Specifically, they found that a 1-unit increase in affect, measured via the FS during moderate-intensity exercise was associated with 38 min per week of additional PA 6 months later and 41 min per week of extra PA 12 months later. A follow up study by Williams , et al. (117) reported similar findings, with affect levels during a 10-min treadmill walk associated with increased PA 6 and 12 months later (29 and 14 min per week, respectively).

One of the first studies to determine the role of enjoyment on PA was by Burt Perrin (1). In 1979, the Regional Municipality of Waterloo, Ontario for the Ministry of Culture and Recreation by Nationwide Market Research Corporation conducted a survey. This survey examined the amounts and types of PA engaged in by the residents of the region and their reasons for activity and inactivity and the related attitudinal factors. The survey was conducted by telephone with 769 randomly selected residents 14 years and over. Perrin utilized an area sampling procedure to provide a randomized, representative sample. He discovered that 92 percent of those who were regularly active considered enjoyment of activity to be important (1).

Hagberg, et al. (37) investigated the importance of enjoyment of PA within a healthcare-based PA intervention. A total of 120 patients participated and were recruited from two primary health care facilities. The intervention group received access to various group exercise courses over three months followed up with support in designing their own exercise programs. The control group received usual primary care PA counseling. Enjoyment of exercise was defined as

the “emotional lift that participants experienced during exercise.” The authors measured enjoyment at baseline, 3, 6, and 12 months using a Graphic Rating Scale (a modified visual analog scale) (98). Associations were found between enjoyment and exercise levels ($r=0.36$, $P<0.01$) as well as between changes in enjoyment and changes in exercise level ($r=0.34$, $P<0.01$). At the 12-month follow-up, enjoyment of exercise was 25% higher in the intervention group than in the control group ($p<0.01$).

Salmon, et al., (88) examined the associations of PA and sedentary behavior with enjoyment preferences. The authors surveyed 1,332 adults. Those reporting high enjoyment and preference for PA were more likely to report high levels of activity. The authors determined that enjoyment of exercise was a significant predictor ($p < 0.05$) of an individual’s participation in moderate-to-vigorous intensity PA. Adults who enjoyed structured PA were two times more likely to report participating in vigorous intensity PA. Additionally, adults who reported high enjoyment of walking were three times more likely to report walking for 2.5 hours per week.

Leslie, et al. (58) examined a group of sufficiently active or inactive Australian college students. Enjoyment ratings for 21 different types of PA were obtained by using a five point scale (“no enjoyment to a lot of enjoyment”). The authors found that those who reported having high enjoyment during PA were more likely to be sufficiently active. Walking, swimming, tennis and cycling were rated highest in enjoyment. Males who reported low enjoyment (< 3) were 25% more likely to be insufficiently active than those who reported high enjoyment. Females who reported low enjoyment of PA were 18% more likely to be insufficiently active than those with high enjoyment.

The link between enjoyment and PA is not limited to adults. Dishman, et al.(21) recruited students from 24 high schools. Twelve of the high schools were allocated to the control group where the other 12 were placed in the treatment group. Students from schools in the control group, received the standard, one year, physical education (PE) course offered by the public school system. However, schools in the treatment group received a comprehensive school-based PA intervention (LEAP) that focused on changing environmental factors to increase PA. The LEAP intervention was designed to promote PA in high school girls through better instruction and fostering a school environment that supported the unique PA needs and interests of adolescent girls. A core component of the program was the promotion of enjoyment of PA and self efficacy. The authors used a modified 16-item version of the PACES to measure PA enjoyment (54). Using structural equation modeling, the authors found that not only did the LEAP intervention positively influence PA levels, but it also directly affected enjoyment of PA (21). The authors concluded that increases in enjoyment partially mediated the positive effect of the LEAP intervention. These findings echo those of Hag berg, et al. (37) in demonstrating that interventions aimed at increasing enjoyment of PA can be effective at increasing PA levels and possibly long-term PA adherence.

The Role of Exercise Intensity

Exercise intensity is important when attempting to understand the effects of music on PA. The dual model theory asserts that affective responses that occur during exercise are influenced by both cognitive factors and interoceptive factors (25). As exercise intensity increases, a shift will occur from a focus on cognitive factors or external stimuli to an inward focus on factors such as fatigue, heart rate, body temperature, breathing rate and acidosis. Ekkekakis has shown that the

ventilatory threshold (VT) is often the point at which an individual will switch over completely from external to an internal focus. However, there are three identified stages at which this occurs. The first phase is below the VT, where affective responses tend to be mainly positive and there is a focus on external cognitive factors. The second phase is when the exercise intensity is approaching the VT. At this stage, affective responses begin to change, and some studies report either an increase in pleasure or a decrease in pleasure. This varies across individuals and is often dependent on the individual's fitness level and exercise history. The third and final stage is past the VT when intensity is so great that heart rate, oxygen uptake, and lactate begin to increase beyond steady state levels. It is in this stage that affective responses are universally negative. However, following completion of the exercise bout and a return to resting levels, a "rebound" effect occurs, in which affective responses are typically reversed immediately. This typically coincides with an increase in positive affective responses (28, 29, 91).

Association/Dissociation

There are two types of cognitive strategies (also referred to as types of attentional focus): association and dissociation (69). Association involves monitoring bodily sensations, such as heart rate or breathing, along with the exercise activity itself, (running pace and distance covered). Dissociation involves focusing on anything that distracts attention away from the physical sensations of the activity (69). Rejeski's parallel processing conceptualization (82) suggests that given the limit on the amount of information that can be processed at one time, external and internal sources of information must compete for the individual's attention since both cannot be processed simultaneously. When internal (e.g., heart rate or respiration) and external stimuli (e.g.,

scenery or music) are both present, the external stimuli must be cognitively salient for dissociation to occur (73). Therefore, if an extrinsic stimulus is cognitively appealing it will be prioritized over the physical sensations of the exercise.

The Role of Music on Dissociation

Music played during exercise may serve to distract people from the physical demands of the activity and thus cause people to dissociate from the internal cues they are experiencing. Many music studies look at the effect of music on ratings of perceived exertion. Mohammadzadeh, et al. (68) concluded that the rating of perceived exertion is less when untrained individuals have upbeat music accompanying their workouts. Additionally, these authors concluded that if a person is able to increase their enjoyment and performance it could potentially lead to "preserving the continuity of a physical exercise." They stated, "The same factors that can affect the perception of exertion may also affect the degree to which exercise can be considered tolerable or the manner in which it is enjoyed"(68).

Dyrlund and Wininger (23) studied the effects of preferred and non-preferred music during 20 min of treadmill exercise at low, moderate, and high intensity levels. Using a between-subjects design, the authors found no differences in rating of perceived exertion (RPE) or enjoyment between music conditions. Participants were assigned to one of three music preference conditions (most preferred, least preferred, or no music) and walked/ran on a treadmill at 1 of 3 exercise intensities (low, moderate, or high) for 20 min. Exercise enjoyment, RPE, and attentional focus (association, dissociation, distress) were measured. To measure enjoyment, the authors used the interest/enjoyment scale of the Intrinsic Motivation Inventory (IMI). A 3 x 3

ANOVA on enjoyment revealed that when participants paid attention to the music, music accounted for roughly 5% of the variance in exercise enjoyment ($p = 0.04$). Additionally, those in the high intensity condition reported the greatest association ($p < 0.001$) and distress ($p < 0.001$). Although not statistically significant, participants in the most preferred music condition reported the highest levels of dissociation.

Brownley, et al. (9) assessed whether persons of above and below average fitness level differed on cardiorespiratory, hormonal, locomotor, thermal, and affective responses to graded treadmill exercise while listening to no music, sedative music, and fast music. The FS was used to measure affective responses. The authors hypothesized that the untrained participants would respond to the music more so than the trained participants. This would be due to their internally-projected focus during exercise. The authors also believed that any effect the music had on affective responses would disappear at the higher intensities. The authors found that there was no main effect of training group. However, there was a trend for a music x group x intensity interaction ($p < 0.05$). The untrained participants reported more positive affect during low-intensity exercise compared to the trained subjects. Additionally, during the low- and high-intensity exercise, the untrained participants reported more positive affect during the fast music condition whereas the trained individuals reported lower affect during the fast music. An interesting but non-significant pattern was observed among the trained participants, who consistently reported feeling values that were lowest during the fast music and highest during the no music condition. These results suggest that listening to fast and upbeat music during exercise may be beneficial for untrained runners but counterproductive for trained runners.

Boutcher and Trenske (6) conducted a study to examine the effects of sensory deprivation and music on RPE and affect. Twenty-four women performed three 18-minute exercise sessions on a cycle ergometer at light, moderate, and heavy workloads during which perceived exertion, affect, and heart rate were monitored. Affect was measured using the FS. Participants performed a submaximal fitness test and three separate 40-min experimental sessions. The three experimental conditions consisted of control, sensory deprivation, and music. The participants cycled during the three trials at 60 % (light), 75 % (moderate), and 85 % (heavy) of maximal HR. RPE and affect were assessed every 1, 2.5, 4, and 5.5 min of each workload. RPE responses in the music condition (M=7.91) were significantly lower than responses in the deprivation condition (M=8.48) at the low load intensity, $t(23)=2.91$ ($p<0.01$). Significant differences also existed between the control (M= 12.2 1) and deprivation conditions (M= 11.77) at the moderate load intensity, $t(23) =2.53$ ($p<0.01$). No significant differences existed between any of the conditions at the heavy load intensity. For affect, the analysis revealed a significant condition-by-load interaction, $F(4,92)=3.39$,$p<0.0$l a significant main effect for load, $F(2,46)=21.67$,$p<0.01$,and a significant main effect for condition, $F(2,46) = 6.5$ I,. 01. No significant differences between conditions were found at the low load intensity. At the heavy load intensity, significant differences existed between the deprived (M=7.41) and music conditions (M= 8.40), $t(23) = 3.37$, $p<0.01$. No significant differences existed between any other conditions at any of the three workloads. The authors concluded that it is feasible that the effects of music on RPE were distraction-like in nature. Listening to music may occupy attention, thus distracting individuals and preventing them from focusing on feelings of discomfort.

More recent studies examined the effects of a visual distraction coupled with an audio

distraction. Hutchinson, et al. (42) examined the effects of external stimuli (music and music-video) on psychophysical and psychological variables (attentional focus, affective valence, perceived activation, and state motivation) at intensities 10% above and 10% below VT during treadmill running. Affective valence (pleasure-displeasure) and perceived activation were assessed using the FS and FAS. Attentional focus was assessed using Tammen's (99) single-item attention scale. The attention scale ranges from 0 to 100, with "0" representing a completely internal focus of attention (i.e., association; e.g., heart rate, muscular fatigue, breathing) and "100" representing a completely external focus (i.e., dissociation; e.g., daydreaming, environment, distractions). Measurements were taken just prior to 5, 10, and 15 min of each condition. Twenty-four participants exercised at 10% of their maximal capacity below VT and 10% above during three separate trials (music, music and video, control). Participants were experienced exercisers. They provided investigators with their four favorite pieces of music for treadmill running. There was a condition × intensity × time interaction for perceived activation and state motivation, and an intensity × time interaction for state attention, perceived exertion (RPE), and affective valence. The music-and-video condition elicited the highest levels of dissociation, lowest RPE, and most positive affective responses regardless of exercise intensity. The intensity main effect indicated that the lowest affective valence scores were recorded at the above-VT intensity ($p=0.049$). The time main effect indicated that perceived activation increased significantly from minute 5to 10 and from minute 5 to 15 (both $p<0.001$), as well as from minute 10 to 15 ($p=0.035$). Attention manipulations influence psychological and psychophysical variables at exercise intensities above and below VT, and this effect is enhanced by the combined presentation of auditory and visual stimuli.

A study by Russell, et al. (85) examined the effect of two different types of distraction (TV viewing vs. reading) among 53 college age students. The subjects' mood was assessed five minutes pre and five minutes post a 25 minute cycle ergometer test at 60-75% of HRR using a Profile of Mood States (POMS) questionnaire. When compared to a non-stimulus control condition, no significant differences were observed in mood among the distraction techniques ($p > 0.05$). The authors concluded that the enjoyment of the content of the distraction (TV program) matters for increasing exercise mood and not just simply if a distraction is present or not. However, it is worth noting that previous research suggests there is a rebound in positive affective and mood responses upon the immediate cessation of an acute exercise bout. Thus post-exercise scores may more accurately represent this rebound effect, rather than the affective response that occur during the exercise bout (3, 85).

Physical Activity/Extrinsic Factors/Enjoyment

Having established the link between enjoyment of exercise and PA behavior, investigators have begun examining different ways of increasing enjoyment levels during PA. Many researchers are focusing on how extrinsic factors can influence enjoyment of an exercise bout. Two of the most often studied extrinsic factors are (1) the exercise environment and (2) music.

In 2003, Wininger and Pargman (119) assessed numerous factors associated with exercise enjoyment. The purpose of their study was to examine variables believed to contribute to exercise adherence within an aerobic exercise class. The variables examined were: satisfaction with the music used in the exercise environment, satisfaction with the exercise instructor, and salience of exercise role identity. The authors assessed 282 female volunteers at two separate university

activity centers. They found that exercise enjoyment was largely based on the participant's satisfaction with the music, which accounted for accounted 21% of the variance in exercise enjoyment followed by satisfaction with the instructor (8%) and exercise role identity (4%).

Martin, et al.(65) examined the effects of exercising in front of a mirror on feeling states and self efficacy, in women. The authors predicted that women with poor body image would experience a much harsher self evaluation and increase in negative affect while exercising in front of a mirror, thus leading to a decrease in enjoyment. They also hypothesized that following exercise in front of a mirror, these participants would experience an increase in negative affect compared to those with more positive body images of themselves. In order to test this, the authors recruited sedentary women from a university community. Body image, self efficacy, and feeling states were all measured via questionnaires. The authors assessed feeling states by using the Exercise Induced Feeling Inventory (EFI) (35) and the Physical Appearance State Anxiety scale (80). The participants attended two exercise sessions exactly one week apart. They performed 20 min of moderate intensity exercise on a stationary bike. After 20 min of exercise the participant performed a 5-minute cool down and then completed a second set of feeling state and self efficacy measures. Women in the non-mirror environment did not experience any change in positive engagement or tranquility but they did experience some mildly positive changes in other feeling states. However, women in the mirrored exercise condition experienced primarily negative outcomes. These included a decrease in positive engagement, greater tendency towards decreased tranquility; they had no change in physical exhaustion, and only a small increase in revitalization. Thus, the mirror negatively affected women with both weak and strong body images.

Chmelo, et al. (13) examined resistance training (as opposed to aerobic exercise) and the effect of mirrors on affective responses compared to a non-mirror condition. Thirty two females participated in this study. They were described as being active and self reported exercising at least three days a week. The authors used the FS (38) and felt arousal scale (FAS) (97) to measure affective responses. Participants were instructed to complete three exercise sessions separated by at least 48 hours of rest. Session one was a baseline session, in which the authors determined each participants 10 rep max (RM) for 7 different resistance exercises. In the following two sessions, participants completed two sets at 60 to 100% 10 RM of the 7 different resistance exercises with one minute of rest separating each set of 10. Affect was measured prior to, during, and immediately following and 15 min post exercise. Repeated measures were used to determine the difference in affect by time and across conditions. The authors found a main effect for time that was attributable to both the FS ($F(3, 78) = 10.3$, $p < 0.001$) and FAS ($F(3, 78) = 20.4$, $p < 0.001$). Compared to the pre-exercise scores, the FS scores were higher during exercise ($p = 0.001$), immediately following exercise ($p = 0.001$) and 15 min post-exercise ($p = 0.002$). FAS scores increased from pre-exercise levels during exercise ($p < 0.001$), immediately following exercise ($p < 0.001$) and 15 min post-exercise ($p = 0.012$). There was no difference between feeling scores between the mirror and non mirror conditions.

Bray, et al. (8) studied the effects of exercise leadership style on enjoyment of the class participants. Seventy-five females were split into two groups. One group received either motivational instructions with dance moves and the other group received plain simple instructions coordinated with restricted moves during a 40-min step aerobics class. The authors measured enjoyment using a 4-item, context-specific exercise session enjoyment measure developed by Fox

, et al. (33). It focused on participants' enjoyment of different aspects of the physical activity session such as the step aerobics skills they learned and the approach the instructor took in teaching the class. Participants rated their level of enjoyment using a 10-point Likert-type scale with the following anchors: 1: did not enjoy at all; 3: enjoyed a little; 5: moderately enjoyed; 8: enjoyed a lot; and 10: thoroughly enjoyed. As expected, the more motivational leadership style and varied choreography resulted in higher enjoyment levels among the participants.

Another environmental factor is whether the exercise is performed indoors or outdoors. Previous work has shown that people generally consider exercise in a natural environment to be more attractive than in an urban one (39, 41). A study by Focht, et al. (32) compared the effect of 10-minute walks completed in both an outdoor and indoor laboratory environment on affective responses, enjoyment and intention to walk for exercise in the future. The secondary aim was to examine the relationship between affective responses to walking and ratings of enjoyment and intention. Thirty five physically active college-age women from a large university were recruited for this study. The authors determined the activity level of the participants by using the leisure-time exercise questionnaire (LTEQ) (36). This measures the self reported frequency of exercise participation performed in one's leisure time during a typical week. Participants were asked to report the number of strenuous, moderate, and mild bouts of exercise they perform during an average week. For measuring affective responses, FS and FAS were used. Fluctuations in categorical affective states were assessed using the EFI (35). Enjoyment was measured with a single item index that had been positively correlated with the PACES. Participants were randomly assigned to attend the two experimental sessions. One was a 10-min walk on a treadmill in a lab and the other was an outdoor walk. Both walks were completed at a self-selected intensity,

2 to 7 days apart. Assessments of the FS, FAS, and EFI were obtained prior to, during (5th min), immediately following, and 10 min post-walking. The authors discovered that both walking conditions improved affective responses. Analysis of the FS yielded significant main effects for environment, $F(1, 34) = 7.67$, $p < 0.001$, and time, $F(3, 102) = 39.49$, $p < 0.001$. FS responses increased significantly from baseline to during ($d = 0.84$) and immediately ($d = 1.00$) and 10-min ($d = 0.92$) after walking. Additionally, FS responses were significantly higher during the outdoor environment ($d = 0.43$). Participants reported greater enjoyment, $t(34) = 5.12$ $p < 0.001$; $d = 1.03$, and intention for future participation, $t(34) = 4.15$ $p < .001$; $d = 0.92$, following the 10-min bout of outdoor walking.

Plante, et al. (74) conducted a similar study but included music as an external factor. Two hundred twenty-nine ($n = 229$) students were randomly assigned to one of 6 conditions: biking alone with iPod or friend in a laboratory, walking alone with iPod or friend outdoors, or biking or walking alone in control conditions. In the biking conditions, participants rode a Monark stationary bike either alone while listening to their iPod or next to a friend. In the friend condition the Monarks were set up side by side at a slight inward angle allowing for interaction between the participant and friend. The students completed 20 min of exercise in their respective conditions at 70% of their maximum target hart rate. The authors measured the participants' exertion using the 6-10 Borg perceived exertion scale, and measured their enjoyment using the PACES scale. A significant main effect for enjoyment was found as measured by the PACES scale [$F (1, 176) = 4.20$, $P<0.05$). (PACES <0.05) demonstrating that the participants found exercising outdoors to be more enjoyable than indoors (mean PACES scores indoors 92.1 vs. outdoors 95.8). There was no significant difference in enjoyment scores between iPod or friend conditions.

Numerous studies have examined the effect of music on exercise and sport performance (47-51). Previously, Karageorghis, et al., (52) developed a conceptual framework to predict the motivational effect of music on exercise and during sport competition. Four factors were identified as contributing to the motivational qualities of a musical piece. They were: Rhythm Response, Musicality, Cultural Impact, and Association (calling to mind any extra-musical images, memories, or other associations.) This conceptual framework was validated by the Brunel Music Rating Inventory (BMRI) (52), a tool designed to assess the motivational qualities of musical pieces. In 2006 this model was modified in response to developments in the research that showed the growing list of benefits, not just motivation, that occurred when PA and music are combined (48).These benefits can be both ergogenic and psychological. Examples of the ergogenic benefits are delaying feelings of fatigue and increasing work capacity. The effect music can have on an individual's perception of effort during exercise represents a major psychological benefit. This change in perception of effort can result in physiological alterations, and changes in HR and BP have also been observed (47-49).

Miller , et al., (101) evaluated the impact of two auditory conditions, music (M) and dialog (D), on RPE and enjoyment during exercise. Twenty subjects (10 males, 10 females) performed 20 min of treadmill running. Runners were allowed to self select the music they listened to, during the music condition. During the dialogue condition participants listened to audio books provided by the investigators. Each participant served as their own control and the order of the conditions was randomized and counterbalanced. RPE was collected every 5 min using a 10-point OMNI scale and enjoyment was assessed using a modified 10-point Likert scale. Results indicated that RPE was significantly lower (4.3 ± 0.83 vs. 3.65 ± 0.87) and enjoyment was greater (8.9 ± 1 0.95 vs. 5.6

± 1.64) during the music condition ($p < 0.05$) in comparison to the dialogue condition. These findings suggest that self-selected music influenced both RPE and enjoyment. The authors concluded that these findings may assist in developing both individual and public environment strategies for promoting exercise adherence. Unfortunately the authors did not assess the motivational qualities of the music or address the tempo or volume of the self selected music, both of which have previously been shown to influence the effects of music on exercise enjoyment (47-52).

Lim, et al.(60) examined the effects of music tempo, when coordinated to synchronize with an individual's cycling cadence, on the metabolic demands of that cycling exercise. Twenty-three recreationally active men were recruited. They visited the lab on two separate occasions. The first visit involved a maximal cycling test to determine the participants' fitness level. The second visit required the participants to complete four randomized 6-min cycling bouts at 90% of ventilatory threshold (control, metronome, synchronous music, and asynchronous music). The main outcome variables of the study were oxygen uptake, HR, ratings of dyspnea and limb discomfort, affective valence, and arousal. In order to assess valence, the authors used the FS and FAS. The participants were unfamiliar with the synchronous and asynchronous music selections. The music was selected by investigators for this reason, as they wanted to decrease the influence of socio-cultural background, age, and musical preferences factors that might occur as a result of familiarity with the music.

The authors found no significant differences in metabolic demand, however, they did report that HR was lower during the metronome condition when compared to the asynchronous music and control conditions. The effect of condition was significant for both in-task affective

valence ($F_{3,66} = 9.51$, $P = 0.001$) and arousal ($F_{3,66} = 4.78$, $P = 0.004$). Although in-task affective valence did not differ between music conditions or between metronome and no-music control conditions, in-task arousal was significantly higher in the synchronous music condition when compared against both metronome ($P = 0.010$, $M = 0.6$, 95% CI = 0.1–1.1, $d = 0.63$) and no-music control ($P = 0.026$, $M = 0.6$, 95% CI = 0.1–1.2, $d = 0.67$). Thus, the authors concluded that the music conditions elicited higher levels of affective valence (i.e., more pleasant affect) compared to metronome and no-music control conditions.

Wilsont and Herbstein (118) studied the relationships between noise (music) intensity and the perception of music loudness, enjoyment and work. Four 1-hour aerobics classes were selected from a Johannesburg gymnasium. The authors surveyed the participants to collect data on each participant's opinion of the music loudness, the influence music loudness had on their enjoyment of the class, and the influence music loudness had on their motivation to work harder in the class. Each aerobics class was assigned a median noise (music) intensity of 80, 85, 90 or 95 decibels. The authors found that participants in the aerobics classes correlated loud sound levels with more enjoyment and softer sound levels with lower enjoyment levels.

Volume can also be paired with music tempo to create an even greater effect in enjoyment. This study by Edworthy, et al., (24) examined the effects of both music volume and tempo on exercise performance. Thirty participants performed five 10-min treadmill sessions. Participants listened to music while exercising that was either: loud/fast (80 dB/200 bpm); loud/slow (80 dB/70 bpm); quiet/fast (60 dB/ 200 bpm); and quiet/slow (60 dB/70 bpm); in the absence of music. Both selections were approximately 2.5 min long and looped so as to play throughout each of the exercise periods. Measures of running speed, heart rate, perceived exertion and affect were taken.

Affect was measured using the FS at the 5-min and 10-min mark. Significant effects and interactions were found for running speed and HR across the different music tempo and loudness levels. More positive affect was observed during the music condition in comparison to the 'no music' condition. No significant differences for perceived exertion were found across conditions. These results confirm that fast, loud music might be played to enhance optimal exercising, and show how loudness and tempo interact. Mean feeling scores were higher after 5 min (mean 1.38) than after 10 min (mean 0.81). No other significant effects or interactions were found. One-way repeated measures ANOVA on all five conditions (including the control) revealed an overall effect of feeling scores ($F_{4,116} = 3.1$, $p < 0.05$). Participants reported a more positive affect during all of the music conditions than during the 'no music' condition.

Elliot, et al. (31) examined the effects of motivational music on a 20-min sub-maximal cycle task. Eighteen untrained participants (10 males, 8 females) were required to cycle in three experimental conditions: no music, non-motivational music, and motivational music. Participants' in-task affective states and rate of perceived exertion were assessed on rating scales during the trials and the distance traveled for each trial was recorded. The authors employed the FS in order to monitor in-task affect. Five measurements were taken during each trial (at 4, 8, 12, 16, and 19 min). Participants were required to perform three 20-min exercise trials, during which they were allowed to vary the work rate as long as they remained within 60-80% of their HRmax. Upon completion of each trial, an average affect score was obtained. To determine the participants' attitudes towards each trial and whether they would consider repeating the behavior, they were presented with a series of statements. Participants were required to rate each statement on a 7-point scale ranging from 1 (not at all true) to 7 (very true) and a total score was calculated by summing

the four responses. The main effect for condition was significant, ($F(2, 30)=19.54$, $p<0.01$). Results indicated that participants in the motivational music ($M=22.00$, $SD=3.70$) and non-motivational ($M=17.81$, $SD=6.33$) music conditions, compared to the no music condition ($M=8.06$, $SD=7.40$), reported more positive attitudes immediately post-exercise (motivational versus no music, $p<0.01$, $d=1.25$; non-motivational music versus no music $p<0.01$, $d=1.43$). However, no significant difference was identified between the motivational and non-motivational music conditions.

Summary

Evidence has shown that enjoyment of exercise is an important construct in the field of behavioral psychology. Previous studies have examined different factors that can influence the enjoyment of an exercise session. In terms of multimedia content, music is the most often studied external factor that influences the psycho-physiological responses to exercise. Research in the field of behavioral psychology has aided in the creation of scales that can be used to accurately assess enjoyment of exercise. Currently, there is an abundance of literature on the effects of music on PA enjoyment, but there is a paucity of literature on the effects of TV viewing on PA enjoyment. In spite of this, many commercial fitness centers are placing TVs in front of aerobic exercise equipment, despite limited evidence of their effect. Thus, there is a need for additional research to identify what effects, if any, TV viewing has on psycho-physiological variables during exercise.

CHAPTER III

MANUSCRIPT

Abstract

Purpose: To examine the effects of television (TV) viewing on psychological and physiological variables during a moderate-intensity exercise bout. **Methods**: 28 insufficiently active adults participated in this study. Each participant performed three separate 30-minute walking bouts on a motorized treadmill. The bouts were separated by 48 hours and the majority of participants completed all bouts within three weeks. During each bout, participants watched a program they selected (self-selected TV condition), a British Broadcasting Corporation (BBC) nature program the investigators selected (standardized TV condition), and one bout involved no TV viewing (no TV condition). Variables measured during exercise were: heart rate (HR), perceived exertion (RPE), affect (FS), and arousal (FAS). The physical activity enjoyment scale (PACES) and subjective exercise experience scale (SEES) were administered at the end of each bout. Three visual analogue scales (VAS) were used to assess a) how much they liked the TV program, b) how focused they were on the TV program, and c) how focused they were on the walking bout. Repeated measures ANOVAs were performed on all variables and additional analyses were conducted to assess the potential mediators of exercise enjoyment (e.g., exercise motivation types). **Results:** Participants rated enjoyment of exercise higher during both self-selected TV and standardized TV conditions (97.1 ± 15.2 and 92.7 ± 15.2) compared to the No TV condition (77.5 ± 13.4, $p < 0.001$). Since intrinsic motivation and introjected motivation were both correlated with enjoyment ($r=0.43$, $p=0.022$), further analyses were conducted to separate out the effects of motivation types and condition. Enjoyment was significantly greater for the TV condition ($p<0.05$), regardless of motivation level (high vs. low). No significant interactions were found between motivation types and condition. Participants reported more positive affect during the

self-selected TV condition compared to the no TV control condition (3.49 ± 0.17 vs. 2.7 ± 0.3, p=0.025). They reported liking the self-selected program more (84.3 ± 2.1 vs. 67.2 ± 4.3, p=0.001) than the standardized program. Nonetheless, the two types of TV programs resulted in similar levels of attentional focus on TV viewing (self: 81.2 ± 19.7 and standardized: 79.1 ± 14.2, p > 0.05) and dissociation from walking, (no TV: 72.6 ± 5.6 vs. self: 38.1 ± 6.7 and standardized: 33.2 ±3.9, p=0.002) compared to the no TV condition. **Conclusion:** The findings indicate that TV viewing, regardless of whether the programming is self-selected or standardized, resulted in greater enjoyment of exercise. This may have occurred because TV viewing caused the participants to focus their attention more on the TV program, and less on the physiological demands of the exercise bout itself.

Key Words: Enjoyment, Dissociation, Physical Activity

Introduction

Enjoyment is an important factor regarding the long-term maintenance of exercise and physical activity (PA) behaviors. In a review of the determinants of PA, Trost, et al. (102) stated that enjoyment of exercise showed a "repeatedly documented positive association with PA". Thus, enjoyment could be a strong predictor of future PA behaviors (4, 58). This hypothesis is rooted in Hedonic Motivation Theory (HMT), which states that individuals will engage in activity they find pleasurable and avoid those they find unpleasurable (40). Specifically, HMT focuses on affective responses (e.g. pride, satisfaction, disappointment) to an activity and their likelihood of predicting future behaviors. Therefore, if an individual has a positive response to an activity and enjoys it, there is a greater likelihood of repeating that activity.

A commonly used approach to increase enjoyment of exercise is through distraction by external means. The change in mood scores is often linked to dissociation from internal cues. According to the Rejeski's parallel processing conceptualization theory, given the limited information that can be processed at one time, external and internal sources of information must compete for the individual's attention, since both cannot be processed simultaneously (82). When external stimuli (e.g., scenery or music) and internal stimuli (e.g., monitoring of HR or breathing) are both present, the external stimuli must be cognitively salient for dissociation to occur (73). A two part comprehensive review by Karageorghis, et al. (50, 51) concluded that listening to music can increase enjoyment of exercise. Music is the most studied approach, and there is evidence to show that tempo (11,12) and volume of music (13, 14) can impact psychological and physiological responses to exercise (9,10) to improve enjoyment.

If a distraction, such as TV, is cognitively appealing, it will be processed primarily over the physical sensations of the exercise, thus allowing an individual to dissociate from the activity. One

factor that may influence enjoyment during TV watching is the program that is watched. Enjoyment may increase when one watches a self-selected, preferred TV program. Recent research supports this idea, having found that the content of the distraction appears to matter in mood scores during exercise (85) (77). Privitera, et al. (77) studied college students, and reported that students who exercised while viewing a pleasurable TV program had a significant increase in pleasant mood, compared to those who exercised while viewing an unpleasurable program or no TV program.

The most prominent leisure time activity among US adults is TV viewing (103), with the average US adult watching approximately 20 hours of TV per week (103). Given that TV viewing is a highly popular activity, and incorporates both visual and auditory stimuli, this activity could possibly serve as a distraction during exercise to promote enjoyment. While commercial fitness centers have begun incorporating TV-watching options (e.g. wall-mounted and equipment-imbedded systems), little research has focused on how watching TV impacts exercise-related psychological experiences (e.g. affect, enjoyment, mood) that are related to adherence.

A recent study, conducted by Wilkerson, et al. (115), sought to determine the effects of TV viewing on enjoyment of exercise in college-aged individuals. The students watched a nature program (British Broadcasting Channel's "Life") that was selected by the investigators because it was "neutral," thus reducing possible gender, racial, and religious biases. Using the Physical Activity and Enjoyment Scale (PACES) (54) to assess enjoyment levels (74), the authors found that average PACES score was significantly higher (by approximately 10%) for the TV condition relative to the control (no TV) condition. Although this finding showed preliminary support for

the use of TV viewing to increase exercise enjoyment, it is limited in terms of generalizability and external validity.

In order to increase our understanding of the effects of TV viewing on exercise enjoyment, more research is needed on subjects with a broader age range, using more commonly prescribed exercise modes. Thus the purpose of the current study was to examine the effects of TV viewing (self-selected and standardized) on both psychological and physiological variables in adults (age 30-60) during a 30-minute, moderate-intensity walking bout.

Methods

Participants

Twenty-eight individuals participated in the study. Individuals were recruited by word of mouth, flyers placed on community bulletin boards and electronically via email. The inclusion criteria were as follows: 30 to 60 years of age, body mass index between 18.5-44.0 kg/m^2, accumulating insufficient levels of PA (less than 150 minutes per week of moderate intensity PA and/or 75 minutes of vigorous PA) (11), and able to complete 30 minutes of continuous moderate intensity exercise on a treadmill. Individuals who had an injury or physical limitation that rendered them unable to meet this requirement or other contraindications to exercise (determined by administering a physical activity readiness questionnaire (PAR-Q) (100) were excluded. Each participant was asked to list their three favorite half-hour TV programs. If none of the programs were available (via Amazon Prime or Netflix.com) the participant was excluded from the study.

Twenty-eight participants attended four visits to the laboratory led by a graduate research assistant. During an initial visit to the lab, the informed consent document was verbally explained and a written copy was provided for review. Participants were given an opportunity to ask

questions about anything that was unclear. Informed consent was obtained, in accordance with a study protocol approved by the university's institutional review board (IRB). Subsequently, individuals were enrolled in the study and were randomly assigned to perform either condition one, two, or three for the first trial.

Height was measured to the nearest millimeter using a standard Seca stadiometer (Birmingham, United Kingdom), and weight was measured to the nearest 0.05 kilogram (kg) with a calibrated Health-o-meter digital scale (Boca Raton, Florida) (Table 1). Body composition was measured via bioelectrical impedance, or BIA, using a Tanita BC-418 (Arlington Heights, Illinois). Resting heart rate (HR) and blood pressure (BP) were measured after the participant had been seated at rest for five minutes. Participants completed a demographic information questionnaire and a contact information form. Participants then completed a Cohen perceived stress survey (PSS)(14), and a behavioral regulations exercise questionnaire (BREQ)(63) and P RETIE-Q (27). These surveys were completed so as to be able to analyze any potential mediating effect of motivation, stress and exercise preferences on enjoyment (e.g., individuals with high intrinsic motivation may enjoy exercise regardless of TV watching). All scales and surveys used in this study were validated by their developers to ensure that they measure appropriate psychometric properties.

Baseline Trait Surveys

Perceived Stress Scale (PSS) – The PSS assesses the degree of stress an individual perceives in a given situation. The PSS (14) used was a 10-item version of the standard 14-tem scale, with all items rated by frequency on a 5-point Likert scale (1=never, 5=very often). Participants were

asked to consider how often they experienced stressful thoughts or feelings over the previous month.

Behavioral Regulations in Exercise Questionnaire-2 (BREQ-2) - This questionnaire examines the underlying reasons people choose or choose not to engage in PA (63). Motivation towards PA is categorized into five distinct regulations: Amotivation, External, Introverted, Identified, and Intrinsic. It is a 19-item tool, in which each item has an accompanying five-point Likert scale (0= not true for me, 2= sometimes true for me, 4= very true for me).

The Preference for and Tolerance of the Intensity of Exercise Questionnaire (PRETIE-Q) - This 16-item questionnaire examines the level of intensity people prefer and will tolerate during exercise (27). Each of the 16 items is scored on a 5-point Likert Scale (1= totally disagree, 3= neutral, 5= totally agree) and eight of the items are reverse scored to specify between preferences for high or low exercise intensity.

Sub-Maximal Exercise Test

Participants were instructed to arrive at the lab having not consumed any caffeine six hours prior, eaten or exercised three hours prior to their visit. During their first visit, demographic information was obtained (table 1). Participants were asked to complete a sub-maximal exercise test on a treadmill. For the initial stage, the speed was set at two mph for three minutes. Speed was then increased by 0.5 mph every three minutes throughout the test, while HR and ratings of perceived exertion (RPE) (5) were recorded every minute. The exercise tests continued until the

participants reached 85% of their age predicted maximal HR. The completion of this submaximal test was necessary to determine treadmill settings for the experimental conditions.

Exercise Conditions

Participants underwent three 30-minute exercise bouts on the treadmill. Participants were fitted with a Polar HR T-31 monitor (Lake Success, NY) to measure HR throughout each bout. Throughout each of the exercise bouts, the treadmill speed was set at a rate that elicited approximately 50% of the estimated HRR. Bouts occurred at the same time of day with a minimum of 48 hours separating each bout, and all bouts were completed within two weeks of one another. Participants were instructed to refrain from caffeine for six hours prior to the exercise bouts and to refrain from food and exercise for at least three hours prior to the exercise bouts. The order of bouts was determined using a balanced Latin square design with each participant serving as his/her own control.

Self-selected TV Condition:

Participants picked one of their three favorite half-hour TV programs to view (Figure 1). If the participant chose a program that did not last for the duration of the 30 minutes, a second episode of the same program was viewed and the participant was given the option of finishing the second episode after completing the post exercise surveys. Heart rate (HR) Rating of perceived exertion (RPE) (5), were measured as indicators of exercise intensity. Feeling Scale (FS) (38), and Felt Arousal Scale (FAS) (97) were measured to examine the affective valence of the bouts. These variables were assessed every 10 minutes throughout the test (10, 20, and 30 minutes). Following

completion of the exercise bout, the participant immediately completed the PACES (54) where participants were instructed to rate how they felt about the exercise bout they just completed, the Subjective Exercise Experience Scale (SEES) (66) where participants were asked to indicate the degree to which they were experiencing different feelings "right now" immediately after exercising and 3 separate visual analogue scales (VAS). During all exercise bouts, only essential communication between investigator and participant occurred so as not to interfere with or impact the psychological and physiological variables being assessed. The height and location of the TV remained the same throughout the trials, as did the TV volume. The testing was performed in a laboratory setting where temperature and ambient noises were controlled. All clocks were removed from the lab and participants were instructed to remove their watches. The investigator obscured the participants' view of the treadmill control panel so that they could not see the walking speed or the amount of time elapsed/remaining in the bout.

Standardized TV Condition:

During the 30 minutes of exercise, subjects viewed the first 30 minutes of the BBC's program *Life* (Disc One, 2010*)*. The exercise protocol was identical to that used during the self-selected TV condition.

No TV Condition:

This bout used the same exercise intensity and duration as the other bouts. However, no TV program or other forms of entertainment were available to the participants. For all three conditions, only essential communication between investigator and participant occurred, so as not

to interfere with or impact the psychological and physiological variables being assessed.

Psychological and Physiological Surveys

Each survey came with 3-5 sentences set of instructions that were read to the participants. The instructions were read aloud to the participants at the beginning of each walking bout to ensure the participants were clear on what the survey was attempting to measure and for consistency between the three bouts.

Feeling Scale (FS) - This survey is used as a measure of valence (i.e., pleasant versus unpleasant feelings) during the exercise bout. Participants responded to the question, "How do you feel right now?" using an 11-point scale ranging from −5 (very bad) to +5 (very good). The FS is a valid measure of exercise-related affect (38).

Felt Arousal Scale (FAS*)* – This survey uses a single-item indicator of perceived activation is scored on a six-point scale from 1 (low arousal) to 6 (high arousal). Measurements were taken at minutes 10, 20 and 30 of exercise (97).

Rating of Perceived Exertion (RPE) - Borg's RPE scale was used to determine each participant's subjective rating of exertion at minutes 10, 20 and 30 of exercise (5).

Physical Activity Enjoyment Scale (PACES*)* - Participants were asked to rate their enjoyment of the preceding PA bout, immediately after the walking bouts during each condition. The PACES

consists of 18 items that are rated on a 7-point Likert scale with opposite descriptions at each end of the scale (1=I enjoyed it or It made me depressed, 7=I hated it or It made me happy) (54).

Subjective Exercise Experience Scale (SEES) – This 12-item scale asks participants to indicate the degree to which they were experiencing various feelings "right now" immediately after exercising (66). The items are rated on a 7-point Likert scale that ranges from "not at all" to "very much so." The scale measures the psychological responses to the stimulus properties of exercise. The three factors measured are positive well-being, psychological distress, and subjective fatigue.

Visual Analogue Scales (VAS) - The purpose of the VAS was to help determine whether TV viewing served as a distraction from the walking bout itself. Participants were asked to assess, on three separate visual analogue scales (VAS) (114): a) how much they liked the TV program they viewed, b) how focused they were on the program they viewed, and c) how focused they were on the exercise (walking bout) they just completed. The participants were instructed to indicate their answer by drawing a vertical line on the horizontal line provided. At the end of each horizontal line was "not at all" and "extremely." VAS attempt to measure characteristics or attitudes that range across a continuum of values and are not easily measured by direct methods

Power Analysis

A sample size calculation was performed using power analysis software (G*Power 3.1.2; Dusseldorf University, Dusseldorf, Germany). With $p = 0.05$, power at 0.95, intercorrelation for repeated measures at 0.3, and a large effect size ($d = 0.80$) to detect the effects of self-selected TV

on enjoyment levels, it was determined that 25 participants would be required for the study.

Data Analysis

All analyses were conducted using SPSS v.21 (Cary, NC). To determine the primary outcome variable, a one-way repeated measures analysis of variance (ANOVA) was used to compare differences in PACES and SEES scores between the three conditions. Given the potential mediating effect of motivation, stress and exercise preferences on enjoyment (e.g., individuals with high intrinsic motivation may enjoy exercise regardless of TV watching), additional analyses were conducted. Bivariate correlational analyses were subsequently conducted to determine whether PSS, BREQ-2, or PRETIE-Q scores were related to post-exercise measurement of enjoyment. Any variable found to be significantly related with enjoyment were analyzed using a 2x2 repeated measures ANOVA, wherein individuals were dichotomized into high and low groups (e.g. high intrinsic motivation, low intrinsic motivation) via the median split technique to determine potential interaction effects between TV condition and enjoyment. Two-way repeated measures ANOVAs (condition x measurement time points) were performed on HR and RPE, FS, and FAS ratings. All values were reported as mean ± standard deviation (SD) and Bonferroni corrections were run on all analysis. The significance level was set at $p<0.05$.

Results

Participants were primarily female (89%) with an average age of 47.4 (±4.6) years and an average BMI of 30 (±5.3). Most participants (99%) were employed and reported working 31 to 50 hours per week (Table 1). Enjoyment of exercise was higher for both the self-selected and

standardized TV conditions (97.1 ± 15.2 and 92.7 ± 15.2) compared to the no-TV condition (vs. 77.5 ± 13.4, $p < 0.001$) (Figure 2).

SEES scores indicated that under both TV conditions (self-selected and standardized), participants reported significantly greater levels of positive well-being, compared to the no TV condition (21.4 ± 4.5 and 20.4 ± 4.5 vs. 18.1 ± 4.6, $p < 0.05$) (Figure 3). This positive well-being was significantly correlated with enjoyment of exercise bout for the self-selected and standardized TV conditions ($r = 0.64$ and $r = 0.67$, $p < 0.05$). Psychological distress (4.5 ± 1.5 vs. 6.9 ± 3.7) and fatigue (8.1 ± 4.7 vs. 11.3 ± 5.9, $p < 0.05$) were both significantly lower for the self-selected TV condition than for the no TV condition.

The BREQ-2 identifies five different types of motivation: amotivation, external motivation, introjected motivation, identified motivation, and intrinsic motivation. Bi-variate regression analyses were run on motivation sub-types and enjoyment of exercise, in order to determine if these were potentially confounding variables. Bivariate analyses revealed significant correlations between exercise enjoyment and two sub-types of motivation: intrinsic and introjected (Figure 4). Exercise enjoyment was correlated with intrinsic motivation type ($r=0.43$, $p=0.022$) during the self-selected TV condition and introjected motivation type for both self-selected ($r=0.39$, $p=0.039$) and standardized TV conditions ($r=0.43$, $p=0.021$). Nonetheless, enjoyment remained higher during both TV conditions, when examining the interaction between motivation types and condition ($p<0.05$).

There were no significant differences in average HR, RPE, or FAS between conditions (Figure 5). RPE increased over time ($f(3,27) = 40.53$, $p < 0.001$) but did not differ between conditions ($f(3,27) = 2.28$, $p=0.123$) (Figure 5). Affect, which is a strong predictor of behavior,

was significantly greater (as shown by mean FS) during the self-selected TV condition than during the no TV control condition (3.49 ± 0.17 vs. 2.7 ± 0.3, p =0.025).

There was no significant differences in reported "focus" on the TV program between conditions, despite participants liking the self-selected program more (84.3 ± 2.1 vs. 67.2 ± 4.3, p = 0.001). Participants focused more on the walking bout itself during the no TV condition (72.6 ± 5.6) when compared to the self-selected and standardized TV conditions (38.1 ± 6.7 and 33.2 ±3.9, respectively) (p = 0.002) (Figure 6).

Discussion

The most important finding of this study was that participants reported a greater level of enjoyment of exercise for a moderate-intensity walking bout while watching TV, compared to a no TV condition. This held true whether they viewed self-selected or standardized TV programming. Additionally, positive affect was greater during the TV condition than during the no TV condition, which confirms that participants had a more positive exercise experience when viewing TV.

The result of the current study are similar to those of Wilkerson, et al. (115). In both studies, TV viewing during moderate intensity exercise appears to improve ratings of exercise enjoyment compared to a no-TV condition. Interestingly, participants in the current study reported greater levels of enjoyment during TV conditions (97.1 ± 15.2 and 92.7 ± 15.2 for self-selected and standardized TV, respectively) than those in Wilkerson's study (87.0 ± 19.0) despite similar enjoyment rating during the no TV condition (77.5 ± 13.4 vs. 79.0 ± 16.0) [32]. This difference in enjoyment ratings could be due to the differences in the study population

(middle-aged adults in the current study vs. university students in Wilkerson's study) or the exercise mode (walking in the current study vs. cycling in Wilkerson's study).

Our findings suggest that it was the disassociation produced by TV viewing, more so than the hedonic nature of television that resulted in increased enjoyment scores. An often-cited reason for the effects of external factors on exercise enjoyment is that they can act as a distraction from internal cues (heart rate, breathing rate) and self-talk ("how long have I been running for? How much longer do I have to go?) that occur during exercise. The parallel processing conceptualization theory of Rejeski et al. (82) suggests that due to the external and internal sources of information competing for the individual's attention, the most appealing source will win out. We initially hypothesized that enjoyment scores during the self-selected TV condition would be greater than the standardized program, since participants were viewing one of their favorite programs. However, according to the VAS, participants like their self-selected program more than the standardized program. But, when asked how "focused" the participants were on each TV program, there was no significant difference. This finding suggests that participants do not rate their enjoyment of exercise higher when presented with a program that is more pleasurable.

Intrinsic motivation is one of the types of motivations measured by the BREQ-2, and was significantly correlated with exercise enjoyment during the self-selected TV condition. Exercise and PA behaviors are often intrinsically or extrinsically motivated (88), meaning they are driven by experiences and feelings of competence, interest, and enjoyment (intrinsic) or driven by rewards that are separate from the activity (extrinsic) (13, 32, 53). These motivations are not mutually exclusive, and the degree to which one is driven intrinsically or extrinsically is often specific to the activity (50). Frederick and Ryan (34) surveyed 376 adults about the types of PA

they engage in regularly and the motivations behind their exercise behaviors. Enjoyment was listed as one of the primary intrinsic motivators (alongside competence), and it was positively associated with hours per week of sports participation.

Brawley and Vallerand (7) propose that while extrinsic motivators can cause people to begin an exercise program, they eventually lead to reduced adherence and PA levels (mostly due to diminished feelings of enjoyment). This view was echoed by the work of Leonard Wankel (104), who argues that intrinsic motivation is the key factor in exercise adherence. Since enjoyment is strongly linked to intrinsic motivation, it is plausible that increasing enjoyment of PA, via TV viewing or other means, could lead to increased long-term adherence of PA (104, 106).

Our findings suggest that watching TV improved affective experiences and rating of enjoyment, which may lead to improved adherence over time. Williams, et al. (116) demonstrated that the affect experienced during an acute bout of aerobic exercise, predicted PA participation 6 and 12 months later. A subsequent study by the same group reported similar findings, with affect experienced during a 10-minute treadmill walk being associated with increased PA 6 and 12 months later (117). Our study found that when affect scores were averaged across time (10, 20, and 30 min FS scores) positive affect was significantly greater during the self-selected TV condition compared to the no TV control condition. Additionally, participants reported greater levels of psychological well-being for the TV conditions compared to the no TV condition.

Most studies showing a change in enjoyment levels have been done using low-to-moderate intensity exercise bouts. The same findings are not typically observed during bouts of high intensity exercise. Previous work from Ekkekakis has shown that the ventilatory threshold (VT) is often the intensity at which an individual switches from an external to an internal focus (27, 29,

91), and it is beyond this point that affective responses are typically negative. This has been termed the "dual mode model theory" (25). Thus in keeping with previous research, for our study we used a moderate level intensity for all participants, approximately 50 percent of their HRR during exercise.

The fact that TV viewing appears to have a positive impact on exercise enjoyment has important implications for changing exercise behavior. Music has previously been shown to increase enjoyment of exercise (50, 51). However, people often listen to music while doing other activities, and is not typically a stand-alone sedentary activity. In other words, individuals are less likely to listen to music and do nothing else, the way that they often do with TV viewing. In addition, TV viewing (approximately 2.8 hours per day) consumes half of our leisure time (approximately 5.6 hours per day). Although studies have attempted to reduce screen time (79) an alternative approach would be to repurpose screen time (62, 90). If TV viewing can be changed from a sedentary behavior to an active behavior, this would allow people to accomplish two things at once, thus removing a major barrier to physical activity (i.e. - lack of time). Furthermore, if people watch TV programs they prefer, it serves as an enjoyable distraction that increases enjoyment of exercise and positive affect (77).

Strengths and Limitations

The current study has both strengths and limitations. A major strength of our study was the study design and the use of an identical exercise protocol for each condition as well as the same research assistant collecting all data. Additionally, we allowed participants to self-select one of their favorite 30-minute TV programs. We also used a neutral TV program to reduce any potential

gender, racial, or religious biases. The use of these two TV conditions along with a "no TV" control condition, allowed us to examine the effects to TV viewing on enjoyment, compared to a no TV condition. We examined adults 30-60 years of age, so the results are more generalizable to a broader segment of the US population than previous studies. Additionally we used a more frequently prescribed activity (walking), and standardized the relative intensity of the bout. Intensity also plays a role in psychological responses during exercise.

A limitation of our study was that both the self-selected and standardized TV programs included some music. TV programs contain different components (e.g. music, dialogue, laugh track, and video.) We did not separate out these various components and thus we could not determine what effect, if any, each one would have on overall enjoyment separately. Nevertheless, ecological validity is important and TV typically infuses imagery, dialogue, and music; thus, there is value in a study design that translates to real world settings.

Our study limited the types of programs participants could watch. The protocol specified 30 minutes of exercise, and thus participants were instructed to choose their favorite half-hour TV shows. As a result, this eliminated any 1-hour shows and resulted in mainly sitcoms being selected (Figure 1). Thus, we did not determine whether selection of drama or action TV would have elicited different results.

Conclusions

This study found that TV viewing, regardless of whether the programming is self-selected or standardized, resulted in greater enjoyment of exercise. This may have occurred because TV viewing caused the participants to focus their attention more on the TV program, and less on the

physiological demands of the exercise bout itself. Given the popularity of TV viewing and low levels of PA in US adults, active TV viewing may be one approach to increasing PA. Many commercial fitness centers are already placing exercise equipment placed in front of TVs, and people are also doing this in their homes (112), despite limited evidence on the effects of this strategy on the psycho-physiological response to exercise. Future studies should be conducted to examine whether television viewing can improve adherence to exercise programs.

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APPENDICES

APPENDIX A

Tables and Figures

Table 1.Participant Characteristics

Variable	n=28 (82% female)
Age (y)	47.4 ± 7.6
Weight (kg)	84.5 ± 17.8
Height (cm)	168.3 ± 7.7
BMI (kg/m^2)	30 ± 5.3
Racial Group (%)	
White	89
Black	7
Other	0
Refuse	4
Hours Worked per Week (%)	
1 to 15	4
16 to 30	14
31 to 40	39
41 to 50	29
50 plus	11
Hours Spent Watching TV per Week (%)	
Less than 10	46
10 to 20	21
21 to 30	18
31 to 40	11
Over 41	4

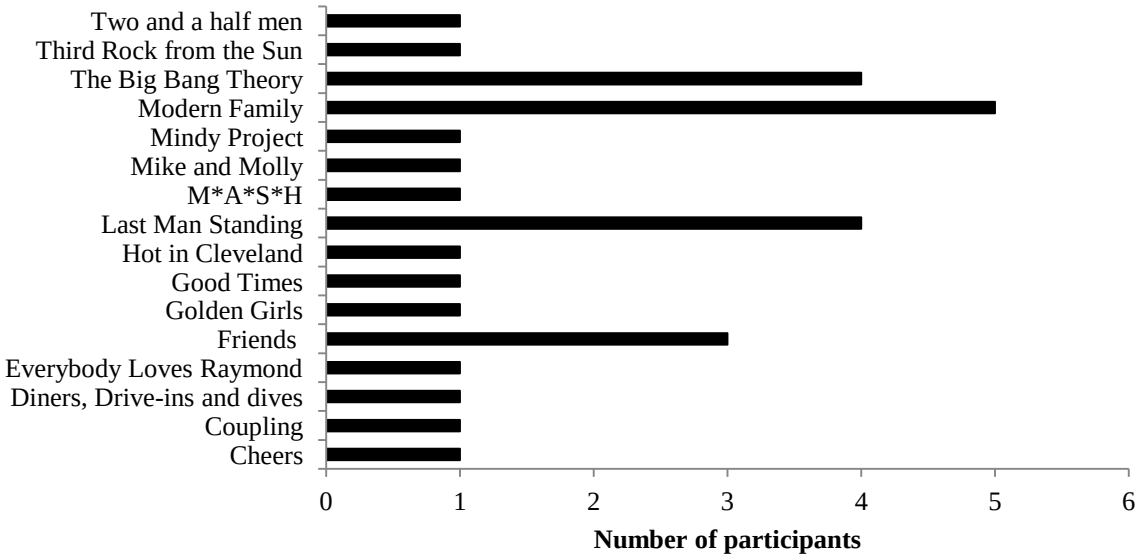


Figure 1.List of programs chosen by participants and number of participants who chose each program

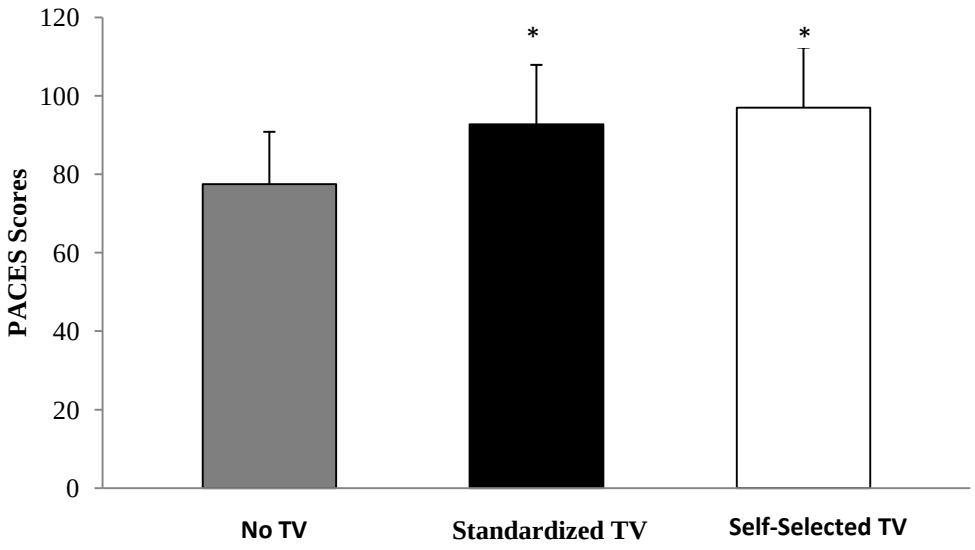
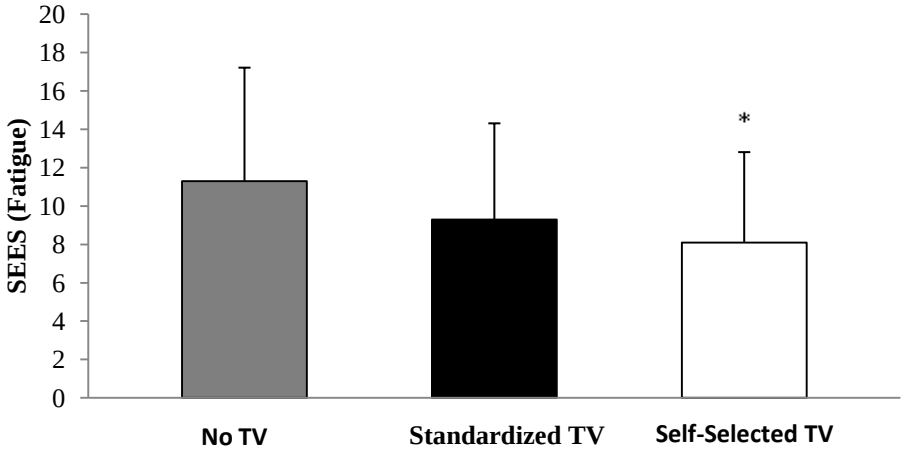


Figure 2. Average ratings for enjoyment of exercise from PACES following the no-TV, standardized TV, and self-selected TV conditions. *Significantly greater than the no-TV condition ($p < 0.05$)

Figure 3. Average ratings for subjective exercise experience from SEES for A) Fatigue, B) Well being, and C) Distress following the non-TV viewing (No TV), standardized TV viewing, and self-selected TV conditions. *Significantly different from the No TV condition ($p < 0.05$)

A)



B)

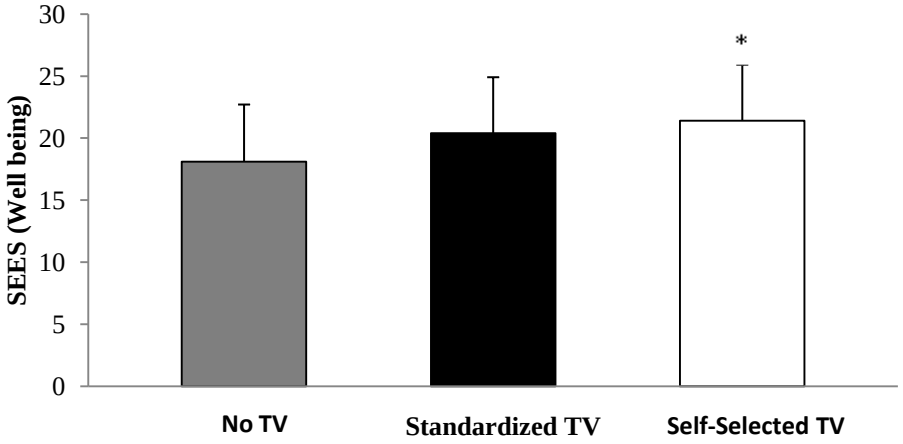


Figure 3 continued

C)

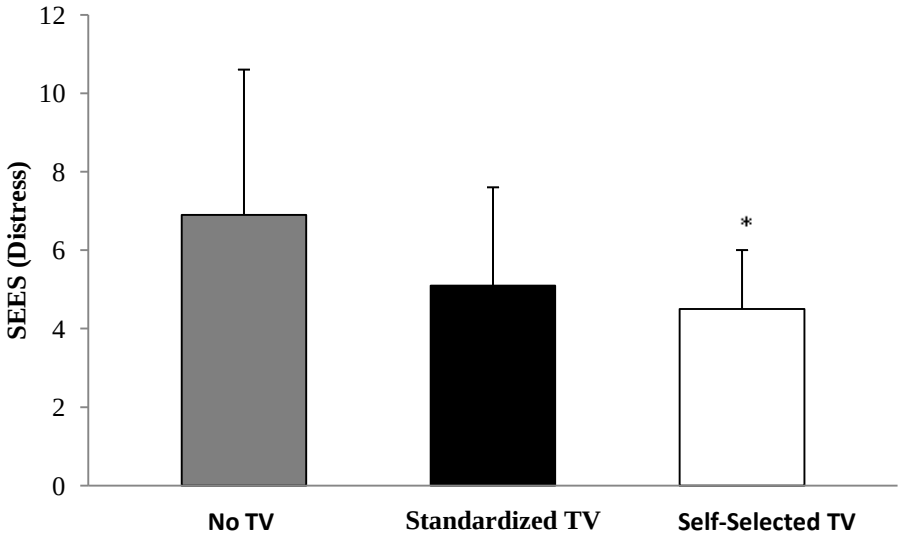
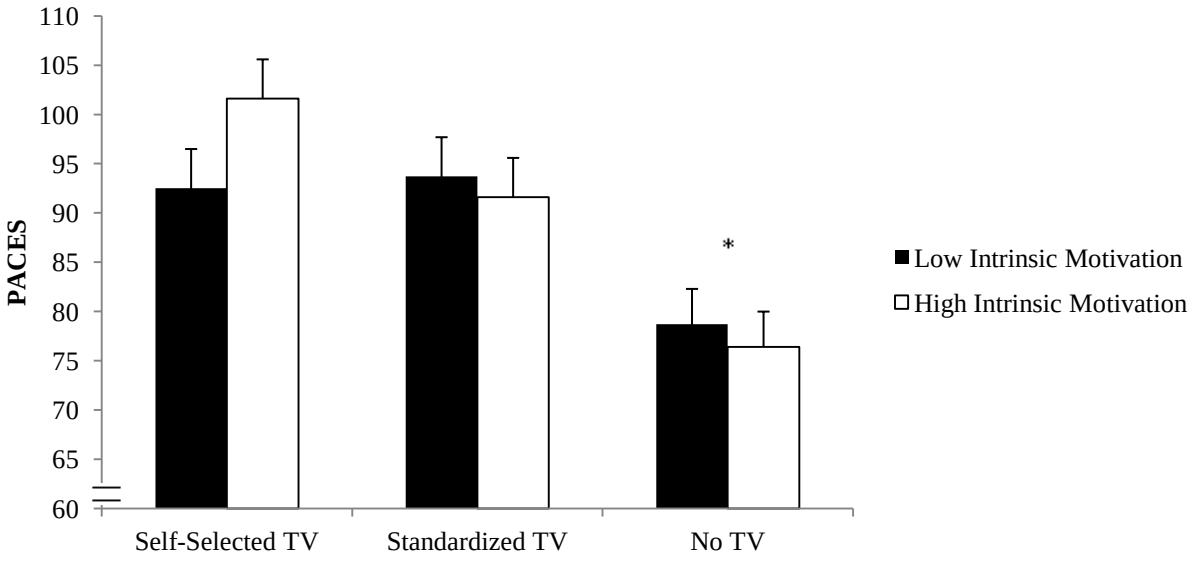


Figure 3 continued

Figure 4.

Interaction between Motivation Types (Lo vs. High) and three TV viewing conditions (self-selected TV, standardized TV and no-TV) on physical activity enjoyment scale, or PACES (mean $\pm$ SE). *Significantly different than the TV conditions ($p < 0.05$)

A.


110
105
100
95
90
85
80
75
70
65
60
PACES
*
Low Intrinsic Motivation
High Intrinsic Motivation
Self-Selected TV
Standardized TV
No TV

B.

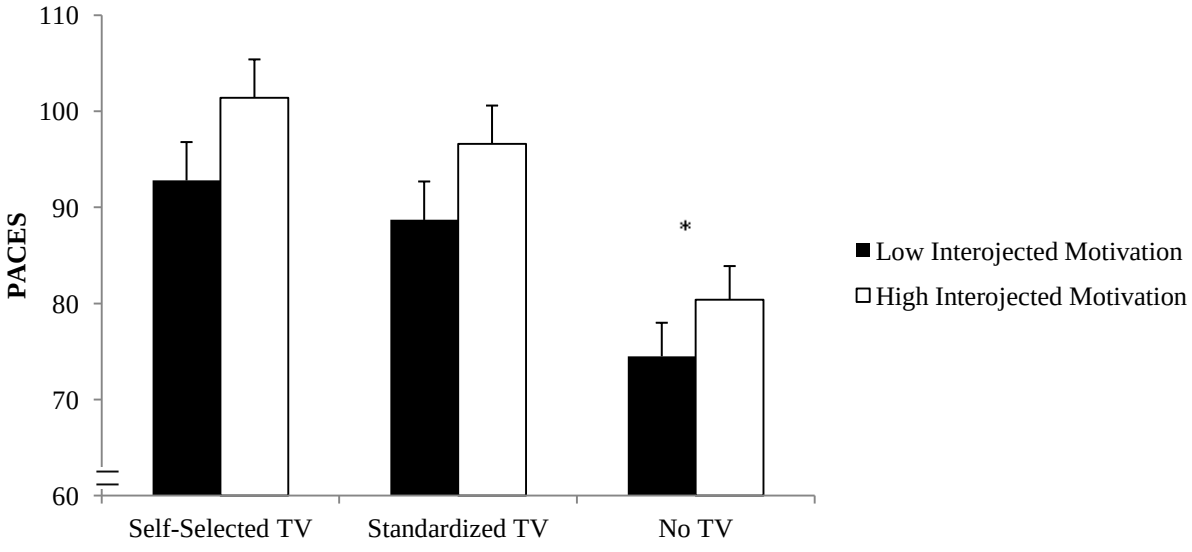
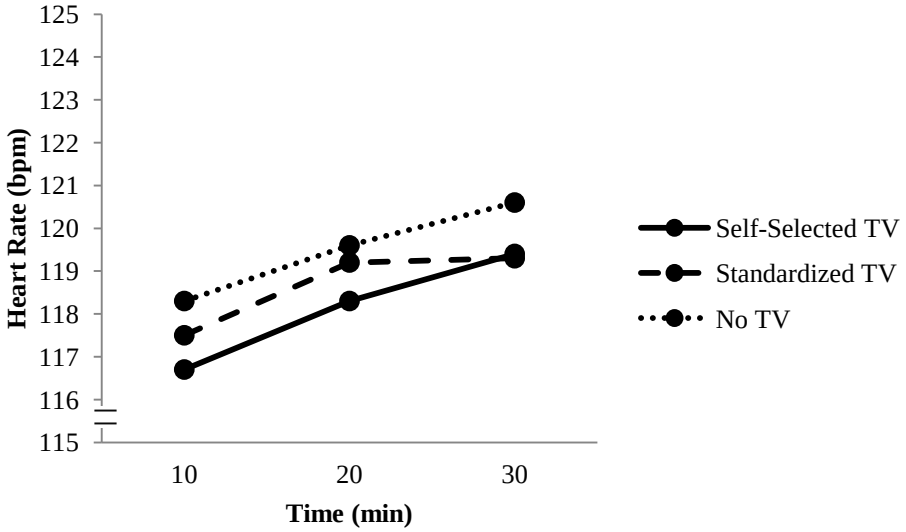

110
100
90
80
70
60
PACES
*
Low Interojected Motivation
High Interojected Motivation
Self-Selected TV
Standardized TV
No TV

Figure 5.Average (± standard error) A) heart rate (HR), B) rating of perceived exertion (RPE), C) affect (FS) and D) felt arousal scale (FAS) measurements at 10, 20 and 30 minutes of exercise for self-selected TV viewing, standardized TV viewing, and no-TV viewing conditions.

A.



B.

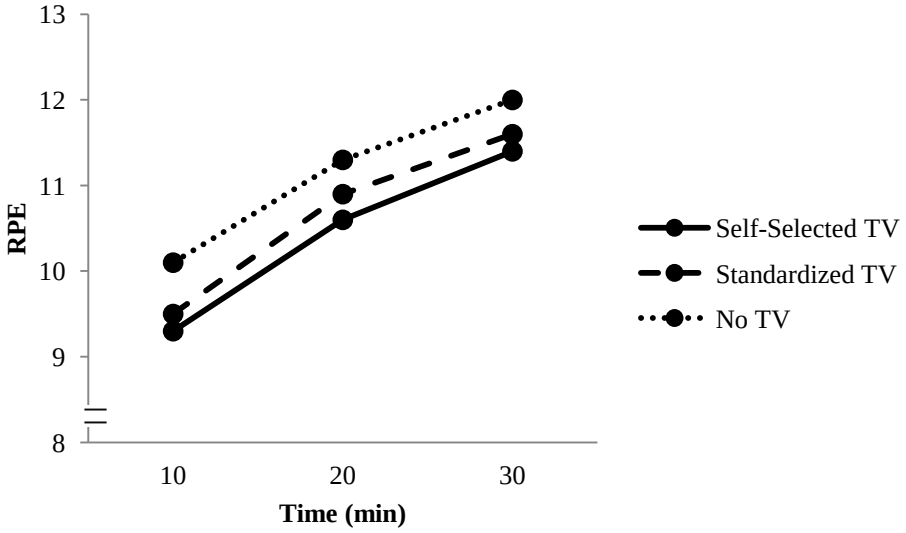
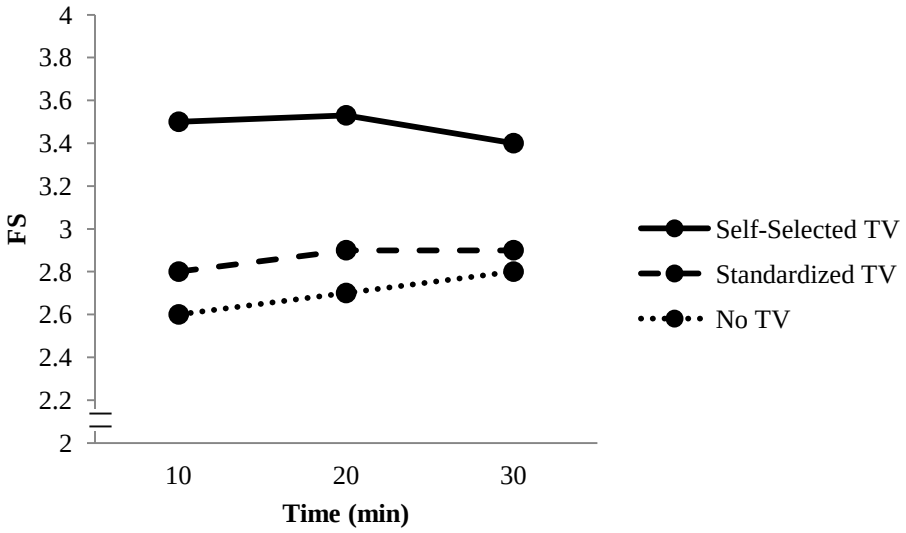


Figure 5 continued

C.



D.

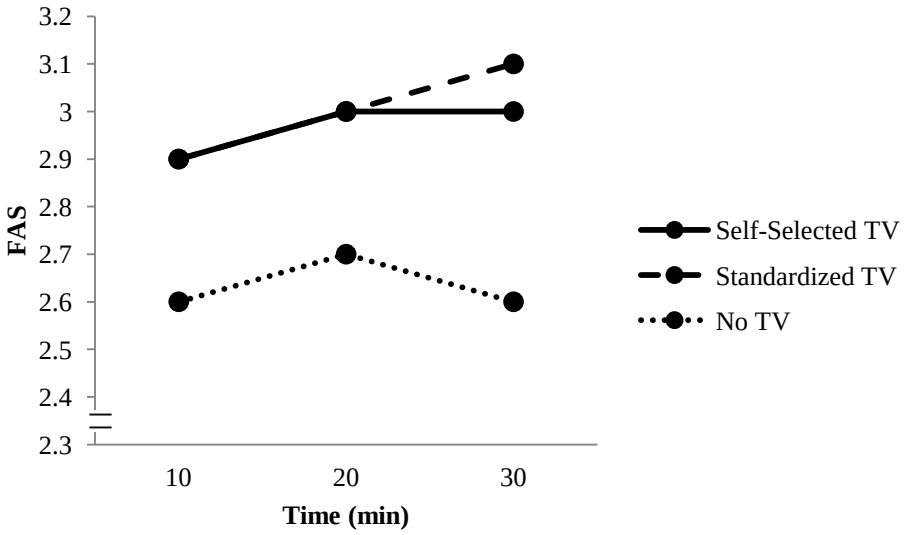
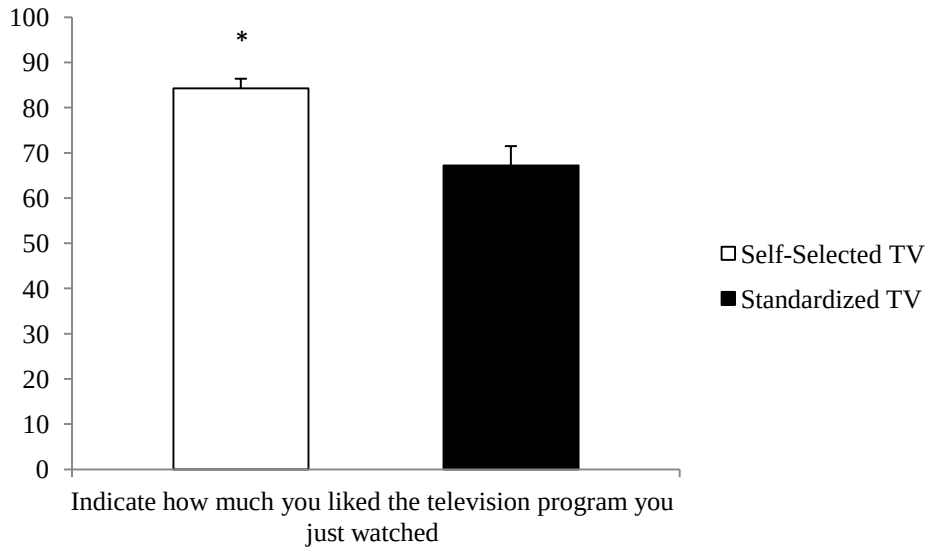


Figure 5 continued

Figure 6. Average (± standard error) response scores on VAS statements. A) *Significantly greater than the Standardized TV condition ($p < 0.05$) C) *Significantly greater than the two TV conditions ($p < 0.05$)

A.



B.

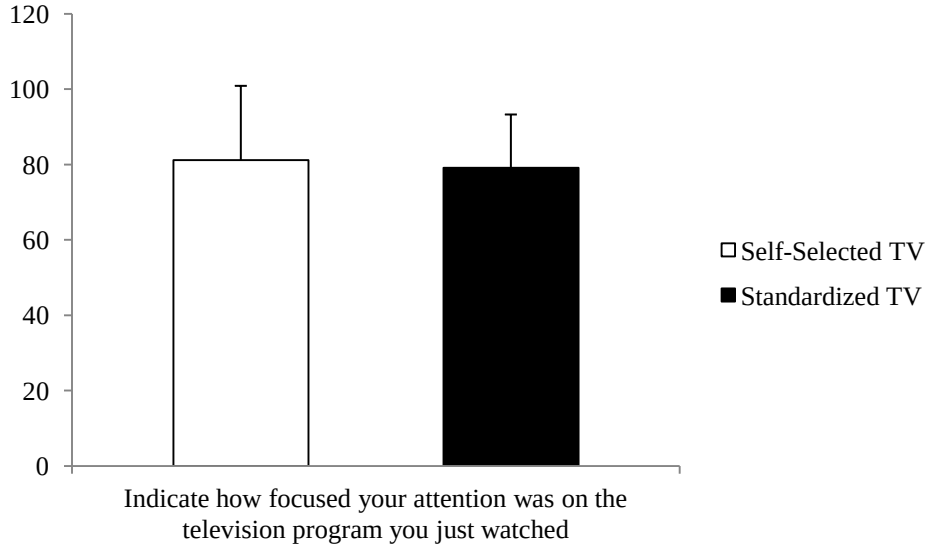


Figure 6 continued

C.

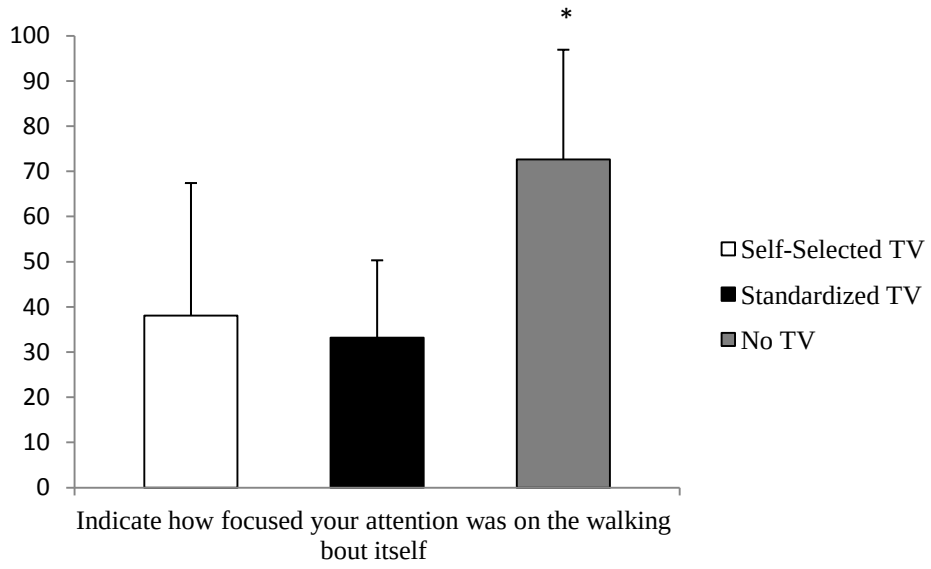


Figure 6 continued

APPENDIX B

Informed Consent- The University of Tennessee

Informed Consent Statement

Title of Research: Psycho-physiological **Effects of Self-Selected Television Viewing During Exercise**

Principal Investigator: Brian C. Rider, M.S., CSCS

Location: Applied Physiology Laboratory, 1914 Andy Holt Ave., University of Tennessee, Knoxville, TN

PURPOSE

You have been invited to participate in this research study. The purpose of the study is to determine the psychological and physiological effects of television viewing during 30 min of moderate exercise on a treadmill.

PARTICIPANT'S INVOLVEMENT IN THIS STUDY

Fifty people will participate in this study. You will make four visits to the Applied Physiology Laboratory. During your first visit, your height and weight will be measured and you will receive this informed consent form. We will give you an opportunity to ask questions about anything that is unclear. If you choose to participate, you will be asked to fill out and sign a physical activity readiness questionnaire to gauge whether or not it is safe for you to participate. We will measure your resting blood pressure, heart rate, and body composition. You will then be asked to complete three surveys on perceived stress, exercise regulations, and your preference and tolerance for intensity of exercise. During this session you will also complete a sub-maximal exercise test on the treadmill. The speed of the treadmill will begin at 2.0mph and increase by 0.5 mph every three min. Heart rate and ratings of perceived exertion will be recorded every minute throughout the duration of the exercise test. The exercise test will continue until you reach 85% of your age-predicted maximal heart rate, or until you experience any other signs, symptoms, or responses that indicate termination of the exercise test. During the second, third, and fourth visits, you will complete a 30-minute exercise session on the treadmill. One session will require you to exercise while watching the first 30-min of the British Broadcasting Company's Discovery Channel program *Life* (Disc One, 2010*)*. Another session will require you to complete the 30-minute exercise session while watching a program you have self selected. Another session will require you to complete the 30-minute exercise session without any television programs or other entertainment stimulus. These meetings will be conducted in the Health, Physical Education, and Recreation (HPER) (room 317) building by Brian Rider (doctoral student in Kinesiology). The order of exercise sessions will be randomly assigned.

Prior to each exercise session you will be asked to complete a survey on initial exercise satisfaction and positive and negative feelings. You will be outfitted with a heart rate monitor and your heart rate will be monitored throughout the test. Following each exercise session, you will then be asked to complete three questionnaires to determine your feelings towards that particular exercise bout. During each exercise bout you will be asked to report your rating of perceived exertion, overall feeling and overall feeling of arousal at min 5, 10, 15, 20, 25 and 30.

RISKS

During any type of exercise, there are health risks including abnormal blood pressure responses, fainting, muscle or skeletal injuries, and heart attack, but the risk of these things happening is remote. Specific to maximal exercise testing, the risk of a cardiac event occurring is low (6/10,000 test). In order to reduce the risks, you will complete a screening tool (PAR-Q) to determine if it is unsafe for you to participate in this study. In addition, in the unlikely event of an injury, the lead investigator is certified in cardiopulmonary resuscitation (CPR) will be available to assist the you. Also, there is an automated external defibrillator (AED) in the lab approximately 50 feet from where you will be. .

BENEFITS

Benefits to Society: We will gain a better understanding of the effect of television viewing during exercise on psychological and physiological variables.

Benefits to You: You will gain information about your cardiorespiratory fitness and attitudes regarding exercise under different television viewing conditions. Following your final exercise session, you will receive a health assessment that will include your resting blood pressure, heart rate, and body composition as well as a brief exercise consultation with the lead investigator. There will be no additional benefits for you, financial or otherwise for participating.

CONFIDENTIALITY

Information and records included in this study will be kept confidential. Data will be stored in a locked file cabinets or password protected computers in the HPER (room 317). Data will only be made available to the people conducting the study, unless you specifically give permission in writing to do otherwise. The results of the study will be published, but no reference will be made in oral or written reports that could link participants to the study. Your data will be destroyed 3 years following the completion of the study.

EMERGENCY MEDICAL TREATMENT

The University of Tennessee does not automatically reimburse subjects for medical claims or other compensation. If physical injury is suffered in the course of research, or for more information, please notify the investigator in charge (Brian C. Rider) or his faculty advisor (David R. Bassett) at (865) 974-8766.

CONTACT INFORMATION

If you have questions at any time about the study or the procedures (or you experience adverse effects as a result of participating in this study), you should immediately contact, Brian Rider or Dr. David Bassett, 325 HPER Building, The University of Tennessee, Knoxville, TN 37996, (865) 974-8766. If you have questions concerning your rights as a participant, contact the Compliance Section of the Office of Research at (865) 974-3466.

PARTICIPATION

Your participation in this study is voluntary; you may decline to participate without penalty. If you decide to participate, you may withdraw from the study at any time without penalty and without loss of benefits to which you are otherwise entitled. If you withdraw from the study before data collection is completed your data will be returned to you or destroyed.

STATEMENT OF CONSENT

"I have read the above information. I have received a copy of this form. I agree to participate in this study."

_____

Participant's name

_____ _____

Participant's signature Date

_____ _____

Investigator's signature Date

APPENDIX C

Cohen Perceived Stress Survey (CPSS)

Participant ID_____ Session_____ Date_____

Cohen Perceived Stress

The following questions ask about your feelings and thoughts during THE PAST MONTH. In each question, you will be asked HOW OFTEN you felt or thought a certain way. Although some of the questions are similar, there are small differences between them and you should treat each one as a separate question. The best approach is to answer fairly quickly. That is, don't try to count up the exact number of times you felt a particular way, but tell me the answer that in general seems the best.

For each statement, please tell me if you have had these thoughts or feelings: never, almost never, sometimes, fairly often, or very often. (Read all answer choices each time)

	Never	**Almost Never**	**Sometimes**	**Fairly Often**	**Very Often**
1. In the past month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2. In the past month, how often have you felt unable to control the important things in your life?	0	1	2	3	4
3. In the past month, how often have you felt nervous or stressed?	0	1	2	3	4
4. In the past month, how often have you felt confident about your ability	0	1	2	3	4

to handle personal problems?					
5. In the past month, how often have you felt that things were going your way?	0	1	2	3	4
6. In the past month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
7. In the past month, how often have you been able to control irritations in your life?	0	1	2	3	4
8. In the past month, how often have you felt that you were on top of things?	0	1	2	3	4
9. In the past month, how often have you been angry because of things that happened that were outside of your control?	0	1	2	3	4
10. In the past month, how often have you felt that difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

APPENDIX D

BREQ-2

Participant ID_____ Session_____ Date_____

Exercise Regulations

WHY DO YOU ENGAGE IN EXERCISE?

We are interested in the reasons underlying peoples' decisions to engage, or not engage in physical exercise. Using the scale below, please indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about exercise. Your responses will be held in confidence and only used for our research purposes.

	Not true for me				Very true for me
1. I exercise because other people say I should	0	1	2	3	4
2. I feel guilty when I don't exercise	0	1	2	3	4
3. I value the benefits of exercise	0	1	2	3	4
4. I exercise because it's fun	0	1	2	3	4
5. I don't see why I should have to exercise	0	1	2	3	4
6. I take part in exercise because my friends/family/partner say I should	0	1	2	3	4

7. I feel ashamed when I miss an exercise session	0	1	2	3	4
8. It's important for me to exercise regularly	0	1	2	3	4
9. I can't see why I should bother exercising	0	1	2	3	4
10. I enjoy my exercise sessions	0	1	2	3	4
11. I exercise because others will not be pleased with me if I don't	0	1	2	3	4
12. I don't see the point in exercising	0	1	2	3	4
13. I feel like a failure when I haven't exercised in a while	0	1	2	3	4
14. I think it is important to make the effort to exercise regularly	0	1	2	3	4
15. I find exercise a pleasurable activity	0	1	2	3	4
16. I feel under pressure from my friends/family to exercise	0	1	2	3	4
17. I get restless if I don't exercise	0	1	2	3	4
18. I get pleasure and satisfaction from participating in exercise	0	1	2	3	4
19. I think exercise is a waste of time	0	1	2	3	4

APPENDIX E

PRETIE-Q

Participant ID_____ Session_____ Date_____

Preference and Tolerance for Intensity of Exercise

Instructions: Please, read each of the following statements and then use the response scale below to indicate whether you agree or disagree with it. There are no right or wrong answers. Work quickly and mark the answer that best describes what you believe and how you feel. Make sure that you respond to all the questions.

	Totally Disagree	Disagree	Neutral	Agree	Totally Agree
1. Feeling tired during exercise is my signal to slow down or stop	1	2	3	4	5
2. I would rather work out at low intensity levels for a long duration than at high-intensity levels for a short duration	1	2	3	4	5
3. During exercise, if my muscles begin to burn excessively or if I find myself breathing very hard, it is time for me to ease off	1	2	3	4	5
4. I'd rather go slow during my workout, even if that means taking more time	1	2	3	4	5
5. While exercising, I try to keep going even after I feel exhausted.	1	2	3	4	5
6. I would rather have a short, intense work out than a long, low –intensity workout	1	2	3	4	5
7. I block out the feeling of fatigue when exercising	1	2	3	4	5

8. When I exercise, I usually prefer a slow steady pace	1	2	3	4	5
9. I'd rather slow down or stop when a workout starts to get too tough	1	2	3	4	5
10. Exercising at low intensity does not appeal to me at all	1	2	3	4	5
11. Fatigue is the last thing that affects when I a workout; I have a goal and stop only when I reach it	1	2	3	4	5
12. While exercising, I prefer activities that are slow-paced and do not require much exertion	1	2	3	4	5
13. When my muscles start burning during exercise, I usually ease off some	1	2	3	4	5
14. The faster and harder the workout, the more pleasant I feel	1	2	3	4	5
15. I always push through muscle soreness and fatigue when working out	1	2	3	4	5
16. Low-intensity exercise is boring	1	2	3	4	5

APPENDIX F

PANAS Questionnaire

Participant ID_____ Session_____ Date_____

The Positive and Negative Affect Schedule (PANAS Questionnaire)

This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word. Indicate to what extent you feel this way right now, that is, at the present moment (circle the instructions you followed when taking this measure)

1	2	3	4	5
Very Slightly or Not at all	A Little	Moderately	Quite a Bit	Extremely

_____ 1. Interested

_____ 2. Distressed

_____ 3. Excited

_____ 4. Upset

_____ 5. Strong

_____ 6. Guilty

_____ 7. Scared

_____ 8. Hostile

_____ 9. Enthusiastic

_____ 10. Proud

_____ 11. Irritable

_____ 12. Alert

_____ 13. Ashamed

_____ 14. Inspired

_____ 15. Nervous

_____16. Determined

_____ 17. Attentive

_____ 18. Jittery

_____ 19. Active

_____ 20. Afraid

APPENDIX G

Rating of Perceived Exertion Scale (RPE)

Borg's Rating Of Perceived Exertion Scale

6	NO EXERTION AT ALL
7	
	EXTREMELY LIGHT
8	
9	VERY LIGHT
10	
11	LIGHT
12	
13	SOMEWHAT HARD
14	
15	HARD (HEAVY)
16	
17	VERY HARD

18

19 EXTREMELY HARD

20 MAXIMAL EXERTION

Instructions for Scale:

While doing physical activity, we want you to rate your perception of exertion. This feeling should reflect how heavy and strenuous the exercise feels to you, combining all sensations and feelings of physical stress, effort, and fatigue. Do not concern yourself with any one factor such as leg pain or shortness of breath, but try to focus on your total feeling of exertion.

Look at the rating scale below while you are engaging in an activity; it ranges from 6 to 20, where 6 means "no exertion at all" and 20 means "maximal exertion." Choose the number from below that best describes your level of exertion. This will give you a good idea of the intensity level of your activity, and you can use this information to speed up or slow down your movements to reach your desired range.

Try to appraise your feeling of exertion as honestly as possible, without thinking about what the actual physical load is. Your own feeling of effort and exertion is important, not how it compares to other people's. Look at the scales and the expressions and then give a number.

APPENDIX H

Feeling Scale (FS)

FEELING SCALE

+5	Very Good
+4	
+3	Good
+2	
+1	Fairly Good
0	Neutral
-1	Fairly Bad
-2	
-3	Bad
-4	
-5	Very Bad

Verbal instructions:

While participating in exercise, it is common to experience changes in mood. Some individuals find exercise pleasurable, whereas others find it to be unpleasant. Additionally, feeling may fluctuate across time. That is, one might feel good and bad a number of times during exercise. Scientists develop this scale to measure such responses.

APPENDIX I

Felt Arousal Scale (FAS)

FELT AROUSAL SCALE

1	Low Arousal
2	
3	
4	
5	
6	High Arousal

Verbal instructions:

Estimate here how aroused you actually feel. Do this by circling the appropriate number. By "arousal" we meant how "worked-up" you feel. You might experience high arousal in one of a variety of ways, for example as excitement or anxiety or anger. Low arousal might also be experienced by you in one of a number of different ways, for example as relaxation or boredom or calmness.

APPENDIX J

Physical Activity Enjoyment Scale (PACES)

Participant ID_____ Session_____ Date_____

Physical Activity Enjoyment Scale

Please rate how you feel about exercise (physical activity).

I enjoyed it I hated it

1 2 3 4 5 6 7

I felt bored I felt interested

1 2 3 4 5 6 7

I disliked it I liked it

1 2 3 4 5 6 7

I found it pleasurable I found it un-pleasurable

1 2 3 4 5 6 7

I was very absorbed with exercise I was not at all absorbed with exercise

1 2 3 4 5 6 7

It was no fun at all It was a lot of fun

1 2 3 4 5 6 7

I found it energizing It found it tiring

1 2 3 4 5 6 7

It made me depressed It made me happy

1 2 3 4 5 6 7

It was very pleasant It was very unpleasant

1 2 3 4 5 6 7

I felt good physically I felt bad physically

while doing it while doing it

1 2 3 4 5 6 7

It was very invigorating It was not at all invigorating

1 2 3 4 5 6 7

I was very frustrated by it I was not at all frustrated by it

1 2 3 4 5 6 7

It was very gratifying It was not at all gratifying

1 2 3 4 5 6 7

It was very exhilarating It was not at all exhilarating

1 2 3 4 5 6 7

It was not at all stimulating It was very stimulating

1 2 3 4 5 6 7

It gave me a strong It did not give me a strong

sense of accomplishment sense of accomplishment

1 2 3 4 5 6 7

It was very refreshing It was not at all refreshing

1 2 3 4 5 6 7

I felt as though I would rather be doing else I felt as though there was something nothing I would rather be doing

1 2 3 4 5 6 7

APPENDIX K

Subjective Exercise Experience Scale (SEES)

Participant ID_____ Session_____ Date_____

Subjective Exercise Experience

By circling a number on the scale below each of the following items, please indicate the degree to which you are experiencing each feeling <u>now</u>, at this point in time, <u>after exercising</u>.

I FEEL:

Great 1 Not at all	2	3	4 Moderately	5	6	7 Very much so
Awful 1 Not at all	2	3	4 Moderately	5	6	7 Very much so
Drained 1 Not at all	2	3	4 Moderately	5	6	7 Very much so
Positive 1 Not at all	2	3	4 Moderately	5	6	7 Very much so
Crummy						

1 Not at all	2	3	4 Moderately	5	6	7 Very much so
Exhausted 1 Not at all	2	3	4 Moderately	5	6	7 Very much so
Strong 1 Not at all	2	3	4 Moderately	5	6	7 Very much so
Discouraged 1 Not at all	2	3	4 Moderately	5	6	7 Very much so
Fatigued 1 Not at all	2	3	4 Moderately	5	6	7 Very much so
Terrific 1 Not at all	2	3	4 Moderately	5	6	7 Very much so
Miserable 1 Not at all	2	3	4 Moderately	5	6	7 Very much

						so
Tired 1 Not at all	2	3	4 Moderately	5	6	7 Very much so

APPENDIX L

Visual Analogue Scales (VAS)

Participant ID_____ Session_____ Date_____

Visual Analogue Scale

During the 30 minute walking session you just completed:

1. Indicate how much you liked the television program you just watched by drawing a vertical mark (I) on the line below.

_____

Not at all **Extremely**

2 Indicate how focused your attention was on the television program you just watched, by drawing a vertical mark (I) on the line below.

_____

Not at all **Extremely**

3. Indicate how focused your attention was on the walking bout itself by drawing a vertical mark (I) on the line below.

_____

Not at all **Extremely**

APPENDIX M

Health Assessment Report

Health Assessment

Name:_____

Heart Rate: _____

Blood Pressure: _____

Estimated Vo2max:_____

Body Fat Percentage: _____

Body Mass Index:_____

APPENDIX N

Recruitment Flyer

Research Participants Needed

For Television Watching and Exercise Study!

The Applied Physiology Lab at The University of Tennessee is conducting a study of the effects of television watching during exercise.

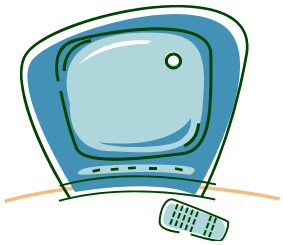
Qualifications

- Between the ages of 30 and 60
- Able to read and speak English
- Able to walk on a treadmill comfortably for 30 min
- Not currently exercising on 5 or more days a week for at least 30 min each session

If you meet the criteria, you will be eligible to participate in a physical activity study that will measure your heart rate and feelings towards exercise during an exercise and following an exercise bout.

For participation you will receive a **free health screening** that includes blood pressure, heart rate, body composition, and fitness assessment.

Please contact Brian Rider at brider1@vols.utk.edu for more details.



APPENDIX O

Recruitment Email

Dear Faculty/Staff,

The purpose of this letter is to invite you to participate in a research study entitled: The Psycho-physiological Effects of Self-Selected Television Viewing During Exercise. This study will be open to 30-60 year olds who meet certain criteria. Participants must not currently be exercising regularly. Participants also must be able to read and speak English, as well as walk on a treadmill comfortably for 30 min. As an incentive to participant in this study, each participant will be provided with a free health assessment that will include resting heart rate, blood pressure, body composition, and aerobic fitness measurements, as well as a brief exercise consultation with a certified strength and conditioning specialist. This study is being conducted by Brian Rider, M.S. CSCS and David R. Bassett Jr., Ph.D. exercise physiologists from the Department of Kinesiology, Recreation and Sport Studies at the University of Tennessee.

The study will involve 50 individuals, and is being done to assess the effect television viewing has on physiological variables during exercise. Participants will be required to come to the Health and Physical Education and Recreation building (HPER) for 4 individual meetings with investigators. Each visit will last approximately 40 min.

Please contact Brian Rider if you are interested in participating in the study.

Sincerely,

Brian C. Rider, M.S., CSCS

Brider1@vols.utk.edu

APPENDIX P

Physical Activity Readiness Questionnaire (PAR-Q)

Physical Activity Readiness Questionnaire (PAR-Q) and You

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active. If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor. Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly:

Check YES or NO:

YES	NO		
☐	☐	1.	**Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?**
☐	☐	2.	**Do you feel pain in your chest when you do physical activity?**
☐	☐	3.	**In the past month, have you had chest pain when you were not doing physical activity?**
☐	☐	4.	**Do you lose your balance because of dizziness or do you ever lose consciousness?**
☐	☐	5.	**Do you have a bone or joint problem (for example, back, knee or hip) that could be made worse by a change in your physical activity?**
☐	☐	6.	**Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?**
☐	☐	7.	**Do you know of any other reason why you should not do physical activity?**

If you answered

YES to one or more questions

Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.

- You may be able to do any activity you want — as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful for you.

NO to all questions

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:

- start becoming much more physically active – begin slowly and build up gradually. This is the safest and easiest way to go.
- take part in a fitness appraisal – this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively. It is also highly recommended that you have your blood pressure evaluated. If your reading is over 144/94, talk with your doctor before you start becoming much more physically active.

DELAY BECOMING MUCH MORE ACTIVE:

- if you are not feeling well because of a temporary illness such as a cold or a fever – wait until you feel better; or
- if you are or may be pregnant – talk to your doctor before you start becoming more active.

PLEASE NOTE: If your health changes so that you then answer YES to any of the above questions, tell your fitness or health professional. Ask whether you should change your physical activity plan.

NOTE: If the PAR-Q is being given to a person before he or she participates in a physical activity program or a fitness appraisal, this section may be used for legal or administrative purposes.

"I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction."

NAME _____

SIGNATURE _____ DATE _____

SIGNATURE OF PARENT or GUARDIAN (for participants under the age of majority) _____ WITNESS _____

Note: This physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if your condition changes so that you would answer YES to any of the seven questions.

APPENDIX Q

Demographic Information Questionnaire

Participant ID_____ Session_____ Date_____

Demographic Information

Please answer the following questions.

1) What is your date of birth? _____

2) What is the highest grade you have completed in school?
   (1) less than high school graduate (write in year 7-12) _____
   (2) high school graduate
   (3) some college
   (4) college graduate
   (5) post-graduate work

3) a) Which of the following do you consider to be your racial group?
   (1) American Indian/Alaskan Native
   (2) Asian
   (3) Native Hawaiian or Other Pacific Islander
   (4) Black or African American
   (5) White
   (6) Other (describe)_____
   (7) Combination (describe):_____ _____
   (88) Don't know/refuse

4) Which of the following do you consider to be your ethnic group?
   (1) Hispanic or Latino
   (2) Not Hispanic or Latino

5) Are you employed?

(0) No (If no, please skip to item 10.)

(1) Yes

7) Which of the following best describes your job?

(1) Professional, administrator, or executive (i.e., Government official, manager, purchasing agent, marketing rep., doctor, nurse, lawyer, teacher)

(2) Clerical work, administrative support, sales, or technician (i.e., Office worker, data processing occupation, sales clerk or supervisor, lab tech, LPN, legal asst.)

(3) Crafts, trade, factory work, service, or labor (i.e., carpenter, electrician, machine operator, machinist, foreman, police officer, restaurant worker, barber)

(4) Other (Please describe): _____

8) How many hours per week (on average) do you spend at your job?

(1) 1-15 hours

(2) 16-30 hours

(3) 31-40 hours

(4) 41-50 hours

(5) 51 or more hours

9) How stressful do you consider your job to be?

(1) Not at all stressful

(2) Somewhat stressful

(3) Stressful

(4) Very Stressful

(5) Extremely Stressful

10) On average, how many hours of television programming do you watch per week? This includes watching television programs on your computer, through services such as Netflix.

(1) Less than 10 hours a week

(2) Between 10 and 20 hours a week

(3) Between 21 and 30 hours a week

(4) Between 31 and 41 hours per week

(5) Greater than 41 hours per week

APPENDIX R

Contact Information Form

Exercise Workloads - Participant Contact Information

TODAY'S DATE: _____/_____/_____

NAME (print): _____

PHONE NUMBER 1: ____(_____) - _____ - _____ (Home, Work, Cell - - please circle one)

Can we leave a message on your answering machine/voice mail? **YES / NO / N/A** please circle one

Can we leave a message with a person? **YES / NO / N/A** please circle one

EMAIL ADDRESS 1: _____

What is the best way to reach you?

- ☐ Phone
- ☐ Email
- ☐ Either

In the unlikely event that we are unable to get in touch with you directly, please list a contact (friend or family member who will be able to help us reach you.

Name: _____
Relationship: _____

Address: _____ Phone: (__) - ____ - _____

SIGNATURE:_____ DATE: _____/_____/_____

VITA

Brian Carl Rider was born in Kansas City, MO on March 1, 1985. He was raised in Troy, MI where he graduated from Troy Athens High School. In 2007, he earned his Bachelor of Arts in Exercise Science and Spanish from Adrian College. In 2011 he completed his Masters of Science degree in Exercise Science from Oakland University. Following the completion of his Masters degree, he worked as an adjunct instructor at Adrian College and Macomb Community college. He taught courses in health and wellness, weight training, and nutrition. He also worked as a certified strength and conditioning specialist at Athens High School and served as the assistant Girls Track Coach. In 2012 he moved to Knoxville Tennessee to begin his doctoral work at the University of Tennessee in the Department of Kinesiology, Recreation, and Sport Studies. He completed his Doctor of Philosophy degree in Kinesiology and Sports Studies in August 2015. After completing his PhD, he assumed a faculty position in the Department of Kinesiology at Hope College in Holland MI.