8-2016

Effects of Television Viewing On Psycho-Physiological And Behavioral Outcomes

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To the Graduate Council:

I am submitting herewith a dissertation written by Brittany Star Overstreet entitled "Effects of Television Viewing On Psycho-Physiological And Behavioral Outcomes." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Kinesiology and Sport Studies.

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Effects of Television Viewing On Psycho-Physiological And Behavioral Outcomes

A Dissertation Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville

Brittany Star Overstreet

August 2016

DEDICATION

This dissertation is dedicated to my family who has been by my side throughout this journey. In particular, to my husband Matt whose unwavering faith and support kept me pushing forward. Also, to my mom, dad, brothers and new extended family, this wouldn't have been possible without your continuous love. Thank you all for being understanding and encouraging of my dreams.

ACKNOWLEDGEMENT

Throughout my academic career I have been fortunate enough to be surrounded by some of the most intelligent professionals in the field of exercise physiology. I would like to thank all of my lab mates and friends for the motivation to pursue this degree. I also wish to thank my committee members Drs. David Bassett, Jr., Kelley Strohacker, Scott Crouter and Debora Baldwin for your dedication to this project and my professional development. Thank you for sharing your knowledge, your skills, and your time, and for always challenging me to be my best.

ABSTRACT

Purpose: To determine the effects of television viewing during exercise on 1) preference for exercise and 2) treadmill walking time. **Methods:** Twenty-five insufficiently active adults (mean±standard deviation; age: 46±12 years; Body mass index: 31±5 kilogram/squared meter (kg/m^2) were recruited for this study. In part 1, participants performed three randomized 1/3-mile walking bouts at an intensity equivalent to 70% of their oxygen consumption at ventilatory threshold (VO_2-at-VT). During these exercise bouts, individuals viewed 1) their favorite television program (FavTV), 2) a standardized nature program (NatTV) or 3) no-TV program (NoTV). A behavioral choice paradigm was used to assess preference for exercising with each television condition. In part two, participants completed two randomized 60-minute visits in which they were asked to walk at 70% of VO_2-at-VT for 10-minutes under FavTV or NoTV conditions. After 10 minutes, participants could choose to continue exercising under the current TV condition or stop exercising and watch television while seated. Participants were allowed to switch between exercise and rest as they desired during the remaining 50 minutes. **Results:** Preference for exercise was greater during FavTV and NatTV versus NoTV ($p<0.05$), with no differences between FavTV and NatTV ($p=0.132$). Despite difference in preferences for exercise, no significant difference in treadmill walking time was observed for FavTV vs NoTV (50.0 versus 44.7 minutes, respectively; $p=0.102$). **Conclusions:** This study provides empirical evidence that inactive individuals prefer walking with television viewing over walking with no television. Further research is needed to determine if active television viewing can translate to observable changes in exercise behaviors.

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CHAPTER I

Introduction

Physical Activity Participation

Participation in physical activity (PA) is associated with health benefits such as reductions in all-cause mortality and morbidity[1, 2], cardiovascular disease[3-6], metabolic diseases (e.g. diabetes, obesity, hypertension)[7-9] and some cancers[10, 11]. In fact, over 40% of premature deaths can be attributed to modifiable behaviors such as improper diet and being inactive[12]. In order to obtain health benefits, the Center for Disease Control and Prevention, along with the American College of Sports Medicine (ACSM), recommend that individuals obtain at least 150 minutes of moderate-intensity aerobic PA, 75 minutes of vigorous-intensity aerobic PA or an equivalent combination of the two each week[13]. Additionally, these guidelines recommend that adults perform muscle-strengthening activities for all major muscle groups on two or more days each week. Despite these well-known health benefits, only one in five U.S. adults self-reports meeting the national aerobic PA recommendations[14]. Additionally, of those who start an exercise regimen, approximately 50% drop out within the first six months[15].

Many barriers to exercise exist that may contribute to these low PA participation rates. Variables including age[16, 17], gender[18], and socioeconomic statuses (SES)[17, 19] have been shown to contribute to individual differences in perceived barriers. For example, independent components of SES including an individual's income, education, occupation, and residential area are suggested to have a direct impact on one's choice to participate in PA. Specifically, low-income individuals may be deterred from purchasing gym membership or home exercise equipment due to the associated costs. Additionally, free forms of PA such as walking around one's neighborhood may be challenging for low SES individuals if their residential areas do not have accessible sidewalks, lighted walkways, or are located in less safe areas compared to higher SES neighborhoods.

In addition to the above-mentioned barriers to exercise, self-motivation is also associated with participation in PA[20]. Motivation towards a behavior can be classified on a continuum that ranges from extrinsic, which is the least autonomous form, to intrinsic, the most autonomous form. Motivation, specifically intrinsic motivation, is closely related to the reinforcing value of a behavior[21, 22]. In regards to PA, extrinsic motivators such as verbal praise and financial incentives are beneficial for initiating exercise programs[23-25]. While evidence suggests that extrinsic motivators may be beneficial for promoting initial engagement, these motivators typically do not result in long-term adherence to exercise programs[23, 26, 27]. Thus, it is necessary to find ways to promote intrinsic motivation through increased feelings of pleasure and enjoyment, given that greater intrinsic motivation towards exercise is associated with greater adherence to programs[28].

Although individuals differ in their perceived barriers and motivation levels, lack of time is the most commonly cited barrier to exercise. Despite this perceived lack of time to exercise amongst the general public, the average U.S. adult self-reports approximately five hours each day designated towards leisure-time activities (i.e.- those outside of work and sleep). On average, approximately 53% of leisure time (2.77 hours) is designated to television viewing (most of which is sedentary), while only 0.30 hours is spent in sport, exercise, or recreational activities[29]. These statistics raise concern among health professionals, as increasing evidence demonstrates that prolonged time in sedentary behaviors poses additional health risks, independent of participation in PA[30, 31], and thus, potentially increasing the risk for cardiovascular, metabolic, or other diseases.

Television Viewing and Health Risks

Television viewing has been show to be independently associated with increased health risks such as obesity[32-34], type II diabetes[32], cardiovascular disease risk factors[34-38], and all-cause mortality[37, 38]. A survey of 3,392 Australian adults demonstrated a dose-depended relationship between hours of seated television viewing and the risk for obesity. Individuals who watched 1-2.5 hours, 2.5-4 hours, or greater than 4 hours of television each day were 93%, 183% and 300% more likely to be overweight (body mass index (BMI) $\geq$25 kg/m^2), respectively, compared to individuals who watched less than 1 hour per day. Additionally, individuals who watched greater than 4 hours each day were twice as likely to be overweight, even after controlling for PA levels[31]. Moreover, a recent meta-analysis examining health risks associated with television viewing concluded that for every two hours of television watched per day, the relative risk for type II diabetes increased 20%, while relative risk for cardiovascular disease increased 15% and the relative risk for all-cause mortality increased 13%[39].

In addition to the negative health consequences related to sedentary television viewing, physical inactivity negatively impacts the economy. Approximately 11.1% of all U.S. health care expenditures are directly related to individuals being insufficiently active[40]. This is equivalent to $117 billion dollars per year in direct health care expenditures and does not include costs associated with disability, illness, or premature death related to inactivity[40]. Given the significant health risks and financial costs of physical inactivity, the U.S. Department of Health and Human Services has added "understanding the knowledge, attitudes, and behavioral/social skills associated with adopting and maintaining a regular exercise program" to its list of primary research objectives[41, 42]. Thus, there is a need for health care professionals to find effective ways to enhance the exercise experience, in order to help individuals meet national PA guidelines.

Constructs Associated with Behavior

The Hedonic Theory of Motivation (HTM)[43] purportedly explains why individuals make specific PA related behavioral choices. The HTM states that individuals participate in activities that make them feel *good* and avoid those that make them feel *bad*. While historically, exercise was purported to make individuals feel *good*[44-46], methodological errors of early exercise psychology research (pre/post exercise measurements only) resulted in overgeneralized conclusions that overlooked important patterns of feelings individuals experience *during* exercise. Recent evidence suggests that, for the general population, exercise (particularly when the exercise intensity exceeds ventilatory threshold (VT) elicits negative, unpleasureable feelings. Even moderate-intensity exercise may elicit negative feelings for some individuals[47] as demonstrated by a high degree of inter-individual variability in affective responses at or slightly below one's VT. This inter-individual variability has caused problems for statistical analyses in such studies, as group level analysis may mask individual responses[48]. Given that moderate-intensity is commonly prescribed in exercise programs, emphasis is now being placed on the importance of individualizing exercise prescriptions, particularly for inactive populations, in order to maximize psychological variables such as positive core affect and enjoyment of exercise, in order to promote adherence to programs[13, 49].

Both core affect (pleasure/displeasure) and enjoyment of exercise have been shown to be important psychological variables associated with why individuals choose to participate in or maintain an exercise program[50-55]. However, hedonic responses (liking/enjoyment of an activity) do not consider all aspects of the reward/motivation neurological decision-making process[56]. To be specific, when two activities are liked or enjoyed the same, other factors must contribute to the decision-making process, resulting in the choice to participate in one behavior over the other.

Thus, research suggests when given the choice between two equally liked or enjoyed activities, individuals typically participant in the activity they prefer (want) to do[22].

Preference for Activities

While hedonic responses are immediate, non-cognitive appraisals of one's environment, preferences rely heavily on the value of rewards associated with an activity as well as additional perceptions and considerations of one's surroundings[56]. Although both constructs, hedonic responses and preferences, relate to the same overall neurological process that ultimately attempts to evaluate the incentive value of a given behavior, two separate neurological pathways regulate them. Whereas evidence suggests that hedonic responses are a result of opioid and Benzodiaxepine agonist pathways, preferences are suggested to be driven by the Mesotelencephalic Dopamine system[56]. Although previous taste reactivity studies have demonstrated that these systems are independent, both neurological pathways are involved in one's "reward pathway" and contribute to an individual's decision-making process and overall behavioral choices. Considering the neurological research surrounding these psychological constructs, the choice to watch television rather than exercise during available leisure time may be explained through reward schedules. That is, television viewing offers immediate rewards (perceived as fun, relaxing, and distracting from daily stressors). Conversely, the immediate consequences of exercise are often perceived negatively by insufficiently active individuals (e.g. rapid heart rate (HR), sweating, shortness of breath, fatigue), whereas the more rewarding aspects (e.g. weight loss, increased muscle mass) are delayed.

Accessibility of activities is also thought to influence one's preferences[57, 58]. While most individuals have high accessibility to sedentary behaviors in their homes and work settings,

exercise typically requires additional travel. Even if individuals have immediate access to exercise, such as walking around their neighborhood, other barriers to exercise exist, such as the need to change clothing and taking time to shower afterwards. These additional barriers may serve to reduce the reinforcing value of exercise for inactive populations. Evidence from previous behavioral research suggests that individuals will continue to choose highly desirable sedentary behaviors over physically active behaviors until access to those sedentary behaviors is reduced and access to PA is increased[22, 59]. These findings serve to explain the overwhelming participation in sedentary behaviors seen among U.S. adults. Furthermore, given that a variety of elements contribute to behavioral choices, these findings support other models, such as the Strength Model[60, 61], which explains additional factors that contribute to one's decision-making process. Specifically, the Strength Model describes how an individual's ability to self-regulate their behavior draws energy from a central and limited resource. Throughout the day, as individuals make decisions, particularly those that require self-control (e.g. choosing not to eat a piece of cake at the work social for diet purposes), their ability to self-regulate diminishes. This phenomenon is called ego depletion[62, 63] and it has been suggested that the best way to replenish this self-regulatory resource is rest and to restore energy levels[64, 65]. This model helps explain why some individuals make the decision to sit on the couch after a long day of work instead of being physically active despite knowing the physiological and psychological benefits of exercise.

Given the link between preference and behavioral choices, recent studies have investigated the relationship between exercise-related behavioral decisions and related topics including preferred exercise modality[66, 67] and preferred exercise intensity[68]. Most recently, a study[68] used a behavior-choice paradigm approach to examine preference for self-selected exercise intensity versus two imposed exercise intensity conditions. This research is timely given

that recent studies have suggested self-selection of exercise intensity promotes adherence to exercise programs[51, 69] as well as more positive in-task affective responses[70]. Results from the behavioral choice paradigm showed that self-selected exercise intensity resulted in greater preference for exercise, which may also have applications for future PA interventions as preference has been used as a proxy for future behavior[71]. However, more research is warranted given that exercise professionals are still searching for ways to make the exercise experience even more desirable in order to help combat the appeal of sedentary behaviors.

Television Viewing and the Exercise Experience

Given that preferences are highly susceptible to change given one's environment and perceptions, finding effective ways to make the exercise experience more pleasurable and enjoyable would likely influence an individual's preference for PA. Previous studies have examined the effects of exercise modality, exercise intensity, and exercise environments[72, 73] on psychological responses to exercise. These results suggests that exercising outdoors[74, 75], in groups[76] and while listening to music[77, 78] have positive effects on affective responses, enjoyment, and preference for exercise. Although these approaches have been applied in various settings to improve exercise enjoyment, they do not address the problem of seated television viewing being a more reinforcing behavior to participate in. To address this limitation, a small, but growing body of literature has addressed the impact of combining exercise with television viewing, in order to improve the exercise experience. In theory, if this combination of behaviors enhances the reinforcing value of exercise, it could translate to increased adherence to exercise.

Previous attempts at combining television viewing and exercise include contingency protocols which requiring participants to exercise in order to obtain access to television viewing.

A previous study observed small increases in PA levels (approximately one hour per week) as well as reductions in television viewing time (approximately 19 hours per week)[79], unfortunately, the increase in PA observed in this study falls short of national PA guidelines. In another attempt to combine television viewing and exercise, Steeves et al.[80, 81] used the novel approach of encouraging stepping in place during commercial breaks and found that energy expenditure increased to similar degrees as those who were given a 30-minute outdoor walking exercise prescription. Enjoyment of exercise was measured using a 10-centimeter visual analog scale at baseline, three-months, and six-months and increased similarly in both groups throughout the intervention. Nonetheless, this study encouraged exercise during commercial breaks and not while viewing desired television programs.

To date, only a few studies have attempted to directly determine the independent effects of television program viewing on psychological responses *during* an exercise bout. Privitera et al.[82] attempted to examine the effects of television viewing during exercise on mood in college students. The results suggest that an enjoyable distraction such as television viewing during exercise enhances pre-post exercise ratings of pleasant mood compared to other exercise and sedentary conditions. However, this study has several notable limitations, such that, an incorrect tool was used to assess mood. The tool used (the Affect Grid[83]) in fact measures affective responses, not mood. Given the proposed rebound effect of affective responses immediately following exercise[84], the lack of in-task measurements is not representative of the effects television viewing has on affective responses *during* exercise. Two additional studies performed in our laboratory have examined the independent effects of imposed and self-selected television programs on enjoyment of exercise (assessed by the Physical Activity Enjoyment Scale[85] (PACES)). These studies suggest that enjoyment of exercise is higher during exercise with

television viewing compared to exercise without television viewing[86], despite whether the content on the television during exercise was self-selected or chosen for them[87]. These findings support the notion of incorporating television viewing (the most common leisure time activity) with exercise to increase hedonic responses during exercise. However, it is not known if television viewing during exercise can also alter other psychological variables associated with future exercise behaviors, such as preference.

Statement of the Problem

It is essential that scientists find ways to increase participation in PA and exercise among the general public. Findings from the Obesity-Related Behavioral Intervention Trials[12] specifically call for phase I and II, theoretically based, pilot data targeting the foundations of behavior change in order to promote the success of future, phase III efficiency trials/behavioral interventions. While the HTM provides a foundation for behavioral exercise studies, the theory does not fully explain behavioral choices, especially when faced with other attractive options. An innovative approach to this problem is to pair exercise with one of its most prominent behavioral competitors, seated television viewing, to enhance positive hedonic (core affect, enjoyment) and preference responses. It is hypothesized that in doing so, the combination of television viewing and exercise yields improvements in affect, enjoyment, and preference for exercise, compared to exercising with no television. Additionally, it is important to determine whether such responses will translate into observable exercise behavior, such as increases in treadmill walking time, when other factors are held constant.

Statement of the Purpose

This study has two primary objectives. The first objective is to determine how television viewing impacts relevant psychological constructs during exercise. It is hypothesized that, within a behavioral choice paradigm[68, 88], exercise paired with television viewing will yield more positive affective responses and be rated as a more preferable activity, compared to exercise with no television. The second objective is to determine the impact of television viewing on observable exercise behavior. It is hypothesized that self-selected walking duration will be longer during television viewing compared to walking without television.

Significance of the Study

Given that adherence to exercise programs is a problem in behavioral interventions, finding ways to alter the exercise experience in order to enhance psychological responses may be beneficial. If television viewing during exercise results in positive changes in psychological responses associated with exercise behavior (in-task affect, enjoyment of exercise and preference for exercise) such findings would warrant further exploration within behavioral interventions to test the impact of explicitly instructing participants to exercise *while* watching television, rather than *instead* of watching television. Additionally, this will be the first study to test whether the combination of exercise and television viewing will produce positive changes in a behavioral outcome (i.e. treadmill walking time). If the hypothesis is correct, it could lend additional support for implementing television viewing in exercise programs.

CHAPTER II

Review of the Literature

Theoretical Framework

Considering the vital role that PA plays in human health, there is a need to identify factors associated with one's choice to participate (or not participate) in PA[89]. The HTM[43] provides the theoretical framework to help explain PA related behavioral choices. This theory states that the human emotional experience ranges from good to bad, and in an effort to maintain a good emotional state; individuals pursue pleasurable activities and avoid those that are unpleasurable. Much of the literature surrounding this theory has been applied to excessive eating behaviors[90], shopping habits[91] and drug addictions[92]. Findings from these studies help explain why, despite negative consequences such as weight gain, financial debt and psychological/physical addiction, individuals still participate in them.

In applying the HTM to PA behaviors, exercise has traditionally been thought of as an activity that makes individuals *feel good*. The physiological reasoning behind this viewpoint is that exercise results in the release of brain-derived neurotropic factor and endorphins such as dopamine that when released, increase positive mood and sensations of euphoria[93-95]. Additionally, regular exercise participation has been shown to attenuate stress related neuroendocrine reactivity, resulting in reductions of tension and anxiety-inducing hormones (adrenaline and cortisol)[96, 97]. The psychological reasoning behind this viewpoint is based on more than 40 years of research examining psychological responses to exercise. Early research suggested that approximately 80-90% of individuals reported that exercise makes them feel better[98]. However, based on the HTM, low PA participation rates among U.S. adults contradict the notion that exercise makes the majority of individuals feel good. It is now understood that due to methodological errors implemented in these early studies, important in-task feelings were largely overlooked and in fact, individuals do not feel good during exercise, particularly at higher

exercise intensities[48, 84, 99]. These findings are more reasonable given that inverse relationships between hedonic responses and behavior are not generally seen among other activities that are considered to be pleasurable. For example, individuals do not typically avoid food when hungry. This is because, for most, fulfilling such wants/needs like hunger brings feelings of pleasure and satisfaction, encouraging further participation in that behavior. Thus, accurately determining how exercise makes individuals feel is essential for explaining related behavioral choices.

Affective Responses

In an attempt to better understand how exercise makes people feel, researchers have revisited the initial claims that individuals feel good during exercise due to the contradictions between this claim and observable PA behavior. Backhouse et al.[84] was one of the first to address several issues with early exercise psychology research including 1) the oversight of directional changes in affective responses, 2) improper measurement tools, 3) improper measurement time points, and 4) improper data analyses techniques.

First, early investigations of psychological variables and exercise were primarily concerned with positive changes in psychological states. Thus, changes in negative psychological responses were largely overlooked, partially due to the use of surveys or questionnaires what could not detect negative changes, resulting in overgeneralized conclusions that exercise generally promoted positive feelings. To combat this, Watson and Tellegens[100] created the Circumplex Model which provides the ability to track both positive and negative changes, as well as the absence of change. Specifically, the Circumplex Model incorporates measure of core affect, defined as the most basic element of all valenced responses (e.g. pleasure/displeasure). Related to, but not to be mistaken for core affect, are the distinctly

different constructs emotions and moods, which have also been examined throughout the literature. Unfortunately, these terms have been incorrectly and interchangeably used throughout the exercise psychology literature to describe core affect. Specifically, core affective responses are immediate and do not rely upon cognitive appraisal of one's environment[47]. Emotions are complex, short-lived, intense feelings typically targeted at something or someone and do require cognitive appraisal of the environment while moods do require cognitive appraisal, are longer-lived, less intense than emotions, and typically do not have a specific target[101]. Affective responses have become a primary variable of interest in many exercise psychology studies, as they are the best measure of in-task feelings. In addition to affective responses, the Circumplex Model also assesses one's state of arousal (e.g., bored, uninterested, excited, or engaged).

The Circumplex Model combines ratings from the Feeling Scale[102], an 11-point, single item scale, ranging from -5 (very bad) to 5 (very good) with 0 (neutral) as a midpoint, and the Felt Arousal Scale[103], a 6-point single item scale ranging from 1 (low arousal) to 6 (high arousal). When combined, these two scales allow for an orthogonal and bipolar measurement of valenced responses. Four quadrants can be created from these responses: 1) high activation and pleasure, 2) low activation and pleasure, 3) high activation and displeasure, and 4) low activation and displeasure. Resting, pre-and post-exercise as well as in-task measurements are plotted on the model to map an individual's psychological state throughout exercise testing, helping combat the issue of only observing positive changes in psychological responses associated with exercise.

Secondly, but potentially the most common error of the early exercise psychology literature, was that many of these studies only obtained measurements pre-and post-exercise. It is now understood that these measurement time points do not accurately reflect how an individual feels during exercise. To date, a variety of evidence suggests there is a rebound effect,

particularly in positive affect, following exercise[104-106]. Thus, it is not the act of exercise, but the end of exercise, that results in the positive affective responses. Studies applying measurements of in-task affect have largely demonstrated that affective responses are not unanimously positive during exercise and factors such as exercise intensity greatly influence these psychological responses to an acute exercise bout. This is concerning considering that exercise intensity has been found to be the component of an exercise prescriptions most strongly related to exercise adherence rates[70, 107, 108]. The specifics of these responses are explained by the Dual Mode Model[109].

The Dual Mode Model states that exercise intensities below VT generally result in positive affective responses, allowing individuals to focus their attention on cues from their surrounding environment. As exercise intensities approach VT, affective responses become highly variable. However, once VT is surpassed, affective responses nearly always become more negative, as individuals begin to direct their attention to the unpleasurable interoceptive cues caused by the physiological disruption of metabolic homeostasis (increased HR, breathing rate, sweating, soreness, etc.). This response is unique to core affect as traditional exercise stress markers such as rating of perceived exertion (RPE) and HR typically demonstrate a continuous, positive response to increasing exercise work rates. The Dual Mode Model supports prescribing exercise using percentages of an individual's VT instead of more commonly used variables such as percent of maximal oxygen consumption or HR, in order to help avoid the negative psychological responses seen following the disruption of metabolic homeostasis. However, although exercise intensities below one's VT generally result in positive affective responses, if exercise intensities are too low, desired benefits such as weight loss or increased muscle mass may not occur in a timely manner which could result in participants dropping out of exercise

programs. Thus, individualizing exercise prescriptions not only to maximize desired physical outcomes, but also to reduce negative psychological constructs becomes imperative.

While the Dual Mode Model has helped explain why findings from previous studies that only utilized pre-and post-exercise measurements have not completely translated into observable exercise behavior, it has also highlighted the high degree of inter-individual variability in affective responses, particularly close to the VT[47]. Such differences in affective responses among individuals at a given exercise intensity may explain why some maintain exercise programs while others do not. An individual's preference for and tolerance of exercise intensities are examples of cognitive factors that may contribute to this inter-individual variability in affective responses. Additionally, as both are related to exercise frequency[49, 110], these factors help explain why individuals who have a greater preference for and tolerance of higher intensity exercise (e.g. athletes) continue to participate in various activities while others (e.g. insufficiently active individuals) do not despite the relatively unanimous reports of decreased pleasure at higher intensities[109, 111]. Body weight is another factor which may contribute to differences in affective responses at a given work rate[70, 112, 113]. In a study by Ekkekakis et al.,[70] normal weight (BMI <25 kg/m^2) and overweight (BMI ≥25 kg/m^2) women were asked to exercise at an intensity only 10% greater than their preferred, self-selected pace. Overweight women had significantly lower affective responses compared to their self-selected exercise bout, whereas normal weight women exhibited no differences in affective responses. Considering that individuals tend to self-select exercise intensities that are slightly below their VT[111, 114, 115], it is possible that the imposed 10% increase in exercise intensity during this study exceeded their VT, intensifying unpleasurable feelings among the overweight women. Despite what causes the variability in affective responses observed near work rates associated with an individual's VT, the inter-individual variability in

affective responses has also been problematic for drawing appropriate research conclusions, particularly when examining data at the group level[48, 116, 117].

For example, in a study by Van Landuynt and colleagues[48], participants cycled for 30-minutes at 60% of estimated maximal oxygen consumption while the Feeling Scale, Felt Arousal Scale, HR and RPE were recorded at minutes 7, 12, 17, 22 and 27. Data were analyzed at the group and individual level. The group analysis revealed no change in mean affective responses during exercise; however, this analysis masked important individual responses. Specifically, only 12.7% of the sample reported no changes on the Feeling Scale, while 33.3% reported positive responses and 22.2% had negative responses to exercise. These findings demonstrate the importance of proper data analysis techniques when assessing psychological responses to exercise. In summary, improper methodological and statistical analysis of previous research has led to overgeneralized conclusions suggesting that exercise makes individuals feel *good.* Through more diligent and appropriate research designs, recent studies have provided a more accurate depiction of how exercise influences psychological constructs, particularly core affect, which have been shown to be associated with future behavior habits.

Specifically, affective responses during moderate-intensity exercise has been shown to be predictive of self-reported PA levels six and 12 months after an exercise intervention[51]. One study showed that a one unit increase in core affect was associated with an additional 38 minutes of self-reported PA per week at six-months and 41 minutes of self-reported PA per week at 12-months[51]. Additionally, a one-unit increase in in-task affective response has also been shown to be both longitudinally (an additional 15 minutes per week) and cross-sectionally (an additional 27-29 minutes per week) associated with self-reported PA levels[52]. Such associations between affective responses and PA behavior have also been observed in children[55]. Promoting changes

in the exercise environment to promote positive affective responses could translate to changes in PA behavior that accumulates enough over time to have clinically significant health benefits.

Enjoyment of Exercise

In addition to in-task affective responses, enjoyment of exercise has also been shown to be an important variable linked to exercise adherence[118-122]. Moreover, lack of enjoyment is a commonly reported barrier to exercise[42, 123]. Enjoyment is defined as "a positive emotion, a positive affective state" and is thought to be one dimension of intrinsic motivation[118], a necessary factor in the maintenance of regular exercise routines[28]. Thus, the more enjoyable an individual finds an activity to be, the more likely they are to participate in it. To date, there is only one validated survey that assesses enjoyment of exercise, the PACES[85]. This survey consists of 18-items that are rated on a seven-point Likert scale with opposite descriptions at each end of the scale (1=I enjoyed it, or 7=I hated it).

The earliest study examining the importance of enjoyment of exercise dates back to 1979 when Perrin et al.[123] surveyed 769 Ontario residents to determine reasons for PA or physical inactivity as well as related psychological factors. Overall, 92% of participants surveyed reported that enjoyment of exercise was the most influential factor when deciding to participate in exercise, ranking higher than factors such as health or weight control. More recently, studies have reported that exercise enjoyment is a significant predictor of an individual's participation in moderate-to-vigorous intensity exercise. Specifically, Salmon et al.[89] reported that those expressing high levels of enjoyment of walking, based on reports from a five-point Likert scale (1=no enjoyment, 5=a lot of enjoyment), were three times more likely to meet PA guidelines compared to those who reported less enjoyment. Papandonatos et al.[54] also found that enjoyment

of exercise and other exercise-induced feelings were associated with PA levels throughout a 12-month intervention.

A variety of approaches have been attempted in order to increase enjoyment of exercise. Several studies have shown that placing mirrors in exercise rooms[72, 73], exercising outdoors[74, 75], exercising in groups[76], and listening to music during exercise[77, 78] can increase one's enjoyment of an acute exercise bout. Promoting enjoyment of exercise is important considering that, according to the HTM, when individuals are able to associate an activity with a pleasurable/enjoyable response, they are more likely to continue participation in that activity. However, despite the strong association between enjoyment and affective responses with exercise adherence, they do not fully explain how individuals choose between two activities that are equally liked. Thus, other influential factors outside of basic hedonic responses, such as how much an individual likes or enjoys an activity, must contribute to an individual's behavioral decision-making process.

Preference, Affective Responses and Enjoyment of Exercise

Behavioral economics is a conceptual model which, in addition to the HTM, allows for a better understanding of factors associated with one's decision-making process[124]. Research in this area has shown that when two activities are enjoyed equally, an individual will participate in the one they *want* (prefer) to do[56]. For the purposes of this study, preference will be defined as one's predisposition to select a particular activity over another[110]. Like hedonic responses, preferences have also been used as a proxy for future behavior[71], however these constructs are distinctly different. The differences between liking (hedonic) and wanting (preference) constructs have been primarily investigated in nutrition research[56]. Studies in this field suggest

that liking and wanting are independent from one another and occur via two distinct neurological processes[56, 125]. Although strongly related to wanting, liking an activity is not always enough to prompt behavior, and thus the two constructs are not equal.

Unlike hedonic responses, preferences account for the reinforcing value of a behavior, resulting in a stronger association with one's choice to participate or not participate in a particular activity. In general, the reinforcing value of an activity is defined by the accessibility and rewards associated with a particular activity. When activities are more accessible, they require less work and effort to participate in them. Additionally, the rewards individuals associate with a particular behavior become positive reinforcers and thus, encourage continued involvement in the given behavior[58]. In regards to PA and sedentary behaviors, sedentary activities are typically more accessible and rewarding. For example, while participation in some PA requires individuals to travel to parks, trails, or fitness centers for most individuals, sedentary activities such as watching television or playing video games can be performed right in the home. For those who have access to in-home exercise equipment or safe neighborhoods to walk in, participation in PA, unlike sedentary activities, still requires additional work (e.g. changing clothes and shoes), reducing the overall reinforcing value of PA. In regards to rewards, for many insufficiently active adults, sedentary behaviors are typically associated with instantaneous benefits such as relaxation and comfort. PA on the other hand usually results in immediate discomfort (e.g. sweating) and has delayed rewards (e.g. weight loss) that only come if participation is continued for these individuals. As seen with hedonic responses, factors such as body weight may further exacerbate sensations of discomfort, lessening the reinforcing value of being physically active[88]. Thus, the high reinforcing value of sedentary behaviors, help explain why many individuals choose to participate in them instead of PA during their leisure time[58, 88].

To further examine this relationship, several studies have manipulated the accessibility of sedentary and physical activities in order to determine how these influences an individual's behavioral choices. These studies have demonstrated that when given equal opportunity (access) to be sedentary or physically active, individuals choose to participate in sedentary behaviors[57, 58, 88, 126]. As predicted, individuals also choose sedentary behaviors when access to PA is reduced[57]. However, when access to sedentary activities is reduced, a change in behavior towards PA is observed as individual's behavioral choices switch[57, 88]. Specifically Raynor et al.[57], found that sedentary activities were preferred over equally-liked PA until proximity of sedentary activities was reduced and the proximity of PA was increased. Unfortunately, in modern society, in an attempt to maximize comfort and convenience, most social environments provide high accessibility to sedentary activities through chairs, couches, trolleys, elevators, moving walkways in airports, etc., which further promotes sedentary behaviors rather than PA.

Given that these environments continue to develop in a manner that supports sedentary behaviors rather than making them less accessible, a more feasible approach may be to increase the reinforcing value of PA to encourage behavior. To date, preferences for exercise environment[127], time of day[128], modality[66, 67] and intensity[70] have all been shown to influence one's exercise experience. Most recently, Williams and Raynor[68] examined how self-selected and imposed exercise intensities affected relative preference using a behavioral-choice paradigm approach. This approach asked individuals to perform three randomized 1/3-mile walking bouts on the treadmill at 1) their self-selected intensity, 2) an imposed intensity (20% higher than the self-selected pace) or 3) a yoked intensity. The yoked intensity was identical to the self-selected pace; however, participants were told it was a different intensity. Participants were blinded to the actual speed and incline of the treadmill during all conditions. In between walking bouts,

individuals were seated and performed a five-minute paperclip-sorting task. This sedentary activity served as a washout period between the walking bouts and exposed participants to the sedentary activity they would be questioned about subsequently. Following all three walking and sedentary paperclip-sorting bouts, participants completed a preference survey. This survey asked individuals to choose if they would prefer to walk one mile distance under each of the three conditions (self-selected, imposed, yoked) or sort paperclips for a given about of time (ranging from 2-20 minutes). The primary findings from this study were that self-selected exercise intensities promoted the greatest preference for exercise, followed by the yoked-self-selected and finally the imposed intensity conditions. The behavioral choice paradigm approach used in this study provides researchers the ability to examine the influence a particular exercise environment on psychological constructs. Additionally, the behavioral choice paradigm also provides a systematic approach that reduces social bias to provide a more accurate depiction of real life choices within the limits of a tightly controlled laboratory-based study. Thus, further research is warranted utilizing approaches such as the behavioral choice paradigm to determine how one's exercise environment influences their preference for exercise. By attempting to improve hedonic responses and preference for exercise through changes to the exercise environment, health care professionals can help combat the appeal of sedentary behaviors.

It is important to note that not all sedentary behaviors are equally desirable or compete with exercise preferences similarly. Specifically, highly desired sedentary activities compete with exercise much more than less desired sedentary activities[126]. Thus, recent studies have examined various intervention techniques in an attempt to decrease time spent in highly desired sedentary activities (such as television watching) and promote exercise behaviors. For example, Raynor et al.[129] compared a reduced television viewing and increased PA prescription to a

traditional PA prescription during an 8-week weight loss intervention in obese adults. Throughout the intervention, the group that received both the reduced television and increased PA prescription decreased television viewing (approximately 16.5 hours per week), with no changes in moderate-to-vigorous PA and a reasonably small (1.5%) increase in light PA compared to baseline. Faith et al.[79] also reported statistically significant reductions in television viewing time (~19 hours per week) and increases in PA (approximately one hour per week) when using a closed-loop contingency cycling protocol in which children were rewarded with television viewing if they simultaneously pedaled the bike. Other findings using a contingency protocol support these findings of increasing PA to obtain highly desired sedentary behaviors such as television viewing[126, 130], supporting the idea that sedentary behaviors can be used to reinforce PA[58]. Thus, it may be advantageous to *combine* one of the most highly desired sedentary activities (i.e., television viewing) with exercise to improve the exercise experience. This is a fundamentally different approach than using television viewing as an incentive for exercise participation or withholding television as punishment for lack of exercise participation. Few studies have looked at the psychological and physiological effects of combining these activities.

In the first attempt, Anessi et al.[131] conducted a 14-week study that tested the effects of various exercise entertainment modalities on distraction during exercise, exercise adherence, and physical outcomes. Participants were encouraged to exercise according to the national aerobic PA recommendations and were randomized to one of three exercise conditions (music, television, or combined entertainment). The music group was provided a radio cassette player that allowed them to listen to the radio or play cassette tapes. The television group viewed one of four non-preferred pre-set television channels on mounted televisions while the combined

entertainment group had a personal television embedded in their exercise equipment with access to 62 channels. This group also had access to the radio, CDs or cassette tapes. Results showed that the combined entertainment group had significantly lower dropout and showed a trend towards higher attendance. Participants in this group also performed significantly longer exercise sessions. Despite these beneficial findings, the study design does not allow us to determine which mode of entertainment in the combined group (television or radio) resulted in the increased exercise frequency and duration observed among participants.

In 2012, Casiolio[132] examined whether television viewing during a 15-minute bout of treadmill walking promoted greater dissociation from exercise stimuli or increased walking distance compared to a 15-minute bout of treadmill walking without television viewing. No differences in walking distance were observed between exercise conditions, however, television viewing resulted in significantly more external thoughts compared to the non-television condition as measured by the Associative Thought Scale[133]. These findings were limited by the 15-minute time restriction for each exercise bout. The authors suggest that television viewing during an unlimited exercise bout may have resulted in increased walking distance.

Privitera et al.[82] also attempted to determine how television viewing impacts the exercise experience. The Affect Grid[83] was used to determine pre- and post-changes in mood following a 10-minute bout of treadmill walking while watching a 10-minute clip of the television sitcom, *Two and a Half Men*. Both exercise with and without television viewing resulted in significant improvement in pleasant mood, however these improvements were enhanced during the television viewing condition. Although this study was the first to show the independent effects of television viewing, it is limited in that the Affect Grid does not actually measure mood but instead it measures core affect. Additionally, as previously explained, pre-and post-exercise

measurements are an inappropriate study design for making any conclusions regarding the effects of television viewing on affective responses during exercise.

More recently, a six-month PA intervention[80, 81, 134] found that stepping in place during television commercial breaks resulted in similar increases in enjoyment of exercise and energy expenditure compared to 30-minutes of outdoor walking. However, considering that exercise was performed during commercial breaks instead of during the television program itself, it cannot be determined if television viewing was responsible for the increases in enjoyment throughout the intervention. Recent laboratory studies[86, 87] have also examined the effects of television viewing during 30-minute bouts of moderate-intensity exercises. Overstreet et al.[86] reported increased enjoyment of exercise in insufficiently active college students during cycling exercise while watching a nature program (British Broadcasting Channel's nature documentary *Life* television program entitled "Challenges of Life") compared to cycling without any television stimulus. Interestingly, intrinsic motivation and mean Feeling Scale values were correlated with enjoyment for both conditions. Rider et al.[87] reported similar findings in a cohort of insufficiently active adults (30-65 years). This study also included a self-selected television program condition, but found no significant differences in enjoyment of exercise between the imposed nature program and self-selected television conditions. Enjoyment of exercise while viewing both television conditions was significantly higher than enjoyment of exercise without any television. These findings support the notion of incorporating the most common sedentary leisure time activity (i.e. television viewing), with exercise to increase one's experience and potentially promote psychological variables associated with future exercise behaviors. However, these two studies by Overstreet et al.[86] and Rider et al.[87] have only utilized hedonic responses and those that have attempted to examine behavioral changes have been limited by exposure

periods that were too short to promote behavioral differences.

Summary

Given that the decision making process can be strongly influenced by one's environment[21, 22], previous efforts have been made to increase the desirability of exercise environments to help promote PA behaviors[120, 135, 136]. Currently, national organizations such as the ACSM are encouraging that exercise not be prescribed as a "one size fits all", but rather that exercise professionals focus on individual preferences for all components of the exercise prescription (frequency, intensity, time and type) in order to promote adherence[13, 135]. Thus, it becomes important to determine how to best alter the exercise experience to enhance positive psychological variables and promote adequate participation in PA to help individuals obtain substantial health benefits associated with exercise[137]. As access to favorite television shows through media outlets such as Netflix (Los Gatos, California, U.S.A.) and Amazon Prime (Amazon, Seattle, Washington, U.S.A.) rise, along with the popularity of trends such as binge-watching of television, so will the need for exercise professionals to understand the influence of hedonic responses and preferences on an individual's choice to participate in sedentary or PA behaviors.

Previous literature supports the use of television viewing during exercise to promote positive changes in hedonic responses. However, it has yet to be determined how television viewing during exercise influences preference for exercise. Additionally, previous studies have not implemented frequent enough measurements of in-task affective responses to accurately describe how television viewing may alter such feelings. Given that preference and hedonic responses are two separate cognitive processes[56], the effects of the exercise environment on both

constructs must be considered, since hedonic responses to an activity do not readily translate to preference for the same activity.

Since preferences for exercise may vary between individuals[138, 139], the purpose of this project was to determine how a positively valenced stimuli (television viewing) alters preference for exercise, enjoyment of exercise and in-task affective responses. Additionally, it was an aim of this study to determine how combining television viewing with exercise would impact self-selected walking duration (treadmill walking time) when individuals are given equal access to seated television viewing.

CHAPTER III

Manuscript

Abstract

Purpose: To determine the effects of television viewing during exercise on 1) preference for exercise and 2) treadmill walking time. **Methods:** Twenty-five insufficiently active adults (mean±standard deviation; age: 46±12 years; Body mass index: 31±5 kilogram/squared meter (kg/m^2) were recruited for this study. In part 1, participants performed three randomized 1/3-mile walking bouts at an intensity equivalent to 70% of their oxygen consumption at ventilatory threshold (VO_2-at-VT). During these exercise bouts, individuals viewed 1) their favorite television program (FavTV), 2) a standardized nature program (NatTV) or 3) no-TV program (NoTV). A behavioral choice paradigm was used to assess preference for exercising with each television condition. In part two, participants completed two randomized 60-minute visits in which they were asked to walk at 70% of VO_2-at-VT for 10-minutes under FavTV or NoTV conditions. After 10 minutes, participants could choose to continue exercising under the current TV condition or stop exercising and watch television while seated. Participants were allowed to switch between exercise and rest as they desired during the remaining 50 minutes. **Results:** Preference for exercise was greater during FavTV and NatTV versus NoTV ($p<0.05$), with no differences between FavTV and NatTV ($p=0.132$). Despite difference in preferences for exercise, no significant difference in treadmill walking time was observed for FavTV vs NoTV (50.0 versus 44.7 minutes, respectively; $p=0.102$). **Conclusions:** This study provides empirical evidence that inactive individuals prefer walking with television viewing over walking with no television. Further research is needed to determine if active television viewing can translate to observable changes in exercise behaviors.

Key words: Exercise, behavior change, entertainment, physical activity

Introduction

The low prevalence of U.S. adults who self report meeting the national PA recommendations continues to be a concern for health professionals, particularly as knowledge concerning the health benefits associated with PA[140] and the health hazards of physical inactivity[141] grows. Recently, national organizations have begun encouraging health professionals to individualize exercise programs in order to promote positive psychological responses, which may, in turn, encourage exercise adherence[13, 49]. Thus, if more attention is placed on making exercise more pleasurable and enjoyable, individuals might be more inclined to participate in and maintain regular exercise routines.

The Hedonic Theory of Motivation (HTM) provides a theoretical framework that attempts to explain the importance psychological constructs, such as pleasure and enjoyment, in regards to future exercise behavior. This theory states that individuals pursue activities that make them feel good and avoid those that make them feel bad[43]. Hedonic responses including in-task affect (e.g. pleasure/displeasure), the most basic element of all valenced responses[142], and enjoyment of exercise (a positive emotion that stems from a positive affective state[118]), have been shown to be predictive of future exercise behaviors[21, 51, 52, 121, 123, 137]. Specifically, affective responses during an acute moderate-intensity exercise bout have been shown to be predictive of self-reported exercise participation six-and-12 months later[51, 52]. Additionally, affective responses during a single bout of moderate-intensity exercise have been shown to also be significantly correlated with total self-reported PA minutes, and minutes spent in vigorous-intensity PA three-months post the completion of an exercise intervention[53]. In regards to enjoyment, Papandonatos et al.[54] reported that enjoyment of exercise was associated with self-reported PA levels during a 12-month intervention. Furthermore, a study by Salmon et al.[137]

demonstrated that individuals who reported high levels of enjoyment of walking were three times more likely to meet PA guidelines compared to those who reported low levels of walking enjoyment.

Despite the relationship of these hedonic responses and future exercise behavior, there has been a discrepancy between early exercise psychology research findings which state that exercise makes most individuals feel good[98, 143] and more recent research. The early studies that reported favorable changes in psychological variables during acute exercise bouts were limited by improper methodological techniques[84]. While these early studies overwhelmingly suggested that exercise makes individuals feel *good*, many of these studies only measured psychological responses pre- and post-exercise, and not during exercise. More recent research has demonstrated that this methodological approach may have resulted in oversimplified conclusions that exercise largely promotes positive feelings amongst the general public. As explained by the Dual Mode Model[50], it is now known that exercise does not always result in positive affective responses. The Dual Mode Model suggests that while exercise intensities below one's VT commonly result in positive affective responses, these responses become more negative for most individuals once VT is surpassed. This decline in affective responses is in part due to individuals directing their focus on the disruption of metabolic homeostasis during high intensity exercise. However, even moderate-intensity exercise can result in negative affective responses for some people, as high variability in inter-individual responses at exercise intensities near or at VT have been observed[48]. Thus, pre-and post-exercise measurements do not accurately reflect how most individual feels during exercise, but rather reflect a rebound in positive affect caused by the cessation of exercise[104-106]. Despite an improved understanding of these psychological constructs, affective responses may only explain 1-6% of the variance in exercise behaviors[53]. This suggests

that other mechanisms contribute to the interplay between psychological responses and long-term behavior.

Preferences, defined as one's predisposition to select a particular activity over another[110], may help further explain exercise-related behavioral choices. Preferences are highly influenced by one's environment as well as the rewards associated with participation in a given activity[56]. Research suggests that when given equal access to sedentary (e.g. seated television viewing) or physical activities (e.g. walking around one's neighborhood), most individuals chose sedentary behaviors[57, 58, 88, 126]. One influential factor contributing to an individual's decision to be physically active or inactive may be that sedentary activities such as seated television viewing are highly rewarding (e.g. relaxation, comfort) while exercise typically imposes immediate, uncomfortable responses (e.g. sweating, muscle discomfort). Additionally, the rewards associated with exercise (e.g. weight loss, increased muscle mass) are delayed and typically only come with long-term participation. Furthermore, while most sedentary behaviors are easily accessible, exercise usually requires additional travel to gyms, parks, recreation centers, etc. Even if individuals have immediate access to exercise, such as walking in their neighborhoods, exercise requires additional efforts such as changing clothes/shoes and showering afterwards, decreasing its reinforcing value of PA for many. This greater reinforcing value of sedentary activities compared to PA may help explain why positive changes in affective responses and enjoyment have not translated into sustained, observable exercise behaviors at the population level.

The most common sedentary leisure time activity (hence potentially posing the most competition to exercise) is television viewing. On average, U.S. adults spend approximately 53% (2.77 hours) of their daily leisure time watching television[29]. With advancements in technology

including on-demand and on-the-go features, allowing individuals to choose when and where they watch their favorite programs, television viewing has become accessible in most places. The high accessibility and immediately rewarding sensations associated with seated television viewing has not only led to it being the most common sedentary leisure time activity, but has also resulted in a new cultural phenomenon, "binge-watching". Binge-watching, the act of watching multiple television programs in rapid succession[144], has become increasingly popular in the past decade as Netflix and similar media services have become more readily available. This trend is concerning since extended periods of time seated in front of the television have been associated with increased health risks such as obesity, type II diabetes, cardiovascular disease and all-cause mortality[39]. While previous researchers have attempted to increase PA by reducing or removing television-viewing time, they have been largely unsuccessful[57, 79]. A promising approach to promoting exercise may be combining two behaviors: television viewing and exercise. Combining the most common sedentary behavior with exercise not only reduces potential barriers, as individuals are no longer required to choose between the two activities, but it may also improve the overall reinforcing value of the exercise experience.

Recently, two studies combined television viewing with exercise to determine the independent effects of television viewing on in-task affective responses and enjoyment of exercise. Overstreet et al.[86] demonstrated that enjoyment of exercise was higher during a 30-minute cycling exercise bout while viewing a nature program, compared to exercise without television viewing. Additionally, this study found that mean in-task affective responses were correlated with enjoyment of exercise during each condition. A follow up study by Rider et al.[87] added a favorite television condition and found that enjoyment of exercise was higher during favorite and nature television program exercise conditions, compared to exercising without

television viewing. No differences in enjoyment of exercise were observed between the favorite and nature television program exercise conditions. Findings from these studies support the idea of combining the most common sedentary behavior, television viewing, with exercise in order to promote hedonic responses associated with future exercise behaviors. However, the degree to which television viewing during exercise may impact preferences for exercise is currently unknown. Assessing this variable, which takes into consideration the reinforcing value of a behavior, may provide deeper insights into exercise related behavioral choices.

Therefore, the current study had two aims. The first aim was to use a behavioral choice paradigm to determine an individuals' preference between three exercise conditions: exercising while watching their favorite television program (FavTV), exercising while watching a nature television program (NatTV), and exercising with no-television (NoTV). The second aim was to compare treadmill walking time under two conditions (FavTV and NoTV).

Methods

Participants

Twenty-five insufficiently active adults (26-65 years of age) participated in this study (Table 1). Being insufficiently active was defined as completing less than 150 minutes of moderate-intensity or less than 75 minutes of vigorous-intensity PA as determined by the 2009 Behavioral Risk Factor Surveillance Systems Physical Activity Questionnaire[145]. A Health History Questionnaire was administered to ensure participants were free of any contraindications to exercise as outlined by the ACSM[13] as well as any acute/chronic injury or physical limitations. Additionally, in order to be eligible for the study, one of the individual's three self-reported most favorite television programs had to be available on either Amazon Prime or Netflix to ensure

access to the program during future visits. Participants were recruited by sending approved emails, posting flyers on University and community bulletin boards, and by word of mouth. Participants did not receive any incentives for their participation in the study. Written informed consent was obtained prior to participation and the study was approved by the university's Institutional Review Board prior to starting.

Experimental overview

Eligible participants made four visits to the laboratory. The first visit included baseline psychological trait questionnaires, anthropometric measurements, and a graded exercise treadmill test. The second visit consisted of the behavioral choice paradigm to address the first objective, to assess how different television conditions (FavTV, NatTV, NoTV) influence preference for exercise as well as affective responses during exercise. This approach allows researchers to examine the influence a particular exercise environment has on psychological constructs while reducing social bias. The third and fourth visits (occurring in a randomized order) participants were asked to exercise for a minimum of 10 minutes, after which they were given a choice to continue exercising or to sit quietly, alternating between these behaviors as desired during the remaining 50 minutes of each visit. During one of these visits, participants viewed their FavTV despite the activity being performed (exercise or seated television viewing). During the other visit, participants could only view their FavTV program while seated. During all visits, participants were asked to refrain from using cell-phones, computers, books or any form of entertainment other than the TV stimulus. All non-essential conversations were restricted throughout the visits and any timepieces (clocks, timers, watches, etc.) were removed from sight.

Additionally, the digital display on the treadmill was covered during to prevent participants from viewing the treadmill settings and exercise duration.

Procedures

Initial Assessment (Visit 1)

Anthropometric and Psychometric Assessments. After obtaining informed consent, baseline trait questionnaires including the Preference and Tolerance for Intensity of Exercise Questionnaire[110] and the Behavioral Regulation in Exercise Questionnaire[146] were administered to determine potential influences on enjoyment or preference of exercise. Next, a Seca stadiometer (Birmingham, United Kingdom) was used to measure height and a calibrated Health-O-Meter digital scale (Boca Raton, Florida, U.S.A) was used to measure weight. For all measurements, participants wore light clothing and were asked to remove their shoes or any additional heavy objects from their pockets. A bioelectrical impedance analyzer (Omron, Netherlands) was used to measure percent body fat.

Graded Exercise Test. Following all baseline measures, participants performed a graded exercise test on a treadmill (Quinton Instrument Company, Bothell, WA, U.S.A.). Walking speeds were held constant while the incline began at 0.0% and increased by 0.5% each minute throughout the test. HR was continuously measured by a Polar HR monitor (Kempele, Finland) and expired gasses were continuously monitored using a Parvomedics metabolic cart (Sandy, Utah, U.S.A.). RPE was assessed using Borg's 6-20 RPE Scale[147] during the final 10 seconds of each stage. The exercise test continued until volitional exhaustion. Peak oxygen consumption (VO_{2peak}) was considered to be the highest 1-minute average oxygen consumption value associated with the highest work rate reached during the graded exercise test.

The software from the metabolic cart was used to identify a participant's VO_{2peak} and VT, which was used to calculate an individual's exercise work rate for the remaining visits (70% of VO_2-at-VT). This exercise intensity was chosen based on the Dual Mode Model, which suggests that work rates below VT allow individuals to monitor the exercise bout under the various television conditions with cognitive appraisal while work rates exceeding VT may direct participant's attention to the physiological cues associated with disruption of metabolic homeostasis and away from the television programs.

Behavioral Choice Paradigm (Visit 2)

The methods described below have been previously published in a study that examined the effects of imposed and self-selected exercise intensities on preferences and affective response[68]. For clarity, Figure 1 outlines the timeline of events during Visit 2. During this visit, participants performed three 1/3-mile exercise bouts (~seven minutes each) on the treadmill (total distance=one mile). Each exercise bout was separated by a 5-minute sedentary task (paperclip sorting). During this task, participants were asked to sort a variety of colored paperclips into associated colored cups. The purpose of the one-mile walk and the paperclip sorting tasks was to familiarize the participant with activities referred to on the behavioral choice questionnaires that assessed preference for exercise. The order of the walking bouts (FavTV, NatTV or NoTV) was randomly assigned using a random number generator program. During FavTV, participants watched an episode of their preferred program designated during initial eligibility screening. During NatTV, all participants viewed the same portion of the British Broadcasting Company's *Life* (Disc 1, Episode 1: *Challenges of Life*). This program was selected as a means of reducing exposure to aversive themes (e.g. socio-political, religious, or upsetting

themes) which may influence psychological states during exercise[82]. Additionally, this program has been previously used during treadmill walking exercise to reduce boredom[148]. During NoTV, the television remained in view, but was turned off and covered to prevent any potential reflection/mirror effect[72, 73]. During each bout, HR was continuously monitored while RPE and affective responses (assed via the Feeling Scale) were measured immediately prior to exercise, every 0.10-mile during exercise, and immediately following exercise. Upon completion of each walking bout, participants were seated and completed the PACES to assess enjoyment of the bout. Following the PACES, participants silently performed the paperclip sorting task for five-minutes.

Next, a behavioral choice paradigm approach was used to assess preference for walking under each of the television conditions. This model allows researchers to test theory driven hypotheses regarding behavioral choices and decision-making, specifically the relative reinforcing value of an activity, while minimizing social bias. In order to minimize potential social bias, participants were under the assumption that they had to perform a final task, either walking one mile or sorting paperclips. These questionnaires (10 items or each condition) prompted participants to select whether they preferred to walk one mile under one of the television conditions (FavTV, NatTV, or NoTV) or sort paperclips for various time periods (2, 4, 6, 8, 10, 12, 14, 16, 18, and 20 minutes). To continue to promote the deception that participants had to complete one of these tasks after filling out the questionnaires, each one of their answers to the 30 items was paired with a corresponding bingo ball. Participants were led to believe that these bingo balls would be placed in a container after the questionnaires and one bingo ball would be randomly selected to determine their final activity. Thus, individuals who circled "walking" more often in the questionnaires had a better chance of having to complete the one-

mile walk under the various television conditions, while those who chose "sorting paperclips" more often had a better chance of remaining seated and sorting paperclips. To ensure understanding, participants were given a mock version of these procedures prior to the presentation of the 30 items. Following completion of the three questionnaires and debriefing procedures, participants were thanked for their time and did not have to complete the additional task. Preference scores for each condition were calculated by taking the highest number of minutes that an individual chose to sort paperclips (rather than walk one mile under the given television condition) and dividing that value by two, creating a 0-10 scale. Lower scores represented greater preference for walking under a given condition (FavTV, NatTV, and NoTV). Scores between the questionnaires were compared to determine if the FavTV condition made exercise more preferable than the NatTV or NoTV conditions.

Observable Behavior (Visits 3 and 4)

For both visits, participants were fitted with a HR monitor and the Feeling Scale was administered (to account for potential differences in pre-exercise affective states). Participants were then asked to stay in the laboratory for 60 minutes, which started once exercise was initiated. Exercise was performed at the same work rate as visit 2 (70% of VO_2-at-VT). Participants first completed 10 minutes of walking and were notified when the required time had elapsed. After the first 10-minutes, participants notified the research assistant when and if they wanted to switch activities (walking or sitting). During the FavTV condition, their favorite television program was available to watch during the entire 60 minutes, regardless of walking or sitting behavior. During the NoTV condition, the television was turned off and covered during exercise and only turned on to watch their favorite television program when the participant was

seated. Total time spent on the treadmill (treadmill walking time) was assessed as the primary outcome of these visits.

Instruments

The Preference Tolerance for Intensity of Exercise Questionnaire (PRETIE-Q)[47]. The PRETIE-Q assesses individual differences regarding the intensity of exercise preferred and the intensity that can be tolerated. A total of 16 items, eight items relating to preference and eight items relating to tolerance, are scored on a five point Likert Scale (1=totally disagree, 3= neutral, 5= totally agree). Higher scores indicate greater preference/tolerance for high intensity exercise. This questionnaire has shown to be internally consistent, structurally valid, and reliable [47, 110].

Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2)[146]. The BREQ-2 assesses self-determined motivation towards PA through 19 items on a five-point Likert scale (0=not true for me, 2=sometimes true for me, 4=very true for me). These items cluster to form five motivation subscales (amotivation, external, introjected, identified and intrinsic motivation). Of these factors, intrinsic motivation was the primary variable of interest due to its strong relationship with enjoyment and preference of activities[15, 88] as well as the behavioral decision making process[88]. This questionnaire has been shown to be valid and reliable in a number of populations[149, 150].

Physical Activity Enjoyment Scale (PACES)[85]. The PACES scale consists of 18-items that are rated on a seven-point Likert scale with opposite descriptions at each end of the scale (1=I enjoyed it, or 7=I hated it). Participants were asked to rate their enjoyment of the preceding

walking bout under various television conditions, immediately following the exercise on Visit 2. The PACES has previously been validate in children[151] and adults[85, 152]. [153].

Rating of Perceived Exertion (RPE)[147]. The Borg 6-20 RPE scale was used to determine participant's subjective rating of exertion at the end of each stage of the VO_{2peak} exercise test during Visit 1 and pre, every 0.10-mile during exercise and post exercise during Visit 2. This scale has been validated in healthy and diseased populations[154, 155].

Feeling Scale[102]. The Feeling Scale is an 11-point scale ranging from -5 (very bad) to 5 (very good), with 0 (neutral) as the midpoint that assesses core affect (pleasure/displeasure). Core affect was measured pre, every 0.10-mile during exercise and post exercise during Visit 2 and prior to exercise during Visits 3 and 4. This scale has been related to future exercise behaviors[51, 102, 156] and valenced responses[157].

Statistical Analyses

All analyses were conducted using SPSS v.23 (Cary, NC). For all analyses, statistical significance was set at an alpha level of 0.05. Data are presented as mean ± standard deviation (SD) unless otherwise noted. Independent sample T-tests were performed to determine potential gender differences for all demographic and body composition variables (Table 1).

Behavioral Choice Paradigm

A repeated measures ANOVA was conducted on preference for exercise between television conditions (FavTV, NatTV, NoTV). A Bonferroni post-hoc analysis was used to

determine where differences existed. Next, three 3x5 (television condition: FavTV, NatTV, NoTV x time: pre, 0.10 mile, 0.20 mile, 0.30 mile, post) repeated measures ANOVAs were run as manipulation checks on mean in-task affect, RPE and HR in order to determine if other measures, besides television condition, influenced preference of exercise. Additionally, frequency analyses were used to examine the percent of participants who increased, decreased or showed no change in in-task affective responses from baseline. Correlations between preference for exercise, enjoyment of exercise, and mean in-task affective responses were also examined.

Observable Behavior

A paired samples t-test was used to compare treadmill time between visits. Correlations were run between treadmill time and various psychological (tolerance for exercise, preference for exercise, enjoyment of exercise, intrinsic motivation), and physiological (VO_{2peak}, HR at VT, VO_2-at-VT, and work rate at VT) variables. Finally, variables that were significantly correlated with exercise time during either visit (VO_2-at-VT, VO_{2peak}, preference and tolerance for exercise intensity) were included in a three-step hierarchical linear regression to examine the ability of these correlated factors to predict walking time during the NoTV exercise condition. In step one, VO_2-at-VT was entered as the predictor variable. In step two, VO_{2peak} was entered into the model while step three included preference and tolerance for exercise.

Results

Behavioral Choice Paradigm

In regards to preference for exercise, there was a significant main effect for condition $F(2,23)=12.134$, $p<0.001$. Specifically, preferences for FavTV ($p<0.001$) and NatTV ($p=0.002$) were significantly higher than NoTV. There was no significant difference in preference scores

between FavTV and NatTV conditions (p=0.132) (Table 2).

Table 3 shows the mean ± SD for affective responses, RPE, and HR at each time point for each television condition. The 3x5 (television condition x time) repeated measures ANOVA for affective responses showed a significant main effect for television condition $F(2,23)=6.511$, p=0.006 and time $F(4,21)=4.174$ (p=0.012). FavTV (p=0.004) and NatTV (p=0.007) conditions resulted in significantly higher mean in-task affect, compared to the NoTV condition. No differences were observed between the FavTV and NatTV conditions (p=0.554). Throughout the FavTV, NatTV and NoTV conditions, 27%, 4%, 12%, respectively of participants increased in affective responses while 8%, 22%, and 27%, respectively reported decreases, and 65%, 73%, and 62% reported no change, respectively.

The 3x5 (television condition x time) repeated measures ANOVA for RPE showed a significant main effect for condition $F(2, 23) = 3.917$, p=0.034 and time $F(4, 21)=8.883$ (p<0.001). There were significantly lower mean in-task RPE scores during the FavTV compared to the NoTV condition (p=0.026) with no significant differences between FavTV and NatTV conditions (p=1.000) or between NatTV and NoTV conditions (p=0.463). The 3x5 (television condition x time) repeated measures ANOVA for mean in-task HR showed no significant main effect for condition $F(2,23)=0.821$, p=0.453. However, there was a significant main effect for time $F(4,21) = 28.933$ (p<0.001).

Preference for exercise with FavTV was significantly correlated with enjoyment of exercise (r=-0.467, p=0.019) and mean in-task affective responses during the FavTV condition (r=-0.534, p=0.006). Preference for exercise with NatTV condition was significantly correlated with enjoyment of exercise (r=-0.500, p=0.011) and mean in-task affective responses during the NatTV condition (r=-0.463, p=0.02). Preference for exercise with NoTV was not significantly

correlated with either enjoyment of NoTV (r=-0.269, p=0.193) or mean in-task affective responses during the NoTV condition (r=-0.364, p=0.075).

Observable Behavior

There was no significant difference in treadmill time between FavTV (50.0 minutes) and NoTV visits (44.7 minutes) (p = 0.102) (Figure 2). Walking duration during the FavTV visit was not significantly correlated with any of the physiological or psychological variables tested (p>0.05). Walking duration during the NoTV visit was significantly correlated with preference (r=0.424, n=25, p=0.003) and tolerance (r=0.456, p=0.022) for high intensity exercise as determined by the PRETIE-Q, relative VO_{2peak} (r=0.463, p=0.020), estimated VO_{2max} (r=0.649, p=0.000) and relative VO_2-at-VT (r=0.859, n=25, p=0.000). Model one of the regression analysis showed that VO_2-at-VT explained a significant portion of walking time during the NoTV visit (Beta=0.485, p=0.014) (Table 4). However, VO_2-at-VT, VO_{2peak}, preference for exercise intensity and tolerance for exercise intensity become non-significant in models two and three.

Discussion

Results from Part A of the current study indicate that our primary hypothesis was partially supported, in that participants more strongly preferred exercise with television over exercise with NoTV; however, no difference in preference was noted when comparing the FavTV versus NatTV conditions. Similar to preference for exercise, hedonic responses were significantly higher during the FavTV and NatTV bouts compared to the NoTV exercise bout. Results from Part B indicate that television viewing during exercise resulted in approximately

five minutes of additional walking behavior, which was not statistically significant. This contradicts the initial hypothesis regarding treadmill endurance time.

Although exercise preference scores were significantly lower for walking with NoTV compared to the other two conditions, preference for exercise did not significantly differ between television conditions. The lack of difference between television conditions may be explained by the exercise enjoyment results. Similar to the study of Rider et al.[87], enjoyment scores for both television conditions were significantly higher relative to the control condition (NoTV), but no significant differences were observed between FavTV and NatTV conditions. Correlational analyses indicated that higher enjoyment was related to stronger preference, for both conditions. Thus, it is reasonable to speculate that many of the participants found the NatTV condition just as appealing as their FavTV program. While contrary to the hypothesis, this finding has practical importance because a variety of programs (regardless of whether they are chosen by individuals) can act as a reinforcing stimulus for exercise. However, it is probably still important to avoid explicitly aversive programming. In a study by Privitera et al.[82], individuals reported increases in post-exercise positive mood rating following 10-minutes of treadmill walking while watching an enjoyable television program. However, those participants who reported not liking the television program at baseline saw a non-statistically significant decrease in post-exercise mood ratings. Although not statistically significant, the lack of change in post-exercise mood ratings among this group demonstrates the importance of selecting neutral or preferred shows when trying to promote positive psychological changes during exercise.

Given that core affective responses drive valenced responses (e.g. enjoyment) and influence wanting to engage in a particular behavior, it is important to assess this variable in terms of both mean and inter-individual responses. Mean affective responses during both

television-viewing conditions were approximately one unit higher than those seen during the NoTV condition. Previous studies have reported that a one-unit increase in core affect to be associated with increased participation in PA ranging from 15-41 minutes depending on follow-up time period[51-53, 55]. However, it is important to note that, given the high inter-individual variability in affective responses, mean values may not be wholly representative of individual responses during exercise[48]. Specifically, 27% of participants in the current study reported increased Feeling Scale scores from baseline during the FavTV condition. This increase was more than twice the percentage of participants who reported increases during the NatTV (4% increased) or the NoTV (12% increased) exercise bouts. Only a small percentage of participants (8%) reported decreases in affective responses during the FavTV condition. This value is substantially smaller compared to the percentage of participants reporting decreases in affective responses across previous studies (21-57%)[48, 51, 52, 148, 158]. While these results suggest that combining FavTV and exercise may prompt more positive individual psychological responses despite the lack of statistical differences in mean in-task affective responses between FavTV and NatTV conditions, these observed changes occurred over a brief 1/3-mile walk (~seven minutes per participant). Given that these results support previous literature regarding the beneficial effects of television viewing during exercise on hedonic responses, more research is warranted to determine if this effect can be replicated during longer bouts of exercise.

The second objective of the current study was to determine the impact of television viewing during exercise on treadmill walking time. Exercise duration was selected as the primary variable as it was surmised that the availability of television might have a greater impact on how long an individual continues to engage in aerobic exercise versus how hard an individual is willing to work. While results from Part A suggests that television viewing enhances the

reinforcing value of exercise (via hedonic responses and preferences), results from Part B indicate that the difference in walking time between the two conditions (~5 minutes) was not statistically significant.

Another interesting finding was that the physiological and psychological variables that are significantly correlated with exercise time during the NoTV condition did not significantly predict behavior when entered into a hierarchical linear regression. Although one might expect each of these variables to independently influence exercise behaviors, given that individuals with higher fitness levels, higher preference or higher tolerance for exercise may participate in greater amounts of PA, these results demonstrate the complex relationships between a single outcome measure and behavior. Thus, it is important to examine the interplay between these physiological and psychological variables and observable behavior. Future studies should examine multiple behavioral occasions (e.g. how many times does an individual work out each week) and utilize more sensitive analyses such as a principal components analysis to obtain a deeper understanding of how such constructs influence exercise-related behavioral choices.

Regarding the walking behaviors observed in the current study, several anecdotal observations are worth mentioning in terms of optimizing future laboratory experiments. First, several participants indicated that they used Visits 3 and 4 as a free time to exercise (i.e. "I'm here for 60 minutes, I might as well walk"). In this regard, 36% of participants walked the full 60 minutes for both FavTV and NoTV conditions. It was hypothesized that an insufficiently active individual would not walk for an hour, however this ceiling effect raises concerns. Future studies may consider extending this time limit. Additionally, despite the autonomy of allowing individuals to choose their favorite television program, this approach may be problematic. Overall, 60% of participants chose television programs that included instances of violence,

death, rape, or sexual innuendo. More striking is that 50% of male participants apologized to the research assistant for their program's content, suggesting some level of discomfort during the visit. This poses a conundrum, in that a research assistant should be present for safety reasons, but it could also place an emotional burden on the participants based on their television program choice. Given that no differences in psychological variables were noted between television conditions in Part A (FavTV vs. NatTV), future research may benefit from choosing a non-aversive show to reduce the discomfort some participants may feel by watching their preferred, but potentially suggestive television program with a stranger. As noted by Privitera et al.[82], aversive television program themes can impact mood responses. While the individuals were not opposed to the content (given their choice in viewing), the addition of a relative stranger (the researcher) could undermine any positive impact of letting people choose their own show. It is possible that participants chose to exercise longer during the NoTV visit than they would in a more natural setting (e.g. their home) in order to avoid watching certain programs in the altered social environment imposed by the laboratory setting. Taken together, future research should consider this aspect during study design to determine the necessity of allowing choice in television programming.

This study is not without limitations. Although all individuals self-reported a favorite, or preferred television program, typical television viewing behaviors were not assessed. Typical television viewing behaviors may have contributed to how long participants were willing to walk during Part B. For example, individuals who watch less television may not have been as inclined to stop or take breaks from exercise, particularly during the NoTV condition. Additionally, only one mode of exercise was assessed during this study. Walking was selected, as it is the most commonly reported leisure time PA among U.S. adults[159-161]. However, it is possible that other

modes of exercise may alter psychological constructs differently. Specifically, if individuals experience musculoskeletal discomfort while walking, a cycle ergometer may be a more comfortable and enjoyable mode of exercise. Other limitations to this study include that only one behavioral outcome (walking duration), and one exercise work rate (70% VO_2-at-VT) were investigated. It is possible that the differences in walking time while watching a preferred television program may be augmented when individuals exercise at intensities above VT. In addition, higher exercise intensities may have limited the number of individuals who exercised for the entire 60-minutes during both visits, reducing the ceiling effect observed in the current study.

Conclusions

Results from the current study provide further insight into exercise related behavioral choices. This study demonstrated that individuals prefer walking with television viewing over walking with no television. Results from the current study also support previous findings regarding the beneficial effects of television viewing during exercise on affective responses and enjoyment of exercise. While the five additional minutes spent on the treadmill with television viewing did not reach statistical significance, these results suggests that further research should be conducted to understand the behavioral impact of television viewing during exercise.

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APPENDICES

APPENDIX A

Tables and Figures

Table 1. Participant characteristics (mean±SD).

	Total (n=25)	**Males (n=8)**	**Females (n=17)**
Age (y)	46±12	46±15	46±11
Height (cm)	169.1±8.2	176.8±9.1	165.4±4.6*
Weight (kg)	90.5±17.6	98.0±16.7	86.9±17.8.
BMI (kg/m^2)	31.2±5.3	30.2±2.9	31.6±6.2
Body Fat (%)	36.1±7.3	29.4±4.8	39.4±5.8*
Avg. PA/Week (mins/week)	63±58	67±60	65±59
VO_{2peak} ($ml \cdot kg^{-1} \cdot min^{-1}$)	21.9±4.8	24.8±4.5	20.5±4.4
HR at VT (bpm)	128±19	118±20	133±17
VO_2-at-VT ($ml \cdot kg^{-1} \cdot min^{-1}$)	15.2±3.1	15.6±2.8	14.9±3.2

*Denotes significantly different from male participants ($p<0.05$). y: years, cm: centimeters, kg: kilograms, BMI: body mass index, %: percent, Avg: average, PA: physical activity, mins: minutes, VO_{2peak}: peak oxygen consumption, ml: milliliters, HR: heart rate, bpm: beats per minute, VO_2: oxygen consumption VT: ventilatory threshold.

Table 2. Relative preference (mean±SD) for exercise scores under three television-viewing conditions.

	FavTV	**NatTV**	**NoTV**
Total (n=25)	1.1±1.3	1.8±1.9	3.0±2.7*

*Denotes significantly different from FavTV and NatTV conditions ($p<0.05$). Lower scores indicate greater preference for exercise during specified television condition. FavTV; participant's self-reported favorite television program, NatTV: Episode 1 (*Challenges of Life*) of the British Broadcasting Company's *Life* program, NoTV: no television program.

Table 3. Feeling scale (FS), heart rate (HR) and rating of perceived exertion (RPE) responses (mean±SD) prior to, during and following exercise under various television conditions.

Variable	Condition	Pre-Exercise	0.10 mile	0.20 mile	0.30 mile	Post-Exercise
FS	FavTV	2.7±1.9	3.3±1.5	3.5±1.4	3.5±1.4	3.2±1.7
	NatTV	2.7±2.0	3.4±1.6	3.2±1.6	3.1±1.7	3.2±1.7
	NoTV	2.6±2.1	2.5±1.7	2.4±1.8	2.4±1.7	2.4±1.8
HR (bpm)	FavTV	94±17	108±15	108±15	110±15	109±15
	NatTV	95±18	107±15	110±17	110±16	109±16
	NoTV	94±18	109±15	110±15	110±16	110±16
RPE	FavTV	6.3±0.7	7.6±1.7	8.0±2.0	8.4±2.0	7.1±1.8
	NatTV	6.3±0.7	7.6±1.8	8.1±2.0	8.6±2.3	7.3±2.3
	NoTV	6.2±0.7	7.7±1.9	8.6±2.3	9.1±2.5	7.4±2.0

FavTV; participant's self-reported favorite television program, NatTV: Episode 1 (*Challenges of Life*) of the British Broadcasting Company's *Life* program, NoTV: no television program.

Table 4. Results From Regression Analysis.

	β	Standard Error	Beta	T	P value
Model 1					
VO_2-at-VT	2.487	0.935	0.485	2.66	0.014*
Model 2					
VO_2-at-VT	1.703	1.857	0.332	0.917	0.369
VO_{2Peak}	0.580	1.179	0.178	0.492	0.628
Model 3					
VO_2-at-VT	1.979	1.814	0.386	1.091	0.601
VO_{2Peak}	-0.106	1.224	-0.033	-0.087	0.932
Preference	0.243	0.721	0.082	0.337	0.740
Tolerance	0.947	0.649	0.317	1.460	0.160

*Denotes statistical significance ($p<0.05$), VO_2: oxygen consumption ($ml \cdot kg \cdot^{-1} \cdot min^{-1}$), VT: ventilatory threshold, VO_{2peak}: peak oxygen consumption ($ml \cdot kg \cdot^{-1} \cdot min^{-1}$), Preference: preference for exercise intensity as determined by the Preference and Tolerance for Intensity of Exercise Questionnaire, Tolerance: tolerance for exercise intensity as determined by the Preference and Tolerance for Intensity of Exercise Questionnaire.

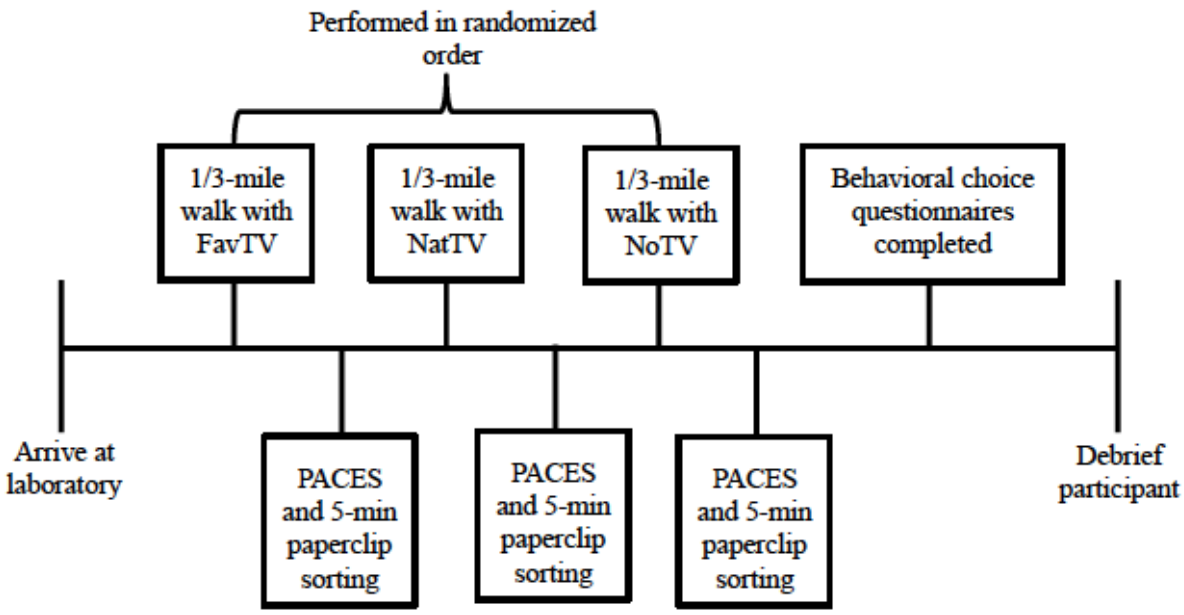

Figure 1. Experimental design of Visit 2 which included three randomized 1/3-mile walking bouts performed at 70% oxygen consumption at ventilatory threshold while either watching their self-reported favorite television program (FavTV) a nature program (NatTV) or no television (NoTV). In between walking bouts, participants completed the Physical Activity Enjoyment Scale (PACES) and a 5-minute sedentary activity (paperclip sorting).

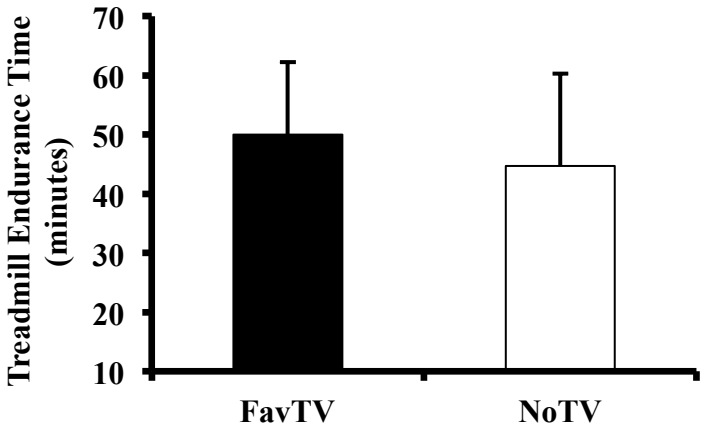

Figure 2. Average walking duration (standard deviation bars) while watching self-reported favorite television program (FavTV) or no television programming (NoTV) during a 60-minute laboratory visit. No statistically significant differences between conditions were observed.

APPENDIX B

Informed Consent

Title of Research: Effects of Television Viewing On Psycho-Physiological And Behavioral Outcomes.
Principal Investigator: Brittany Overstreet
Location: Applied Physiology Laboratory, 1914 Andy Holt Ave. Office #303, University of Tennessee, Knoxville, TN 37996

PURPOSE

You have been invited to participate in the research study entitled *Effects of Television Viewing On Psycho-Physiological And Behavioral Outcomes*. The purpose of the study is to examine various psychological, physiological and behavioral responses to walking exercise with and without television viewing.

PARTICIPANT'S INVOLVEMENT IN THIS STUDY

If you choose to participate in this study, you will make four visits to the Applied Physiology Laboratory (Health, Physical Education and Recreation building room 317). Total time commitment for the entire study will be approximately 4-5 hours.

Visit 1:

Following explanation this informed consent form, you will be asked to fill out the following forms: a Health History Questionnaire, an Exercise History Questionnaire, a Preference for and Tolerance of Exercise Intensity Questionnaire, a Behavioral Regulations in Exercise Questionnaire, and an Exercise Benefits/Barriers Scale. You will also be asked three short questions regarding your exercise habits and your favorite 30-minute television shows. If you fail to meet the eligibility criteria from the questionnaires your participation in the study will be terminated and you will have your health history document returned to you for your keeping. Next, you will be asked to perform a maximal exercise test on the treadmill. You will walk at 3.0 miles per hour as the incline is increased 0.5% each minute. Heart rate, ratings of perceived exertion and affective responses will be recorded every minute while we continuously measure expired gasses. The exercise test will continue until you can no longer maintain the exercise work rate or if any signs or symptoms of abnormal responses are experienced.

Visit 2:

During visit two you will complete a 1-mile walk on the treadmill which will be divided into three 1/3 of a mile bouts. During one bout you will exercise while watching your favorite television show, during another you will watch the first 30-minutes of a nature program and during the other you will walk without any television program. You will complete all three walking bouts, but the order will be randomized. Rating of perceived exertion and affective responses and heart rate will be measured. Following each exercise bout, you will be asked to sit and complete the Physical Activity Enjoyment Scale. Once this scale is complete, you will take a 5-minute break during which you will sort a variety of paperclips into different colored cups. At the end of the 5-minute break you will return to the treadmill to complete your next walking bout. Following the walking bouts, you will complete a behavioral-choice questionnaire. This questionnaire contains 30-questions asking you report your preference of activities based on your recent experience in the laboratory. Each potential answer on the questionnaire will be associated with a bingo ball. For each answer you provide, the associated bingo ball will be placed in a bag and one will be randomly drawn to determine your final task (a 1-mile walk or paperclip-sorting task).

Visits 3 and 4:

IRB NUMBER: UTK IRB-15-02469-FB
IRB APPROVAL DATE: 10/06/2015
IRB EXPIRATION DATE: 09/16/2016

Initials _____

The order of these visits will be randomized. During one of the visits you will exercise while watching your favorite television show and during the other you will exercise without any television viewing. During both visits you will complete the Positive And Negative Affect Schedule Scale, Feeling Scale and Felt Arousal Scale upon arrival to the laboratory. Once completed, you will be required to spend the next hour in the laboratory. During that hour, at least 10-minutes must be spent walking on the treadmill. Once the required 10-minutes of walking has been satisfied, you will be given the option to continue walking for as long as you want or you may choose to watch television while seated. For the remaining 50-minutes you may choose to switch between walking and being seated as you desire.

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 events occurring is remote. Previous studies have predicted that 1 out of every 15,000-18,000 individuals will experience an acute myocardial event as a result of exercise. In order to reduce the risks, you will complete a screening tool to determine if it is unsafe for you to participate in exercise.

BENEFITS

By participating in the study you will gain information about your body composition and cardiorespiratory fitness. You will receive a summary sheet with this information upon completion of the study.

CONFIDENTIALITY

Information and records associated with this study will be kept confidential and will be stored in a locked in a filing cabinet in the HPER (room 317) or saved on a password-protected computer. Brittany Overstreet and other co-investigators including Dr. David Bassett, Dr. Kelley Strohacker, Dr. Scott Crouter and Dr. Debora Baldwin will have access to study documents. 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.

EMERGENCY MEDICAL TREATMENT

The University of Tennessee does not "automatically" reimburse subjects for medical claims or any other compensation. If physical injury is suffered in the course of research, or for more information, please contact Brittany Overstreet: at (240) 215-5009 or bwilker8@vols.utk.edu.

CONTACT INFORMATION

If you have questions at any time please contact the principal investigator, Brittany Overstreet: 303 HPER Building, The University of Tennessee, Knoxville, TN 37996 (240) 215-5009, bwilker8@vols.utk.edu. If you have questions concerning your rights as a participant, contact the Compliance Section of the Office of Research and Engagement at (865) 974-7697.

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 all data collection is complete you will be provided any available information on your health summary sheet and your data file will be returned to you or destroyed.

Initials _____

IRB NUMBER: UTK IRB-15-02469-FB
IRB APPROVAL DATE: 10/06/2015
IRB EXPIRATION DATE: 09/16/2016

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

Recruitment Flyer

Research Recruitment Flyer

NEW RESEARCH STUDY

What Will It Take To Get *YOU* To Exercise?

The Applied Physiology Laboratory at The University of Tennessee is conducting a study to help determine the effects of television viewing during exercise.

Qualifications

- Between the 30 and 65 years of age
- Able to walk 1-mile
- Not currently exercising on 3 or more days each week

If you meet the additional study criteria, you will be eligible to participate in an exercise study that will measure your heart rate, fitness and feelings towards exercise.

Receive A Free Health Summary!

4 visits to the Applied Physiology Lab
Approximate time commitment <1.5 hours per session
Please contact **Brittany Overstreet** at **bwilker8@vols.utk.edu** for more details.

Brittany O: Bwilker8@vols.utk.edu
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APPENDIX D

Participant Recruitment Email

Research Recruitment Email

Good (morning/afternoon),

The Applied Physiology Laboratory is currently looking for volunteers to participate in an upcoming research study examining the psychological, physical and behavioral effects of television viewing during exercise. Volunteers should be between 25-70 years old, exercising less than <3 days per week, and have no known health conditions that would prevent participation in exercise. This study requires 4 visits, each 1-1.5 hours long, to the Health, Physical Education and Recreation building (room 317). For your participation in the study, you will receive a health assessment summary including information regarding your body composition and cardiorespiratory fitness levels. If interested, or to obtain more information, please contact Brittany Overstreet at bwilker8@vols.utk.edu.

Thank you,

Brittany Overstreet
Doctoral Candidate
Department of Kinesiology, Recreation and Sport Studies
1914 Andy Holt Ave
Knoxville, TN 37996
Phone: 865-974-6040
Fax: 865-974-8981
Email: bwilker8@vols.utk.edu

APPENDIX E

Participant Results Sheet

Results Summary Sheet For Participant (Example)

(Participant's name) –

Thank you for your participation in the Effects *of Television Viewing On Psycho-Physiological And Behavioral Outcomes* research study. Here are your results from your body composition and fitness testing. Your values are presented below along with normal ranges for each measurement as stated by the American College of Sports Medicine. Bolded values indicate values outside of the desired range for optimal health. If you have any questions regarding these values we suggest you contact your primary care physician. If you have any questions about your involvement, results or general questions regarding the study please feel free to contact me.

It has been a pleasure working with you,

Brittany Overstreet
Doctoral Candidate
Dept. of Kinesiology, Recreation, and Sport Studies
1914 Andy Holt Ave
Knoxville, TN 37996
Phone: 865-974-6040

Variable	Your Value	Normal or ideal-range for optimal health
Weight (lbs)		
Height (cm)		n/a
Percent body fat (%)		
BMI (kg/m^2)		
VO_{2max} ($ml \cdot kg \cdot min^{-1}$)		
Fitness percentile (%)		
Maximal heart rate (bpm)		

APPENDIX F

Behavioral Risk Factor Surveillance Survey

Exercise History Questionnaire

2009 BRFSS Physical Activity Questionnaire

Instructor Note: If the individual is "Employed for wages" or "Self-employed answer 19.1, if not – skip and go to 19.2. If respondent has multiple jobs, include all jobs.

19.1: Instructor reads: When you are at work, which of the following best describes what you do? Would you say –

1. Mostly sitting or standing
2. Mostly walking
3. Mostly heavy labor or physically demanding work

Instructor does not read:

4. Doesn't know/Not sure
5. Refused

Instructor reads: We are interested in two types of physical activity – vigorous and moderate. Vigorous activities cause large increases in breathing or heart rate while moderate activities cause small increases in breathing or heart rate.

19. 2 Instructor reads: Now, thinking about the moderate activities you do (fill in "when you are not working" if employed or self-employed) in a usual week, do you do moderate activities for at least 10-minutes at a time, such as brisk walking, bicycling, vacuuming, gardening, or anything else that causes some increase in breathing or heart rate?

1. Yes
2. No (Go to 19.5)
3. Doesn't know/Not sure (Go to 19.5)
4. Refused (Go to 19.5)

19. 3 Instructor reads: How many days per week do you do these moderate activities for at least 10-minutes at a time?

1. ____ Days per week
2. Do no do any moderate physical activity for at least 10-minutes at a time (Go to 19.5)
3. Doesn't know/Not sure (Go to 19.5)
4. Refused (Go to 19.5)

19. 4 Instructor reads: On days when you do moderate activities for at least 10-minutes at a time, how much total time per day do you spend doing these activities?

1. __:__ __ Hours and minutes per day
2. Doesn't know/Not sure
3. Refused

19. 5 Instructor reads: Now, thinking about the vigorous activities you do (fill in "when you are not working if employed or self-employed) in a usual week, do you do vigorous activities for at least 10-minutes at a time, such as running, aerobics, heavy yard work, or anything else that causes large increases in breathing or heart rate?

1. Yes
2. No
3. Doesn't know/Not sure
4. Refused

19. 6 Instructor reads: How many days per week do you do these vigorous activities for at least 10-minutes at a time?

1. ____ Days per week
2. Do no do any moderate physical activity for at least 10-minutes at a time
3. Doesn't know/Not sure
4. Refused

19. 7 Instructor reads: On days when you do vigorous activities for at least 10-minutes at a time, how much total time per day do you spend doing these activities?

1. __:__ __ Hours and minutes per day
2. Doesn't know/Not sure
3. Refused

APPENDIX G

Health History Questionnaire

Health History Questionnaire

Name: _____

Address: _____

City: _____ **Zip Code:** _____

Phone: _____ **Date of Birth:** _____ **Age:** _____

Gender: ___ M ___ F **UT Faculty/Staff:** _ Y ____ N

Occupation: _____ **Full Time?** _____ Y ____ N

Marital Status: (circle one) Single Married Divorced Widowed

Education: (check highest level completed) Elementary _____ High School _____ College _____ Graduate School_____

Race: White _____ American Indian _____ Asian _____ Hispanic _____
Black / African American _____ Native Hawaiian / Pacific Islander _____ Other _____

Personal Physician: _____ **Location:** _____

Are you taking any prescription or over-the counter medication? YES _____ NO _____

Name of Medication	Reason for Taking	For How Long?

Please Turn Over

Emergency Contact

Name: _____

Relationship: _____ Phone: Work: _____

Home: _____

PAST HISTORY

Have you ever had? (please check all that apply)

_____ Heart attack
_____ Any heart problems
_____ Arthritis
_____ Recurring leg pain (not related to arthritis)
_____ Liver or Kidney Disease
_____ Any breathing or lung problems
_____ Ankle swelling (not related to twisting)
_____ Low back or joint problems
_____ Uncontrolled Diabetes
_____ Cancer
_____ Blood Clots
_____ Stroke

PRESENT SYMPTOMS

Do you currently have? (Please check all that apply)

_____ Chest pain / discomfort
_____ Shortness of breath
_____ Heart palpitations
_____ Skipped heart beats
_____ Chronic Fatigue Syndrome
_____ Diabetes
_____ Cough on exertion
_____ Coughing of blood
_____ Dizzy spells
_____ Frequent headaches
_____ Orthopedic / joint problems
_____ Back Pain

APPENDIX H

Preference and Tolerance for Intensity of Exercise Questionnaire

Preference and Tolerance for Intensity of Exercise Questionnaire (PRETIE-Q)

Participant ID_____ Session_____ Date_____

Instructions for survey: 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 I

Behavioral Regulation In Exercise Questionnaire

Behavioral Regulation in Exercise Questionnaire (BREQ-2)

Participant ID_____ Session_____ Date_____

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 each question. Your responses will be held in confidence and only used for our research purposes.

	Not true for me		Sometimes 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 J

Rating of Perceived Exertion

Borg's Rating Of Perceived Exertion (RPE) 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

Verbal instructions for scale to be read by instructor :
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.

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. Look at the scales and the expressions and then give a number.

APPENDIX K

Feeling Scale

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 for scale to be read by instructor:

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. Please indicate your level of pleasure or displeasure you are experiencing right now.

APPENDIX L

Physical Activity Enjoyment Scale

Physical Activity Enjoyment Scale (PACES)

Participant ID_____ Session_____ Date_____

Physical Activity Enjoyment Scale
Please review each scenario below and rank each one from 1 to 7 based on which side of the scale you feel best represent how you feel about the exercise bout you just performed.

I enjoyed it	1	2	3	4	5	6	7 I hated it
I felt bored	1	2	3	4	5	6	7 I felt interested
I disliked it	1	2	3	4	5	6	7 I liked it
I found it pleasurable	1	2	3	4	5	6	7 I found it un-pleasurable
I was very absorbed with the exercise	1	2	3	4	5	6	7 I was not at all absorbed with the exercise
It was no fun at all	1	2	3	4	5	6	7 It was a lot of fun
I found it energizing	1	2	3	4	5	6	7 I found it tiring
It made me depressed	1	2	3	4	5	6	7 It made me happy
It was very pleasant	1	2	3	4	5	6	7 It was very unpleasant

I felt good physically while doing it	1	2	3	4	5	6	7	I felt bad physically while doing it
It was very invigorating	1	2	3	4	5	6	7	It was not at all invigorating
I was very frustrated by it	1	2	3	4	5	6	7	I was not at all frustrated by it
It was very gratifying	1	2	3	4	5	6	7	It was not at all gratifying
It was very exhilarating	1	2	3	4	5	6	7	It was not at all exhilarating
It was not at all stimulating	1	2	3	4	5	6	7	It was very stimulating
It gave me a strong sense of accomplishment	1	2	3	4	5	6	7	It did not give me a strong sense of accomplishment
It was very refreshing	1	2	3	4	5	6	7	It was not at all refreshing
I felt as though I there was nothing else I would rather be doing	1	2	3	4	5	6	7	I felt as though there was something else be I would rather be doing

APPENDIX M

Behavioral Choice Paradigm Practice Questionnaire

Practice Behavioral Choice Paradigm Questionnaire

Please answer the following *practice* questions by circling the option you would prefer completing.

1. Walking 1-mile outside or sitting and sorting paperclips for 2-minutes

2. Walking 1-mile outside or sitting and sorting paperclips for 4-minutes

3. Walking 1-mile outside or sitting and sorting paperclips for 6-minutes

4. Walking 1-mile outside or sitting and sorting paperclips for 8-minutes

5. Walking 1-mile outside or sitting and sorting paper-clips for 10-minutes

6. Walking 1-mile outside or sitting and sorting paperclips for 12-minutes

7. Walking 1-mile outside or sitting and sorting paperclips for 14-minutes

8. Walking 1-mile outside or sitting and sorting paperclips for 16-minutes

9. Walking 1-mile outside or sitting and sorting paperclips for 18-minutes

10. Walking 1-mile outside or sitting and sorting paperclips for 20-minutes

APPENDIX N

Behavioral Choice Paradigm Questionnaires

Behavioral Choice Paradigm Questionnaire Part A: Self-Selected Television Program

Reflect on the 1/3 of a mile walking bout you previously completed while watching your favorite television program and the 5-minute paperclip-sorting task that followed. Please answer the following questions by circling which option (treadmill walking or paper-clip sorting) you would prefer completing for each scenario. For each option that you choose walking 1-mile over paper clip sorting, the associated bingo ball will be placed in a container. Once you complete all 30-questions, one bingo ball will be randomly selected and you will perform the activity associated with that bingo ball.

1. Walking 1-mile while watching your self-selected TV show or sitting and sorting paperclips for 2-minutes **Bingo balls = White A1**

2. Walking 1-mile while watching your self-selected TV show or sitting and sorting paperclips for 4-minutes **Bingo balls = White A2**

3. Walking 1-mile while watching your self-selected TV show or sitting and sorting paperclips for 6-minutes **Bingo balls = White A3**

4 Walking 1-mile while watching your self-selected TV show or sitting and sorting paper-clips for 8-minutes **Bingo balls = White A4**

5. Walking 1-mile while watching your self-selected TV show or sitting and sorting paperclips for 10-minutes **Bingo balls = White A5**

6. Walking 1-mile while watching your self-selected TV show or sitting and sorting paperclips for 12-minutes **Bingo balls = White A6**

7. Walking 1-mile while watching your self-selected TV show or sitting and sorting paperclips for 14-minutes **Bingo balls = White A7**

8. Walking 1-mile while watching your self-selected TV show or sitting and sorting paperclips for 16-minutes **Bingo balls = White A8**

9. Walking 1-mile while watching your self-selected TV show or sitting and sorting paperclips for 18-minutes **Bingo balls = White A9**

10. Walking 1-mile while watching your self-selected TV show or sitting and sorting paperclips for 20-minutes **Bingo balls = White A10**

Behavioral Choice Paradigm Questionnaire Part B: Nature Television Program
Reflect on the 1/3 of a mile walking bout previously completed while watching the nature (Life) television program and the 5-minute paperclip-sorting task that followed. Please answer the following questions by circling which option (treadmill walking or paper-clip sorting) you would prefer completing for each scenario. For each option that you choose walking 1-mile over paper clip sorting, the associated bingo ball will be placed in a container. Once you complete all 30-questions, one bingo ball will be randomly selected and you will perform the activity associated with that bingo ball.

11. Walking 1-mile while watching the Nature TV show or sitting and sorting paperclips for 2-minutes **Bingo balls = Blue B1**

12. Walking 1-mile while watching the Nature TV show or sitting and sorting paperclips for 4-minutes **Bingo balls = Blue B2**

13. Walking 1-mile while watching the Nature TV show or sitting and sorting paperclips for 6-minutes **Bingo balls = Blue B3**

14 Walking 1-mile while watching the Nature TV show or sitting and sorting paperclips for 8-minutes **Bingo balls = Blue B4**

15. Walking 1-mile while watching the Nature TV show or sitting and sorting paperclips for 10-minutes **Bingo balls = Blue B5**

16. Walking 1-mile while watching the Nature TV show or sitting and sorting paperclips for 12-minutes **Bingo balls = Blue B6**

17. Walking 1-mile while watching the Nature TV show or sitting and sorting paperclips for 14-minutes **Bingo balls = Blue B7**

18. Walking 1-mile while watching the Nature TV show or sitting and sorting paperclips for 16-minutes **Bingo balls = Blue B8**

19. Walking 1-mile while watching the Nature TV show or sitting and sorting paperclips for 18-minutes **Bingo balls = Blue B9**

20. Walking 1-mile while watching the Nature TV show or sitting and sorting paperclips for 20-minutes **Bingo balls = Blue B1**

Behavioral Choice Paradigm Questionnaire Part C: No Television Program
Reflect on the 1/3 of a mile walking bout you previously completed without any television program viewing and the 5-minute paperclip-sorting task that followed. Please answer the following questions by circling which option (treadmill walking or paperclip-sorting) you would prefer completing for each scenario. For each option that you choose walking 1-mile over paper clip sorting, the associated bingo ball will be placed in a container. Once you complete all 30-questions, one bingo ball will be randomly selected and you will perform the activity associated with that bingo ball.

21. Walking 1-mile without TV viewing or sitting and sorting paperclips for 2-minutes

Bingo balls = Red C1

22. Walking 1-mile without TV viewing or sitting and sorting paperclips for 4-minutes

Bingo balls = Red C2

23. Walking 1-mile without TV viewing or sitting and sorting paperclips for 6-minutes

Bingo balls = Red C3

24. Walking 1-mile without TV viewing or sitting and sorting paperclips for 8-minutes

Bingo balls = Red C4

25. Walking 1-mile without TV viewing or sitting and sorting paperclips for 10-minutes

Bingo balls = Red C5

26. Walking 1-mile without TV viewing or sitting and sorting paperclips for 12-minutes

Bingo balls = Red C6

27. Walking 1-mile without TV viewing or sitting and sorting paperclips for 14-minutes

Bingo balls = Red C7

28. Walking 1-mile without TV viewing or sitting and sorting paper-clips for 16-minutes

Bingo balls = Red C8

29. Walking 1-mile without TV viewing or sitting and sorting paperclips for 18-minutes

Bingo balls = Red C9

30. Walking 1-mile without TV viewing or sitting and sorting paperclips for 20-minutes

Bingo ball = Red C1

APPENDIX O

Participant Debrief Script

Debriefing Script

To be read by investigator: Thank you for completing the behavioral-choice questionnaire and for your participation in our study thus far. Although you were originally told you would now be completing randomly selected final task, we will not be requiring you to perform that task. The purpose of informing you that you would perform a final task was to promote truthful and honest answers and to prevent passive answering of the questionnaire. Did you have any inclination that you would not be asked to complete this task? **(YES or NO).** If you would like to complete the 1-mile walking bout or paperclip-sorting task, I would be more than happy to carry out the remainder of the project as previously described. If not, then I am more than willing to answer any questions you may have at this point. Additionally, just for your information, this is the only time during the study that you will have to complete a bout of exercise you were told you would have to do. During the next two visits you will have to perform the exercise as we have previously discussed. If you have no further questions we can schedule your remaining visits at this time.

VITA

Brittany Star Overstreet was born in Mount Airy, MD on January 8, 1989 where she was raised and graduated from Linganore High School in 2007. She earned her Bachelor of Science degree in Exercise Science with an Allied Health Track from Salisbury University in 2011 and completed her Masters of Science degree in Clinical Exercise Physiology at Ball State University in 2013. Following the completion of her Masters degree, she moved to Knoxville, Tennessee to begin her doctoral work at the University of Tennessee in the Department of Kinesiology, Recreation, and Sport Studies under the advisement of Dr. David Bassett, Jr. She completed her Doctor of Philosophy degree in Kinesiology and Sports Studies in August 2016. After completing her Ph.D., she assumed a faculty position in the Department of Kinesiology and Applied Physiology at The University of Delaware.