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Increasing awareness of the myriad risk factors and dangers related to a sedentary lifestyle is not always a sufficient catalyst to motivate behavior change. Even with the knowledge of the health-related benefits, 51.2% of the U.S. population currently leads a lifestyle that is either sedentary or insufficient in physical activity. Researchers interested in understanding how to increase exercise behaviors may benefit from examining the role of motivation directly. In particular, recent behavioral research has illustrated a connection between the personal meaning of doing a task and the resultant performance of that task. Thus, the purpose of the current study was to explore the possible effects of the meaning/purpose for exercising on the self-selected duration of a cycling task.

Participants were randomly assigned to one of three different treatment conditions (health, wealth, charity). Participants in each treatment condition watched a short video about the health benefits of exercise. Those in the health condition did not receive any additional information. Those in the wealth condition were informed that they would earn money for every two kilometers (KM) cycled. Those in the Charity condition were informed that they would earn money for a charity for every two KM cycled.

Analyses using current physical activity as a covariate revealed that for total KM cycled there was a nearly significant difference between groups such that the

wealth and charity groups cycled approximately two times as far as did the health group. The results for this sample thus suggest that immediate intrinsic or immediate extrinsic rewards may have a clinically meaningful effect on the number of KM cycled compared to delayed extrinsic rewards.

FOR HEALTH, WEALTH, OR OTHERS: HOW THE PURPOSE FOR PARTICIPATING IN A CYCLING TASK AFFECTS PERFORMANCE

by

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Approved by

_____
Committee Chair

To…

My Family (Piepmeier and Hutchison)

for their love and support.

And, to Mary

for her inspirational spirit

and unwavering love.

APPROVAL PAGE

This thesis has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

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CHAPTER I

INTRODUCTION

It is probably fair to say that everyone knows that exercise is "good for you." It is also fair to say that while some people honestly enjoy, and look forward to, the experience of exercising, others are perfectly content with a life void of exercising, and are not at all motivated to be physically active. This may seem odd, especially given the recent increase in public service announcements and campaigns to raise awareness to the multitude of health benefits that can be derived from a physically active lifestyle. However, the fact remains that the majority of the population of the United States is either sedentary or receives an insufficient amount of physical activity to fully receive the health benefits (CDC, 2010).

By reviewing research on motivation, this seemingly puzzling phenomenon of people having a concurrently high awareness of the health benefits of exercise and low occurrence of actual exercise behavior starts to make sense. The answer may lie in the main type of motivation that is being internalized relative to exercise and physical activity. Motivation to perform a given task can come from a variety of sources and researchers have been able to identify several types of motivating rewards (Abuhamdeh & Csikszentmihalyi, 2009; Ariely, Bracha, & Meier, 2008; Ariely, Gneezy, Loewenstein, & Mazar, 2009; Ariely, Kamenica, & Prelec, 2008; Deci, 1971; Deci, Koestner, & Ryan, 1999; Heyman & Ariely, 2004; Skinner, 1932; Spray, John Wang, Biddle, &

Chatzisarantis, 2006). The two major sources of motivation are intrinsic rewards and extrinsic rewards; both of which can motivate behavior (Abuhamdeh & Csikszentmihalyi, 2009; Ariely, Bracha, & Meier, 2008; Ariely, Kamenica, & Prelec, 2008; Deci, Koestner, & Ryan, 1999).

Examples of extrinsic rewards can be found in numerous areas of one's everyday life. Paychecks/bonuses, grades, coffee club cards, and the number of "likes" on a facebook post are just a few of the extrinsic rewards that motivate behavior on a daily basis. Researchers in behavioral psychology have demonstrated that these types of rewards are effective and reliable motivators of multiple types of behaviors **(**Skinner, 1932).

While extrinsic rewards have been shown to be effective motivators in certain situations (Abuhamdeh & Csikszentmihalyi, 2009; Ariely, Bracha, & Meier, 2008; Ariely, Gneezy, Loewenstein, & Mazar, 2009; Ariely, Kamenica, & Prelec, 2008; Deci, Koestner, & Ryan, 1999; Skinner, 1932), recent research has revealed some caveats to relying on this type of reward for increased or sustained behavior (Abuhamdeh & Csikszentmihalyi, 2009; Ariely, Bracha, & Meier, 2008; Ariely, Gneezy, Loewenstein, & Mazar, 2009; Ariely, Kamenica, & Prelec, 2008; Deci, Koestner, & Ryan, 1999). In fact, evidence suggests that extrinsic rewards may actually be detrimental to the quality and quantity of the performance of a desired behavior (Ariely, Bracha, & Meier, 2008; Ariely, Gneezy, Loewenstein, & Mazar, 2009; Ariely, Kamenica, & Prelec, 2008; Glucksberg, 1962). The lack of motivational power generated by extrinsic rewards may be more salient during the performance of boring or dull tasks (Ariely, Bracha, & Meier,

2008; Ariely, Kamenica, & Prelec, 2008). If the expected extrinsic reward is not received, behavior tends to stop **(**Deci, 1971). Additionally, if the extrinsic reward provides too powerful a stimulant (i.e., payment of a large sum of money), it may actually decrease the quality of behavior performed (Ariely, Gneezy, Loewenstein, & Mazar, 2009).

There have also been observations that suggest that the temporal nature of the extrinsic reward (i.e., when the reward is received) may have an effect on the participant's motivation (Mischel, Shoda, & Peake, 1988; Weller, Cook, Avsar, & Cox, 2008). When extrinsic rewards are not received immediately, participants have to rely on their ability to delay gratification for that reward. When given the choice between two extrinsic rewards, those participants who have a less developed ability to delay gratification, will be more likely to choose the more immediate reward, even if it does not bring them the most benefit. Following these observations and assuming that the health benefits that are received from regular exercise are delayed extrinsic rewards (e.g., weight loss, reduced cholesterol level and blood pressure, lowered risk of stroke and cardiovascular disease), it may make sense that people would choose a behavior (i.e., sitting on the couch) with a more immediate reward (i.e., relaxation, low exertion) over a behavior (i.e., jogging one mile after work) with more delayed rewards (i.e., the physical and mental health benefits that accumulate over time). This concept may explain part of the reason behind the seemingly paradoxical high rate of sedentary behavior in the United States.

The other major source of motivation comes from intrinsic rewards. Those motivated by intrinsic rewards perform a task because the simple performance of the task

brings them pleasure. People may refer to some tasks that bring them intrinsic rewards as hobbies (e.g., playing music, video games, chess, gardening, martial arts). Those performing these tasks do so without the intention of generating tangible rewards for their effort (though extrinsic rewards may be a byproduct). The motivation for this behavior comes from the feeling of meaning or purpose that these tasks generate for the performer (Ariely, Bracha, & Meier, 2008; Ariely, Kamenica, & Prelec, 2008). "Meaning and purpose," in this context, can be operationalized as perceptions of accomplishment, acknowledgement, or altruism. It is important to take into consideration that "meaning and purpose" are philosophical constructs that are difficult to objectively measure and may be defined differently by each individual. However, the previously stated operational definition allows for the inclusion of many definitions of meaning/purpose, including both personal and social aspects. In the interest of parsimony, meaning/purpose will be simply referred to as "meaning" from this point forward.

Research has shown that motivation originating from intrinsic rewards is very resilient and can sustain the performance of a desired behavior past the point of extrinsic rewards (Ariely, Bracha, & Meier, 2008; Ariely, Kamenica, & Prelec, 2008). Intrinsic rewards have not only been observed to increase the performance of desired behaviors, but research also suggests that those motivated by intrinsic rewards may retain a perception of enjoyment for performing a difficult task, even if it ends in failure (Abuhamdeh & Csikszentmihalyi, 2009).

Past research on motivation and behavior has revealed findings that are applicable to those interested in finding effective ways to increase physical activity levels in the

United States. This literature suggests that intrinsic rewards (i.e., meaning) are the best way to cultivate increased and sustained behavior (Ariely, Bracha, & Meier, 2008; Ariely, Kamenica, & Prelec, 2008; Deci, 1971)**.** However, there has been a limited amount of research exploring this methodology in exercise-related settings (Ariely, Bracha, & Meier, 2008).

Ariely, Bracha, and Meier (2008) performed an experiment to explore the differences in performance on a cycling task between two different motivational conditions. Participants in the first motivational condition were told that they would earn $1.00 for each mile cycled during a 10-minute exercise bout and that this money would be donated to a charity on their behalf. The second motivational condition used an identical payment design, but added an extrinsic reward (i.e., personal payment). Participants were told that in addition to earning money for charity, they would personally earn $1.00 per mile cycled. Analyses revealed that those in the exercise condition with both a charitable donation and an extrinsic reward cycled more miles during the 10-minute bout.

However, when interpreting this data, a few things should be considered. This experiment was conducted through the lens of Behavioral Economics and, therefore, did not approach the study with a focus on *exercise*. Several important aspects of the exercise bout were not addressed in the study. Measures of exercise intensity (e.g., HR and RPE), cycle resistance, and past exercise experience were not assessed. Another limitation of this study was the artificial ceiling placed on the observed behavior by

utilizing a predetermined exercise duration of 10 minutes. The possible effects of these considerations were not addressed by the authors.

Additionally, a major focus of the Ariely, Bracha, and Meier (2008) study was on aspects relating to the effect of image motivation on performance; exploring the effects of earning money for charities with either positive or negative stereotypes (as determined by the participant) on labor output (i.e., miles cycled). While effects of image motivation are important to consider in relation to exercise behavior, it is vital to initially explore the individual effects of meaning or extrinsic rewards (i.e., charitable donations or personal payment) on exercise behavior in a randomized control trial in order to increase the knowledgebase regarding exercise motivation.

Thus, the purpose of this experiment was to ask an important question related to the promotion of exercise behavior: how does the meaning behind performing exercise affect the actual exercise behavior? A randomized control trial to assess the difference in exercise behavior between three different treatment groups (health benefits only, health benefits plus personal monetary gain, health benefits plus charitable donation) was used to assess the impact of the meaning of exercising on the resultant exercise behavior. Measures of HR, RPE, affect, satisfaction, and enjoyment were assessed in order to begin exploration into how the subjective experiences of exercise may relate to the exercise behavior.

Research into the effects of different types of motivation/rewards (i.e., intrinsic and extrinsic) on measures of behavior has revealed that those motivated by intrinsic rewards tend to have a higher quality and quantity of the desired behavior than those

motivated by extrinsic rewards (Abuhamdeh & Csikszentmihalyi, 2009; Ariely, Bracha, & Meier, 2008; Ariely, Gneezy, Lowenstein, & Mazar, 2009; Ariely, Kamenica, & Prelec, 2008; Glucksberg, 1962;). Additionally, when a behavior is performed due to intrinsically motivating factors, it is said that the behavior comes from a sense of meaning that is derived from the performance of the behavior. This suggests that an exercise condition designed to include a meaningful component (i.e., accomplishment, acknowledgement, or altruism) should be expected to produce a resultant behavior that is identical to those motivated by intrinsic rewards.

The primary hypothesis of this experiment was that the total number of kilometers cycled would increase as a function of the degree of meaning for the exercise. Participants randomly assigned to an exercise condition with an increased degree of meaning (health benefits plus charitable donation [charity]) would cycle more kilometers than those in the other treatment conditions (i.e., health benefits only [health], health benefits plus personal monetary gain [wealth]).

The assessment of a person's perception of affect during exercise is an important factor to consider when exploring the relation of intrinsic motivation to the resultant exercise behavior. Researchers have found that positive affect has a tendency to increase after an acute bout of exercise (Bixby & Lochbaum, 2006; Bixby & Lochbaum, 2008; Ekkekakis, Hall & Petruzzello, 2008; Kean & Bryan, 2010; Parfit & Gledhill, 2004; Parfitt, Rose, & Burgess, 2006). However, taking measurements of affect at multiple time points during an exercise session may allow researchers to

identify if and when different types of motivation have an effect on psychological perceptions of affect during exercise.

During exercise sessions, that follow a protocol with predetermined exercise intensities, participants' perceptions of affect during exercise tend to be more positive at lower exercise intensities and more negative at higher exercise intensities (Bixby & Lochbaum, 2006). However, researchers have observed that by simply allowing participants to self-select their preferred level of exercise intensity, perceptions of affect and exertion do not continue to follow this previously observed path (Parfitt, Rose, & Burgess, 2006). Those who self-selected their preferred level of exercise intensity tended to choose a *medium* intensity level (as assessed by HR and blood lactate levels), but reported subjective experiences (i.e., RPE and affect) that were as if they were exercising at a predetermined *low* intensity level (i.e. lower levels of RPE and higher levels of positive affect). The act of being able to choose their own exercise intensity level resulted in psychological perceptions (i.e., RPE and affect) that were inconsistent with the physiological signals being produced by their body (i.e., blood lactate, & HR). This suggests that the ability to self-select ones level of exercise intensity may be related to a change in psychological perceptions due to intrinsically motivating factors.

The measuring of psychological perceptions of affect, RPE, and HR during different motivational conditions is an important next step in understanding the connection between the psychological perceptions of exercise and the resulting exercise behavior. By utilizing an experimental design that allows participants to

end the exercise session at will, the observed perceptions of the participants' psychological (affect and RPE) and physiological (HR) state in different conditions may be combined with behavioral measures (i.e., kilometers cycled) to help reveal subtleties relating to motivation and exercise behavior.

Thus, secondary hypotheses were that improvements in affect (i.e., change in affect from pre to post), positive affect experienced during the cycling task, and levels of satisfaction and enjoyment upon completion of the cycling task would be greater as a function of treatment condition (i.e., health, wealth, charity). It was important to obtain objective (HR) and subjective (RPE) assessments of exercise intensity in order to further explore the relation of meaning, affect, and the resultant exercise behavior.

CHAPTER II

EXTENDED LITERATURE REVIEW

Health Behavior

Evidence suggests that simply increasing the public's awareness of the myriad of risk factors and dangers related to a sedentary lifestyle is not always enough of a catalyst to motivate a behavior change. In fact, it is probably fair to say that *everyone* knows that exercise is "good for you." However, even with this widely held knowledge, the Center for Disease Control and Prevention reported, in their 2007 report of U.S. Statistics on Physical Activity, that only 48.8% of people in the U.S. met the recommended level of physical activity (CDC, 2010). That means that 51.2% either reported physical activity levels that were insufficient (i.e. not meeting the recommended level by Healthy People 2010) or reported that they were completely inactive.

There are many physiological health benefits resulting from an active lifestyle (e.g., weight loss, reduced cholesterol level and blood pressure, lowered risk of stroke and cardiovascular disease) and this is enough for some adults to begin a physically active lifestyle. With health issues, like the increasing obesity epidemic, affecting individuals at increasingly younger ages it is becoming more important to discover ways to motivate the public to change this sedentary behavior.

There are also neuropsychological factors that benefit from exercise. These benefits, though important to survival and daily function, are even harder for the general

population to recognize because these changes are not easily perceived or assessed. Improvements in cognitive function (Ploughman, 2008), an amelioration of gray and white matter loss in the frontal, temporal, and parietal lobes (Colcombe et al., 2003), and an increase in production of brain-derived neurotrophic factor (a protein involved with neural health and plasticity) (Tang, Chu, Hui, Helmeste, & Law, 2008) are a few of the benefits derived from a physically active lifestyle. These factors show that exercise is not only important for the development of a healthy body, but it is also an important factor in the development of a healthy mind and brain.

Public awareness of the psychological benefits of exercise is also less widely known than the physiological benefits. Anecdotally, people may say that they "feel good" after a workout, but they may not actually understand the possible magnitude of this feeling. Researchers have found convincing evidence that suggests that exercise may actually help reduce depressive symptoms in individuals diagnosed with Major Depressive Disorder (Ernst, Olson, Pinel, Lam, & Christie, 2006). This "feel good" effect may be an important key to increasing people's physical activity levels and improving their mental health.

Scientists are currently conducting experiments in order to more fully understand the dynamic perceptions of affect as it changes throughout an exercise session and, ultimately, leads to an improvement in affect during and after chronic and acute bouts of exercise **(**Bixby & Lochbaum, 2006; Bixby & Lochbaum, 2008; Bixby, Spalding, & Hatfield, 2001; Ekkekakis, 2008; Ekkekakis, Hall, & Petruzzello, 2005; Ekkekakis, Hall, & Petruzzello, 2008; Kwan & Bryan, 2010). Humans have a tendency to behave in a

manner that enables them to experience things that feel good. Discovering ways to maximize the intensity and longevity of these exercise-related positive feelings may be an important step in the search for understanding how to identify and generate a sense of intrinsic motivation to exercise. These discoveries may help more people to find the motivation to live a physically active life and, ultimately, live a life of optimal well-being.

Prevention is the hot topic in the world of public health. Much attention is being placed on increasing the public's awareness to the necessary adoption of a physically active lifestyle in order to prevent illness and increase quality of life. This is seen in the recent public awareness campaigns such as Michelle Obama's "Let's Move" program and the Department of Health and Human Services "Get Up and Play an Hour a Day" commercial starring the cast from Shrek. However, as previously stated, increasing awareness and knowledge of the risks is not likely to be enough to get people to change their behavior. Given evidence that motivation is an important determinant of behavior, it is important for future research to discover ways to enhance motivation in ways that will encourage people to adopt a physically active lifestyle.

Motivation

Researchers have mounted a multidisciplinary exploration into the effects of motivation on behavior in different environments. When humans perform a task for the sole reason that it "feels good" to do it, scientists say that the tasks are being performed due to intrinsically motivating factors. It has been observed that behavior increases as the individual is driven by intrinsic motivation (Deci, Koestner, & Ryan, 1999; Ariely,

Kamenica, & Prelec, 2008; Abuhamdeh & Csikszentmihalyi, 2009). Intrinsic motivation may even increase one's perception of enjoyment of performing a difficult task that ends in failure (Abuhamdeh & Csikszentmihalyi, 2009).

Another type of motivation comes from receiving material or non-material rewards when desired behaviors are performed. This extrinsic motivation is the basis of how many of us live our daily lives. We go to work in order to pay our bills and put food on the table, we put in the extra hours on our thesis in order to get a degree, and we go to the gym in order to fit into our bathing suit and show off our rippling muscles. Behavioral Psychologists, such as B.F. Skinner, have demonstrated how predictable and reliable behavior can be shaped using these types of extrinsic rewards (Skinner, 1932). However, new interest in the area of behavioral economics and psychology has sparked the interest of scientists from several disciplines to design creative experiments that explore the effects of such rewards.

When examined in isolation, it has been found that, in some conditions, extrinsic rewards may not reinforce a desired behavior (Ariely, Bracha, & Meier, 2008), may result in a decrease of a desired behavior (Heyman & Ariely, 2004), may be detrimental to performance quality (Ariely, Gneezy, Loewenstein, & Mazar, 2009; Glucksberg, 1962), and may decrease intrinsic motivation (Hitt, Marriott, & Esser, 1992). For this reason, experts in sport psychology and behavioral economists have been conducting research into the relative effects of different types of incentives (i.e., monetary and charitable donations) and motivational orientations (e.g., intrinsic, extrinsic, task, ego) (Ariely, Bracha, & Meier, 2008; Ariely, Kamenica, & Prelec, 2008; Deci, Koestner, &

Ryan, 1999; Abuhamdeh & Csikszentmihalyi, 2009; Spray, John Wang, Biddle, & Chatzisarantis, 2006) on measures of performance. The results of this research have led to a focus on the importance of intrinsic motivation, with a particular emphasis on the perceived meaningfulness of a task, on improvements of performance.

Keeping in mind that research in motivation suggests that emphasis should be placed on intrinsic rewards when attempting to increase behavior, the previously mentioned data in regards to inadequate physical activity levels may not be as surprising. It may be possible that exercisers are placing too much emphasis on extrinsic rewards gained from exercise. Furthermore, the benefits gained from these extrinsic rewards are likely to be delayed (e.g., weight loss, muscle gain) and difficult to perceive (e.g., cardiovascular health, reduced cholesterol level and blood pressure).

The timing of the reward may be of particular relevance in terms of exercise behavior. The ability of a participant to delay gratification may affect his/her ability to make a decision that reaps the biggest payoff. Foundational research on the topic of delayed gratification was performed by Mischel, Shoda, and Peake (1988), who explored the ability, of young children, to exercise self-regulation by assessing the children's ability to delay gratification for a self-selected extrinsic reward. Participants (children aged 4-5 years) were presented with a choice between two rewards (e.g., one marshmallow or two marshmallows) and were asked which they would prefer to have. The participants were then told that the researcher was going to leave the room for a while and that they would receive the reward they previously identified as the most desirable if they *waited until his return* (i.e., show ability to delay gratification). They

were also provided with a bell they could ring to summon the researcher back into the room whenever they wanted. However, if they chose to ring the bell, they would be given the reward they previously identified as least desirable. Further manipulations were made by systematically changing environmental factors that altered the experimental condition in which the participants would wait. These conditions included the presence of physical objects to attend to during wait (e.g., the reward, nothing) and specific thoughts to attend to during the wait (e.g., eating the reward, other fun activities).

The results of this study were focused on prospective correlations between the children's current ability to delay gratification and future assessed variables related to social competence and academic success, obtained from self-report measures filled out by the children's parents 10 years later. Observations from this study suggest that those participants who were more successful at delaying gratification during childhood were more likely at adolescence to be given higher ratings from their parents on variables such as verbal fluency, academic success, and social competence. Though causation is not, and cannot be, implied by a prospective design, this experiment suggests that one's ability to delay gratification, even during childhood, may have significant implications for success later in life.

More current research, conducted by Weller, Cook, Avsar, and Cox (2008), has shown a significant difference between obese and healthy-weight women in the ability to delay gratification. This study explored the ability of non-obese and obese men and women to delay gratification for hypothetical monetary rewards during a series of seven computerized trials. During these trials participants were presented with two amounts of

money and were instructed to select the desired amount. One of the amounts was larger, with a varied delay for delivery (e.g., 2 weeks to 10 years), while the other was smaller, varied in amount, and had an immediate delivery. The researchers utilized two different versions of the larger amount to assess differences in the size of the larger hypothetical monetary award on the ability to delay gratification. The larger amount in one version was $1,000, while in the other version was $50,000. The smaller amount in both versions always began with an amount equivalent to one half of the larger amount, and then varied for the subsequent trials.

The results from this study suggest that obese women are significantly less likely to delay gratification than non-obese women. That is, obese women chose significantly *more* immediate smaller rewards than delayed larger rewards. This result was only found for the female participants and the authors suggest that further research be conducted to assess why these effects were moderated by gender.

Though some decisions, resulting from failures in delaying gratification may seem trivial (e.g., marshmallows now or later), others may have more severe consequences. The health implications, resulting from impulsive decision-making behaviors, are easy to imagine. Compare the immediate gratification that comes from sitting on a couch with a cold beer after a long day at the office versus the delayed gratification that comes form the cardiovascular health benefits gained from going straight to the gym before going home for the night. Or, perhaps, the immediate gratification that comes from the time “saved” by buying lunch at a fast food restaurant versus the delayed gratification from packing a healthy alternative the night before.

Though purely speculative, one might infer that people perceive the health benefits received from exercise as a type of future extrinsic reward. Given this reasoning, along with the current influx of Public Service Announcements telling of the importance of exercise, it is clear why the general population seems to have a detriment of motivation to adopt and adhere to a physically active lifestyle. The immediacy of the positive effects experienced by meaningful and intrinsically motivating exercise is missing from the message.

By performing a meta-analytic review, Deci, Koestner, and Ryan (1999) have been able to explore the effects of many combinations of motivators on human behavior. Through these analyses, observations have been made of the negative effect of extrinsic rewards actually overpowering the positive effects of intrinsic rewards. The primary measure of intrinsic motivation, that was part of the inclusion criteria of the meta-analysis, was defined as a free-choice variable. A typical method, utilized by the studies included in this meta-analysis, of assessing this variable was by giving participants the choice to continue performing a task even after they were told the experiment was over. By observing the participant's activity during this free-choice period, the experimenters were able to assess levels of intrinsic motivation for the tasks. More performance of this task during the free-choice period was considered to be indicative of a higher level of intrinsic motivation for that task. The secondary measure of intrinsic motivation was assessed by self-reported interest in the task.

The results from the meta-analysis (Deci, Koestner, & Ryan, 1999) show that extrinsic rewards had a significant negative effect on free-choice behavior and a non-

significant effect on self-reported interest. Both of these variables (i.e., free-choice behavior, self-reported interest) produced heterogeneous effect sizes, so additional analyses were performed to search for moderators related to the reward type (i.e., verbal and tangible).

Further analysis revealed that verbal rewards significantly improved intrinsic motivation as assessed by free-choice behavior. An additional analysis was performed to test the effects of age as a moderator (i.e., children and college students). Analysis revealed that verbal rewards significantly improved free-choice behavior in college students, but had a non-significant effect in children. Analysis of self-reported interest also revealed that verbal rewards significantly improved intrinsic motivation.

Analysis of the effect of tangible rewards on observed free-choice behavior and self-reported interest revealed a significant decrease in intrinsic motivation. Subsequent analyses revealed that unexpected tangible rewards had a non-significant effect on intrinsic motivation as assessed by free-choice behavior and self-reported interest. However, expected tangible rewards had a significant detrimental effect on intrinsic motivation.

Researchers also examined the effects of rewards that were either contingent on some aspect of performance or not contingent on performance. Task-noncontingent rewards were defined as rewards that are received regardless of participation in the specific task (i.e., payment just for participating in the study), while task-contingent rewards are only received by participating in the specific task. There are three categories of rewards that fit within the term task-contingent rewards. These three different

categories of task-contingent rewards were then identified as engagement-contingent rewards, which required participation in a task in order for the reward to be received, completion-contingent rewards, which required completion of the task in order for the reward to be received, and performance-contingent rewards, where rewards were dependent on the quality of performance of the task. Analyses revealed that task-noncontingent rewards did not affect free-choice behavior and self-reported interest. However, engagement-contingent and completion-contingent rewards had significantly detrimental effects on free-choice behavior and self-reported interest. Performance-contingent rewards had a significantly detrimental effect on free-choice behavior, but did not affect self-reported interest.

This meta-analysis helps to shed some light on the complex issues surrounding human motivation. The various heterogeneous effects stemming from the specificity of the type and timing of rewards given, and the age of those receiving the rewards, suggest that an extrinsic "reward" may result in decrements in free-choice behavior. This may help explain why so many people still lead a sedentary life. Expected tangible rewards (e.g., weight loss and muscle gain) may be undermining the intrinsically motivating reward (i.e. "feel good effect") experienced from exercising.

One of the experiments included in the previously mentioned meta-analysis, was conducted by Deci (1971). This study was "the first published intrinsic motivation experiment" (Deci, Koestner, & Ryan, 1999, p. 641) and focused on the effects of tangible completion-contingent rewards on measures of intrinsic motivation (i.e. free-choice behavior). Participants attended 3 sessions in which they attempted to solve a

geometric puzzle by arranging the pieces into predetermined shapes. The conditions were the same for the experimental and control group, with the exception of the second session of the experimental group. During this session, the participants were told that they would receive a per unit monetary payment if they solved each puzzle within a 13-minute time limit. This reward structure was then removed during the third session, so that it matched the non-extrinsic reward structure of the first session.

Intrinsic motivation for the task was determined during an 8-minute free-choice period where the experimenter would leave the participant alone in the room while he, supposedly, entered data into a computer in order to obtain the next puzzle pattern. In reality, the experimenter was observing the participant through a 1-way mirror. The participant had access to reading material as well as the puzzle during this period. Measures of intrinsic motivation for the puzzle task were assessed by the number of seconds the participant interacted with the puzzle.

Analyses revealed that those in the control group had a non-significant difference in amount of time spent interacting with the puzzle, during the free-choice periods, between all 3 sessions. Those in the experimental group spent a greater amount of time in the second session (i.e. payment condition) interacting with the puzzle during the free-choice period than they did during sessions 1 or 3. However, the focus of the results rests on the observation that the level of intrinsic motivation for the task was lowest during the 3rd session for the experimental group. Though statistical significance was not reached, this finding offered enough support of the researcher's hypothesis to spur future research in the effects of tangible rewards on intrinsic motivation. The author noted that the small

sample size (n=24) is a limitation to this study, and hindered the likelihood of obtaining statistical significance.

Meaningfulness as Intrinsic Motivation

Exercise has many beneficial effects, both physical and psychological. However, there are other benefits that come from physical activity. The performance of some types of physical activity has more personal meaning to those performing it than other types. Many careers require a great deal of physical activity on a daily basis. Farming, construction, manufacturing, fishing, waiting tables, cooking, and cleaning are a few examples of physically demanding jobs. In these examples, a high level of physical activity results in the creation of things like sellable products, a paycheck, and a clean and pleasant house to live in. These tasks are not performed for the decrease in blood pressure or a potential decrease in visceral adiposity (though these benefits may result from the work performed). These tasks encompass a broader meaning than personal health. For example, these tasks may be performed in order to support a family or friend, for the enjoyment of interacting with nature, or for the experience of creating something.

The experience of performing an exercise or physical activity is completely different when looked at through the lens and context of meaning. One's perception of their own affective states may be altered by the context in which the physical activities are taking place. Given what is known about the path that one's perception of affect follows throughout a typical acute bout of exercise (Bixby & Lochbaum, 2006; Bixby & Lochbaum, 2008; Bixby, Spalding, & Hatfield, 2001; Ekkekakis, 2008; Ekkekakis, Hall, & Petruzzello, 2005; Ekkekakis, Hall, & Petruzzello, 2008), as well as what is known

about the effects of extrinsic and intrinsic rewards on motivating behavior, it is important to explore how these variables relate to the perception of, and performance in, tasks containing different levels of meaningfulness. Specifically, the meaningfulness of a task seems to act as a type of intrinsically motivating factor that is able to resist the negative effects of extrinsic rewards on behavior.

Motivation Literature

Some promising research on performance, in regards to reward structure and meaning, is being conducted in the fields of psychology and behavioral economics. Since researchers in these fields are not directly focused on exploring aspects of exercise performance, the literature presented in this section of the review is primarily focused on performance of non-exercise tasks.

However, the findings from these experiments may still be relevant to researchers interested in perceptions and performance of exercise. Many aspects of these experiments are similar to those conducted in the exercise psychology domain. For example, assessments of level or quality of performance are made on repetitive tasks. Also, motivation orientations and reward structures are used to describe significant differences in these performances. However, the assessment of affect before, during, and after the actual task has failed to be incorporated into the current research being performed in these disciplines. Combining experimental methods utilized in the fields of behavioral economics, psychology, and exercise psychology into a multi-disciplinary style research project will assist in broadening the knowledge base of the intrinsically motivating effects the meaning of tasks have on performance and affect.

Research examining the influence of meaning on behavior has typically used a research paradigm which includes the use of a concept called a reservation wage. Since this technique/term originates from the discipline of Economics, and may be an unfamiliar term for researchers in Exercise Psychology, it is appropriate here to include a small explanation of this type of payment method.

A reservation wage is the lowest wage (i.e., extrinsic reward) that would motivate a participant to perform a task (i.e., labor). Any offer of payment below the reservation wage would result in the participant refusing to perform the task (Hall & Lieberman, 2008). It is important to keep in mind that the discipline of Economics relies on rational behavior.

The utilization of a declining per unit payment scale, resulting in the meeting of the participant's reservation wage, is an important technique when conducting studies that explore the combination of intrinsic and extrinsic motivation for performance. With this technique, one is able to observe the point at which an extrinsic reward (in this case monetary payment) ceases to motivate performance. As will be explained in more detail, during the review of the study conducted by Ariely, Kamenica, and Prelec (2008), motivation for performance can come from very different areas (i.e., money, meaning), and can operate for different lengths of time throughout a performance task. By using a declining per unit payment scale that reaches the participant's reservation wage, one is able to take advantage of the, initially, motivating affect of an extrinsic reward on performance without relying on this method of motivation throughout the entire performance. In a control group, the point at which the reservation wage is met is

assumed to be the point at which extrinsic rewards cease to be a motivating reward for further performance of the specific task. When a comparison group (i.e. experimental condition) continues to performance the task, past the reservation wage point of a control group, it reveals the existence of a motivating force that is inherent in the experimental condition (e.g., intrinsic motivation, meaning).

For example, the following study explored the effects of different meaning conditions on participant's performance at different tasks. By performing a between groups analysis, researchers were able to discern which group experienced the most motivation to perform (i.e., had a lower reservation wage, produced most labor), and which group experienced the least motivation to perform (i.e., had a higher reservation wage, produced less labor). Since the extrinsic rewards were held constant in all groups, it was inferred that the group with the lowest reservation wage experienced an intrinsic motivation that originated from the actual meaning experienced from doing the work (i.e. beyond the extrinsic reward of monetary payment).

Ariely, Kamenica, and Prelec (2008) performed two different experiments to assess the effects of the perception of a task having "minimal perceived meaning" (Ariely, Kamenica, & Prelac, 2008) on the participant's level of productivity. In order for the task to be meaningful it is stated that the performance of the task must have recognition and purpose. Recognition is simply the acknowledgement that the task was performed and purpose is participant's perception that the task is linked to a general goal. Being studied from the view of behavioral economics, the experimenters utilized a

declining per unit payment scale in order to define labor as a per unit measure, as well as to identify the reservation wage of the participants.

In the first experiment, productivity was calculated as the number of completed sheets of paper containing a mundane "letter matching" tasks. The participants, 104 university students, were given a sheet of paper, filled with a random-looking selection of letters, and were asked to find 10 sequential appearances of the letter 's.' The students would hand in the finished sheet (earning $0.55) and were asked if they wanted to complete another sheet (for $0.50). This continued, with each subsequent sheet completed earning the participant an amount $0.05 less then the previous sheet, until the students decided to stop, which ended the session. This between-subjects experiment consisted of 3 different conditions. Participants performed the same task, were offered the same payment scale, but were randomly assigned to 1 of 3 different "meaning" conditions (i.e., acknowledged, n=35; ignored, n=35; shredded, n=34).

Participants in the acknowledged condition were instructed to write their name on the top of each sheet of paper they were given. Upon turning in the finished sheet, the experimenter looked over the sheet and placed it in a file folder. Participants in the ignored condition were not given any instruction to write their name on the sheets of paper. Upon handing in their finished sheet, it was placed in a stack of papers without being looked at. Participants in the shredded condition experienced the same instructions as the ignored condition. However, upon handing in their finished work, their sheet was put into a paper shredder without being looked at.

Statistical analysis revealed that those in the acknowledged condition produced significantly more finished sheets than those in the ignored condition. There was no significant difference between those in the ignored condition and the shredded condition. It is also important to note that the average reservation wage of those in the acknowledged condition (14.85¢) was almost half the size of the average reservation wages in the ignored (26.14¢) and shredded (28.29¢) conditions. In other words, participants in the acknowledged condition continued completing the task when the payment they received had been reduced to a much greater degree than it had been reduced in the other two groups. This suggests that the simple act of recognizing the participant's work was enough to motivate a significantly greater number of sheets of paper to be completed at almost half the unit price of the other conditions.

In the second experiment, productivity was calculated as the number of Lego figures built by the participants. The participants, comprised of 40 male university students, were randomly assigned to either a meaningful (n=20) or Sisyphus (n=20) condition in which they would assemble Lego Bionicle models until they elected to stop. Participants in each condition were paid $2.00 for the first Bionicle and, before building subsequent Bionicles (all Bionicles were identical models), were told how much money they had earned (gross), as well as how much they would earn for the next Bionicle (wage decreased $0.11 per unit).

Upon completion of a Bionicle, participants in the meaningful condition were instructed to place the model on the table in front of them, were handed a new box of Lego pieces, continued building a new model, and accumulated a display of models as

the work continued. Participants in the Sisyphus condition were only allotted 2 boxes of Legos. When the participant began working on the second box of Legos, the experimenter would disassemble the previous Bionicle and put its pieces back in to its box. Thus, the accumulation of models was not possible in this condition. It is important to note that the design of the models was always the same. Therefore, those in the meaningful condition acquired a collection of identical models.

Statistical analysis revealed that the reservation wage of those in the Sisyphus condition ($1.40) was significantly higher than those in the meaningful condition ($1.01). Even though participants, in each condition, had an equal opportunity to increase their gross earnings, from continued Bionicle building, those in the Sisyphus condition chose to stop building significantly sooner. This is an illustration of the motivational power of the meaningfulness of a task (intrinsic) as compared to the monetary gain earned from completing a task (extrinsic). Analysis also revealed that those in the meaningful condition (M=10.6) produced significantly more Bionicles than those in the Sisyphus condition (M=7.2). It is important to note that there was a significant correlation between the number of models built and the average speed at which they were built by participants in the meaningful condition. Participants in the meaningful condition became significantly faster Lego builders, while those in the Sisyphus condition showed a non-significant correlation between average speed and number of models built.

Ariely, Bracha, and Meier (2008) performed a series of studies to investigate the effects of monetary payments on pro-social behavior (i.e. charitable donations). The scientists explored the specific effects of image motivation, charity type, monetary

payment, and privacy on pro-social behavior. However, the focus of this summary will be placed on the more general findings of the effects of monetary payment on pro-social behavior.

The study was initially performed in 2 different non-exercise settings as well as a follow-up experiment performed in an exercise setting. The non-exercise-based experiment consisted of 161 undergraduate students who were randomly assigned to treatment conditions (i.e., personal payment or no personal payment). Participants took part in a simple keystroke task, where they were instructed to hit the 'z' and 'x' keys on a keyboard for a total of 5 minutes. The amount of money each keystroke pair was worth was determined on a decreasing payment schedule. Each pair, up to 200, received 1 cent; the second set of 200 pairs received 0.5 cents; all subsequent pairs received 0.25 cents with all pairs over 1,200 keystrokes receiving 0.01 cents. In the "no personal payment" condition, the researchers donated the total money earned by each participant to a charity, on the participant's behalf. In the "personal payment" condition, participants, as well as the charity, were paid the total money earned through completion of the described tasks.

Statistical analysis revealed that there was a significant difference between the "no personal payment" and "personal payment" conditions. The performance of those in the "personal payment" condition was significantly greater than those in the "no personal payment" condition.

A follow-up experiment was performed in an exercise setting. Participants consisted of 151 people exercising at a university gym. The participants were randomized into the same type of "personal payment" or "no personal-payment" conditions as existed

in the previous experiment. The amount of money donated was determined by cycling performance on a stationary bike. Participants were allowed to cycle for a maximum of 10 minutes. A total of $1 per mile, cycled in those 10 minutes, was donated to a charity on their behalf. Those in the "personal payment" condition received personal payment matching the amount of money to be donated to a charity for their participation in this task. Statistical analysis revealed that those in the "personal payment" condition performed significantly better (i.e., cycled more miles) than those in the "no personal payment" condition.

This series of studies illustrates that personal payment plus charitable donations was more motivating than charity alone in two different settings. However, these studies do not make any attempt to assess the participant's perceptions of satisfaction or affect from taking part in these activities. This is especially of interest in the exercise-based experiment, where measures of affect and satisfaction might help predict future exercise adherence.

It is also important to note that both conditions (i.e., "no personal payment" and "personal payment") resulted in a charitable donation being made in the participant's name. As the focus of these studies was on the effects of personal payment on pro-social behavior, this type of design is appropriate. However, this design does not explore the possible differences in performance that could be observed between conditions consisting of "personal payment with no charitable donation." This type of design will be important to explore in order to more fully understand performance motivation, as well as perceptions of affect and satisfaction in these different conditions.

Abuhamdeh and Csikszentmihalyi (2009) explored the role of intrinsic and extrinsic motivation on performance in chess playing over a two-week period. The study utilized the participants of an online chess website, where questionnaires could be administered after each game played and information relating to the participants' performance levels could be collected. Measurements of enjoyment, challenge, game outcome, and affect were assessed as within-subject variables. Measurements of motivation orientation (i.e., high-intrinsic, low-intrinsic, extrinsic) were assessed as between-subject variables.

Behavioral Activation (BA) and Achievement Motivation (AM) are two motivational constructs. BA is related to one's inclination to take part in challenging activities, and AM is related to one's aspiration to achieve difficult goals. Both constructs were significantly correlated with intrinsic motivation orientations and were used to determine high or low intrinsic motivation orientations in this study.

High intrinsic motivation orientation had a significant curvilinear correlation with affect. Those who reported a high intrinsic motivation orientation experienced increased enjoyment when playing against opponents who were more skilled than themselves, as determined by the website's rating system that was based on the rating system used by the World Chess Federation, than with opponents less skilled than themselves. Enjoyment peaked at a rating difference of about -200 (i.e. the opponent was 200 points more skilled than the participant) and began to drop rapidly at a difference of about +150 (i.e. the opponent was 150 point less skilled than the participant). It is important to note that statistical analysis revealed that the probabilities of the participant winning the chess

game was linear; increasing as the opponent's skill level decreased. Therefore, even though the participant was more likely to win the game with a less skilled opponent, participant's reported level of affect that decreased significantly as the challenge of the game decreased.

Though this study does not address affect in an exercise setting, it does provide an illustration of the correlation of positive affect and intrinsic motivation. Feeling good (positive affect) is intrinsically motivating. This study supports the notion that participation in, and enjoyment of, a challenging activity will continue as long as it is intrinsically motivating, even if it results in more losses. This information is important, as exercise is a challenging activity. By generating greater improvements in positive affect from exercise, an increase in intrinsic motivation may occur.

Affect Literature

Though the majority of the literature, that will be discussed in this section, is concerned with observations of affect and performance during acute bouts of exercise, it is important to briefly note research that has been conducted on reported levels of energy and fatigue during chronic exercise interventions. Chronic exercise is described as repeated bouts of acute exercise.

A quantitative review, performed by Puetz, O'Conner, and Dishman (2006), revealed the existence of a significant effect of chronic exercise on improved levels of energy and decreased levels of fatigue. Analyses also revealed the importance of the type of control group/placebo group used in the included studies. Many of the control/placebo groups actually participated in activities that could be considered as moderate exercise

(e.g., yoga) for certain populations (i.e., older, sedentary adults). This would result in a reduced effect size, and thus an underestimation of the effect of chronic exercise on levels of energy and fatigue.

This quantitative review reveals that participation in a chronic exercise intervention may lead to increased levels of energy and decreased levels of fatigue. These improvements in energy levels may be perceived as an intrinsically motivating factor to continue the exercise regimen (i.e., “it makes me feel good”). However, it is important to take a reductionist approach to exercise in order to more fully understand the effects of exercise on affect. Looking at the dynamic path of affect, during an acute bout of exercise, is a clear method of performing this research.

Parfitt and Gledhill (2004) performed an experiment to assess the effect of type of exercise on measures of ratings of perceived exertion (RPE), psychological well-being, psychological distress, and fatigue. The first section of the experiment consisted of participants, 10 males and 10 females (M=20.55 years), being brought to the lab on three separate occasions, three days apart, to be familiarized with three different forms of exercise (i.e. treadmill, cycle ergometer, rowing machine).

Participants were asked to rate each type of exercise in order of preference. They were then asked which type they would prefer to use as their method of exercise, if given the choice. Section two and three of this experiment consisted of the participant returning to the lab to exercise for 20 minutes, one day on their most preferred form of exercise, and the other day on their least preferred form of exercise.

The Subjective Exercise Experience Scale was used to assess measures of psychological well-being, psychological disturbance, and fatigue. Participants experienced significantly higher measures of psychological well-being, as well as significantly lower measures of RPE, psychological disturbance, and fatigue when exercising on their preferred type of exercise as compared to their least preferred type of exercise.

Bixby and Lochbaum (2008) explored the effects of mode of exercise on measurements of RPE and affect in 42 female (M=20.17 years old) college students. Participants were asked to rate three modalities of exercise, aerobic (aerobic dance), cardio (elliptical machine, stair master, or exercise bicycle), or jogging (walking or jogging) in order of preference. Over the course of 12 weeks, the participants were randomized to exercise on their most and least preferred mode of exercise, as well as attend a health lecture (control). All exercise sessions were designed to allow the participant to choose their level of intensity and included a five-minute warm-up, a 30-minute exercise period, and a 15-minute cool-down period. All exercise conditions took place at the campus recreation facility to increase ecological validity.

Measures of affect were assessed using the circumplex model, thus allowing data that was collected after the five-minute warm-up, at five and 10-minute intervals during and after the actual exercise session as well as during the 15-minute cool-down period to be mapped on a single chart. This form of data visualization is helpful in determining the temporal attributes of measures of affect during exercise. The circumplex model was utilized to assess measures of affect during the control condition as well. Measures of

RPE were assessed at 10-minute intervals throughout the exercise session, as well as during the 15-minute cool-down period.

Participants experienced significant increases in RPE over the course of both exercise modes. Though it was reported that participants experienced higher levels of RPE in the least preferred exercise conditions, the significance of this difference was not addressed. Participants experienced significant increases in the Felt Arousal Scale (Y-axis component of the circumplex model) in both preference conditions. However, assessments of the Felt Arousal Scale showed that participants experienced a greater increase in measures of felt arousal after the most preferred exercise conditions than the least preferred exercise conditions, though the significance of this difference was not reported.

Participants in the most preferred exercise condition experienced a significant increase in the Feeling Scale (X-axis component of circumplex model). However, of greatest interest is that measures of the Feeling Scale did not decrease or increase until immediately after the 30-minute exercise session when participants experienced the sudden significant increase. When participants performed their most preferred type of exercise, at a self-selected intensity, there were no significant decreases in positive affect. The only significant change in affect was observed during the most preferred condition and was a significant increase in positive affect during the cool-down period. This not only supports the connection between intrinsic motivation and increases in positive affect, but it may open a line of research into the possible connection between intrinsic motivation and a reduction in negative affect during exercise sessions.

As part of a study investigating the effect of different cognitive strategies utilized during exercise (i.e., association and dissociation), LaCaille, Masters, and Heath (2005) assessed additional psychological measures, including RPE, affect, and satisfaction with exercise performed in different settings (i.e., running on an outside track, running on an inside track/treadmill). Those participating in the treadmill condition reported the highest RPE, slowest performance, and lowest level of satisfaction. Those participating in the outside track condition reported the greatest increase in positive engagement, revitalization, tranquility, and satisfaction, as well as the lowest RPE. This study illustrates the significant effect that environmental factors can have on levels of satisfaction during similar modes of exercise. This is an important insight to gain when exploring experiences of positive affect during exercise. Though the actual mode of exercise was similar (i.e., running), the setting in which it took place played a significant role in the feelings experienced by the participants.

Bixby and Lochbaum (2006) performed a study to assess measures of affect during acute exercise bouts to explore possible differing effects with fit and unfit participants. Measurements of affect were obtained while participants exercised at different intensity levels (low and high) relative to their ventilatory breakpoint (VB). Ventilatory breakpoints, identified during VO_{2max} assessment during the initial experimental session, are defined as the point at which the participant's exhalations contain an increase in levels of O_2 without a concomitant increase of CO_2. High intensity exercise was defined as being at or slightly below the VB while low intensity exercise was defined as being at 75% of the VB.

Bixby and Lochbaum utilized a recumbent cycle, instead of the mode of exercise more frequently used in laboratories (i.e., treadmill), as the mode of exercise. Measures of affect were assessed with the Activation Deactivation Adjective Checklist. This tool measures levels of energetic arousal and tense arousal in order to assess the range of positive and negative affect.

Analyses revealed that participants experienced significantly more positive affect while exercising at a low intensity level when compared to exercising at a high intensity level. However, an important aspect of this study is the differences experienced by fit and unfit participants. Fit participants experienced significantly more positive affect during exercise than unfit participants.

This is an important finding in understanding conditions in which experiences of positive affect are more powerful. Though it may be looked at as "common sense" (i.e., the more fit one is, the more they enjoy exercise), the increase in affect/perception that accompanies an increase in physiological fitness may be a glimpse into the participant's perception of the effects/benefits/meaning of exercise. Those who are more fit have already received noticeable health and fitness benefits from their past exercise regimens. Therefore, the meaning behind their effort may be more apparent than it is for those who have not experienced as many noticeable fitness gains from past exercise.

Parfitt, Rose, and Burgess (2006) assessed the effect of different exercise intensity levels, as measured by blood lactate levels, on measures of affect in a sample consisting of sedentary adults. An incremental blood lactate test was performed to calculate individualized exercise gradient protocols that would elicit the desired blood lactate level

during exercise. On a separate day, participants took part in the acute exercise session, by walking on a treadmill for 24 minutes, with the gradient of the treadmill increasing 1% each minute, at either a low intensity (blood lactate reading=2 mmol/l), high intensity (blood lactate reading=4 mmol/l), or self-selected intensity. Blood lactate readings were assessed at minutes 10 and 20 of the exercise bout. During the self-selected intensity condition, participants were allowed to make changes to the intensity of the exercise at minutes 5, 10, and 15. The order of the 3 exercise intensity conditions (i.e., low, high, self-selected) were randomized.

Measures of affect were assessed, using the circumplex model (valence and arousal), at baseline, during the last 45 seconds of each 5-minute section of the exercise bout, as well as during the last 45 seconds of minutes 10, 20, and 30 post exercise. Analyses revealed that valence was significantly higher during low intensity and self-selected intensity exercise when compared to high intensity exercise. The difference in valence between self-selected intensity and low intensity was non-significant. Participants experienced a significant improvement in valence from pretest to 10, 20, and 30 minutes post exercise during all 3 conditions.

This study illustrates that the improvement in affect from pretest to post exercise, as well as the difference in affect as a function of exercise intensity, is present in a sample of sedentary participants during an acute exercise bout. Another main finding of this study was the non-significant difference between self-selected exercise intensity and low exercise intensity in measures of affect from pretest to post test. This is important, since the greatest improvements in affect have been assessed during low intensity exercise.

However, when exercise intensity is self-selected, participants tend to exercise at an intensity that is somewhere between low and high. This evidence suggests that sedentary exercisers, when given the choice, will exercise at an intensity level that will produce physiological benefits that are greater than those at a low intensity, while still reaping the psychological benefits experienced during exercise at low intensities.

Ekkekakis, Hall, and Petruzzello (2008) explored the possible existence of a chain of causality that connects exercise intensity, affect, and adherence in 30 male and female adult college students (mean age =21). The study consisted of 5 separate exercise sessions. Sessions 1 and 2 were used to determine and then verify the ventilatory threshold (VT) of each participant. VT is essentially the same physiological activity as the previously described VB, wherein the amount of O_2 exhaled by the participant begins to increase while the amount of CO_2 exhaled by the participant remains at a constant level. VT was used as a measure of individual intensity for each participant. Sessions 3 through 5 were the actual experimental trials which consisted of participants walking on a treadmill for 5 minutes as a warm-up, followed by running for 15 minutes at intensities of either 20% below VT, equal to VT, or 10% above VT, and ending with 5 minutes of walking as a cool-down. The order in which the specific VT intensities were performed was randomized among the participants and each session occurred on separate days.

Affect was assessed and illustrated by plotting scores from the Feeling Scale (valence/hedonic tone) and Felt Arousal Scale (arousal/activation) on the circumplex model. Measures of affect were assessed a total of 9 times throughout each exercise session. Measures were made prior to the warm-up walk, 15 seconds prior to beginning

the running section, during the last 15 seconds of minutes 3, 6, 9, 12, and 15, during the last 15 seconds of the 5-minute cool-down, and at 10 and 20 minutes post cool-down. The quantity and intervals of measurements enabled the researchers to assess the temporal nature of affect as it related to the intensity level of the run.

Analyses revealed that participants running at 10% above VT experienced a significant reduction in valence from baseline as well as compared to valence reported during runs at intensities of 20% below VT and equal to VT. However, analyses showed that measures of valence in all three intensities improved significantly from baseline to immediately after the run. However, this significance was nonexistent by the measurements taken at 20 minutes post cool-down.

This study reveals the effect that intensity has on measures of affect during a running session on a treadmill. The author uses these findings to illustrate a possible chain of causality between exercise intensity, affect, and adherence by showing that those who exercise at an intensity 10% above VT will experience a significant decrease in valence and the following "rebound" will be very short lived (not even 20 minutes). Although not assessed in this study, the authors hypothesized that the experience of these negative feelings may lead to a reduction in exercise adherence.

Kwan and Bryan (2010) conducted a study to explore this type of connection between affect and adherence. The study consisted of 2 sessions. During the first session, preliminary VO_{2max} measures were obtained to assess fitness levels. Also, during the first day, participants completed several questionnaires to assess exercise behavior during the last 3 months, attitudes towards exercise, exercise self-efficacy, subjective norms towards

aerobic exercise, and intentions to exercise in the next 3 months. On a separate day, the participants then completed an acute exercise session of 30 minutes at 65% VO_{2max}, matching the ACSM definition of moderate intensity. During this acute bout of moderately intense exercise, affect was assessed using the Physical Activity Affect Scale during minutes 5, 10, 20, and 30 of the exercise session, as well as during minutes 15 and 30 post exercise. A follow-up, assessing exercise behavior and motivation, was performed after 3 months.

Analyses revealed that the improvements in positive and negative affect experienced during the acute bout of exercise are correlated with reports of positive attitudes and stronger intentions and self-efficacy to exercise at the follow-up assessment. The increased intentions to exercise, at follow-up, were also associated with an increase in voluntary exercise behavior during the 3-month period between the acute exercise session and the follow-up. This suggests that a positive affective response to exercise may be the causal factor, resulting in an increase in intrinsic motivation, which then results in increased adherence to exercise.

Research Problem/Conclusion to Literature Review

Through the years, much time has been spent exploring the effects of acute exercise on measures of affect. The increase in levels of positive affect from acute bouts of exercise is an important issue for many reasons. With an increased understanding of the immediate effects of exercise on measures of affect, professionals will be able to better prescribe certain methods of exercise that will generate the biggest improvement in positive affect. Also, with the growing obesity epidemic in America, it is of great benefit

to areas of public health to understand the situations where the experience of exercising is perceived as the most enjoyable. Additionally, since the physical benefits of exercise are often invisible (e.g., cardiopulmonary) or very slow to be seen (e.g., weight loss) a focus on these benefits may be detrimental to one's motivation to begin or continue an exercise regimen (because they represent delayed extrinsic rewards). The "feel good" effect may be an important key in creating an increase in levels of intrinsic motivation. Thus, increasing the likelihood of adherence to an exercise regimen.

Researchers have studied the effects of different intensity levels of exercise, fitness levels of participants, and different modes of exercise on measure of affect. Insight into the temporal path of affect during and after an acute exercise bout has been gained through the use of bi-dimensional tools such as the circumplex model of affect (Russell, 1980). The utilization of the circumplex model to assess measures of affect, as they change throughout an acute bout of exercise, has become a beneficial tool in increasing our understanding of how exercise affects how we feel (Ekkekakis, 2008). A review of the current literature, shows that utilizing this measurement device in an exploration into the effects of exercise conditions on measures of affect increased our knowledge of the dynamic nature of this area of research.

Of particular interest, are the effects of preference of exercise type on positive affect as reported by Bixby and Lochbaum (2008). By utilizing the circumplex model to measure affect, it was shown that the participants exercising in their most preferred modality not only experienced a significant increase in positive affect from pre-exercise

session to post cool-down, but there was no significant change in affect at all, until immediately post exercise session when there was a significant increase in positive affect.

However, one aspect that has not been addressed in this literature is the effect that the participant's perception of personal meaning of the exercise may have on measures of affect before, during, and after a task or acute exercise bout. The intrinsically motivating effect of different meanings, behind performing the task, on one's perception of affect may be an important "missing link" that will expand our understanding about the complexities surrounding exercise adherence.

Based upon the previous evidence, it is expected that an increase in the meaningfulness of an exercise bout will result in a significant improvement in levels of positive affect experienced during and post exercise. Similarly, it is expected that an increase in the meaningfulness of an exercise bout will result in participants choosing to exercise for longer periods of time. The findings from this study have possible implications for use in designing more effective health policies, in both the private and public sectors, which may lead to an increase in physical activity behaviors as well as an improvement in perceptions of affect during and after exercise

CHAPTER III

METHODS

The purpose of this research was to explore possible differences in exercise behavior in a between-subjects design consisting of 3 exercise conditions which convey different meanings for performing the exercise (health, wealth, charity) as a means to better understand how the manipulation affects behavior. The mode of exercise consisted of cycling on a recumbent cycle-ergometer. Participants were allotted as much time as desired to perform the exercise and participants were allowed to stop cycling at any point during the task. Analyses were performed to assess the distance cycled (number of kilometers cycled), change in affect (activation deactivation adjective checklist [ADACL]), and personal enjoyment of, and satisfaction with their performance in each condition. Measures of affect (feeling scale [FS]/felt arousal scale [FAS]) were also taken during exercise in order to assess possible differences in exercise experience between groups. Measures of heart rate (HR) and ratings of perceive exertion (RPE) were taken to assess possible differences in objective and subjective measures of exercise intensity between groups.

Participants

Participants for this study consisted of male and female adults (18 to 35 years of age) recruited from the University of North Carolina at Greensboro. All participants were required to pass the AHA/ACSM Health/Fitness Facility Pre-participation Screening

Questionnaire, which assessed if it was safe for them to exercise at a moderate intensity, before being allowed to participate in the study. In order to decrease the risk for potential confounds related to performance by endurance athletes, and to increase the likelihood of a more homogenous sample, inclusion criteria were used for current physical activity levels. Specifically, participants currently participating in more than 30 minutes of exercise on more than 3 days per week were not permitted to take part in this study. Those who exceeded the predetermined exercise level due to taking part in non-endurance forms of exercise (e.g., basketball, handball, ballet) were allowed to participate. A questionnaire was completed prior to the exercise session in order to identify any possible remaining moderating effects of a physically active/inactive lifestyle within the predetermined boundaries.

Though an effort was made to recruit participants from a variety of schools and departments at UNCG (e.g., public health, nursing, counseling, kinesiology) the majority of participants originated from the kinesiology department. This was due to the large number of students in this field who were genuinely interested in helping with research related to exercise. Assessments of previous exercise experience were obtained in order to reduce the risk for possible confounds that come with a sample that is *potentially* predisposed to exercise. Additionally, participants were asked how they heard about the study/what degree program they are attending in order to correctly identify/describe the resulting sample demographics.

During the recruiting process, potential participants were told that the total time commitment for participation in this study would be approximately 90 minutes when in

fact the typical testing session only lasted 26 minutes. This was done to reduce potential confounds that could result from participants having a priori knowledge of the self-determined nature of the total time commitment required for participation in the study. In other words, this reduced the likelihood that those who self-selected for shorter duration cycling tasks did so because of previous commitments/time constraints.

Data Collection

Dependent Variables

Distance cycled was operationally defined as the total number of kilometers reported on the display of the cycle at the end of the exercise session. The measure of kilometers was obtained from the readout on the display of the recumbent cycle-ergometer control panel.

Affect was operationally defined as the combination of two separate components (i.e., valence and activation). Valence relates to the perception of feelings of pleasure or displeasure experienced by the participant. Activation relates to the intensity or arousal level (i.e., high to low) experienced by the participant. The circumplex model of affect is a multi-dimensional model of affect that allows the researcher to visualize both dimensions of affect simultaneously (Ekkekakis, Hall, & Petruzzello, 2008; Bixby & Lochbaum, 2008;Russell, 1980). The two tools utilized in this model are the FS and FAS. This model consists of plotting the two separate measures onto the X and Y coordinates of a graph. Both the Feeling Scale (Backhouse, Ekkekakis, Bidle, Foskett, & Williams, 2007; Ekkekakis, Hall, & Petruzzello, 2008; Hardy & Rejeski, 1989) and Felt Arousal Scale (Backhouse, Ekkekakis, Bidle, Foskett, & Williams, 2007; Ekkekakis, Hall, &

Petruzzello, 2008; Svebak & Murgatroyd, 1985) have demonstrated reliability and validity in the assessment of affect before, during, and after acute exercise bouts.

The X-axis contains scores from the FS, which measures the valence experienced by the participant (i.e., pleasant - unpleasant). Developed by Rejeski, Best, Griffith, and Kenney (1987), this 11-item tool measures the participant's perceived feelings of displeasure and pleasure on a scale from -5 (I feel very bad) to +5 (I feel very good). One of the benefits of this scale is its balance in measuring both positive and negative feelings.

The Y-axis contains scores from the FAS, which measures the level of activation experienced by the participant (i.e., low arousal – high arousal). Developed by Svebak and Murgatroyd (1985), this 6-item tool measures the participant's perceived experience of arousal on a scale from 1 (low arousal) to 6 (high arousal).

An additional method was utilized to assess any pre to post cycling task changes in affect. Change in affect is operationally defined as differences in measures of tense arousal and energetic arousal as assessed by the ADACL pre and post cycling task. The ADACL, developed by Thayer (1986), is a valid and reliable method of assessing affect (Thayer, 1989) before and after an acute bout of exercise **(**Ekkekakis, 2005). This self-report tool measures tense arousal and energetic arousal to assess perceptions of a positive or negative affective state.

RPE was operationally defined as the perception of exertion experienced by the participant. The Borg Rating of Perceived Exertion Scale, developed by Borg (1982), is a valid and reliable (Borg, 1990)15-item scale that assesses the participant's perceived

level of exertion during and after exercise. The scale consists of scores that range from 6 (no exertion at all) to 20 (maximal exertion). This scale was designed with ease of use in mind and is a widely excepted form of measurement used in exercise related research.

HR was operationally defined as the number of heart beats per minute experienced by the participant and reported by the HR monitoring device worn by the participant. A Polar Heart Rate monitor, with chest strap, was utilized to measure the participant's HR during the study. The recumbent cycle ergometer is equipped with a built-in control panel that is compatible with the HR monitor. This allowed the data from the HR monitor to automatically synchronize with the control panel and display HR information to the experimenter without being visible to the participant. This measure was utilized in conjunction with measures of RPE to assess intensity level of the exercise that was performed.

Enjoyment was operationally defined as the perception of the task as being interesting, exciting, and fun. Enjoyment was assessed with a 3-item likert-type tool that ranges from 1 (not at all) to 5 (very much) that has shown reliability in a previous study (Abuhamdeh & Csikszentmihalyi, 2009).

Satisfaction was operationally defined as the perceived satisfaction with the given performance on the task. A 1-item satisfaction tool was used to assess participant's response to the question "How satisfied are you with your cycling performance?" Scores on this 6-point scale range from 1 (extremely dissatisfied) to 6 (extremely dissatisfied). This tool is a modified version of a 2-item satisfaction tool that has been found to be reliable (coefficient alpha=0.8) in a previous study (Elicker et al., 2009).

Independent Variable

The independent variable was meaning condition group (health, wealth, charity). Given that almost everyone already knows that exercise is good for you, but that there may have been a rare few who were not aware of the multitude of health benefits that result from exercise, participants in all treatment conditions received information pertaining to the health benefits received from performing an acute bout of exercise by watching a short video produced by the American College of Sports Medicine (ACSM). Additionally, participants in the wealth and charity conditions received information pertaining to the personal payments or donations that would result from their performance (kilometers cycled) during the cycling session.

The health condition was one in which participants did not receive any additional information regarding the exercise. Participants watched a short film, produced by the ACSM, on the health benefits and recommendations of exercise. Participants were then asked to perform a cycling task with the understanding that the duration and pace of the task were completely self-selected.

The wealth condition was one in which participants earned a monetary reward for every 2 kilometers cycled during the exercise session. This reward was calculated by using a declining per unit payment scale (Hall, R. E., & Lieberman, M., 2008.). The first 2 kilometers cycled earned the participant $1.00 and the amount of reward decreased by $0.10 for every 2 kilometers cycled. Kilometers cycled past the 20-kilometer mark resulted in a $0.01 per 2-kilometer payment.

The charity condition was one in which participants earned a monetary reward, for every 2 kilometers cycled during the exercise, that was donated to a charity. The participant was able to select his/her desired charity from a list prepared by the researcher. The same declining per unit payment scale was utilized as is defined in the monetary gains condition.

Potential Confound

Current level of physical activity was operationally defined as the frequency and type of physical activity performed by the participant in the previous two weeks. The National Health and Nutrition Examination Survey (NHANES) is a questionnaire that was used to assess the regular patterns of physical activity performed by the participant in the previous two weeks. Participants were asked to report the total number of times they had performed each physical activity in the last two weeks, how many minutes were spent actually performing the activities, and the perceived change in heart rate and breathing during the activity (i.e., small increase, moderate increase, large increase, no increase, they do not know).

Apparatus

Lode Corival Recumbent Cycle-Ergometer

Participants performed exercise by cycling on a recumbent cycle-ergometer located in the Exercise Psychology lab on the UNCG campus. The Lode Corival cycle-ergometer is equipped with a built-in dual-screen control panel. The dual-screen control panel was programmed to display specific reference information to the participants while displaying a larger range of data to the experimenter. To ensure the participant was aware

of the progress being made throughout the session the participant's display provided information pertaining to total kilometers cycled and time cycled. The experimenter's display provided the same data as the participant's display with the addition of current HR.

Safety Procedures

All researchers involved with data collection had CPR certification. An automated external defibrillator (AED) was accessible at all times during the exercise session of the study and a phone was available to call campus police/paramedics if needed. Participants were required to wear adequate attire that was suitable for exercising at a moderate level of intensity and water was provided for consumption during each exercise session.

The collection of all data related to this study took place in the Exercise Psychology lab located on the UNCG campus. Signed copies of the informed consent were stored in a separate binder to ensure the confidentiality of the participants. The order and protocol used to obtain all data is outlined below.

Exercise Protocol

Upon scheduling a time to participate in the study, participants were instructed that on the day of the session, they should not exercise prior to coming to the lab. Additionally, they were instructed to refrain from ingesting any caffeine 3 hours prior to the session, to eat only a light meal no less than 2 hours prior to the session, and to wear clothes that were comfortable for exercise.

Upon completion of the informed consent, AHA/ACSM Health/Fitness Facility Pre-participation Screening Questionnaire, and NHANES, all participants secured the HR

monitor around their chest and remained in a seated position for 5 minutes in order to obtain a measurement of their resting HR. During this time, participants watched a short film, produced by the ACSM, on the health benefits and recommendations of exercise. When a measure of resting HR had been established, the participants then completed the ADACL (change in affect) and were instructed in the use of the RPE, FS, and FAS scales. The participant then began the cycling task. Participants were reminded that the length of time and pace they chose to cycle was up to them (i.e., self-selected).

The first 5 minutes of the cycling task was utilized as an introductory period aimed at identifying the participant's preferred wattage to cycle for the duration of the task. The participants were told "the goal is to get to a resistance level (i.e., wattage) that is the most comfortable for you to continue cycling." All participants began cycling at 80W for the first minute. At the beginning of minute-2, wattage increased by 20W to equal a total of 100W. At the beginning of minute-3 the wattage increased by 20W to equal a total of 120W. At the beginning of both minute-4 and minute-5 the participant was given the choice to either remain at the current wattage, decrease by the same (i.e., 20W) or a lesser (i.e., 10W) amount, or increase by the same or a lesser amount. The wattage selected at minute-5 was considered the preferred wattage, and remained unchanged for the remainder of the cycling task.

The rationale for this 5-minute introductory period aimed at identifying the participant's preferred wattage is derived from assessing effort levels as classified by the compendium of physical activities tracking guide's "stationary bicycle effort levels" [i.e., 100W - light effort (5.5 METS), 150W - moderate effort (7.0 METS), and 200W-

vigorous effort (10.5 METS)] (Ainsworth, 2002). Participants had the freedom to exercise at levels between very light and light, light, moderate, and approaching vigorous effort. The effort levels were self-selected based on the individual comfort level of the participant. This allowed assessments of RPE to be used as a dependent variable and not a scale used to direct an increase or decrease in wattage.

The exercise session was concluded as soon as the participant decided they wished to end the session. Assessments of HR, RPE, and affect during exercise (FS and FAS) were taken at 5-minute intervals throughout the session. Upon completion of the exercise bout participants stopped cycling, dismounted the cycle, and completed post-exercise measures of change in affect from pre to post exercise (ADACL), satisfaction, and enjoyment. An additional question ("why did you choose to stop when you did?") was asked upon completion of the cycling task. This was done to obtain qualitative data that would serve to support quantitative observations.

Data Analysis

Current Level of Physical Activity

Data from the NHANES questionnaire was used as a covariate to control current level of physical activity in all analyses. It was important to control for current level of physical activity because from a logical perspective it would be predictive of KM cycled.

Primary Analysis

A between-subjects ANCOVA was performed to assess differences in kilometers cycled between treatment groups.

Secondary Analyses

A between-subjects ANCOVA was performed to assess differences in satisfaction, and enjoyment between treatment groups. A MANCOVA with repeated measures was performed for ADACL subscales to assess a possible significant interaction of time (pre, post) by treatment group.

Because the duration of the exercise bout was self-determined and HR, RPE, FS, and FAS were measured at 5-minute intervals, participants had different numbers of scores on these variables. For the purposes of this study, these variables were analyzed using the initial measurement period (i.e., minute-5), a time-point which was closest to the middle of the total exercise period, and the last measurement period. An ANCOVA with repeated measures was performed in order to determine any statistically significant changes ($p<.05$) in measures of HR, RPE, FS, or FAS over time (first, middle, last), as a function of treatment group (health, wealth, charity), or relative to possible significant interactions as a function of time by treatment group.

The circumplex model was utilized as a method of visualizing FS and FAS data. This allows the researcher to quickly decipher the path of affect experienced throughout the course of the session. An average of the affective change of each condition was assessed and plotted on the circumplex model. This illustrates differences in measures of affect throughout the exercise session between the three meaning condition groups.

Sphericity

For all repeated measures analyses Mauchly's test of sphericity was utilized to ensure the sphericity assumption had been met. If it was not met, a Huynh-Feldt

adjustment was used for degrees of freedom.

Table 1 Assessment Intervals

Measures	Baseline	5 min	k min	Post
Affect (ADACL)	X			X
Heart Rate	X	X	X	
FS		X	X	
FAS		X	X	
RPE		X	X	
Satisfaction				X
Enjoyment				X
Distance				X

CHAPTER IV

RESULTS

Descriptives

A list of 268 volunteers was obtained from visits to 32 different classes at the University of North Carolina at Greensboro. From this list, 47 undergraduate and graduate volunteers agreed to take part in the study. The final sample consisted of 16 men and 31 women. Participant characteristics are listed in Table 2.

Table 2 Participant Characteristics

	Men (n=16)		Women (n=31)		Total (n=47)	
Age (years)	20.75	(1.98)	22.26	(3.83)	21.74	(3.37)
METS (daily)	2.43	(2.14)	1.74	(1.41)	1.98	(1.70)

The ethnicity of the sample consisted of African American (n=12), Caucasian/White (n=27), Asian/Pacific Islander (n=3), Hispanic (n=2), and Other (n=3). Though participants consisted mainly of students majoring in Kinesiology (n=23), a diverse range of degree programs was represented in the final sample (Business, n=3; Biology, n=3; Nursing, n=3; Education, n=2; Psychology, n=2; Sociology, n=1; Social

Work, n=1; Conflict Studies, n=1; Political Science, n=1; History, n=1; Acting, n=1; Media Studies, n=1; Information Sciences, n=1; Library Sciences, n=1; Recreation/Tourism, n=1; Undecided, n=1).

Statistical Analyses

Primary Analysis

A between-subjects ANCOVA revealed that there was a non-significant difference (p=0.059) in kilometers cycled between treatment conditions. Examination of the means indicated that those in the wealth and charity conditions cycled more KM than those in the health condition. Estimated marginal means and standard errors are listed in Table 3. Means and standard deviations are listed in Table 8 (see appendix C). F-scores, degrees of freedom, and η^2 are listed in Table 4.

Secondary Analyses

A between-subjects ANCOVA revealed that there were no statistically significant differences in satisfaction or enjoyment between treatment conditions (p>.05). Estimated marginal means and standard errors are listed in Table 3. Means and standard deviations are listed in Table 8 (see Appendix C). F-scores, degrees of freedom, and η^2 are listed in Table 4.

Table 3 Estimated Marginal Means (EMM) and Standard Errors (SE) for Kilometers, Satisfaction, and Enjoyment for Each Treatment Condition

	Health (n=14)		Wealth (n=16)		Charity (n=17)	
Kilometers	6.29	(1.92)	12.32	(1.71)	11.72	(1.67)
Satisfaction	3.81	(.28)	4.43	(.25)	4.28	(.24)
Enjoyment	8.40	(.77)	10.27	(.69)	9.53	(.67)

Table 4 Statistical results of ANCOVA for Between-Subjects Effects of Post-Exercise Assessments

	df	*F*	*p*	η^2
Kilometers	2, 43	3.03	.059	.12
Satisfaction	2, 43	1.37	.26	.06
Enjoyment	2, 43	1.58	.22	.07

A MANCOVA with repeated measures revealed that for ADACL subscales there were no statistically significant changes as a function of time (p>.05) or as a function of treatment condition (p>.05). There was also no statistically significant time by treatment

condition interaction for the ADACL (p>.05). Estimated marginal means and standard errors are listed in Table 7. Means and standard deviations of ADACL subscales are listed in Table 10 (see Appendix C).

An ANCOVA with repeated measures revealed that for FS and RPE there were no statistically significant effects as a function of time (p>.05). However, for FAS and HR, there were statistically significant changes as a function of time. Increases in FAS and HR were observed from the initial time points through the end of the exercise session. For RPE, HR, FS, and FAS there were no significant changes as a function of treatment condition (p>.05) or time by treatment condition (p>.05).

F-scores, degrees of freedom, and η^2 are listed in Table 5. Estimated marginal means and standard errors of HR, RPE, FS, and FAS at time points included in this analysis are listed in Table 6. Means and standard deviations of HR, RPE, FS, and FAS, at the time points included in these analyses, are listed in Table 9 (see Appendix C). Means of RPE, HR, FS, and FAS at every time point are available in Appendix B.

Table 5 Statistical Results for Main Effects and Interactions

		(df)	*F*	*p*	η^2
RPE					
	Time	(1.58, 64.72)	1.85	.17	.04
	Group	(2, 41)	.76	.48	.04
	Time by Group	(1.58, 64.72)	2.28	.08	.10
HR					
	Time	(1.93, 81.05)	3.31	.04	.07
	Group	(2, 42)	.73	.49	.03
	Time by Group	(3.86, 81.05)	1.53	.20	.07
FS					
	Time	(1.30, 48.21)	2.34	.13	.06
	Group	(2, 37)	.61	.55	.03
	Time by Group	(2.61, 48.21)	.59	.60	.03
FAS					
	Time	(1.69, 62.69)	5.18	.01	.12
	Group	(2, 37)	1.02	.37	.05
	Time by Group	(3.39, 62.69)	1.41	.25	.07
ADACL					
	Time	(1, 42)	2.63	.11	.07
	Group	(2, 42)	2.12	.13	.09
	Time by Group	(2, 42)	.67	.52	.03

Table 6 Estimated Marginal Means (EMM) and Standard Error (SE) for Heart Rate (HR), Ratings of Perceived Exertion (RPE), Feeling Scale (FS) and Felt Arousal Scale (FAS) for Each Treatment Condition at Each Time Point

		n	EMM (SE) first	n	EMM (SE) mid	n	EMM (SE) last
HR							
	Health	n=14	151.33 (5.23)	n=14	150.50 (5.41)	n=14	157.07 (5.53)
	Wealth	n=15	148.12 (4.82)	n=16	158.09 (5.00)	n=16	164.49 (5.11)
	Charity	n=17	141.04 (4.58)	n=17	150.39 (4.47)	n=17	156.98 (4.74)
	Total	n=46	146.83 (2.74)	n=47	152.99 (2.84)	n=47	159.51 (2.91)
RPE							
	Health	n=14	13.68 (.74)	n=14	13.84 (.75)	n=13	14.57 (.87)
	Wealth	n=15	13.48 (.64)	n=16	14.71 (.66)	n=16	16.18 (.76)
	Charity	n=17	13.59 (.61)	n=17	15.15 (.62)	n=17	16.88 (.72)
	Total	n=46	13.58 (.37)	n=47	14.56 (.38)	n=46	15.88 (.44)

Table 6 Continued

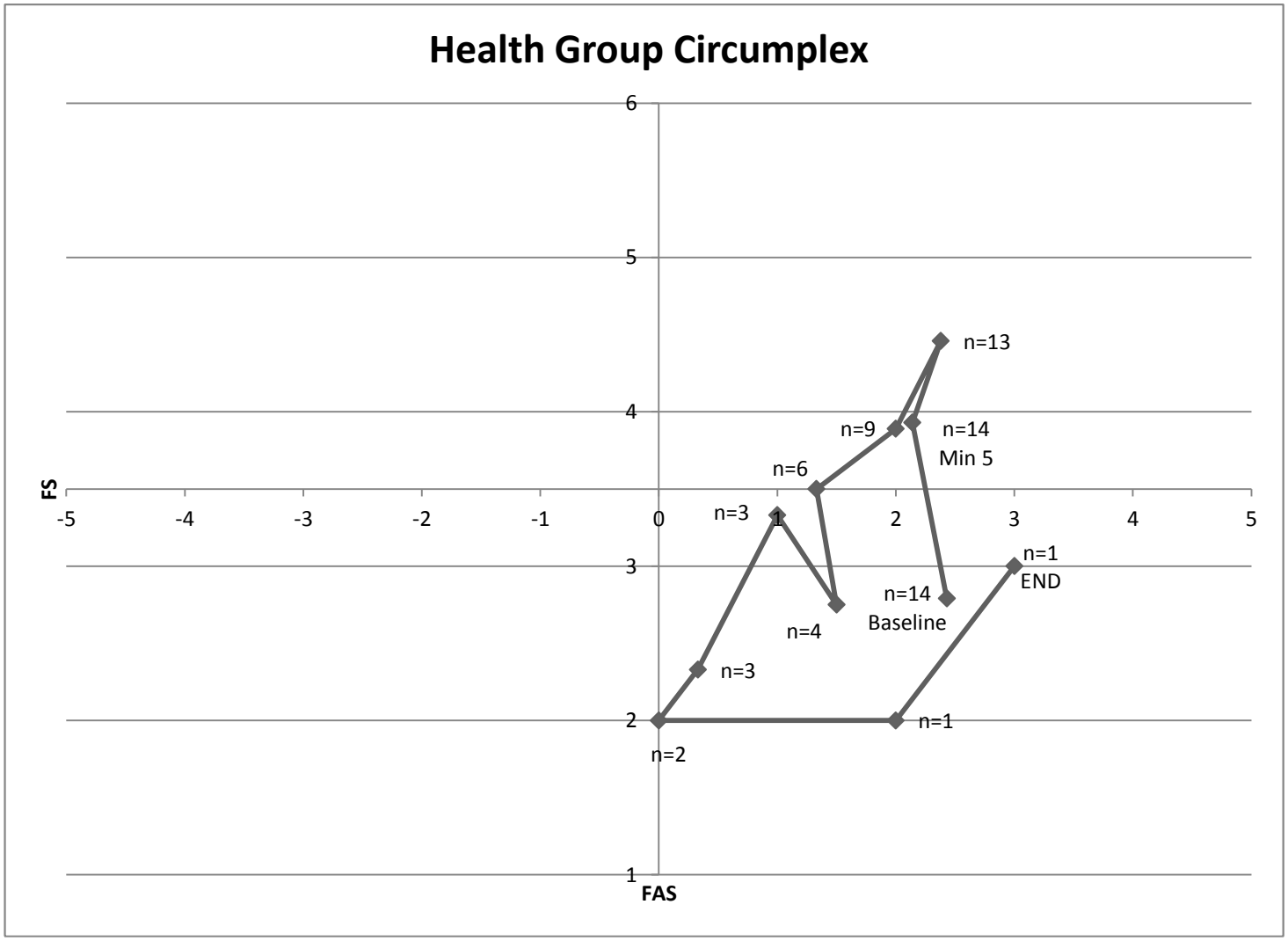
		n	EMM (SE) first	n	EMM (SE) mid	n	EMM (SE) last
FS							
	Health	n=14	1.94 (.45)	n=14	2.07 (.57)	n=13	2.14 (.78)
	Wealth	n=15	1.91 (.43)	n=13	1.39 (.53)	n=15	1.01 (.74)
	Charity	n=17	2.53 (.41)	n=15	2.14 (.51)	n=17	1.68 (.70)
	Total	n=46	2.13 (.24)	n=42	1.87 (.30)	n=45	1.61 (.41)
FAS							
	Health	n=14	3.76 (.28)	n=14	3.67 (.34)	n=13	4.05 (.40)
	Wealth	n=15	4.05 (.30)	n=13	4.21 (.32)	n=15	4.29 (.38)
	Charity	n=17	3.70 (.25)	n=15	4.45 (.31)	n=17	4.90 (.36)
	Total	n=46	3.93 (.98)	n=42	4.12 (1.15)	n=45	4.49 (1.33)

Table 7 Estimated Marginal Means (EMM) and Standard Errors (SE) for ADACL for Each Treatment Condition at Pre-Test and Post-Test

	EMM (SE) Pre-Test	EMM (SE) Post-Test
ADACL		
Health (n=14)	.57 (.42)	1.14 (.46)
Wealth (n=15)	1.76 (.39)	1.75 (.42)
Charity (n=17)	1.38 (.37)	2.11 (.40)
Total (n=46)	1.24 (.22)	1.67 (.24)

Circumplex Model of Affect

Given the broad range of time for which participants chose to exercise, sample sizes changed across time points making it unreasonable to look at group averages as a statistical function of time. Thus, FS and FAS change were plotted on a circumplex model as a method of visualizing affective data. This allows the average path of affect experienced throughout the course of the session to be visualized by treatment condition. See Figure 1. Health Group Circumplex, Figure 2. Wealth Group Circumplex, and Figure 3. Charity Group Circumplex for circumplex models of each treatment condition.


Health Group Circumplex
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FAS
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3
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-4
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-1
0
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3
4
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n=14
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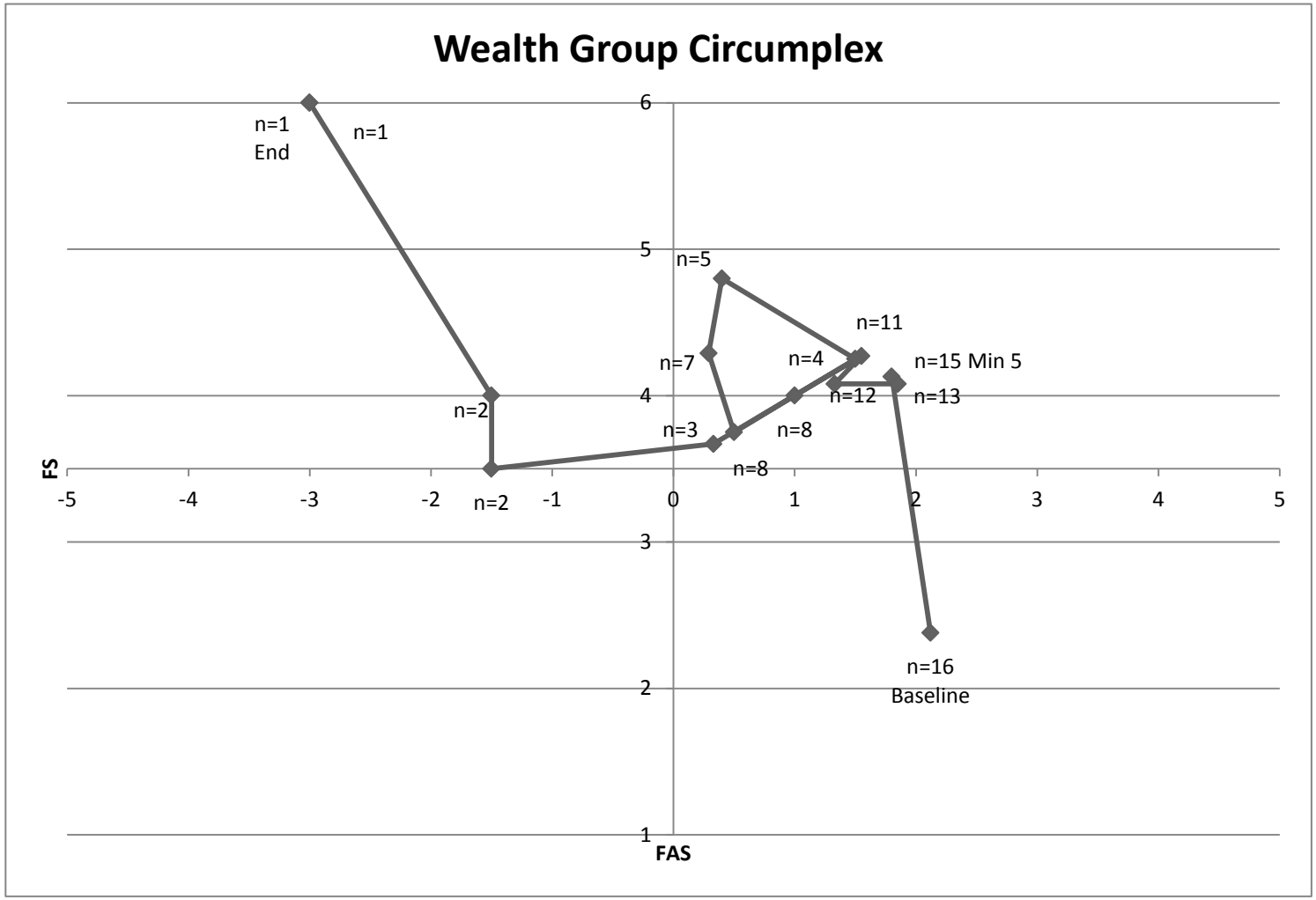
n=1
END
n=14
Baseline
n=4
n=3
n=1
n=2

Figure 1


Wealth Group Circumplex
n=1
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n=1
n=5
n=11
n=7
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n=3
n=8
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n=2
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Baseline
FS
FAS
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Figure 2

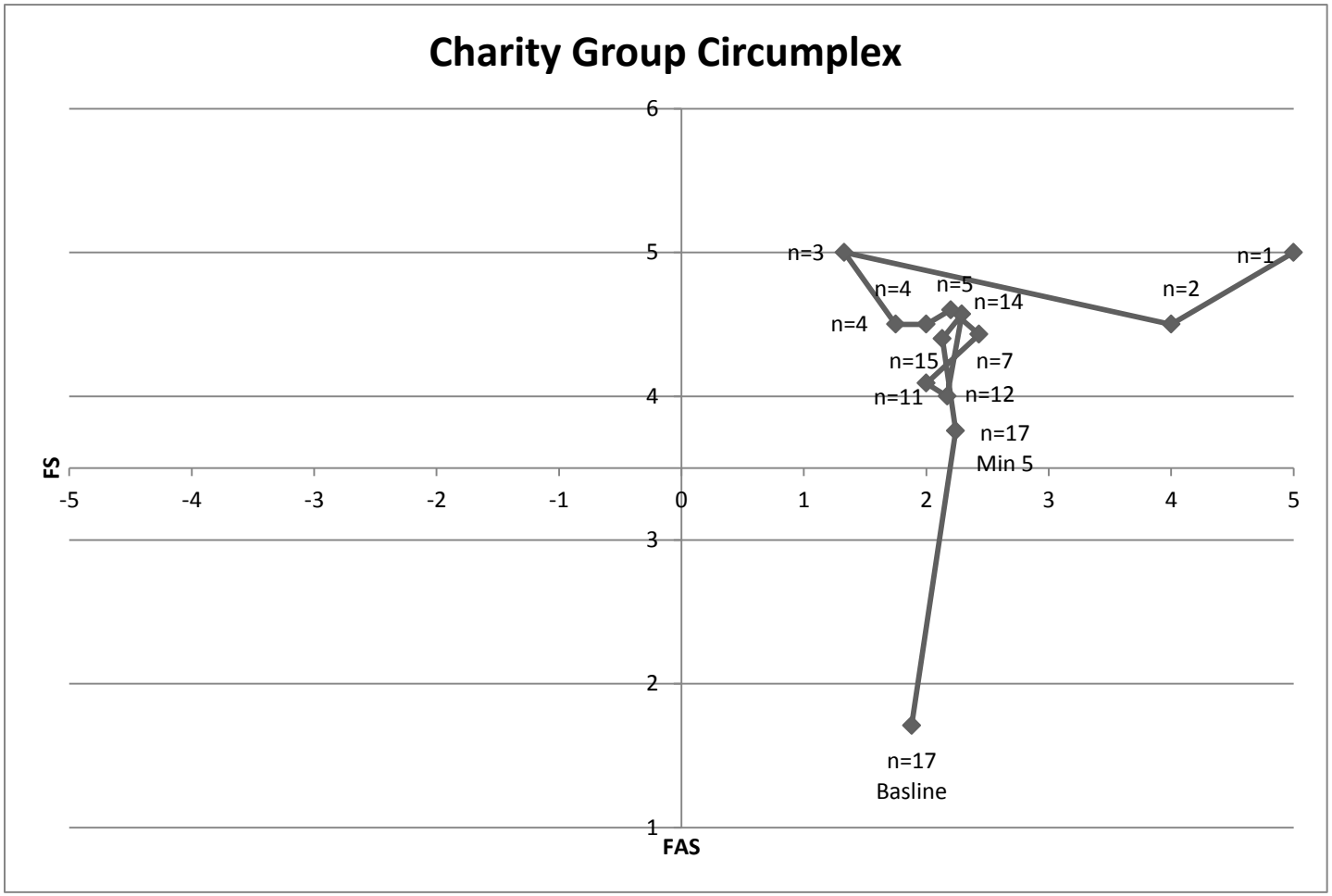
Charity Group Circumplex
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Figure 3

CHAPTER V

DISCUSSION

It can be said that *everyone* knows that exercise is "good for you." However, as of 2010, only 48.8% of people in the U.S. reported that they were meeting the recommended level of daily physical activity (CDC, 2010). This evidence suggests that simply knowing about the myriad health benefits that come from a physically active lifestyle is not sufficient to motivate the majority of the people in the U.S. to actually become physically active. This physical activity paradox may be explained by understanding how rewards affect behavior. Specifically, how does the meaning behind performing an exercise affect the actual exercise behavior?

Ariely, Bracha, and Meier (2008) performed a study that explored the connection between the meaning of performing a cycling task and the resultant performance on the cycling task. In their study, the treatment conditions consisted of a group that earned a charitable donation and a personal payment (both intrinsic and extrinsic rewards) and another group that earned a charitable donation without a personal payment (intrinsic reward only) for each mile cycled in a 10-minute period. The results revealed that the group earning a charitable donation and a personal payment cycled the most miles. Since the intrinsic reward was received by both treatment groups, this study effectively compared the effects of an extrinsic reward or the lack of an extrinsic reward on cycling performance.

Although the study performed by Ariely, Bracha, and Meier (2008) was designed to test the effects of meaning on cycling performance, the design did not allow for a direct comparison between intrinsic rewards and extrinsic rewards because each group contained an intrinsically rewarding component (i.e., charitable donation). Thus, the study described herein provides an important extension to our understanding of how different meanings for performing exercise (i.e., intrinsic and extrinsic) affect exercise behavior. Furthermore, the addition of a control group that contains a natural form of a delayed extrinsic reward (i.e., the health benefits of exercise) provides an appropriate and important real world comparison.

In this study, a cycling task consisting of a self-selected intensity, pace, and duration allowed the total number of kilometers cycled to be utilized as a measure of exercise behavior between different conditions in a randomized control trial. Participants in each treatment condition watched a video about the health benefits of exercise. The health condition received no further information, the wealth condition received information pertaining to the personal monetary payment (immediate extrinsic) that would result from cycling, and the charity condition received information pertaining to the charitable donation (immediate intrinsic) that would be generated from cycling.

The two groups that were observed to have the best performance, in terms of total KM cycled, were the groups that were given an immediate incentive for the cycling task (wealth and charity). While the results failed to reach the *a priori* level of statistical significance, this difference could be meaningful for this sample. Those in the wealth and

charity group cycled approximately twice the number of KM as did those in the health group. This difference may be clinically meaningful in terms of increasing public health.

This study provides an important extension to the literature because its design makes it possible to tease apart this effect. By having three different treatment conditions, each containing their own reward type, it is possible to attribute the results directly to a specific reward type. In this case, immediate extrinsic or immediate intrinsic rewards seem to have a similar effect on exercise behavior. Conversely, the provision of information about health benefits alone resulted in the shortest distance cycled. Given that many public health campaigns focus on the health benefits of exercise, if future study supports the reliability of this study's findings in other samples, then these results may help to explain the relative lack of effectiveness of public health campaigns expected to increase physical activity levels (Ekkekakis, Hall, & Petruzzello, 2008).

The lack of significant differences between groups for measures of HR, RPE, FS, and FAS, suggests that the exercise experience was the same for all three treatment conditions. This is important because it implies that the observed results are attributable to the reward structures imbedded in the treatment conditions. If the exercise experience were different for the three treatment conditions, one might infer that the differences in the KM cycled were due to the exercise itself and not the treatment conditions.

Additionally, HR and FAS, were the only variables in which significant changes over time were observed. These findings demonstrate the expected relation between exercise performance and those variables reflective of exercise intensity such that increases in HR were observed and increases in FAS were reported as participants

progressed into the exercise session. The lack of a significant change in RPE as a function of time is likely due to the participants' self-selection of a desired intensity level and maintenance of a comfortable level throughout the entire experience.

The lack of an observed "feel good" effect from the exercise, as assessed by the FS, is most likely due to only taking assessments of FS during the exercise session. The "feel good" effect is often observed as a rebound or after-effect several minutes post exercise (Bixby, & Lochbaum, 2008). Results from the study conducted by Bixby and Lochbaum (2008) suggest that significant improvements in FS do not occur during a 30-minute bout of moderately intense exercise. However, when assessed at 10 and 20 minutes post exercise levels of FS improvement reach statistical significance (i.e., "feel good).

Future Direction and Implications

Given the lack of current research exploring the effect of meaning on exercise performance and the promising results demonstrated here which suggest that intrinsic and extrinsic rewards that are immediate in nature result in increased exercise, future research is warranted. Adding a fourth treatment condition, thus completing the cells of a 2 (charitable donation) by 2 (personal payment) experimental design, would allow for a direct comparison with the findings of Ariely, Bracha, and Meier (2008) and would enhance our understanding of how the combination of rewards might benefit exercise behavior.

Future research using a similar design to that employed here would also benefit from the use Hierarchical Linear Modeling as a more statistically sophisticated way of

analyzing the data given that the sample sizes change across time points. The use of these techniques with the design used herein would allow for further exploration of the precise nature of the changes in FS, FAS, RPE, and HR across time because it would allow for the use of all data points rather than having to identify a relative mid-point to be used in conjunction with the first and last measures taken during the exercise bout.

The results from this and future studies may be able to assist in the development of initiatives to increase long-term exercise adherence. An example of a potential initiative, taking place at the level of the University community, could consist of student recreation centers recording (by scanning student ID cards) and rewarding student exercise behavior. Students who have exhibited a certain amount of exercise behavior could receive refunds from the student health insurance fees. This could also provide opportunities for student organizations to formulate charity drives based on exercise behavior. Exercise equipment (e.g., exercise bikes, treadmills) could utilize card scanners that, when activated with a student ID card, tracked the total number of miles/KM the specific student performed at each exercise session. The student would be able to select how the "exercise credits" would be applied (i.e., health insurance fee refund, charitable donation).

Limitations

A major limitation of this study is that it was underpowered. The primary hypothesis fell just short of being statistically significant at the level of $p<.05$. This is due to the total number of participants in the study, as well as the unequal number of participants in each treatment condition. If the mean differences reported here for KM

cycled are reliable, then increasing the total number of participants would result in greater statistical power that would allow for the detection of statistically significant results.

Lastly, the complicated nature of the declining per unit payment scale may have made it difficult for the participants to keep a running account of the total money they had earned during the exercise session. In both the wealth and charity conditions, adjustments could be made to increase the participant's awareness of the total amount of money earned by cycling. This could be accomplished by placing a card on the cycle's display that shows the total amount of money earned. This card should immediately be updated for every 2 KM cycled.

Conclusion

The purpose for performing this study was to explore how the meaning behind performing an exercise task affects the resultant exercise behavior. The findings from this study suggest that the presence of an immediate intrinsic (charitable donation) or immediate extrinsic (monetary payment) reward results in an increase in exercise performance as compared to a delayed extrinsic (health benefits) reward. These findings, if shown to be reliable in future studies, may suggest methods by which to improve the efficacy of public health campaigns aimed at increasing the physical activity levels in the United States.

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APPENDIX A

ASSESSMENT TOOLS

Demographics

Subject #:_____

Age: _____ Date of Birth: _____ Gender: Male Female

Ethnic Background: African American/Black Asian/Pacific Islander
Caucasian/White Hispanic
Native American Other: _____

Education Completed: College/Secondary School: 1 2 3 4

Degree program: _____

Graduate School: Yes/No

If Yes, then degree: _____

AHA/ACSM Health/Fitness Facility Pre-participation Screening Questionnaire

Please mark all statements that are *true* ***Subject #_____***

History

You have had:

____ a heart attack
____ heart surgery
____ cardiac catheterization
____ coronary angioplasty (PTCA)
____ pacemaker/implantable cardiac
____ defibrillator/rhythm disturbance
____ heart valve disease
____ heart failure
____ heart transplantation
____ congenital heart disease

If you marked any of these statements in this section, consult your physician or other appropriate health care provider before engaging in exercise.

Symptoms

____ You experience chest discomfort with exertion.
____ You experience unreasonable breathlessness.
____ You experience dizziness, fainting, or blackouts.
____ You take heart medications.

You may need to use a facility with a medically qualified staff.

Other health issues

____ You have diabetes.
____ You have asthma or other lung disease.
____ You have burning or cramping sensation in your lower legs when walking short distances.
____ You have musculoskeletal problems that limit your physical activity.
____ You have concerns about the safety of exercise.
____ You take prescription medication(s).
____ You are pregnant.

AHA/ACSM Health/Fitness Facility Pre-participation Screening Questionnaire

Cardiovascular risk factors

____ You are a man older than 45 years.
____ You are a woman older than 55 years, have had a hysterectomy, or are postmenopausal.
____ You smoke, or quit smoking within the previous 6 months.
____ Your blood pressure is >140/90 mm Hg.
____ You do not know your blood pressure.
____ You take blood pressure medication.
____ Your blood cholesterol level is >200 mg/dL.
____ You do not know your cholesterol level.
____ You have a close blood relative who had a Heart attack or heart surgery before age 55 (father or brother) or age 65 (mother or sister).
____ You are physically inactive (i.e. – you get <30 minutes of physical activity on at least 3 days per week).
____ You are >20 pounds overweight.

If you marked two or more of the statements in this section you should consult your physician or other appropriate health care provider before engaging in exercise. You might benefit from using a facility with a professionally qualified exercise staff to guide your exercise program.

NOTE: If don't know BP or cholesterol, ask if they know if it's high?

____ None of the above

You should be able to exercise safely without consulting your physician or other appropriate health care provider in a self-guided program or almost
any facility that meets your exercise program needs.

Subject # _____

NHANES

NOTE: COMPLETE PAGE 2 NEXT IF THEY ANSWERED YES TO QUESTION 1a AND THEN COME BACK TO QUESTIONS 3 AND 4. IF THEY DID NOT ANSWER YES TO QUESTION 1a, YOU CAN GO STRAIGHT TO 3 AND 4 BELOW.

Part E

3. About how long has it been since your last medical check-up?	Less than 1 year (4)	_____
	1 year, less than 2 years	_____
	2 years, less than 3 years	_____
	3 years, less than 4 years	_____
	4+ years	_____
	Never had a checkup	_____
	Don't know (4)	_____
4. During your last check-up, did the doctor recommend that you BEGIN or CONTINUE to do any type of exercise or physical activity? If YES, ask: Was it BEGIN or CONTINUE?	Yes, to BEGIN	_____
	Yes, to CONTINUE	_____
	Yes, BOTH	_____
	No	_____
	Don't know	_____

NHANES

2a. In the past 2 weeks (outlined on the calendar), beginning Monday (date) and ending this past Sunday (date), have you done any of the following exercises, sports, or physically active hobbies?	b. How many times in the past 2 weeks did you (go/do) this activity?	c. On the average, about how many minutes did you actually spend (doing) this activity each time?	d. What usually happened to your HR or breathing when you (did/went) activity? Did you have a small, moderate, or large increase, or no increase at all in your HR or breathing?
1. Walking for exercise? ___ Yes _____No	(1) ___ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK
2. Gardening or yard work? ___ Yes _____No	(2) ___ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK
3. Stretching exercises? ___ Yes _____No	(3) ___ Times	_____ Minutes	
4. Weightlifting or other exercises to increase strength? ___ Yes _____No	(4) ___ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK
5. Jogging or running? ___ Yes _____No	(5) ___ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK
6. Aerobics or aerobic dancing? ___ Yes _____No	(6) ___ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK
7. Riding a bicycle or exercise bike? ___ Yes _____No	(7) ___ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK

8. Stair climbing for exercise? ___ Yes _____No	(8) ___ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK
9. Swimming for exercise? ___ Yes _____No	(9) ___ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK
10. Playing tennis? ___ Yes _____No	(10) __ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK
11. Playing golf? ___ Yes _____No	(11) __ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK
12. Bowling? ___ Yes _____No	(12) __ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK
13. Playing baseball or softball? ___ Yes _____No	(13) __ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK
14. Playing handball, racquetball, or squash? ___ Yes _____No	(14) __ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK
15. Skiing? ___ Yes _____No	(15) __ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK
a. Downhill? ___ Yes _____No	(a) ___ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK
b. Cross-country? ___ Yes _____No	(b) ___ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK
c. Water? ___ Yes _____No	(c) ___ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK
16. Playing basketball? ___ Yes _____No	(16) __ Times	_____ Minutes	__ Small __ Large __ Moderate -- No Inc. _____ DK

17. Playing volleyball? ___ Yes _____No	(17) __ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK
18. Playing soccer? ___ Yes _____No	(18) __ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK
19. Playing football? ___ Yes _____No	(19) __ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK
20. Have you done any (other) exercises, sports, or physically active hobbies in the past 2 weeks? ___ Yes (what were they?) _____No If activity listed above, mark YES for it; otherwise specify below.			
a.	(20a) _ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK
b.	(20b) _ Times	_____ Minutes	__ Small __ Large __ Moderate __ No Inc. _____ DK

AD ACL

Following are some adjectives that describe people's feelings. Please read each of the adjectives and then indicate how you are feeling *at this particular moment* by circling the appropriate response. There are no right or wrong answers, so do not spend too much time on any one item.

	Definitely Feel	Feel Slightly	Cannot Decide	Definitely Don't Feel
1. Active	vv	v	?	no
2. Placid	vv	v	?	no
3. Sleepy	vv	v	?	no
4. Jittery	vv	v	?	no
5. Energetic	vv	v	?	no
6. Intense	vv	v	?	no
7. Calm	vv	v	?	no
8. Tired	vv	v	?	no
9. Vigorous	vv	v	?	no
10. At rest	vv	v	?	no

AD ACL Continued

	vv	v	?	no
11. Drowsy				
	vv	v	?	no
12. Fearful				
	vv	v	?	no
13. Lively				
	vv	v	?	no
14. Still				
	vv	v	?	no
15. Wide-awake				
	vv	v	?	no
16. Clutched-up				
	vv	v	?	no
17. Quiet				
	vv	v	?	no
18. Full of pep				
	vv	v	?	no
19. Tense				
	vv	v	?	no
20. Wakeful				

RPE

Please choose the number that best represents your *current* state of exertion/effort.

6…

7-Very, Very Light

8…

9-Very Light

10…

11-Fairly Light

12…

13-Somewhat Hard

14…

15-Hard

16…

17-Very Hard

18…

19-Very, Very Hard

20…

Feeling Scale

Please choose the number that best represents your *current* state of feeling (i.e., Pleasurable/Un-pleasurable).

-5 – Very Bad

-4 …

-3 Bad

-2 …

-1 – Fairly Bad

0 – Neutral

1 – Fairly Good

2 …

3 – Good

4 …

5 – Very Good

Felt Arousal Scale

Please choose the number that best represents you *current* state of arousal

1 – Low Arousal

2 …

3 …

4 …

5 …

6 – High Arousal

Satisfaction Scale

How satisfied are you with your cycling performance?

Please circle the number that best describes your level of satisfaction.

1	2	3	4	5	6
Extremely Dissatisfied					Extremely Satisfied

Enjoyment Scale

Please circle the number that best describes your answer to the following questions.

A) How interesting was the cycling?

1	2	3	4	5
Not at All				Very Much

B) How exciting was the cycling?

1	2	3	4	5
Not at All				Very Much

C) How fun was the cycling?

1	2	3	4	5
Not at All				Very Much

Cycling Task

Subject #_____ Treatment Condition_____ Date_____

Time HR Monitor attached_____ Time Resting HR Read_____

- Resting HR_____ FS_____ FAS_____

Watched Video(check) _____

Time Start Cycling_____ Time Stop Cycling_____ Total Time Cycled_____

Minute 1------ HR_____ RPE_____ Watts_80_ KM _____RPM _____
Minute 2------ HR_____ RPE_____ Watts_100 KM _____RPM_____
Minute 3------ HR_____ RPE_____ Watts_120_ KM ____ _RPM _____
Minute 4------ HR_____ RPE_____ Watts_____ KM _____RPM _____
Watts_____
Minute 5------ HR_____ RPE_____ FS ___FAS___KM ____RPM _____

Minute 10------ HR_____ RPE_____ FS ___FAS___KM ____ RPM_____

Minute 15------ HR_____ RPE_____ FS____FAS___KM ____ RPM ____

Minute 20------ HR_____ RPE_____ FS____FAS___KM ____ RPM ____

Minute 25------ HR_____ RPE_____ FS____FAS___KM ____ _RPM ____

Minute 30------ HR_____ RPE_____ FS____FAS___KM ____ _RPM____

Minute 35------ HR_____ RPE_____ FS____FAS___KM _____ RPM____

Minute 40------ HR_____ RPE_____ FS____FAS___KM ____ _RPM____

Minute 45------ HR_____ RPE_____ FS____FAS___KM _____RPM____

Minute 50------ HR_____ RPE_____ FS____FAS___KM _____RPM____

Minute 55------ HR_____ RPE_____ FS____FAS___KM _____RPM____

Minute 60------ HR_____ RPE_____ FS____FAS___KM _____RPM____

Why did you choose to stop when you did?

Notes

APPENDIX B

MEANS OF HR, RPE, FS AND FAS FOR EACH TREATMENT CONDITION AT EVERY TIME POINT

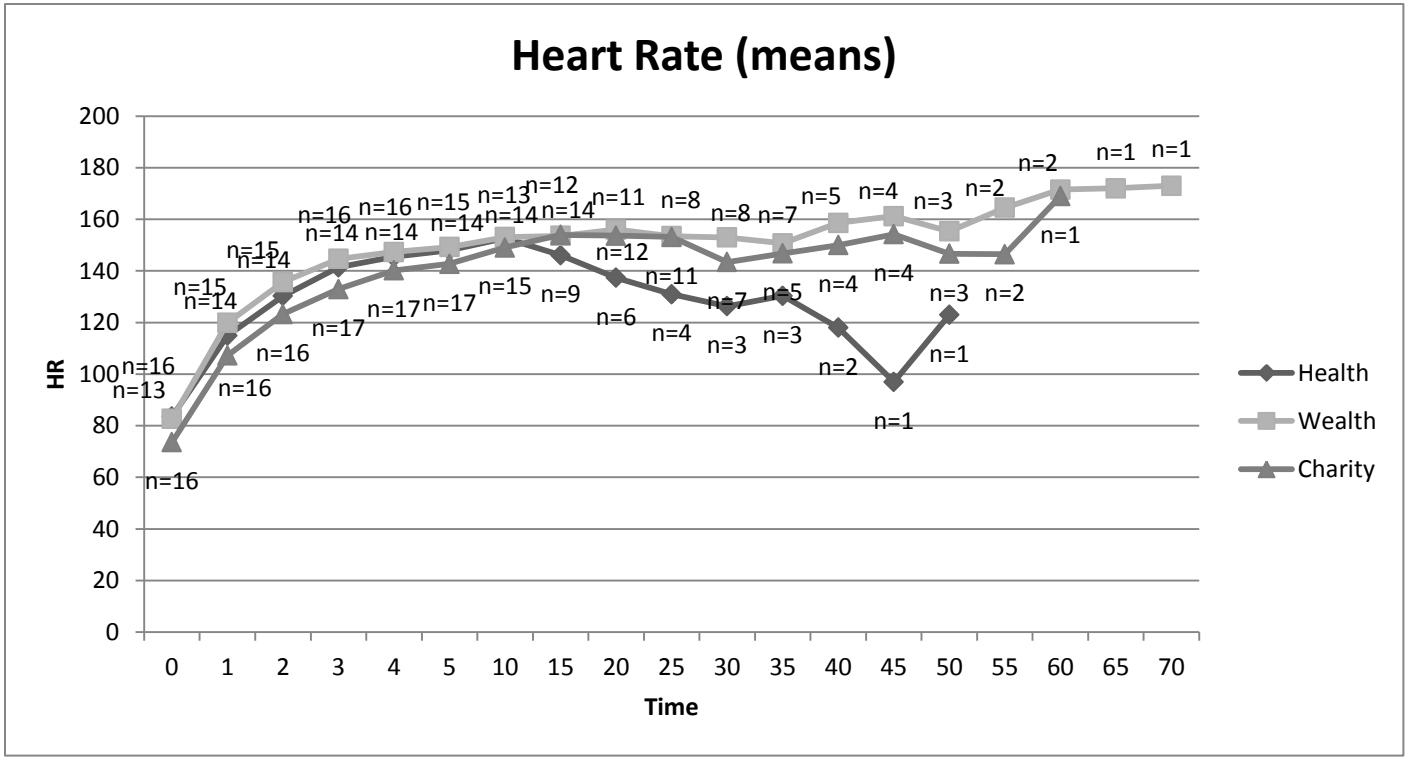

Figure 4

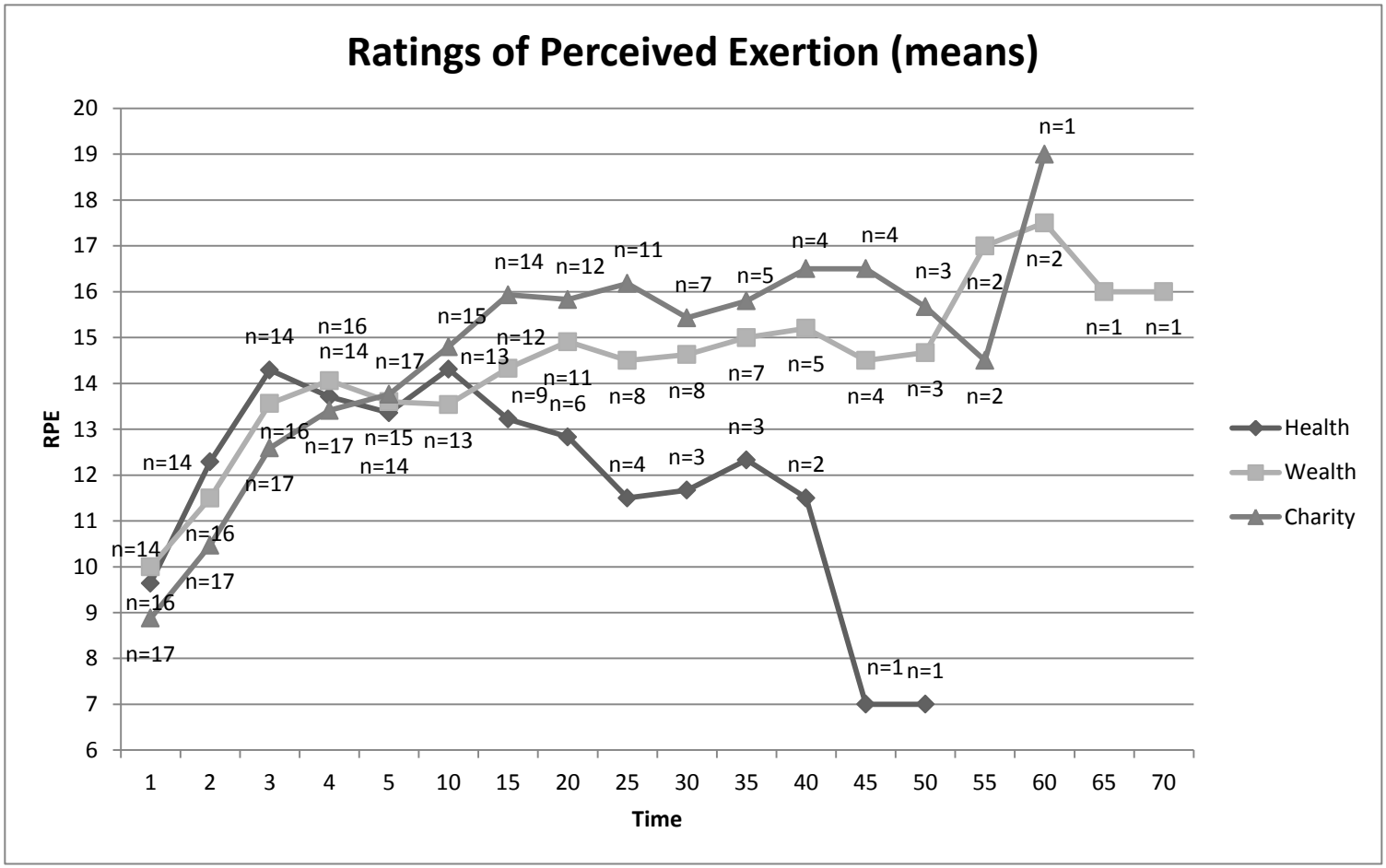
Ratings of Perceived Exertion (means)
RPE
Time
Health
Wealth
Charity

Figure 5

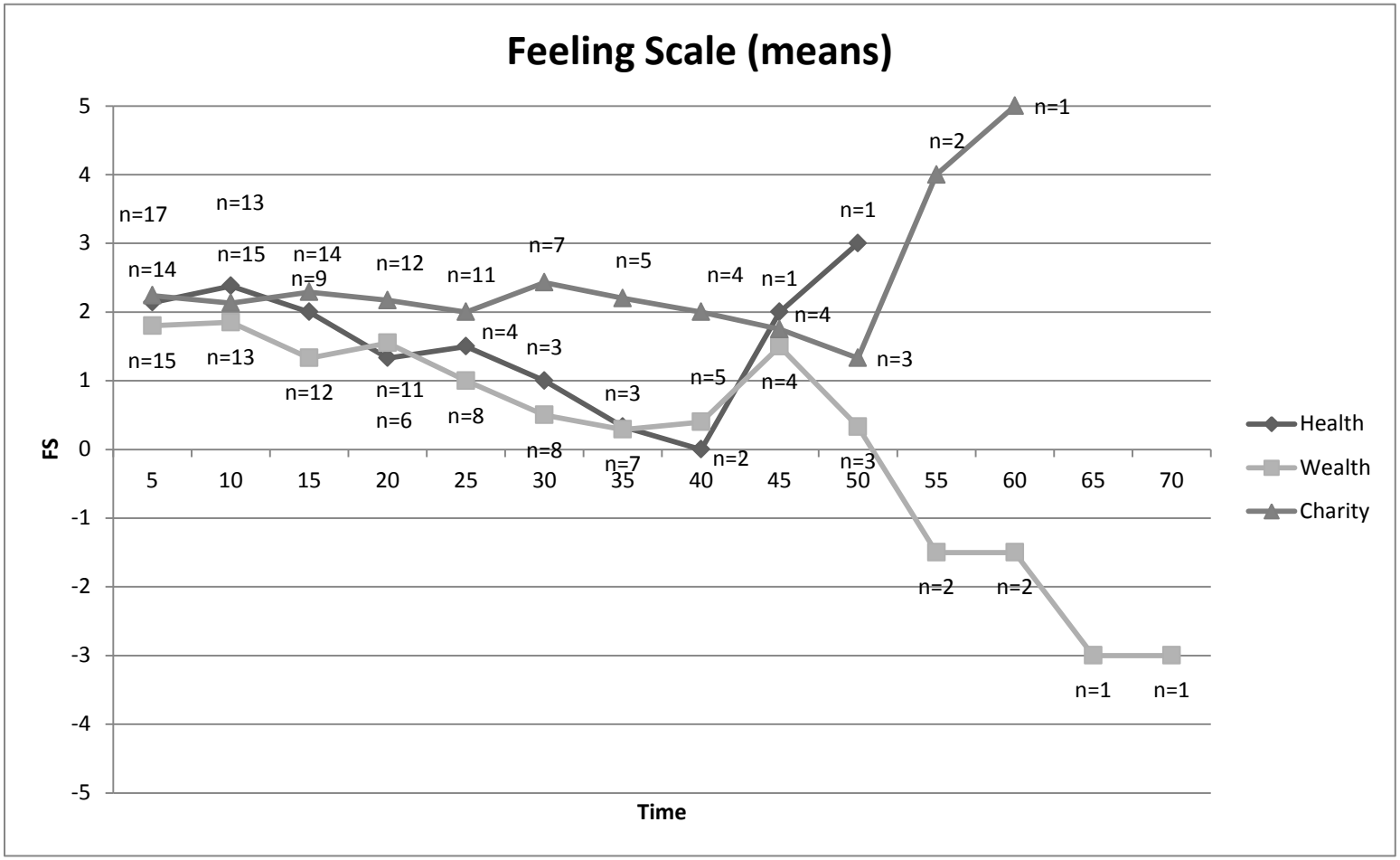
Feeling Scale (means)
FS
Time
5
4
3
2
1
0
-1
-2
-3
-4
-5
5
10
15
20
25
30
35
40
45
50
55
60
65
70
n=17
n=13
n=14
n=15
n=14
n=9
n=12
n=11
n=7
n=5
n=4
n=1
n=1
n=2
n=1
n=15
n=13
n=12
n=11
n=6
n=8
n=4
n=3
n=8
n=3
n=7
n=5
n=2
n=4
n=4
n=3
n=3
n=2
n=2
n=1
n=1
Health
Wealth
Charity

Figure 6

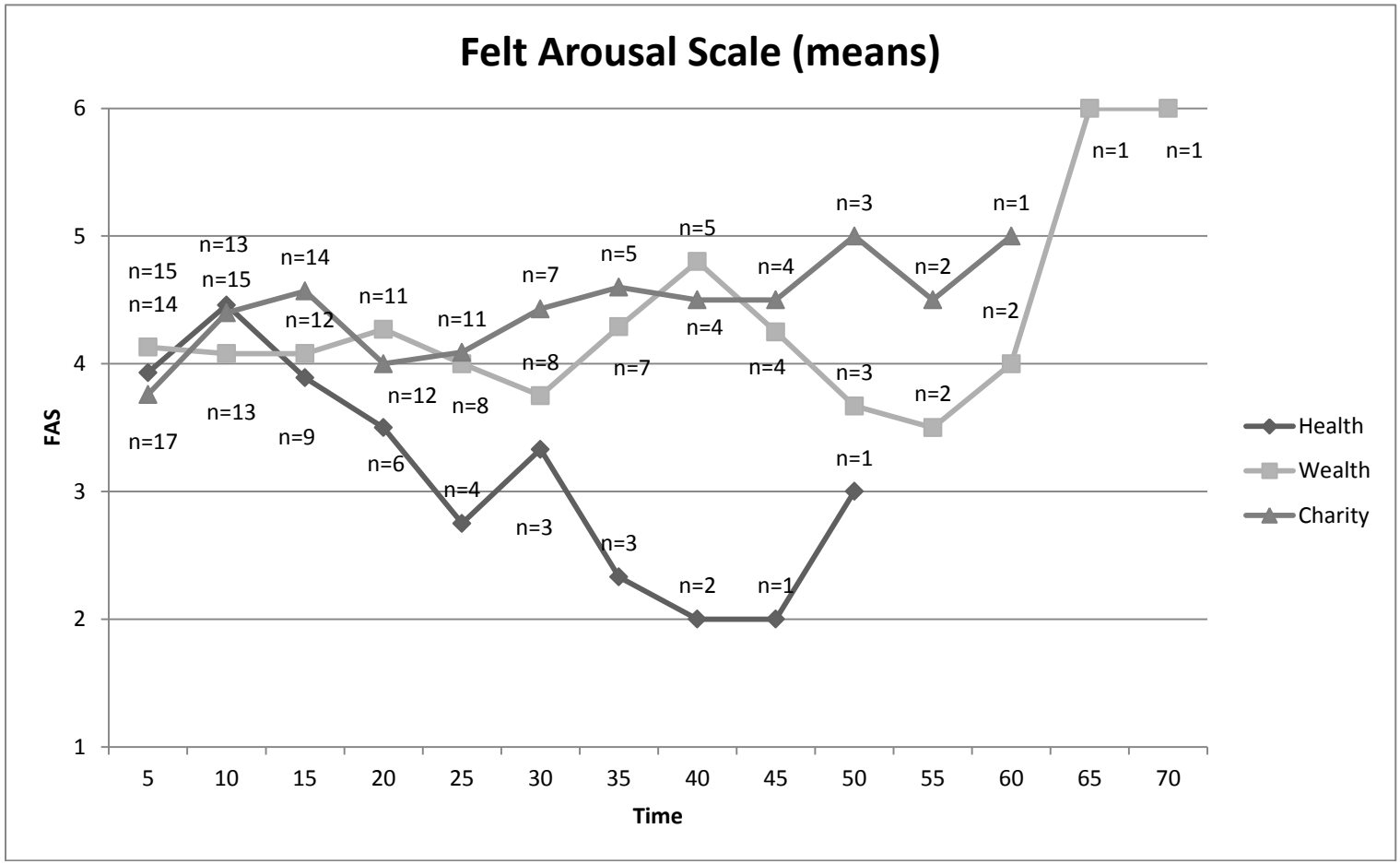
Felt Arousal Scale (means)
FAS
Time
Health
Wealth
Charity
6
5
4
3
2
1
5
10
15
20
25
30
35
40
45
50
55
60
65
70
n=15
n=14
n=17
n=13
n=15
n=13
n=14
n=12
n=9
n=11
n=12
n=6
n=11
n=8
n=4
n=7
n=8
n=3
n=5
n=7
n=3
n=5
n=4
n=2
n=4
n=4
n=1
n=3
n=3
n=1
n=2
n=1
n=2
n=2
n=1
n=1

Figure 7

APPENDIX C

MEANS (SD) FOR EACH TREATMENT CONDITION AT EACH TIME POINT

Table 8 Means (SD) for Each Treatment Condition

	Health (n=14)		Wealth (n=16)		Charity (n=17)	
Kilometers	6.99	(4.10)	12.07	(8.90)	11.38	(6.30)
Satisfaction	3.79	(.98)	4.44	(1.10)	4.29	(.85)
Enjoyment	6.37	(4.37)	8.15	(5.12)	8.00	(4.09)

Table 9 Means (SD) for HR, RPE, FS, and FAS for Each Treatment Condition at Each Time Point

		n	M (SD) first	n	M (SD) mid	n	M (SD) last
HR							
	Health	n=14	148.00 (18.60)	n=14	149.21 (23.28)	n=14	155.79 (19.93)
	Wealth	n=15	149.27 (22.55)	n=16	157.63 (15.59)	n=16	164.44 (17.79)
	Charity	n=17	142.76 (16.26)	n=17	151.06 (18.06)	n=17	157.65 (20.25)
	Total	n=46	146.48 (18.99)	n=47	152.74 (18.95)	n=47	159.40 (19.29)
RPE							
	Health	n=14	13.36 (2.56)	n=14	13.79 (2.67)	n=13	14.92 (3.04)
	Wealth	n=15	13.60 (2.95)	n=16	14.50 (2.73)	n=16	16.25 (2.70)
	Charity	n=17	13.76 (1.86)	n=17	15.18 (2.07)	n=17	16.71 (3.04)
	Total	n=46	13.59 (2.42)	n=47	14.53 (2.50)	n=46	16.04 (2.95)

Table 9 Continued

		n	M (SD) first	n	M (SD) mid	n	M (SD) last
FS							
	Health	n=14	2.14 (1.52)	n=14	2.07 (1.39)	n=13	1.62 (1.76)
	Wealth	n=15	1.80 (1.78)	n=13	1.38 (2.18)	n=15	1.20 (3.08)
	Charity	n=17	2.24 (1.30)	n=15	2.13 (1.96)	n=17	1.88 (2.80)
	Total	n=46	2.07 (1.53)	n=42	1.88 (1.85)	n=45	1.58 (2.61)
FAS							
	Health	n=14	3.93 (.10)	n=14	3.86 (1.10)	n=13	4.00 (1.41)
	Wealth	n=15	4.13 (.99)	n=13	4.15 (1.51)	n=15	4.40 (1.45)
	Charity	n=17	3.76 (.97)	n=15	4.33 (.82)	n=17	4.94 (1.03)
	Total	n=46	3.93 (.98)	n=42	4.12 (1.15)	n=45	4.49 (1.33)

Table 10 Means (SD) of ADACL Sub-Scales at Pre-Test and Post-Test

	M (SD) Pre-Test	M (SD) Post-Test
ADACL Energy		
Health (n=14)	9.00 (3.64)	13.50 (4.27)
Wealth (n=15)	11.10 (3.14)	15.40 (3.50)
Charity (n=17)	10.29 (3.93)	15.77 (2.91)
Total (n=46)	10.16 (3.62)	14.96 (3.61)
ADACL Calm		
Health (n=14)	13.86 (2.25)	8.14 (3.30)
Wealth (n=15)	13.00 (3.14)	8.60 (3.94)
Charity (n=17)	13.00 (3.55)	8.29 (2.76)
Total (n=46)	13.26 (3.03)	8.35 (3.27)
ADACL Tired		
Health (n=14)	-12.64 (4.27)	-9.21 (4.30)
Wealth (n=15)	-10.47 (3.72)	-7.93 (2.34)
Charity(n=17)	-11.94 (3.78)	-7.76 (2.66)
Total (n=46)	-11.67 (3.93)	-8.26 (3.16)
ADACL Tense		
Health (n=14)	-6.57 (2.53)	-7.07 (2.30)
Wealth (n=15)	-7.07 (2.22)	-9.33 (2.58)
Charity(n=17)	-6.53 (2.24)	-8.29 (2.17)
Total (n=46)	-6.72 (2.29)	-8.26 (2.47)

APPENDIX D

INFORMED CONSENT FOR HEALTH GROUP

UNIVERSITY OF NORTH CAROLINA AT GREENSBORO

CONSENT TO ACT AS A HUMAN PARTICIPANT: LONG FORM

Project Title: FOR HEALTH, WEALTH, OR OTHERS: HOW THE PURPOSE FOR PARTICIPATING IN A CYCLING TASK AFFECTS PERFORMANCE

Project Director: Dr. Jennifer Etnier & Aaron Piepmeier

Participant's Name: _____

What is the study about?
This is a research project. This study is being completed to assess differences in self-selected duration of a cycling task in students at UNCG who are adults between the ages of 18-35.

Why are you asking me?
You are being asked to participate in this study because you fit the initial inclusion criteria of being a student at UNCG, are an adult between the ages of 18-35 years, and currently do not exercise more than 30 minutes per day on more than 3 days per week.

What will you ask me to do if I agree to be in the study?
If you choose to participate in this study, we will ask you to attend 1 session of approximately 90 minutes. During this session, you will be asked to complete some questionnaires, wear a heart rate monitor, and peddle a stationary bicycle at your own pace.

Are there any audio/video recording?
There will be no video of audio recording of any kind.

What are the dangers to me?
Participation in this study involves minimal risk. Light physical activity of any kind always includes some risk of physical injury. You will be asked to complete a health screening questionnaire to help ensure that you are fit enough to complete the physical activity components of the study. Further, the investigator will closely monitor all physical activity in order to help prevent possible injury. There is no risk involved with the pencil and paper questionnaires. If any injury does occur during the course of, or relating to, participation in the study, the researcher will make the participant as comfortable as possible, provide the participant with CPR or AED (defibrillation) if

needed, and contact emergency medical services. Contact information to the UNCG Office of Research Compliance will also be provided.

If you have any concerns about your rights, how you are being treated or if you have questions, want more information or have suggestions, please contact Eric Allen in the Office of Research Compliance at UNCG at (336) 256-1482 Questions, concerns or complaints about this project or benefits or risks associated with being in this study can be answered by [Aaron Piepmeier] who may be contacted at (336) 937-3757 (atpiepme@uncg.edu) or [Dr. Jennifer Etnier] who may be contacted at (jletnier@uncg.edu).

Are there any benefits to me for taking part in this research study?
There are no direct benefits to participants in this study. However, participants may find it enjoyable to exercise.

Are there any benefits to society as a result of me taking part in this research?
Knowledge gained from this research may be an important contribution to society in furthering our understanding of exercise behavior in the United States.

Will I get paid for being in the study? Will it cost me anything?
There are no costs to you for participating in this study. You will not receive payment for participating in this study.

How will you keep my information confidential?
The researchers will keep any and all information confidential and data forms will not include your identity. All information obtained in this study is strictly confidential unless disclosure is required by law. All data collected during the study will be stored in a locked file cabinet in a locked office. By law, we are required to keep consent forms for at least 3 years following the study. After that time period has elapsed, consent forms will be shredded. Information collected in this study will be kept locked in the Sport Psychology lab on the UNCG campus, in a locked office, in a locked drawer.

What if I want to leave the study?
You have the right to refuse to participate or to withdraw at any time, without penalty. If you do withdraw, it will not negatively affect you in any way. If you choose to withdraw, you may request that any of your data which has been collected be destroyed unless it is in a de-identifiable state.

What about new information/changes in the study?
If significant new information relating to the study becomes available which may relate to your willingness to continue to participate, this information will be provided to you.

Voluntary Consent by Participant:
By signing this consent form you are agreeing that you have read it, or that it has been read to you and you fully understand the contents of this document and are openly willing to consent to take part in this study. All of your questions concerning this study have been answered. By signing this form, you are agreeing that you are 18 years of age or older and are agreeing to participate, or have the individual specified above as a participant participate, in this study described to you by _____.

Signature: _____ Date: _____

APPENDIX E

INFORMED CONSENT FOR WEALTH GROUP

UNIVERSITY OF NORTH CAROLINA AT GREENSBORO

CONSENT TO ACT AS A HUMAN PARTICIPANT: LONG FORM

Project Title: FOR HEALTH, WEALTH, OR OTHERS: HOW THE PURPOSE FOR PARTICIPATING IN A CYCLING TASK AFFECTS PERFORMANCE

Project Director: Dr. Jennifer Etnier & Aaron Piepmeier

Participant's Name: _____

What is the study about?
This is a research project. This study is being completed to assess differences in self-selected duration of a cycling task in students at UNCG who are adults between the ages of 18-35.

Why are you asking me?
You are being asked to participate in this study because you fit the initial inclusion criteria of being a student at UNCG, are an adult between the ages of 18-35 years, and currently do not exercise more than 30 minutes per day on more than 3 days per week.

What will you ask me to do if I agree to be in the study?
If you choose to participate in this study, we will ask you to attend 1 session of approximately 90 minutes. During this session, you will be asked to complete some questionnaires, wear a heart rate monitor, and peddle a stationary bicycle at your own pace.

Are there any audio/video recording?
There will be no video of audio recording of any kind.

What are the dangers to me?
Participation in this study involves minimal risk. Light physical activity of any kind always includes some risk of physical injury. You will be asked to complete a health screening questionnaire to help ensure that you are fit enough to complete the physical activity components of the study. Further, the investigator will closely monitor all physical activity in order to help prevent possible injury. There is no risk involved with the pencil and paper questionnaires. If any injury does occur during the course of, or relating to, participation in the study, the researcher will make the participant as comfortable as possible, provide the participant with CPR or AED (defibrillation) if

needed, and contact emergency medical services. Contact information to the UNCG Office of Research Compliance will also be provided.

If you have any concerns about your rights, how you are being treated or if you have questions, want more information or have suggestions, please contact Eric Allen in the Office of Research Compliance at UNCG at (336) 256-1482 Questions, concerns or complaints about this project or benefits or risks associated with being in this study can be answered by [Aaron Piepmeier] who may be contacted at (336) 937-3757 (atpiepme@uncg.edu) or [Dr. Jennifer Etnier] who may be contacted at (jletnier@uncg.edu).

Are there any benefits to me for taking part in this research study?
You have the opportunity to receive monetary benefits from this study. Monetary benefits are determined by the total number of kilometers cycled during the session. A complete explanation of the payment method is provided below.

Are there any benefits to society as a result of me taking part in this research?
Knowledge gained from this research may be an important contribution to society in furthering our understanding of exercise behavior in the United States.

Will I get paid for being in the study? Will it cost me anything?
There are no costs to you for participating in this study. Monetary payment to you will be calculated using a declining payment scale that is based on kilometers peddled (without taking a break) during the session. The payment scale will begin with the *second* kilometer cycled earning you $1.00. The amount of money will decrease by $0.10 for each additional 2 kilometers cycled (e.g., ***total money earned*** for peddling 2 kilometers=$1.00, 4 kilometers =$1.90, 6 kilometers=$2.70). All kilometers cycled past the 20-kilometer mark will result in a $0.01 per 2 kilometers. You will receive payment in cash upon completion of the cycling task. You will not receive any payment if the total distance you peddle is less than 2 kilometers. Once you stop peddling, you will not be allowed to begin peddling again to earn money.

How will you keep my information confidential?
The researchers will keep any and all information confidential and data forms will not include your identity. All information obtained in this study is strictly confidential unless disclosure is required by law. All data collected during the study will be stored in a locked file cabinet in a locked office. By law, we are required to keep consent forms for at least 3 years following the study. After that time period has elapsed, consent forms will be shredded. Information collected in this study will be kept locked in the Sport Psychology lab on the UNCG campus, in a locked office, in a locked drawer.

What if I want to leave the study?
You have the right to refuse to participate or to withdraw at any time, without penalty. If you do withdraw, it will not negatively affect you in any way. If you choose to withdraw, you may request that any of your data which has been collected be destroyed unless it is

in a de-identifiable state.

What about new information/changes in the study?
If significant new information relating to the study becomes available which may relate to your willingness to continue to participate, this information will be provided to you.

Voluntary Consent by Participant:
By signing this consent form you are agreeing that you have read it, or that it has been read to you and you fully understand the contents of this document and are openly willing to consent to take part in this study. All of your questions concerning this study have been answered. By signing this form, you are agreeing that you are 18 years of age or older and are agreeing to participate, or have the individual specified above as a participant participate, in this study described to you by _____.

Signature: _____ Date: _____

APPENDIX F

INFORMED CONSENT FOR CHARITY GROUP

UNIVERSITY OF NORTH CAROLINA AT GREENSBORO

CONSENT TO ACT AS A HUMAN PARTICIPANT: LONG FORM

Project Title: FOR HEALTH, WEALTH, OR OTHERS: HOW THE PURPOSE FOR PARTICIPATING IN A CYCLING TASK AFFECTS PERFORMANCE

Project Director: Dr. Jennifer Etnier & Aaron Piepmeier

Participant's Name: _____

What is the study about?
This is a research project. This study is being completed to assess differences in self-selected duration of a cycling task in students at UNCG who are adults between the ages of 18-35.

Why are you asking me?
You are being asked to participate in this study because you fit the initial inclusion criteria of being a student at UNCG, are an adult between the ages of 18-35 years, and currently do not exercise more than 30 minutes per day on more than 3 days per week.

What will you ask me to do if I agree to be in the study?
If you choose to participate in this study, we will ask you to attend 1 session of approximately 90 minutes. During this session, you will be asked to complete some questionnaires, wear a heart rate monitor, and peddle a stationary bicycle at your own pace.

Are there any audio/video recording?
There will be no video of audio recording of any kind.

What are the dangers to me?
Participation in this study involves minimal risk. Light physical activity of any kind always includes some risk of physical injury. You will be asked to complete a health screening questionnaire to help ensure that you are fit enough to complete the physical activity components of the study. Further, the investigator will closely monitor all physical activity in order to help prevent possible injury. There is no risk involved with the pencil and paper questionnaires. If any injury does occur during the course of, or relating to, participation in the study, the researcher will make the participant as comfortable as possible, provide the participant with CPR or AED (defibrillation) if

needed, and contact emergency medical services. Contact information to the UNCG Office of Research Compliance will also be provided.

If you have any concerns about your rights, how you are being treated or if you have questions, want more information or have suggestions, please contact Eric Allen in the Office of Research Compliance at UNCG at (336) 256-1482 Questions, concerns or complaints about this project or benefits or risks associated with being in this study can be answered by [Aaron Piepmeier] who may be contacted at (336) 937-3757 (atpiepme@uncg.edu) or [Dr. Jennifer Etnier] who may be contacted at (jletnier@uncg.edu).

Are there any benefits to me for taking part in this research study?
There are no direct benefits to participants in this study. However, participants may find it enjoyable to exercise.

Are there any benefits to society as a result of me taking part in this research?
Knowledge gained from this research may be an important contribution to society in furthering our understanding of exercise behaviors in the United States. Additionally, a charitable donation will be made on your behalf based on the number of kilometers peddled during the session. You will be given the opportunity to select the charity of your choice from a list provided prior to beginning the session.

The total monetary amount of the charitable donation will be calculated using a declining per unit payment scale that is based on kilometers peddled (without taking a break) during the session. The payment scale will begin with the *second* kilometer cycled earning the charity $1.00. The amount of money will decrease by $0.10 for each additional 2 kilometers cycled (e.g., ***total money earned*** for peddling 2 kilometers=$1.00, 4 kilometers =$1.90, 6 kilometers=$2.70). All kilometers cycled past the 20-kilometer mark will result in a $0.01 per 2 kilometers payment. The selected charity will receive payment on your behalf. No payments will be made if the total distance you peddle is less than 2 kilometers. Once you stop peddling, you will not be allowed to begin peddling again to earn donations.

Will I get paid for being in the study? Will it cost me anything?
There are no costs to you for participating in this study. You will not receive payment for participating in this study.

How will you keep my information confidential?
The researchers will keep any and all information confidential and data forms will not include your identity. All information obtained in this study is strictly confidential unless disclosure is required by law. All data collected during the study will be stored in a locked file cabinet in a locked office. By law, we are required to keep consent forms for at least 3 years following the study. After that time period has elapsed, consent forms

will be shredded. Information collected in this study will be kept locked in the Sport Psychology lab on the UNCG campus, in a locked office, in a locked drawer.

What if I want to leave the study?
You have the right to refuse to participate or to withdraw at any time, without penalty. If you do withdraw, it will not negatively affect you in any way. If you choose to withdraw, you may request that any of your data which has been collected be destroyed unless it is in a de-identifiable state.

What about new information/changes in the study?
If significant new information relating to the study becomes available which may relate to your willingness to continue to participate, this information will be provided to you.

Voluntary Consent by Participant:
By signing this consent form you are agreeing that you have read it, or that it has been read to you and you fully understand the contents of this document and are openly willing to consent to take part in this study. All of your questions concerning this study have been answered. By signing this form, you are agreeing that you are 18 years of age or older and are agreeing to participate, or have the individual specified above as a participant participate, in this study described to you by _____.

Signature: _____ Date: _____