ABSTRACT

Title of Dissertation: UNDERSTANDING AND RETRAINING THE CAUSAL ATTRIBUTIONS OF EXERCISE INTENDERS

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Given that ~50% of all exercise intenders will fall into the intention-behavior gap (i.e., a situation where people fail to act on their intentions), it is necessary to identify the constructs and/or theories that can explain the discord between intention and behavior (i.e., the intention-behavior gap). For this purpose, the present research was conducted through two studies that were designed to test the efficacy of causal attributions as a means to reduce the intention-behavior discord. The first study collected information from 952 individuals on their exercise behavior and their associated causal attributions over a six-week period. The findings from this study included: (1) those individuals who fell into the intention-behavior gap made self-serving attributions for their exercise failure; (2) Weiner's model accurately predicted several of the affective and cognitive responses to exercise behavior for the sample of exercise intenders; and (3) causal attributions were not found to be effective moderators of the intention-behavior relationship. The second study was an experiment that tested whether an attribution retraining intervention could improve exercise behavior for a sample of sedentary, exercise intenders (n=200). Results of this study were mixed as the intervention appeared to have been able to modify one of the targeted attributional dimensions (control), but the effect was not strong enough to change the exercise behavior of the participants in the

experimental group. It is suggested that attributions may not be able to reduce the gap because they represent conscious deliberations of the behavior, while sustained exercise is based on nonconscious processing of relevant information to make exercise an automatic behavior.

UNDERSTANDING AND RETRAINING THE CAUSAL ATTRIBUTIONS OF EXERCISE INTENDERS

by

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PREFACE

The attached dissertation is the culmination of several years of study and engagement with the exercise community in the District of Columbia. Ten years ago, while working as a part-time group fitness instructor, I began to question what motivated people to exercise. I believed then, as I firmly do now, that psychology provided the clearest lens through which to view this issue. I wanted to formally study this issue and sought out and identified a mentor – Dr. Seppo Iso-Ahola. Dr. Iso-Ahola guided me through my studies at the University of Maryland. He helped me select the relevant coursework, reviewed and critiqued my (often painful) writing, and helped me understand the value of theory and its practicality. Armed with this knowledge, I feel better prepared to re-integrate myself with the exercise community and make contributions to the field by investigating various research questions– both basic and translational. This is the first of hopefully many efforts on my part to use research to help solve a complex problem that people struggle with every year (often around January 1st): How can I exercise regularly?

DEDICATION

This dissertation is dedicated to my wife and my mother. First, to my wife, who has been extremely helpful to me throughout this whole process. She has provided me with everything from encouragement when I experienced self-doubt, to immeasurable amounts of practical assistance (e.g., cooking meals, walking the dog on cold mornings (I promise I was writing on those mornings!)), to printing out different versions of the document when I was unable to gain entry to my office so I could do it myself. Second, to my mother who always seemed to take a strong interest in my studies and who made me feel that this whole process has been worthwhile.

ACKNOWLEDGEMENTS

This work would not have been possible without the help of several people and establishments. First, my dissertation committee each of whom provided me with invaluable advice during this process that helped refine this work. First, to Dr. Hatfield who suggested that I use the knowledge from one study to inform the next. This advice helped me to maintain a level of consistency throughout the manuscript. Secondly, to Dr. Brown, whose comments trained me to focus on maintaining the experiential similarity between the treatment and control groups in the second study. Third, Dr. Harring whose advice through formal coursework and informal discussion helped select the correct statistical tools to conduct the analyses presented in these studies. Finally, to my advisor, Dr. Iso-Ahola who took a chance on me as an experienced student, helped me design the experiment, and patiently corrected my writing during the writing of the manuscript. He has also been flexible in mentoring me as I had to work full-time throughout most of my time at University of Maryland.

Second, I wish to thank the many individuals associated with the establishments that helped me execute the two studies. In particular, the staff from the fitness company who graciously allowed me to recruit participants from their client base and use their facilities to conduct the experiment. The staff at Amazon TurkPrime also provided services above and beyond their purview to help execute the first study.

I would also like to thank my colleagues at the National Science Foundation and the Science and Technology Policy Institute who provided financial support and time to complete my education. Finally, I wish to thank my family who also provided support and sometimes necessary boosts to my self-esteem.

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Chapter 1: Introduction

General Introduction

Even though the benefits of regular exercise - defined as a type of physical activity that is planned, structured, and repetitive and has a final or an intermediate objective to improve of maintain physical fitness (Caspersen, Powell, & Christenson, 1985) - are well-documented, most people (~80%) do not get the recommended amount of weekly exercise (Centers for Disease Control and Prevention, 2015) - a pattern that has been steadily increasing over the past decade. Engaging in regular exercise helps to prevent physical ailments, such as cardiovascular disease, diabetes, cancer, and obesity (Warburton, Nicol, & Bredin, 2006). Moreover, regular exercise improves certain cognitive functions, particularly executive control processes (Colcombe & Kramer, 2003). Additionally, several studies have linked exercise to lower anxiety and stress levels, as well as to enhanced self-confidence and self-esteem (Knapen, Vancampfort, Moriën, & Marchal, 2015; Warburton, Katzmarzyk, Rhodes, & Shephard, 2007).

This low rate of exercise participation has spurred efforts by both the public and private sectors to encourage individuals to exercise. The public sector not only funds research in exercise promotion (e.g., the National Institute of Health's Office of Disease Prevention has a unit focused on physical activity), but it has agencies dedicated to researching and promoting positive exercise behavior (e.g., the CDC's Division of Nutrition, Physical Activity, and Obesity (DNPAO) which has an annual budget of approximately $50 million ("Fact Sheets | Budget | Funding," 2015)). The private sector promotes exercise behavior by creating products that provide exercise-related

information and equipment. Sales of fitness DVDs, home exercise equipment, and gym memberships have steadily risen over the years. The demand for exercise-related products indicates that the public has an interest in exercise and is willing to invest its money in support of this behavior.

Reflecting this investment, at any given time, 15 to 35% of Americans are attempting to lose weight (Kassirer & Angell, 1998). Furthermore, approximately 60% of these individuals are trying to lose weight by increasing their levels of exercise (Horm, 1993). However, these efforts have not yet resulted in long-term changes in exercise behavior. Exercise is like many other health behaviors (e.g., quitting smoking, dieting) in that people often start and stop exercise programs. Individuals begin exercise programs only to drop out when their motivation wanes. Then, some external event causes their motivation levels to grow yet again, and they consequently launch another program, continuing the start-and-stop cycle of exercise behavior (Sherwood & Jeffery, 2000). Ultimately, of those individuals who begin a new exercise program, only half of them will manage to maintain it. Thus, exercise failure appears to be a motivational issue that is best approached through psychological theory (Iso-Ahola & St. Clair, 2000).

Researchers have tackled this issue by identifying those constructs that are predictive of exercise behavior. Trost et al. (2002) reviewed several empirical studies conducted between 1998 and 2002 that used exercise as a dependent variable. From these studies, Trost et al. identified multiple correlates for exercise ranging from demographic characteristics, such as marital status and education, to psychological factors, such as self-efficacy and affect towards exercise. One such determinant, behavioral intention, has received a great deal of attention from behaviorists (Dishman, Sallis, & Orenstein, 1985).

Several health promotion models and theories have utilized intention as the proximal determinant of behavior. However, while intention is clearly necessary to initiate a behavior, research has demonstrated that intention alone is a rather weak predictor of exercise (Rhodes & Yao, 2015; Sheeran, 2002). The purpose of this study is to shed light on the intention-behavior gap in exercise. The study is concerned with exercise only, not with physical activity more generally (e.g., taking stairs, gardening).

The Intention-Behavior Gap in Exercise

Behavioral intention is a construct that several theories (e.g., theory of Planned Behavior (TPB), Theory of Reasoned Action (TRA)) have utilized as a proximal determinant of behavior (Abraham, Sheeran, & Johnston, 1998), and specifically, exercise behavior (Rhodes & Dickau, 2013). TPB, for instance, states that behavior is a function of four constructs: perceived behavioral control, behavioral intention, attitude towards the behavior, and normative beliefs about the behavior (Ajzen, 1991). Research has indicated that while TPB constructs predict behavioral intentions reasonably well, they are less predictive of actual exercise behavior. Multiple studies (Armitage & Conner, 2001; Hagger, Chatzisarantis, & Biddle, 2002) have found that while TPB constructs were able to explain approximately 50% of the variation in behavioral intention, only about 25% of variance was explained in behavior.

Because of this drop in explained variance from intention to behavior, researchers have been trying to answer the question of how to best turn positive intentions into actual exercise behavior. One rather straightforward method is to identify the constructs that have demonstrably bridged the intention-behavior gap and to then integrate these constructs into existing theoretical perspectives that use intention as a proximal

determinant of behavior (Kuhl & Fuhrmann, 1998; Milne, Orbell, & Sheeran, 2002; Rhodes & Yao, 2015). Rhodes and Yao (2015) reviewed several exercise-behavior models (i.e., models that used exercise behavior as the primary dependent variable) that included constructs hypothesized to span the intention-behavior gap. Their investigation identified several constructs that were predictive of post-intention exercise: maintenance self-efficacy, behavioral regulation strategies, affect, perceived control, and habit. Furthermore, researchers have also developed new models incorporating both motivational and volitional components (Prochaska & DiClemente, 1983; Schwarzer, Lippke, & Luszczynska, 2011). For instance, Schwarzer et al.'s (2011) Health Action Process Approach (HAPA) provides a theoretical underpinning to study both the motivational and volitional processes with respect to health behavior change. The HAPA model proposes that engaging in healthy behaviors is a two-stage process in which an individual first develops the intention to change his/her behavior on the basis of his/her risk awareness, outcome expectancies, and task self-efficacy (MacPhail, Mullan, Sharpe, MacCann, & Todd, 2014). Once intention has been established, the individual enters the volitional stage. In this phase, he or she engages in self-regulatory efforts to set goals, initiate and maintain the behavior, and persist through setbacks (Sniehotta, Scholz, & Schwarzer, 2005).

This multi-stage approach to modeling health behaviors reflects the idea that intention alone is not enough to maintain a regular exercise program. Falling into the intention-behavior gap clearly constitutes failure to maintain a desired exercise regime. Attribution theory, which addresses how an individual's interpretation of his/her success or failure on a task affects one's motivation, could provide a valuable theoretical lens

from which to further study and understand the intention-behavior gap population, as well as why some individuals succumb to this gap.

Attribution Theory

Attribution theory is concerned with how individuals interpret their behaviors and how they assign causes to outcomes. The study and application of attributions within the field of social psychology has a rich history. Fritz Heider's (whom many consider to be the father of attribution theory) earliest work was on attributions. His initial research on attributions that investigated how people perceive and attribute characteristics to inanimate objects gave birth to an object-perception theory. When Heider's focus later shifted towards people, he applied some of the principles from the object perception theory to study people's interpersonal relationships and their own behavior. Heider's work on attributions served as the basis for several other theories that employed attributions. One such theory, Kelly's Theory of Attribution as Causal Judgement (1973), was one of the first systematic attempts to address causal attributions. Kelly focused on two aspects of Heider's work relating to the locus of causality dimension: (1) the choice between internal and external attributions, and (2) the process that a person uses to arrive at the internal/external designation. Heider and Kelly's work formed some of the basis for Weiner's (1985) theory on attributions for motivation and achievement. Weiner was interested in how the attribution process impacted a person's emotions and future motivation towards a behavior. Weiner's work has had a significant impact on several other well-known psychological theories; Dweck's (2017) work on the growth mindset, for instance, leans heavily on attributions and their effect on learning. To say

that attribution theory has made a significant impact on the study of motivation would be an understatement.

Heider (1958) believed that all individuals consider themselves to be naïve scientists trying to understand their behaviors and the consequences that result from them. When individuals are successful at an activity, they seek to understand how they brought about this success so that they can replicate it. Did the accomplishment stem from their efforts and exertions, or was it rather the product of inherent ability? Was luck involved, or did their skills generate the success? Similarly, when individuals experience failure, they try to understand the cause so as to avoid similar outcomes in the future. Irrespective of the results, most individuals attempt to understand and explain the causes of their behaviors for themselves. These perceived reasons, or causal attributions, that people use to explain behaviors can have profound effects on individuals' subsequent emotions, cognitions, and future attempts to enact the behavior.

Weiner (1985) advanced Heider's theory in three important ways. First, he formalized the theoretical framework linking causal attributions with subsequent cognitions, emotions, motivations, and behaviors. Second, while Weiner (1985) recognized that people could provide infinite reasons (e.g., personality, mood, cheating) for success/failure outcomes, he suggested that these explanations could be broken into four primary causes: ability, effort, task difficulty, and luck. He further proposed that the raw causes for outcomes are less critical to motivation than the attributor's classification of these raw attributions on three key dimensions: locus of causality, controllability, and stability. The locus of causality dimension represents a person's beliefs about whether his/her behavior was caused by internal aspects (internal locus) or environmental factors

(external locus). Weiner et al. (1978) posited the second dimension, stability, to account for the fact that some internal and external causes fluctuate (unstable cause), while others remain constant (stable causes). The third dimension, controllability, was introduced by Rosenbaum (1972) and is a more recent addition to the literature. Controllability was incorporated into the theory, because individuals can evaluate causes as more or less inside of their control, regardless of where these explanations fall on the other dimensions. For example, effort and mood are considered to be internal and unstable attributions. However, an individual might deem effort as under his/her control and mood as outside of his/her control.

Taken as a whole, these dimensions form a 2x2x2 model for categorizing primary attributions. The final classification system, including the primary attributions, is summarized in Figure 1-1 (below).

Figure 1-1: Weiner's Model of Causal Attributions

		Ability	Effort	Task Difficulty	Luck
Locus of Causality	Internal	X	X		
	External			X	X
Stability	Stable	X		X	
	Unstable		X		X
Controllability	Controllable		X		
	Uncontrollable	X		X	X

This structure is remarkable in that it allows any situation with a success or failure outcome to be evaluated within the context of this attribution model. For example,

consider social acceptance and a scenario in which an individual's love interest can either accept or reject his romantic overtures. A shy young man musters up the courage to ask out a pretty woman in his class, but she turns him down. Faced with this failure, the young man considers reasons why this outcome may have occurred, and he concludes that the attractive woman spurned him because he is physically unappealing to her. Translating his justification into the dimensions, rejection due to unattractiveness is an internal, stable, and uncontrollable dimension. Moreover, this translation has consequences for his cognitions, affect, and motivation concerning future enactment of the behavior.

Consequences of Attributions

As stated earlier, the main principle of the model (Weiner, 1985, 1986) is that these attributional dimensions have consequences on an individual's future cognitions (specifically on his/her future expectations regarding outcomes), affect, and motivation concerning future behavior (Perry, Hechter, Menec, & Weinberg, 1993). In particular, Weiner found that the stability dimension is relevant to the formation of future expectations for outcomes. A stable attribution suggests that the individual believes that a similar outcome is likely to occur in the future. Contrast this with an unstable attribution which would lead the individual to believe that in the future, the outcome is changeable. Combining the stability dimension with the outcome, if an individual ascribes failure to a stable cause (i.e., ability), he/she will expect similar negative outcomes in the future, because the failure's cause will not change. Similarly, if an individual attributes success to a stable cause (again, ability), he/she will expect similar positive outcomes in the future, because the cause of success is a constant. On the other hand, a failure that is

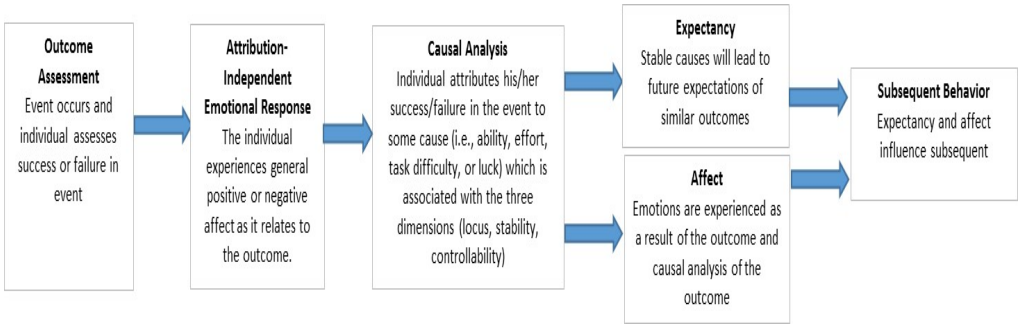
attributed to an unstable cause (e.g., low effort) suggests that the individual believes future outcomes may be different than that just experienced and that increased efforts could lead to more positive results (Andrews & Debus, 1978). In turn, an individual's future expectations play a key role in determining future intentions and behaviors (Weiner, 1985, 1986), a finding that is especially important in achievement contexts. An individual who approaches a task with low expectations of success is unlikely to perform at the level of those with high and realistic expectations (Rudisill, 1989; Singer & McCaughan, 1978). Additionally, low expectations can also affect initiative, as those who expect to perform poorly often choose to not even engage in the task, and they quickly become discouraged when they encounter failure (Weiner, 1971).

According to Weiner (1986), the relationship between the attributional dimensions and affect is more complex than the one-to-one relationship between stability and future expectations. Broadly speaking, people are liable to experience positive emotions (e.g., pride) after a success and negative emotions (e.g., disappointment) after a failure. However, according to attribution theory, the emotions triggered by an outcome are influenced by how the individual understands the reason behind it. Weiner suggested that feelings of pride and competence are related to the locus of causality dimension. Pride follows positive results if the individual accredits his/her success to an internal cause (e.g., high ability). However, if the individual attributes an accomplishment to an external cause (e.g., luck), the same feelings of pride do not occur. Similarly, if an individual believes that an internal cause (i.e., low ability) led to failure, then the model predicts that he/she will experience diminished feelings of pride and competence. Weiner (1985) proposed that the controllability dimension is associated with feelings of anger or

pity. An individual may experience feelings of pity if he/she believes that his/her failure was due to a cause outside of his/her control (i.e., task difficulty). Likewise, if an individual deems task failure to have resulted from a controllable cause, Weiner's model suggests that he/she will experience feelings of anger related to this outcome.

As with future expectations, these emotional experiences influence future intentions and behaviors (Weiner, 1986). For instance, if an individual experiences success after engaging in a task and ascribes this to his/ her own abilities (an internal, stable, and uncontrollable attribution), he/she will experience heightened feelings of pride or competence. This positive self-esteem often causes an approach tendency towards future engagement in the task. On the other hand, if an individual experiences failure in task performance and credits this outcome to a lack of ability (also an internal, stable, and uncontrollable attribution), the resultant affective experience centers on shame or some other negative emotion, thus discouraging the individual from future engagement in the task. However, as Fosterling (1985) suggested, the individual might still approach the task if he/she believes that functional attributions, such as lack of effort, are responsible for the negative outcome. Figure 1-2 provides a visual summary of the attributional process, as described by Weiner (1985).

Figure 1-2: Causal Attribution Process (Weiner, 1985)



An illustrative example of the causal process from the sports domain clarifies how Weiner's theory would predict future enactment of a behavior. Suppose a novice basketball player attempts a free throw during a game and misses, a clear failure (*the outcome assessment*). The player's initial emotional reaction is sadness, because he/she failed (*the attribution-independent emotional response*). After the game, the player attempts to understand why he/she missed the free throw (*causal analysis*). Finally, the player surmises that the missed free throw stemmed from his/her lack of free-throw-making ability. According to the attributional classification system described in Figure 1-1, ability is an internal, stable, and uncontrollable factor. The individual believed that his/her miss had a stable cause, and in consequence of this causal attribution the player now expects a similar outcome (i.e., failure) in the future (*expectancy*). In terms of affect, the theory predicts that the player would experience feelings of pity due to the uncontrollable nature of his/her attribution (*distinct affect*). Ultimately, for this attributional pattern, the theory predicts that the player would be disinclined to continue practicing free throws, as he/she believes the failure's cause was both stable and uncontrollable. Thus, the player anticipates that the outcome will not change (*subsequent behavior*). Contrast this with a player who holds a fixable, mechanical error (e.g., not following through on the shot) responsible for his/her failure. This attribution is internal, unstable, and controllable and is conducive to future motivation to master the free throw-shooting task.

Critiques of Attribution Theory

Despite its impact, attribution theory has received some criticism from other scholars. In a recent critique, Pekrum and Marsh (2018) argued against Weiner's (2018) proposition that causal attributions were both necessary and sufficient to elicit the emotional responses (e.g., pride, competence, anger) as predicted by the theory. They argued that emotional responses can come about for a multitude of reasons that are unrelated to any sort of systematic reflection and analysis of an outcome. For instance, a person does not need to determine that failure in a task was caused by a controllable factor to feel anger; anger could have been elicited from a prior link a person made between a situation and an emotion.

Pekrum and Marsh also argued against the idea that attributions alone are sufficient enough to elicit certain emotional responses. They reasoned that individual undergoing the causal analysis must deem the underlying task important enough to elicit a strong emotional response. Applying this argument to exercise behavior, an individual must consider exercise an important aspect of his/her life for the attributional process to elicit the predicted emotional response. For example, a person who attributed his/her failure to exercise to controllable causes would not have felt any anger (the emotional response Weiner's model predicts for failure due to a controllable cause) if he/she did not consider the exercise class to be important. In considering this critique, it is instructive to evaluate the strength of the link between behavioral intention and the affective response resulting from an attributional evaluation. Toward this end, there are several meta-analyses that have reported large effect sizes of the affective responses predicted by Weiner's model (Roesch & Weiner, 2001; Rudolph, Roesch, Greitemeyer, & Weiner,

2004). However, many of these studies included in these meta-analyses did not include a measure for behavioral intention, which makes it difficult to determine how important the behavior was to the participants. Yet, it is difficult to imagine a person investing the time and effort to undertake the attributional process for an activity that he/she does not have interest in doing. Thus, while the importance of the behavior to a person is a valid criticism of the theory, it raises more empirical than theoretical questions.

Attribution theory has also faced criticism for not considering any historical or cultural factors that could impact a person's attributional process (Mezulis, Abramson, Hyde, & Hankin, 2004). This critique is particularly salient with respect to exercise behavior as a person's cultural background is known to play a role in a person's exercise behavior (Booth, 2000; Williams & Collins, 2001). However, it can be argued that the instruments used to measure attributions (e.g., the Causal Dimension Scale II (McAuley, Duncan, & Russell, 1992)) inherently account for these factors. Historically, researchers would classify a person's causal attributions onto the dimensions themselves. However, by doing the classification themselves, researchers run the risk of making attribution errors (e.g., fundamental attribution error, researcher attribution error) by misclassifying a person's interpretation of the cause on the attributional dimensions. In more recent measurement instruments, however, the respondent indicates how he/she interprets his/her behavior with respect to the three dimensions. By having the person do his/her own classification, any relevant historical or cultural factors are naturally accounted for.

Attributions and Exercise Behavior

A handful of studies have examined attributions for health-related physical activity (McAuley, Poag, Gleason, & Wraith, 1990; Minifee & McAuley, 1998).

McAuley et al. (1990) ran a retrospective study that investigated the causal attributions for individuals who dropped out of a structured exercise program. The researchers found that motivation, dislike of exercise and time management were the most frequently cited causes for halting the program. Both of these factors represent internal, unstable, and controllable attributions. Minifee and McAuley (1998) replicated these findings in a separate study with an African-American population. The subjects reported that motivation, time management, and exercise-related fatigue were the primary reasons for exercise failure, while they named motivation and pursuit of better health or appearance as reasons for success. Individuals who perceived themselves as failures cited internal, unstable, and controllable causes, while successful individuals attributed their achievements to internal, stable, and controllable causes. Similarly, Schoeneman and Curry (1990) surveyed college-aged students to understand their attributions for success and failure in changing several health-related behaviors, including exercise. Their subjects reported internal, unstable, and controllable attributions for both exercise failure and success.

Collectively, these studies provide insight into the relationship between causal attributions and exercise behavior. First, in terms of raw attributions, individuals attribute failure to exercise to motivation, time management, and exercise-related fatigue. Second, from a dimensional perspective, these causes of failure are internal, unstable, and controllable. Third, while individuals who effectively maintained their exercise routines also ascribed their success to internal and controllable causes, these causes were stable rather than unstable. Anderson (1983) deemed this pattern of attributing both successful and failure outcomes to internal and controllable elements as the phenomenon of

personally changeable patterns. Personally changeable attributional patterns occur when individuals attribute all outcomes to internal and controllable causes but hold stable factors responsible for success and unstable factors responsible for failure. Personally changeable attributions reflect a belief held by the individual that even though he/she may have failed at exercise, it is still within his/her control to remedy the situation.

These studies faced certain collective limitations worth addressing. Again, the crux of Weiner's theory is that attributions affect subsequent motivations and behavior through outcome expectancies and affective judgment of the behavior. One limitation, which Ingledew et al. (1996) highlighted, is that none of the studies included constructs to test the entirety of Weiner's theory. Two studies that were reviewed for this research (McAuley et al., 1990; Minifee & McAuley, 1998) included attributions related to affect, but did not include measures for future outcome expectations. Since the difference in attributions for success and failure in the exercise studies concerned the stability dimension, this would seem to be a key aspect worth investigating. The Schoeneman and Curry (1990) study collected future expectations but neglected to include any affect measurements, which the theory claims are also predictive of the future approach to the task.

A second limitation is that the studies asked subjects to recall their most recent attempt to change their exercise behavior and then provide attributions for why they might have succeeded or failed. Because of the retrospective nature of the studies, it was impossible to validate the motivational tenets of Weiner's theory and the mechanisms explaining why some attributions are more likely to result in increased motivation and behavior. Ideally, attributions should be measured closer to the point of failure, followed

by an evaluation of subsequent exercise behavior. For instance, in the previously mentioned studies, individuals attributed their failure to exercise to internal, unstable, and controllable causes. Such an attribution is considered to be conducive for future attempts at the task. However, without assessing exercise behavior following such an attribution, it is not possible to determine whether these attributions actually led to such behavior. Lastly, the McAuley et al. (1990) study may have had a self-selection bias issue. The researchers recruited the study's participants from a pool of individuals who were signing up for a structured exercise class, and these subjects attributed their previous exercise failure to internal, unstable, and controllable causes. Since these individuals believed that their previous failures were within their control, Weiner's theory would predict that they would enroll in another exercise course, because they had identified unstable, controllable attributions for their failures. Therefore, McAuley et al.'s study would have missed individuals who had attributed their previous failures to external or uncontrollable causes, for example.

Attributional Retraining

Fosterling (1985) provided guidance on desirable and undesirable attributions with respect to subsequent motivations and behavior following an outcome. Regarding desirable attributions, an individual who ascribes a successful outcome to ability (an internal, stable, and uncontrollable attribution) will experience positive affect and increased expectancies of future success. Such an individual will thus be more likely to engage in the task in the future. On the other hand, an individual who attributes an unsuccessful result to a lack of effort or strategy (internal, unstable, and controllable attributions) will experience negative affect (i.e., guilt). However, the latter individual

will also be more likely to engage in the task in the future, because he/she believes that his/her failure was due to a changeable factor. Moreover, guilt is considered to be motivationally activating (Weiner, 1985). Undesirable attributions include crediting success to temporary factors, such as luck (an external, temporary, uncontrollable attribution), or ascribing failure to a lack of ability (an internal, stable, uncontrollable attribution), which Weiner suggested leads to feelings of shame (motivationally inhibiting) and decreased expectations for future success. These attributions generate both negative affect and undesirable future expectations, which encourage the individual to avoid the task the next time when it is undertaken.

As certain attributional patterns are conducive to task-approach behavior, one strategy used to encourage motivation by promoting adaptive attributions is known as *attributional retraining (AR)*. Used almost exclusively in achievement settings, AR has been quite successful, not only in retraining attributions but also in changing behaviors. The AR approach works by adjusting maladaptive attributions to more adaptive ones. These adjustments can center on the raw attributions themselves or the attributional dimensions (Hall, Hladkyj, Perry, & Ruthig, 2004). The specific dimension targeted by AR depends upon the outcome and on the dimension making the greatest contribution to the negative behavior (Försterling, 1985). For instance, for failure outcomes, AR could entail changing stable attributions to unstable ones (e.g., from lack of ability to lack of effort or strategy). According to attribution theory, this shift should influence motivation by altering the individual's future expectations for the behavior. The goal of the intervention is to suggest that the failure outcome is changeable, because its cause is also changeable.

Wilson and Linville (1982) conducted one of the most influential studies on AR. They wanted to determine if a simple AR intervention could improve academic achievement in college freshmen who were at risk of failing an introductory psychology course. The authors reasoned that the novelty of attending college renders freshmen college students especially susceptible to misattributing their initial academic setbacks to ability. That is, freshmen might think that their initial college failures stem from a lack of inherent ability to succeed in college (an internal, stable, and uncontrollable cause) rather than from difficulty adjusting to a new environment (an external, unstable, controllable cause). The authors designed an AR intervention to encourage the freshmen to attribute their failures to unstable causes rather than stable ones. The authors achieved this by conveying the message that initial college setbacks were temporary (i.e., unstable) rather than permanent, and that the students' grades would improve once they had adjusted to college life. The authors believed that if they could effectively impart this idea to the students, they could prompt the students to select more adaptive attributions for their academic failures. These new attributions were intended to alleviate academic performance anxiety, encourage task-approach behavior, and hopefully improve academic performance.

Wilson and Linville's protocol entailed showing their subjects videotaped interviews of upper-class students. The students in the films emphasized that despite initial struggles in college, they were eventually able to boost their performance as they progressed through school. This idea was reinforced by showing the participants real data demonstrating how grades often improve over time - even for those students who began

poorly. Students who experienced the intervention had lower dropout rates and higher grade point averages than subjects in the control group.

Several different AR protocols, which are based on the work of Wilson and Linville, have been developed and successfully applied to retrain individuals' attributions for task outcomes. Perry et al. (1993) reviewed 10 years' worth of AR studies conducted in academic settings to identify their strengths and weaknesses. Several themes emerged from this review, and these demonstrate which techniques are effective. One theme involved the frequency of intervention delivery. While AR for grade age children was often delivered using multiple one-on-one interventions, AR for college students tended to be offered in single-session group interventions. Also, Menec et al. (1994) found that multiple exposures did not produce incrementally better results in terms of academic outcome measures than a single intervention. Finally, when considering the vehicle for intervention delivery, Perry et. al. (1993) recommended using videotaped messaging for practicality reasons. Using a videotape allows researchers to deliver the intervention to a large group of people at once. This approach is not only cost effective, but also easier to scale up for a larger sample.

While most AR interventions have focused on academic achievement, other disciplines have also successfully made use of the approach. In a study on retention rates for physical therapists, Curtis (1992) found that physical therapists often had negative experiences with their physician colleagues. Those physical therapists who made maladaptive attributions for these negative interactions had high rates of job dissatisfaction and low retention rates. In addition, they were more likely to quit than those who made adaptive attributions for these exchanges. Specifically, physical

therapists who ascribed their failure to controllable attributions tended to stay in their position and chosen profession longer than those who attributed outcomes to uncontrollable factors. With this in mind, Curtis designed an AR intervention intended to change maladaptive attributions for failure. The objective was to replace uncontrollable factors, such as the physician's disposition, with more strategy-oriented attributions that the physical therapists could control. Results indicated that subjects who received the intervention were more likely than the control group to endorse strategy attributions and to believe that future interactions with physicians would be positive. Behaviorally, subjects in the treatment group not only had higher retention rates than those in the control group, but also experienced higher promotion rates.

In addition, AR techniques have proven effective at improving motivation and performance within competitive sports. Sinnott and Biddle (1998) conducted a study to ascertain whether AR could improve the performance of a small sample of students on a ball-dribble task. Their case-control study divided a group of 12 students into 2 groups: the first group received AR, while the other group did not receive any training. After an initial attempt at the ball dribble task, the AR consisted of a single 20-minute group session that focused on retraining their failure attributions strategy (an unstable, controllable attribution) rather than ability attributions (stable, uncontrollable). The students in the treatment group were also provided with some basic strategies for improving their performance on the dribble task. In the subsequent retest, students in the intervention group demonstrated improvements in intrinsic motivation for the task and in task performance itself.

Attribution Retraining Applications to Exercise Behavior

The use of AR in exercise promotion has been very limited. To the best of this investigator's knowledge, only one pilot study has attempted to use AR to encourage exercise behavior. Sarkisian et al. (2007) performed a pilot study utilizing a pre-post design to examine whether an AR method could increase walking behavior in sedentary senior citizens. One reason that senior citizens fail to exercise is because they believe that inactivity is inevitable as they age. The researchers attempted to retrain the senior citizens' attributions. They emphasized that age does not directly lead to exercise failure (an internal attribution for failure) and that it is preferable to attribute sedentary behavior to factors other than old age. The intervention was delivered over four one-hour weekly sessions with a trained therapist. The results were positive, as those in the intervention group significantly increased their walking behavior.

While the Sarkisian et al. (2007) study showed that AR can increase exercise behavior, certain methodological flaws call its findings into question. First, the study did not have a control group. Thus, there was no way of determining whether it was the intervention that triggered the increase in behavior, or whether some external factor was responsible. Second, the researchers did not focus their intervention efforts on individuals who considered themselves "failures" in walking behavior. The intervention was delivered to individuals who may have considered themselves successful at non-sedentary behavior. The reported average increase in walking might have been due to elderly individuals who already considered themselves as successful. In other words, the intervention might not have necessarily increased the behavior in those individuals who truly needed it (the failures). Third, the study lacked an effective manipulation check. The

researchers used an age-expectation scale to measure the subjects' beliefs about cognitive and physical declines as they aged. They took these measurements at baseline, four weeks into the protocol (when the intervention sessions ended), and seven weeks after baseline. However, due to the time elapsed between the initial baseline measurements and the end of the intervention, it is difficult to say whether AR changed age expectations (leading to increased walking behavior), or whether the increased behavior changed age expectations. Without a manipulation check soon after the intervention, it is impossible to determine if the intervention changed expectations. Lastly, AR was delivered in multiple sessions as opposed to one session. Although this does not necessarily constitute a limitation, it implies that scaling up the intervention would have been more difficult than if it had been delivered only once.

Summary and Purpose of Research

Falling into the intention-behavior gap clearly constitutes a failed attempt to exercise. Thus, attribution theory, which deals with the causes of success and failure, would appear to be an attractive foundation on which to base an exercise intervention. However, a review of the literature revealed attribution theory has had limited application in the health behavior domain and that it has been utilized even less often to explain and promote regular exercise. The few studies that have applied attribution theory to exercise behavior have demonstrated that individuals who fail to consistently exercise attribute this outcome to internal, controllable, and unstable causes. As mentioned earlier, taken together, this attributional pattern is known as *personally changeable*. Due to the presence of this attributional pattern, AR does not appear to be a valid intervention for reversing exercise failure, because ascribing failure to an internal, unstable, and

controllable (i.e., effort or strategy) cause is a desirable attribution (Försterling, 1985) that should encourage individuals to strive to overcome exercise failure.

However, despite this finding, there are several reasons to believe that an AR intervention could be utilized to prompt exercise behavior. First, the Sarkisian et al. pilot study demonstrated improvements in both walking behavior and the age expectancy construct, thus seemingly indicating that AR interventions can modify exercise behavior. Second, these studies (McAuley et al., 1990; Minifee & McAuley, 1998; Schoeneman & Curry, 1990) that examined exercise failure attributions had methodological issues that could have clouded their results. The first potential issue is that the three studies employed a retrospective design that asked respondents to recall the last time they had attempted to start a new exercise program and why they had failed. This approach introduced the possibility that measurement error, and specifically recall bias, clouded the studies' results. Second, McCauley et al.'s study had a potential problem with self-selection bias, which might have further introduced error into the results. Third, none of the studies investigated all of the constructs of Weiner's theory, meaning that a complete picture of the theory, as it pertains to exercise behavior, does not appear to exist. Lastly, besides the Sarkisian et al's. pilot study, none of the studies examined subsequent exercise behavior as it relates to causal attributions. As a result, it is unclear whether Weiner's motivational theory is appropriate for exercise behavior.

This research investigated causal attributions for individuals who have fallen into the intention-behavior gap. As stated before, since individuals who have fallen into this gap have not been successful in their efforts to maintain an exercise program, attribution theory appears to provide a solid theoretical underpinning for explaining and encouraging

exercise behavior. In fact, this population might be especially well suitable targets for AR, because they might be more susceptible to making maladaptive attributions for failure than other types of non-exercisers (e.g., those who have never attempted to begin a program or who have intended to exercise). Of particular interest are those individuals who have experienced multiple failed attempts to maintain an exercise program. These individuals might be more likely to attribute failure to maladaptive (i.e., internal, uncontrollable, and stable) factors because of their history of unsuccessful attempts.

This investigation was comprised of two studies. The first study examined the nature of causal attributions for individuals who have fallen into the intention-behavior gap. The second study attempted to determine if AR can successfully alter these individuals' attributions and increase subsequent exercise behavior. These studies were designed to address some of the gaps in the literature, particularly the lack of prospective designs in attributional exercise studies. In addition, these two studies tested Weiner's model in its entirety and incorporated measures of exercise.

Chapter 2 – Study 1

Introduction

Worldwide, people's lack of exercise is a large, expensive problem. Individuals who fail to engage in regular exercise have a significantly higher risk of cardiovascular disease (Reddigan, Ardern, Riddell, & Kuk, 2011), Type II diabetes (Admiraal et al., 2011), obesity, and a slew of other health-related risks than regular exercisers. The costs associated with exercise failure are estimated to be quite large. A report has suggested that Canadian's failure to exercise accounts for ~4% of all Canadian health care costs (Janssen, 2012); in China, more than 15% of medical costs per year can be attributed to a lack of exercise (Zhang & Chaaban, 2013); and in the United States, approximately 9% (Carlson, Fulton, Pratt, Yang, & Adams, 2015) of medical costs are related to not exercising. Because of these health risks and associated costs, it is clearly in the best interests of society for people to exercise regularly.

However, because most Americans are inactive (CDC, 2015), much research has been conducted to identify the factors that are predictive of exercise behavior. One such factor, *intention,* is a necessary yet insufficient psychological state that is positively associated with exercise behavior (Rhodes, Plotnikoff, & Courneya, 2008; Rhodes & Yao, 2015; Sheeran, 2002). That is, just because a person intends to exercise does not mean that he/she will follow through with that intention. The discrepancy between intention and behavior is known as the intention-behavior (I-B) gap, and Rhodes and de Bruijn (2013) estimate that about 46% of exercise intenders fall into the I-B gap.

While researchers have identified several moderators of the I-B relationship (e.g., demographic variables such as age and annual income (Amireault, Godin, Vohl, & Pérusse, 2008) and psycho-social variables such as anticipated regret (Abraham & Sheeran, 2003) and action control (Sniehotta et al., 2005)), the 46% statistic indicates that the problem has not been fully solved. Therefore, researchers must continue to identify and test the utility of other constructs as moderators of the I-B relationship.

The purpose of this study is to investigate the effects of one such construct – causal attributions – on the I-B relationship. A causal attribution is an explanation that a person gives for what caused his/her behavior. Weiner (1985) proposed that how a person *interprets* this cause can have a profound impact on his/her motivation towards future enactment of the behavior. Furthering this idea, Weiner proposed a classification system for the raw attributions that people give for their *success or failure* in a given task/behavior. Weiner's system classifies raw attributions into three dimensions: (1) locus of causality (i.e., is the cause internal or external to the actor?); (2) stability (i.e., is the cause stable or unstable?); (3) controllability (i.e., is this cause within the actor's control or is the cause uncontrollable?). Furthermore, Weiner proposed that, contingent on the outcome, specific combinations of these dimensions (referred to as attributional styles) could either foster motivation toward future enactment of the behavior (i.e., an adaptive attributional style) or discourage it (i.e., maladaptive attributional style).

As an illustrative example of the interplay between attributions and future exercise behavior, consider a person who attributes her exercise failure to her (lack of) ability. Furthermore, she considers exercise ability to be, from an attributional perspective, an internal/stable/uncontrollable cause. According to the theory, this

maladaptive attributional style would discourage her from future attempts at exercising because she views ability as an uncontrollable and unchanging characteristic of himself. Now consider a different person who also attributes his exercise failure to ability, yet he views ability as an internal/controllable/unstable cause. The theory would predict that he would be motivated to exercise in the future because of his belief that ability is a changeable characteristic that he can control. In summary, the example illustrates that even though both people attribute their exercise failure to the same cause (i.e., lack of ability), their varying interpretations of ability has a profound effect on their motivation to attempt exercise in the future.

The present study was designed to measure the causal attributions of exercise intenders and determine the effect a person's attributional style has on the I-B relationship. To achieve these research goals, information about the exercise behaviors of a sample of sedentary individuals was collected over a six-week period. The participants' intentions to exercise were measured at baseline and their perceptions of success or failure in their exercise behavior were then measured at the end of the study period. Four analyses were conducted to guide this investigation.

Analysis 1 – Comparing the causal attributions of those individuals who were able to bridge the I-B gap and individuals who were unable to bridge the gap

The first analysis focused solely on exercise intenders. The primary independent variable for this analysis was defined by creating three exercise groups based on the participants' exercise behavior over the six-week study period: (1) those who signaled an intention to exercise yet never started, (2) those who signaled an intention to exercise and dropped out / exercised inconsistently after starting, and (3) those who signaled an

intention to exercise and experienced success. Groups one and two represented those participants who had fallen into the I-B gap. The causal attributions for the three different exercise groups were then compared. As an additional analysis, the study also examined whether the I-B gap participants exhibited the attributional pattern of *personal changeability* (i.e., successful individuals attribute success to internal, controllable, and ***stable*** attributions whereas unsuccessful individuals attribute their failure to internal, controllable, and ***unstable*** attributions), as suggested by Anderson (1983). The study also analyzed causal attributions as a function of demographic variables (age, gender, education, and income) and of the number of previous attempts made by an individual in the past year (rather than only the six-week study period) to start and maintain an exercise program.

Research Question 1: Do causal attributions for individuals who fall into the intention-behavior gap differ from the causal attributions of those who have bridged the I-B gap? The study's primary independent variable was the type of exerciser (groups 1, 2, or 3, as defined above), and the dependent variable was the groups' causal attribution dimensions. Additionally, the analysis addressed whether causal attributions differ as a function of demographic variables (age, gender, education, and income) and the number of lapsed attempts to exercise in the previous year (not just the six-week study period).

Hypothesis 1: It was predicted that individuals who fell into the I-B gap would make more maladaptive attributions (i.e., internal, uncontrollable, and stable) for their failures than the individuals who are able to bridge the I-B gap. With respect to variables covering demographic information and previous attempts at exercise, the expectation was that those individuals who had made multiple attempts within the past year to maintain an

exercise program, but failed to do so, would exhibit more profound maladaptive attributions. There were no specific hypotheses made for the demographic variables.

A corollary of the first hypothesis was that the causal attributions of the participants would *not* follow the attributional pattern of personal changeability, as identified by Anderson (1983). Rather, it was predicted that the participants falling into the I-B gap would exhibit internal, uncontrollable, and stable attributional patterns for failure (rather than internal, controllable, and unstable patterns) and that these differences in attributions would become more pronounced for those individuals who had made multiple, failed attempts to exercise in the past year.

Analysis 2 – A validation of Weiner's emotional and cognitive predictions on a sample of exercise intenders

Research Question 2: The second research question investigated whether Weiner's model predicted exercise-related affect and cognitions (i.e., future expectations for exercise behavior) for exercise intenders. In this analysis, the dependent variables consisted of the participants' affective and cognitive judgments concerning exercise behavior. The independent variables were the participants' perceptions of success/failure in their exercise behavior at the end of the study period and their associated causal attributions for their outcome.

Hypothesis 2a: It was hypothesized that participants' perceived successes/failures would interact with their attributions to predict affect towards exercise in a pattern consistent with the specific relationships outlined in Weiner' (1985) proposed theory. Specifically, it was predicted that:

1) Individuals who were able to successfully bridge the I-B gap would generate more positive emotions (i.e., competence, pride) regarding their behavior in comparison to individuals who were unsuccessful in bridging the I-B gap. Conversely, individuals who failed to bridge the I-B gap would experience more shame regarding their behavior in comparison to individuals who successfully bridged the I-B gap.
2) Individuals who attributed their success in bridging the I-B gap to internal causes (e.g., ability and effort) would experience greater feelings of competence and pride in comparison to individuals who attributed their success to external causes (e.g., task difficulty, luck). Conversely, individuals who attributed their failure to bridge the I-B gap to internal causes would experience greater feelings of shame in comparison to individuals who attributed their failure to external causes.
3) Individuals who attributed their failure to bridge the I-B gap to controllable causes would experience greater feelings of anger in comparison to those individuals who attributed their failure to uncontrollable causes.

Hypothesis 2b: It was hypothesized that individuals who attributed their failure to bridge the I-B gap to stable causes would have higher expectations of similar failures concerning their future exercise behavior in comparison to those who attributed their failure to unstable causes. Similarly, it was predicted that individuals who attributed their success to stable causes would have increased expectations of similar success concerning their future exercise behavior in comparison to those who attributed their success to unstable causes.

Analysis 3: Assessing the moderating effects of causal attributions on the I-B relationship

The third analysis tested the moderating effects of causal attributions on the I-B relationship. While several studies have looked at the role of psycho-social constructs as moderators of the I-B relationship (Amireault, Godin, Vohl, & Pérusse, 2008; Sheeran, 2002) in exercise, there do not appear to be any studies that have considered causal attributions as moderators.

Given the small body of literature relating causal attributions to exercise, attributional studies from other domains were reviewed to develop the hypotheses for this research question. Specifically, a review was conducted of those studies that have demonstrated that different attributional styles moderate success and failure (Hong, Chiu, Dweck, Derrick, & Wan, 1999). The results of previous studies, along with the previous research that has investigated attributions in the context of physical activity (McAuley et al., 1990; Minifee & McAuley, 1998; Schoeneman & Curry, 1990), suggested several testable hypotheses associated with this analysis.

Research question 3: To what extent do the attributional dimensions moderate the I-B relationship? In this analysis, the dependent variable was exercise behavior at follow-up, the independent variable was exercise intention at baseline, and the moderating variables were the attributional dimensions (i.e., locus of control, stability, and controllability) for participants' previous exercise behavior. Moderating effects were tested separately for the three attributional dimensions.

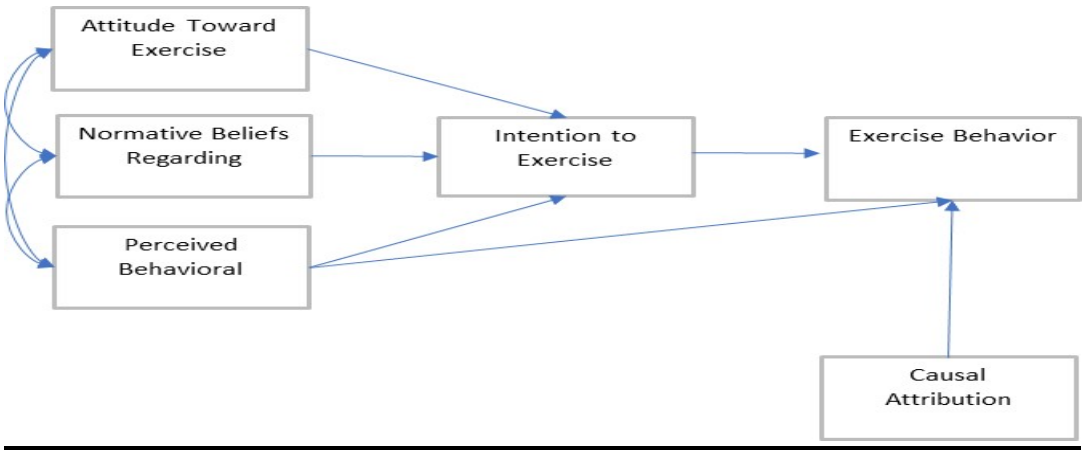
Hypothesis 3: There are three hypotheses related to this research question – one for each of the three attributional dimensions – namely, that the I-B relationship would be moderated by:

a. The locus of causality dimension such that participants are more likely to exercise if they both intended to exercise and attribute prior exercise failure to external causes.
b. The stability dimension such that participants are more likely to exercise if they both intended to exercise and attribute prior exercise failure to unstable causes.
c. The controllability dimension such that participants are more likely to exercise if they both intended to exercise and attribute prior exercise failure to controllable causes.

Analysis 4: An integrated model for predicting exercise behavior

The fourth analysis investigated whether the inclusion of causal attributions improved the explanatory power of the well-established, intention-based model, the Theory of Planned Behavior (TPB), to predict exercise behavior. While testing the TPB is not the primary focus of this study, this examination was included as a supplementary analysis, because the I-B relationship is a central part of the TPB. Since the TPB proposes that intention is the primary antecedent of behavior, it seems reasonable to examine the effect of causal attributions on the I-B relationship (see Figure 2-1 on the next page) to determine whether the integrated model can better explain the total variance (R^2) in exercise behavior.

Figure 2-1: Integrated Model for Exercise Behavior



Research question 4: Does the addition of a direct effect of causal attributions on exercise behavior significantly increase the amount of explained variance (as measured by R^2) in exercise behavior?

Hypothesis 4: It was hypothesized that the addition of causal attributions to the TPB model would significantly improve the explained variance in exercise behavior over the model without the causal attribution construct included.

Method

Participants and Design

The study's participants were selected from Amazon's TurkPrime panel – a population of individuals who had agreed to take part in surveys for a fee. After receiving approval from the University of Maryland, College Park's Institutional Review Board (IRB) office (Approval Number: 1046388-1; see Appendix 5), a sample of sedentary individuals (those panel participants who responded affirmatively to the TurkPrime supplied screener question "I generally don't exercise") was selected to participate in the study. Upon completing the entire survey, the participants were provided with unique codes that were used to track their responses across the two data collection points. Six weeks later, these same participants were contacted again and asked to take another, almost identical survey with questions about their exercise habits over the past six weeks. Responses from time 1 (T1) and time 2 (T2) were merged in SAS using unique codes assigned to track the respondents across the two-time points.

To ensure that the targeted sample size was reached (see the *Sample Size Considerations* section for details on sample size calculations), 1,198 participants were selected to complete the surveys. Of these participants, 952 completed the follow-up questionnaire six weeks later at T2, yielding a 17% attrition rate. Respondents were paid $1.75 for their time, and Amazon services charged $2.09 per respondent; this amounted to a total cost of $3.84 per respondent.

Respondents were provided with a statement of consent and informed that by completing the survey, they were providing implied consent. Each participant was

provided with a personal code generated by TurkPrime to match the data across the two waves of the study and preserve anonymity.

Responses were collected for approximately one week until the target sample size of 1,198 was reached. The completion rate (analogous to a response rate) was 88%, and the bounce rate (a measure of how many potential respondents opened the survey but did not complete any questions) was 15%. The average time taken to complete a survey was 14.9 minutes.

Table 2-1: Descriptive Statistics for Study One Participants (n=952)

Characteristic	N	%
Age		
18–25	238	25%
26–34	286	30%
35–50	190	20%
51–65	143	15%
65+	95	10%
Gender		
Female	552	58%
Male	391	41%
Missing	9	1%
Race/Ethnicity		
Asian/Pacific Islander	76	8%
Black or African American	173	18%
Hispanic	95	10%
White/Caucasian	590	62%
Multiple Race	18	2%
Education		
Graduated from High School	95	10%
Some College	344	36%
Graduated from College	364	38%
Some Graduate School	28	3%
Completed Graduate School	114	12%
Missing	1	1%

Table 2-1: Descriptive Statistics for Study One Participants (n=952) (cont.)

Characteristic	N	%
Income		
$ 0–24K	133	14%
$ 25–49K	344	36%
$ 50–74K	192	20%
$ 75–99K	114	12%
$ 100K+	162	17%
Missing	5	1%
Exercise Intention Status		
Yes	602	63%
No	350	37%
Prior Attempts at Exercise		
0	143	15%
1–3	571	60%
4–6	143	15%
7+	67	7%
Total	952	100%

The average weekly exercise score (M=20.2, SD=7.4, median=27, range=0 - 119) as measured by Godin and Shephard (see *Measurements* section) for the 952 participants indicates that, as expected, the participants were relatively sedentary.

The demographic variables and psycho-social constructs were compared at T1 to determine whether any significant differences existed between the participants who completed both surveys (n = 952) and those who completed the survey only at T1 (n = 246). Statistically significant differences were found for exercise intention ($t(1,196) = 3.32$, $p < 0.01$, 95% CI [0.28, 0.52], $d=0.43$, 95% CI[0.33, 0.56]), affect toward exercise ($t(1,196) = 1.81$, $p = 0.07$, 95% CI [0.23, 1.19], $d=0.26$, 95% CI [0.19, 0.32]), and perceived benefits of exercise ($t(1,196) = 3.46$, $p < 0.01$, 95% CI [0.35, 1.04], $d=0.28$, 95% CI [0.20, 0.42]). Specifically, participants who failed to complete the follow-up survey had lower intentions to exercise ($M = 4.07$, $SD = 1.07$) than those who completed

both surveys (*M* = 4.47, *SD* = 0.77). They also tended to have a less positive outlook on exercise (full sample *M* = 2.89, *SD* = 3.45; dropouts *M* = 2.18, *SD* = 3.45) and perceived fewer exercise-related benefits (full sample *M* = 3.85, *SD* = 2.40; dropouts *M* = 3.15, *SD* = 2.65).

Measures

All psychological and behavioral measures used in this study were previously developed scales that have well-established reliability and validity. Appendix Table 3-1 reports the full scales with their ranges, inter-item correlations, and Cronbach's alphas for the psycho-social measures.

Demographic Information

Demographic characteristics (see Table 2-1) measured included the following: age, gender, race/ethnicity, highest level of education, and income.

Perceived Outcome

The perceived outcome (i.e., successful/unsuccessful) of the participants' exercise behavior was assessed by registering their responses to the following statement: "In the past six weeks, I have been successful in maintaining a regular exercise routine (Y/N)." Participants responded by indicating if they perceived this statement to be true or not. This statement is a modified version of a question developed by Ajzen (1991). In the attribution process, the subjective measure of outcome is preferred over an objective measure (Shields, Brawley, & Lindover, 2005; Spink & Roberts, 1980).

To examine the concurrent validity of the perceived outcome measure, the point-biserial correlation coefficient was calculated for the relationship between perceived

outcome and Godin and Shephard exercise behavior at T2 and was found to be acceptable ($r(962)=0.76$, $p<.001$).

Exercise History Information

Two variables were used to measure participants' previous exercise behavior. The first measure – number of failed attempts to maintain an exercise program in the past year – was used as a covariate in several analyses. The respondents were asked the following question: "In the past year, approximately how many times have you intended to begin an exercise program, yet failed to start or maintain an exercise routine?" Participants selected one of four options ("0," "1-3," "4-6," or "7+") indicating the number of times they had attempted to exercise (see Table 2-1).

Exercise history was measured using Godin and Shephard's (1985) simple method to assess exercise behavior. The participants answered the following question: "Considering a 7-day period (a week), how many times on average do you do the following kind of exercise for more than 15 minutes during your free time?" They did so by indicating the number of times per week they engaged in strenuous exercise (heart beating rapidly, as with running, jogging, swimming, basketball, or biking), moderate exercise (not exhausting, as with tennis, walking, or badminton), and mild exercise (minimal effort). The participants' responses to these questions were weighted to give more value to more strenuous bouts of exercise (i.e., strenuous bouts of exercise were weighted by 9, moderate by 6, and light by 3) and then summed to generate a weekly exercise score.

Intention to Exercise

Intention to exercise was measured by calculating the mean of three items adopted from Gonzalez (2012) (e.g., “I intend to begin regularly exercising in the next six weeks”). Participants then rated their intentions on a scale from 1 (“very unlikely”) to 5 (“very likely”) with higher scores indicating a high intention to exercise. The Cronbach’s alpha values at time 1 and time 2 for this scale were 0.82 and 0.87 respectively. Appendix Table 3-1 details the items associated with this measure.

Causal Attributions

The revised Causal Dimensions Scale (CDS-II) (McAuley et al., 1992) was used to measure the participants’ attributions for the success or failure to engage in exercise over the study period. The CDS-II asks participants to provide their own reason for an outcome and then code that reason along the four attributional dimensions: locus of causality, personal controllability, external controllability, and stability. The dimension of external controllability was not examined in this study because the intent was to test hypotheses from Weiner’s (1985) theory and therefore was not concerned with this dimension. The CDS-II has been shown to have acceptable construct validity using similar populations (McAuley et al., 1992).

The CDS-II instructed this study’s participants to provide the most important reason for their success or failure in their exercise behavior. Using a nine-point Likert-type scale, participants then rated the reason using nine items, with three items representing each of the dimensions of interest: locus of causality, personal controllability, and stability. Values for each of the dimensions were then summed with higher scores indicating that attributions were more internal, controllable, and stable. The three dimensions demonstrated acceptable internal reliability with Cronbach’s alphas at

time 1 of 0.77, 0.65, and 0.92 for locus, stability, and control dimensions respectively. The Cronbach's alphas at time 2 were 0.92, 0.82, and 0.95 for locus, control and stability. Correlations between the items and the overall scale ranged from 0.69 to 0.94. See Appendix Table 3-1 for details on this measure.

Future Expectations

Future expectations about exercise behavior were assessed through the following question: "How certain are you that you will be able to engage in regular exercise over the next six weeks?" Responses ranged from 1 ("very unlikely") to 5 ("very likely").

Exercise Affect

Exercise affect was measured by having respondents rate their emotional experience with exercise (e.g., happy, sad, proud, guilty) over the past six weeks. A nine-point scale was used again, with lower scores indicating that respondents did not feel an emotion toward exercise at all over the past six weeks and higher scores indicating that participants strongly felt the emotion. Cronbach's alpha at time 1 was 0.91 for the positive affect scale and 0.93 for the negative affect scale. The Cronbach's alpha at time 2 were 0.96 and 0.95 for positive affect and negative affect respectively. Individual items' correlations with the overall score ranged from 0.78 to 0.91. See Appendix Table 3-1 for details on the affective scale used for this study.

The convergent and discriminant validity of the exercise affect scale was assessed using a factor analysis with a varimax orthogonal rotation. Factor analysis revealed two factors, one for positive affect and one for negative affect, which explained 40.6% of the variance in the 11-item scale. The Cronbach's alphas for the two factors were 0.92 for the negative affect and 0.91 for the positive affect factor (see Appendix Table 3-3) with the

items measuring positive emotions all loading on the same factor and the items related to the negative emotions loading on the other scale. The correlation coefficient between the two factors ($r=-0.25$, $p<.01$) confirmed the divergent validity of the measure. Lastly, the correlations were calculated for the two sub-scales and the weekly exercise score. The correlations were moderate in magnitude ($r=-0.21$, $p<.01$ for negative affect and weekly exercise; $r=0.34$, $p<.01$ for positive affect and weekly exercise), and the directions of these correlations were as expected. See Appendix Table 3-4 for details.

Perceived Norm

Borrowing from Armitage (2005), three items were used to assess individuals' normative beliefs about exercise (e.g., "Most people who are important to me would approve of me exercising"). The mean of the three items represented the final subjective norm value. Responses were recorded on a five-point scale, with a lower score indicating that a respondent disagreed with a normative statement. Cronbach's alpha at time 1 for the perceived norm measure was 0.89; at time 2 the Cronbach's alpha was 0.84. Individual items' correlations with the overall score ranged from 0.88 to 0.92. See Appendix Table 3-1 for details.

Perceived Behavioral Control

One measure borrowed from Ajzen (1991) was used to measure perceived behavioral control. The item measured an individual's capacity for exercise: "I am confident that I can exercise regularly for the next six weeks." Respondents indicated their level of agreement with the statement on a five-point scale with higher scores indicating a high level of perceived behavioral control associated with their exercise behavior.

Attitude toward Exercise

This measure was taken directly from Crites (1994) and consisted of three statements asking participants to assess their attitudes to exercise on a semantic differential (e.g., undesirable–desirable) using a seven-point scale. Lower numbers indicated a negative attitude toward exercise and higher numbers indicated a positive attitude toward exercise. The Cronbach's alphas at time 1 and time 2 were 0.92 and 0.98 respectively. The correlations between the individual items and the overall score ranged from 0.92 to 0.95. See Appendix Table 3-1 for details.

Analytical Approach

The first research question investigated whether causal attributions differed between those study participants who fell into the I-B gap (i.e., unsuccessful participants) and those participants who were able to bridge the gap (i.e., successful participants). Since the first research question focused solely on exercise intenders, only the participants who signaled an intention to exercise at T1 (n=602) were used. The data were analyzed by running a series of one- and two-way analyses of covariance (ANCOVAs) with causal attributions serving as the dependent variable and the exercise group assignment (i.e., failure to bridge the gap due to never starting, failure to bridge the gap due to inconsistent exercise habits, or success in bridging the I-B gap) serving as the independent variable. The demographic variables and number of previous exercise attempts served as covariates in each model. Post-hoc tests (Tukey's procedure with a Bonferroni adjusted p-value of 0.02 for each test) were run for models for which the F-test was significant at the $p< 0.05$ level. Since this analysis investigated the group differences for the three attributional dimensions, a multiple analysis of variance

(MANOVA), with the three dimensions serving as the response variables, was considered as an analytical technique. However, since the hypotheses associated with the group differences were tested separately for the individual causal attributions rather than collectively, running three individual ANCOVAs seemed more appropriate. The standard assumptions for ANCOVA (e.g., normality, independence of cases, homogeneity of variance, covariates are independent of treatment effects) were all validated.

The second research question tested whether Weiner's hypothesized relationships regarding perceived outcome, the attributional dimensions, cognitive (future expectations), and affective variables (pride, competence, shame, and anger) held true for this study's exercise intenders (n=602). To test the four hypotheses associated with the second research question, five hierarchical regression models were built using one of the hypothesized affective or cognitive states as the dependent variable. The demographics, perceived outcome, and depending on the hypothesis, the attributional dimensions were included as predictors. To represent the sequential ordering of events of a person's attributional process, demographics were entered first, followed by perceived outcome, and finally the attributional dimension and the interaction term between perceived outcome and the attributional dimension. The overall model fit statistics (as measured by R^2 and global F-statistics) and the standardized beta coefficients are reported.

The third analysis sought to determine the extent to which a participant's attributional style moderated the I-B relationship. This analysis used the entire sample of exercise intenders and non-intenders (n=952). As recommended by Aiken and West (1991), a three-step hierarchical regression was used to test for moderation. At step one, exercise behavior at T2 was regressed on intention at T1. At step two, the moderator (i.e.,

causal attribution dimension at T1) was added and, finally, at step three, the interaction term was added. A moderating effect was identified if the interaction term was statistically significant.

The fourth and final research question assessed the contribution (in terms of explained variance in exercise behavior) of adding a causal attribution construct to the TPB's constructs as a direct effect on exercise behavior (see Figure 2-1). This analysis used both the exercise intenders and the non-intenders who took part in the study (n=952). Path analysis was used to fit the proposed models. Each model was then compared to a model fitted with the TPB constructs alone. Since these competing models are nested (i.e., the model with TPB constructs is nested within the model that include the attributional dimension), chi-square tests were used to determine if the model including attributions provided superior fit to the TPB model.

Sample Size Considerations

Samples sizes were calculated using G-Power 3.1.9.2 (Faul, Erdfelder, Lang, & Buchner, 2007). G-power requires a researcher to input alpha level, power, number of groups, and effect sizes for statistical tests. In the current research, a Bonferroni corrected alpha level (0.05/3) of 0.02 and power of 0.80 were utilized. Due to the limited number of attributional studies of exercise, it was difficult to determine what theoretically meaningful effect sizes should be. . Reflecting this challenge, the study adopted effect sizes reported in general attribution studies (Higgins & LaPointe, 2012; Martin & Carron, 2012; Orbach, Singer, & Murphey, 1997). Table 2-2 displays an inventory of different sample sizes based on various combinations of the dependent and independent variables used in an ANCOVA test, the analytic method used for the first two analyses that focused

on exercise intenders. Ultimately, a sample size of 649 was chosen as this was the largest sample required to achieve the desired power for the ANCOVA test.

Table 2-2: Estimated Total Sample Sizes for Study One

Model Number	Dependent Variable	Independent Variable #1	Independent Variable #2	Interaction Term	Effect Size	Total Sample Size
1	Locus	Exercise Group	N/A	N/A	0.32	207
2	Locus	Exercise Group	Age	Exercise Group* Age	0.32	296
3	Locus	Exercise Group	Gender	Exercise Group* Gender	0.32	206
4	Locus	Exercise Group	Income	Exercise Group* Income	0.32	369
5	Locus	Exercise Group	Education	Exercise Group * Education	0.32	335
6	Locus	Exercise Group	Exercise History	Exercise Group*Exercise History	0.32	272
7	Control	Exercise Group	N/A	N/A	0.25	
8	Control	Exercise Group	Age	Exercise Group* Age	0.25	478
9	Control	Exercise Group	Gender	Exercise Group* Gender	0.25	362
10	Control	Exercise Group	Income	Exercise Group* Income	0.25	631
11	Control	Exercise Group	Education	Exercise Group * Education	0.25	649
12	Control	Exercise Group	Exercise History	Exercise Group*Exercise History	0.25	408
13	Stability	Exercise Group	N/A	N/A	0.90	108
14	Stability	Exercise Group	Age	Exercise Group* Age	0.90	155
15	Stability	Exercise Group	Gender	Exercise Group* Gender	0.90	106
16	Stability	Exercise Group	Income	Exercise Group* Income	0.90	195
17	Stability	Exercise Group	Education	Exercise Group * Education	0.90	176
18	Stability	Exercise Group	Exercise History	Exercise Group*Exercise History	0.90	142

A sample of non-intenders was included to conduct the third and fourth analyses for this study. For hierarchical regressions, G-power requires the researcher to input alpha level, power and the number of predictors corresponding to each step in the regression. Here, an alpha level of 0.05 and a power of 0.80 were again used to generate a target sample size of 88. The sample size targets for both intenders and non-intenders were exceeded to account for attrition.

Results

Descriptive Statistics

Table 2-3 presents the sample means, standard deviations, and correlations for exercise behavior, future expectations for exercise and the causal attributions at T1 and T2 for the exercise intenders (n=602). A higher score on the attributions indicates that the

participant made internal/controllable/stable attributions for his/her exercise behavior; higher scores on future expectations and weekly exercise score indicate a higher association with those two variables. As indicated by the means at T1, the participants appeared to be making adaptive attributions for their previous exercise failure (i.e., internal/controllable/unstable attributions), which would be expected given that the participants had already signaled an intention to exercise. There was a strong, positive association between the locus and control dimensions at both T1 and T2.

Table 2-3: Descriptive Statistics and Correlations for Exercise Intenders (n = 602)

Measure	1	2	3	4	5	6	7	8	9	10	Mean (SD)
1.Weekly Ex., T1	1.00										38.4 (31.5)
2. Future Exp., T1	0.20*	1.00									4.1 (0.9)
3. Locus, T1	-0.16	-0.08	1.00								18.9 (5.9)
4. Stability, T1	0.11	0.11	0.16	1.00							12.4 5.8)
5. Control, T1	-0.14	0.11	0.52**	-0.10	1.00						20.1 (6.4)
6. Weekly Ex., T2	0.13	0.15	0.14	0.04	0.24*	1.00					38.4 (27.0)
7. Future Exp., T2	0.11	0.24*	-0.01	0.08	0.19*	0.49*	1.00				3.9 (1.0)
8. Locus, T2	0.11	0.09	0.11	0.05	0.24*	0.14	0.24*	1.00			19.0 (6.1)
9. Stability, T2	0.13	0.15	-0.13	0.16	-0.03	0.18*	0.21	0.09	1.00		13.8 (5.8)
10. Control, T2	0.06	0.16	0.01	-0.18*	0.37**	0.17*	0.18*	0.25*	0.11	1.00	19.5 (6.0)

Higher scores on the attributional dimensions indicate a tendency to make more internal/controllable/stable attributions
Higher scores on other constructs indicate a higher association with those variables.
***Significant at p<.001 level, **Significant at p<.01 level, *Significant at p<.05 level

Table 2-4 presents the means, standard deviations, and statistical tests for the participants' exercise behavior, future expectations, and attributional dimensions aggregated by the participants' perceived outcomes at T2. As expected, the successful participants engaged in more exercise than the unsuccessful participants; successful participants also reported higher expectations for future engagement in exercise than unsuccessful participants. The successful participants attributed their exercise behavior to more internal, controllable, and stable causes than did the unsuccessful participants. Interestingly, all the participants made adaptive attributions for their exercise behavior. That is, successful participants attributed their exercise behavior to controllable and

stable causes while the unsuccessful participants attributed their behavior to unstable, environmental factors (e.g., inclement weather).

Table 2-4: Means, Standard Deviations, Confidence Intervals, and Statistical Test Results Comparing Successful vs Unsuccessful Participants at T2 (n=602)

Measure	Successful (*n* = 326)	Unsuccessful (*n* = 276)	Mean Diff 95% CI	Effect Size 95% CI
Exercise Behavior	73.6 (29.9) (64.2, 80.4)	27.7 (22.5) (17.1, 37.8)	45.9*** (41.7, 50.1)	1.68 (1.5, 1.9)
Future Expectations	4.2 (0.8) (3.8, 4.6)	3.4 (0.94) (2.9, 3.9)	0.8*** (0.7, 1.0)	0.93 (0.8, 1.1)
Locus Dimension	21.0 (4.9) (20.4, 21.5)	17.3 (6.5) (16.5, 18.1)	3.6* (2.7, 4.6)	0.63 (0.5, 0.7)
Control Dimension	22.0 (5.2) (21.4, 22.5)	17.4 (5.9) (16.5, 18.1)	4.6* (3.7, 5.5)	0.82 (0.7, 0.9)
Stability Dimension	16.2 (5.3) (15.6, 16.8)	11.4 (5.1) (10.7, 12.0)	4.8** (3.9, 6.5)	0.98 (0.9, 1.1)

Higher scores on the attributional dimensions indicate a tendency to make more internal/controllable/stable attributions.
Higher scores on other constructs indicate a higher association with those variables.
***Significant at p<.001 level, **Significant at p<.01 level, *Significant at p<.05 level

The zero-order correlations at T2 between exercise behavior, future expectations for exercise, and the attributional dimensions when aggregated by perceived outcome are reported in Table 2-5. Of note, the negative association between stability and future expectations for the unsuccessful participants indicates that as attributions to stable causes decreased (i.e., the participants made increasingly unstable attributions for their failure) their future expectations for exercise increased.

Table 2-5: Zero-Order Correlations at T2, by Perceived Outcome (N=602)

	Successful Participants (n=326)					Unsuccessful Participants (n=276)				
Measure	1	2	3	4	5	1	2	3	4	5
1)Weekly Ex.	1.00					1.00				
2)Future Expt.	0.25*	1.00				-0.45**	1.00			
3)Locus	0.00	0.21	1.00			0.03	0.06	1.00		
4) Control	-0.22	0.21	0.75**	1.00		-0.14	-0.07	0.58*	1.00	
5)Stability	0.04	0.04	0.33*	0.35*	1.00	0.04	-0.54**	0.11	-0.01	1.00

. ***Significant at p<.001 level, **Significant at p<.01 level, *Significant at p<.05 level

Analysis 1 Results

The first analysis compared the successful participants' attributions with those of the unsuccessful participants. The unsuccessful participants were further aggregated by whether they were unsuccessful due to having never started an exercise program or because they started an exercise program and then dropped out. The hypothesis was that individuals who were unable to bridge the I-B gap would make more maladaptive attributions (i.e., increasingly internal, uncontrollable, and stable causal attributions for failures) than those participants who were successful.

The ANOVA results comparing the three groups are reported in Table 2-6; the associated post-hoc tests are reported in Table 2-7. The ANCOVA results when including the demographic and number of previous attempts covariates are not reported because no statistically significant differences were found. The hypothesis was not supported by the data. The participants who perceived themselves as unsuccessful due to dropping out made increasingly adaptable attributions for the cause of their behavior (i.e., external, uncontrollable, and unstable).

Table 2-6: Means, Standard Deviations, and ANOVA Results for the T2 Attributions (n=602)

		Unsuccessful (*n* = 276)			
Attributional Dimensions	Successful (*n* = 326)	Drop Outs (*n* = 238)	Never Started (*n* = 38)	F-Test Result	Effect Size 95% CI
Locus	20.97 (5.2) (20.4, 21.5)	16.92 (6.4) (16.1, 17.7)	20.16 (7.5) (17.7, 22.5)	$F(2,599) = 27.2^{***}$	0.69 (0.59, 0.79)
Control	21.97 (5.9) (21.3, 22.6)	17.12 (6.1) (16.3, 17.9)	19.33 (4.6) (17.8, 20.8)	$F(2,599) = 30.0^{***}$	0.79 (0.69, 0.89)
Stability	16.22 (5.4) (15.6,16.8)	11.02 (4.6) (10.4, 11.6)	14.00 (7.8) (11.5, 16.5)	$F(2,599) = 66.4^{***}$	1.02 (0.92, 1.12)

Higher scores indicate a tendency to make more internal/controllable/stable attributions
***Significant at p<.001 level, **Significant at p<0.1 level, *Significant at p<.05 level

Table 2-7: Tukey Test Results Comparing the Attributions for the Three Exercise Groups at T2 (n=602)

Attribution	Exercise Group Comparison	Mean Diff 95% CI	Effect Size 95% CI
Locus	Successful vs. Drop Out	4.05 (1.0, 7.0)*	0.69 (0.65, 0.74)
	Successful vs. Never Started	0.81 (-5.2, 6.8)	NS
	Drop Out - Never Started	-3.20 (-9.2, 2.8)**	0.46 (0.41, 0.51)
Control	Successful vs. Drop Out	4.85 (1.9, 7.8)*	0.80 (0.71, 0.89)
	Successful vs. Never Started	2.64 (-3.2, 8.5)	NS
	Drop Out vs. Never Started	-2.21 (-8.0, 3.6)*	0.41 (0.35, 0.47)
Stability	Successful vs. Drop Out	5.52 (2.8, 8.2)**	1.03 (0.92, 1.15)
	Successful vs. Never Started	2.54 (-2.8, 7.9)	NS
	Drop Out vs. Never Started	-2.97 (-8.3, 2.4)**	0.47 (0.40, 0.54)

**Significant at p<0.01 level, *Significant at p<.05 level, NS non-significant

While the data did not support the hypothesis, the strategy of breaking the unsuccessful participants into two groups uncovered two related findings. First, as initially observed in Table 2-6 and subsequently confirmed in the post-hoc tests, the 38 participants who perceived themselves as failures due to never having started an exercise program exhibited an attributional pattern that was similar to that of the successful participants. Specifically, both groups attributed their exercise behavior to internal/controllable/stable causes more so than the other unsuccessful participants. Additionally, the differences between the successful participants and the unsuccessful participants became more pronounced when those participants who were unsuccessful due to never having started were removed from the analysis (see Tables 2-4 and 2-6). The meanings of these differences are addressed in the discussion section.

The corollary to the first analysis tested if the participants exhibited the attributional pattern known as “personal changeability.” Recall that personal changeability reflects a pattern in which successful individuals attribute their outcome to internal, controllable, and *stable* causes, whereas unsuccessful individuals attribute their failure to internal, controllable, and *unstable* causes. The hypothesis associated with this

analysis – that the participants would not exhibit a personal changeability pattern because unsuccessful participants would make internal, uncontrollable, and stable attributions for their behavior – was not confirmed. Rather, the data showed that the unsuccessful participants made more external, uncontrollable, and unstable attributions for their behavior than the successful participants (see Table 2-4), instead of the attributional patterns usually observed when a personal changeability tendency occurs.

Analysis 2 Results

The second analysis investigated whether Weiner's model predicted exercise-related affects and cognitions for the exercise intenders in our sample (n=602). A two-stage hierarchical regression model was constructed for each of the predicted affective or cognitive states with the affective state or cognition serving as the dependent variable. The participants' perceived outcome for their exercise behavior in the past six weeks was entered in step one. In step two, the attribution that would predict the dependent variable and the interaction term between the attribution and perceived outcome were entered. Table 2-8 summarizes the results of the five regression models built for this analysis. Since none of the demographic variables were statistically significant, these variables were omitted from the analysis.

The first hypothesis – that successful participants would experience more positive emotions (i.e., *competence* and *pride*) than unsuccessful participants, and conversely that unsuccessful participants would experience more *shame* than successful participants – was confirmed (see the model results corresponding to *Step 1* in Table 2-8). Perceived outcome significantly predicted the positive emotions of *competence* and *pride* with successful participants experiencing feelings of *competence* and *pride* more than

unsuccessful participants. Similarly, perceived outcome predicted the negative emotion of *shame*, indicating that unsuccessful participants experienced more *shame* than successful participants.

The hypotheses that made predictions for the attribution-dependent affective responses (i.e., competence, pride, and shame) were generally supported (see the model results corresponding to *Step 2* in Table 2-8). Specifically, successful participants experienced greater feelings of competence than unsuccessful participants, and these feelings were greater for those participants who attributed their outcome to internal factors; unsuccessful participants experienced greater feelings shame than successful participants, and these feelings of shame were greater for those who attributed their outcome to internal causes. The hypothesis that predicted pride was not supported.

The third hypothesis that predicted the anger response was also confirmed. Specifically, unsuccessful participants experienced greater feelings of anger than successful participants, and those participants who attributed their failure to controllable causes experienced greater feelings of anger than those who attributed their failure to uncontrollable causes. See the model results corresponding to anger, specifically *Step 2,* in Table 2-8 for details.

The fourth and final hypothesis made predictions regarding future expectations of exercise behavior. The data suggested that successful participants experienced enhanced future expectations for exercise behavior when compared with unsuccessful participants, and these expectations for future success were greater for the participants who attributed their success to stable causes. See the model results corresponding to future expectations, specifically *Step 2,* in Table 2-8 for details.

Table 2-8: Hierarchical Regressions Results for Weiner's Model – Predicted Emotional and Cognitive Responses to the Participants' Exercise Behavior (n=602)

Predicted Affective/Cognitive State	R^2	F Statistic	Standardized β w/ 95% CI
Competence			
Step 1	0.06	6.06**	
Perceived Outcome (A)			0.25 (0.18, 0.3 3)**
Step 2	0.13	4.32*	
Perceived Outcome (A)			-0.54 (-0.63, -0.24)
Internal/External Attribution (B)			-0.29 (-0.37, -0.21)*
Interaction Term (AxB)			0.94 (0.80, 1.09)**
Pride			
Step 1	0.16	16.48***	
Perceived Outcome (A)			0.53 (0.44, 0.64)**
Step 2	0.17	5.58*	
Perceived Outcome (A)			0.18 (-0.15, 0.41)
Internal/External Attribution (B)			-0.13 (-0.05, 0.21)
Interaction Term (AxB)			0.06 (-0.10, 0.32)
Shame			
Step 1	0.05	5.91**	
Perceived Outcome (A)			-0.25 (-0.35, -0.15)**
Step 2	0.14	4.85**	
Perceived Outcome (A)			0.71 (0.55, 0.86)*
Internal/External Attribution (B)			0.30 (0.13, 0.47)*
Interaction Term (AxB)			-1.13 (-1.22, -1.04)*
Anger			
Step 1	0.07	10.73***	
Perceived Outcome (A)			-0.26 (-0.36, -0.16)**
Step 2	0.11	6.17**	
Perceived Outcome (A)			0.39 (-0.10, 0.73)
Control Attribution (B)			0.18 (0.11, 0.37)
Interaction Term (AxB)			-0.76 (-1.07, -0.42)**
Future Expectations			
Step 1	0.19	21.06***	
Perceived Outcome (A)			0.44 (0.21, 0.67)***
Step 2	0.33	13.72***	
Perceived Outcome (A)			0.23 (0.15, 0.31)**
Stability Attribution (B)			-0.65 (-1.10, -0.20)*
Interaction Term (AxB)			1.08 (0.55, 1.63)**

***Significant at p<.001 level, **Significant at p<0.1 level, *Significant at p<.05 level
The unsuccessful participants (perceived outcome=0) acted as the referent group in these models.

Analysis 3 Results

Three hierarchical regression models were constructed to test the hypotheses that the participants' prior attributions for exercise failure moderated the I-B relationship (Aiken, West, & Reno, 1991). Using exercise behavior at T2 as the dependent variable, intention at T1 was entered as the first step, the attributional dimension at T1 as the second step, and the intention and attributional dimension interaction term in the third step.

Table 2-9: Summary of Regression Models Assessing the Moderating Effects of Causal Attributions on the I-B Relationship (n=952)

		Standardized Beta Coefficient w/ 95% CI		
Step	Variable Entered	1	2	3
1	Intention (A)	0.38***	0.39**	0.21
		(0.22, 0.54)	(0.17, 0.61)	(-0.05, 0.47)
2	Locus Attribution (B)		0.11	-0.01
			(-0.02, 0.21)	(-0.22, 0.20)
3	Interaction Term (AxB)			0.22
				(-0.10, 0.54)
	R^2	0.15	0.16	0.16
	Model F	22.75***	12.38**	10.44**
1	Intention (A)	0.38***	0.35**	0.12
		(0.22, 0.54)	(0.19, 0.52)	(-0.17, 0.41)
2	Control Attribution (B)		0.19	0.01
			(-0.35, 0.54)	(-0.50, 0.49)
3	Interaction Term (AxB)			0.33
				(-0.11, 0.77)
	R^2	0.15	0.18	0.19
	Model F	22.75***	14.44**	10.21**
1	Intention (A)	0.38***	0.38**	0.29
		(0.22, 0.54)	(0.18, 0.62)	(-0.05, 0.51)
2	Stability Attribution (B)		0.01	-0.07
			(-0.30, 0.50)	(-0.34, 0.54)
3	Interaction Term (AxB)			0.12
				(-0.11, 0.23)
	R^2	0.15	0.15	0.15
	Model F	22.75***	11.24***	7.54**

Significant at p<0.001, **Significant at p<0.01, *Significant at p<0.05

Since the interaction term between the attributional dimension and intention was not statistically significant in any of the models, the hypotheses that the attributional dimensions would moderate the I-B relationship were not confirmed.

Analysis 4 Results

The fourth and final research question investigated the contribution of adding a causal attribution construct as a direct effect to exercise behavior with the well-known intention-based behavioral model, the Theory of Planned Behavior (TPB). The contribution was assessed in two ways: (1) in terms of any additional explained variance in exercise behavior, and (2) whether the overall model fit was improved by adding an attribution construct. The fit indices, statistical test results, and standardized path coefficients for the competing models are presented in Tables 2-10 and 2-11. In the two tables, model one represents the TPB constructs and paths; model two represents the model that added the ***T1 control*** attribution construct as a predictor of T2 exercise behavior; similarly, model three added the ***T1 locus*** construct; lastly, model four added the ***T1 stability*** construct.

Table 2-10 reports the four models' fit statistics, the amount of explained variance in T2 exercise behavior, and the results of the chi-squared difference tests that tested whether the models containing the attribution construct provided superior fit to the TPB model. Maximum likelihood was the method used to estimate the model parameters; the SAS procedure PROC CALIS was used to generate the fit statistics and the path model coefficients. Model fit was assessed through the model's chi-square value and three fit indices: root mean square error of approximation (RMSEA), comparative fit index (CFI), and the adjusted global fit index (AGFI). A CFI value >0.89, RMSEA value <0.08, and

AGFI value >0.94 indicate that the hypothesized model provides a good fit for the observed data (Hooper, Coughlan, & R. Mullen, 2007). Using these benchmarks, all four proposed models provide acceptable fit to the observed data. The few degrees of freedom associated with the chi-square tests for these models indicate that they are nearly saturated - meaning that these models have as many parameters as there are data points. In general, a nearly saturated model, while not technically inaccurate, could indicate a certain level of triviality with respect to how well the model fits the data. For this study, the near-saturation indicates that while the estimated models fit this particular dataset well, the fact that the models are nearly saturated calls into question the generalizability of the models to other populations. The inclusion of the T1 control and locus attribution constructs marginally increased (models 2 and 3) the amount of explained variance in T2 exercise behavior. It should be added that the models were also tested in the latent variable context, but no changes to the results were observed.

Three chi-square difference tests were run to assess whether the inclusion of the causal attribution construct to the TPB significantly improved the overall fit to the observed data. The chi-square difference test determines whether a more complex model (in the present study, the three models including the attributional dimension) provides a significantly better fit to the observed data over a simpler model (TPB) . Given that the three chi-square tests are not statistically significant (see Table 2-10), the inclusion of the attribution construct is not warranted.

Table 2-10: Comparison of Selected Model Fit Indices (n=952)

Model	χ2 (df)	*RMSEA*	*CFI*	*AGFI*	R^2	χ2 diff (df diff)
Model 1: TPB	1.76 (2), p=0.54	0.00	1	0.95	0.16	-
Model 2: TPB w/ Control	2.21 (3), p= 0.34	0.00	1	0.96	0.19	0.45(1)
Model 3: TPB w/ Locus	1.51 (3), p=0.64	0.00	1	0.97	0.17	0.15(1)
Model 4: TPB w/ Stability	3.66 (3), p=0.17	0.04	1	0.94	0.16	1.6 (1)

While the primary research question associated with this analysis investigated model fit and explained variance, it is instructive to examine the statistical significance of the direct effects between the attribution construct and exercise behavior (see Table 2-11). As a reminder, the conceptual diagram for the proposed model is presented below.

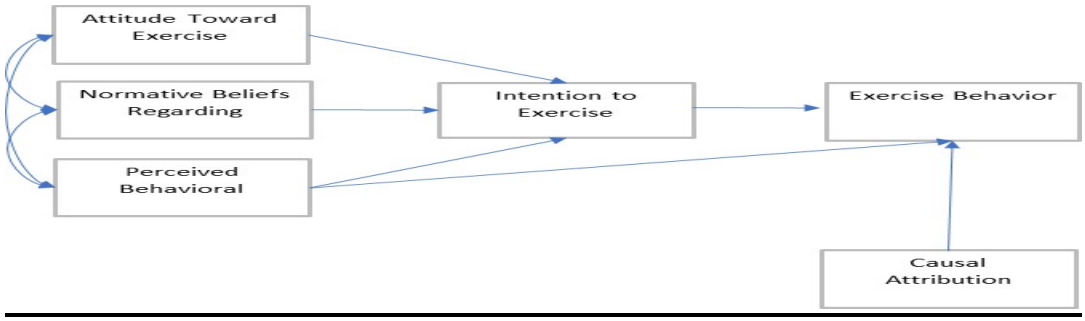


Table 2-11: Standardized Path Coefficients with Statistical Significance for TPB-Based Models (n=952)

Path	Model 1 Std. β (Std. Error)	Model 2 Std. β (Std. Error)	Model 3 Std. β (Std. Error)	Model 4 Std. β (Std. Error)
Attitude➔Intention	0.39 (.07)*	0.39 (.07)*	0.39 (.07)*	0.39 (.07)*
Perceived Norm➔Intention	0.08 (.07)	0.08 (.06)	0.08 (.07)	0.08 (.06)
Perceived Behavioral Control➔Intention	0.37 (.08)*	0.36 (.08)*	0.37 (.08)*	0.37 (.08)*
Intention➔Behavior	0.30 (.10)*	0.39 (.10)*	0.30 (.10)*	0.30 (.10)*
Perceived Behavioral Control➔Behavior	0.13 (.10)	0.10 (.10)	0.14 (.10)	0.13 (.10)
Control Attribution➔Behavior		0.19 (.08)*		
Locus Attribution ➔Behavior			0.12 (.07)	
Stability Attribution➔Behavior				0.03 (.08)

***Significant at p<.001 level, **Significant at p<0.1 level, *Significant at p<.05 level

For all the models, three of the path coefficients were statistically significant (see Table 2-11). Regarding the attributions, only the direct effect between the control attribution and exercise behavior was statistically significant.

Discussion

Individuals who signal an intention to start and maintain an exercise program will either be successful or unsuccessful in their efforts. Because of this dichotomous outcome, Weiner's attribution theory (1985) is an appropriate theoretical framework to study the possible reasons why some people fall into the I-B gap. The first analysis was designed to both measure and compare the causal attributions of exercise intenders who were able to bridge the I-B gap with the attributions of those who could not bridge the gap. The second analysis tested several of the specific affective and cognitive predictions made by Weiner's theory on exercise intenders. The final two analyses tested the effects of causal attributions on the I-B relationship using: (1) causal attributions as a moderator of the I-B gap and (2) as a construct integrated into the TPB. To the best knowledge of this researcher, the hypotheses associated with these analyses do not appear to have been previously tested on a population of exercise intenders.

It was hypothesized that the participants who failed to bridge the I-B gap (i.e., unsuccessful participants) would make maladaptive attributions (i.e., internal, uncontrollable, and stable) for their failure. However, as reported in Table 2-4, the unsuccessful participants attributed their failure to unstable, environmental causes (e.g., inclement weather); an attributional style that should promote future attempts at exercise.

Additionally, the negative correlation between future expectations and the stability dimension for the unsuccessful participants (see Table 2-5) provided support for this finding as the increasingly unstable attributions for failure were associated with higher levels of future expectations toward exercise.

When the data were analyzed for the three exercise groups, statistically significant differences in the attributions were found between the successful participants and participants who were unsuccessful due to inconsistent exercise behavior. Interestingly, the unsuccessful participants who never started an exercise program appeared to be attributionally similar to the successful participants. However, since the two groups had different outcomes, the interpretation of their attributions drastically changes. That is, attributing a success to an internal/stable cause is considered adaptive because the person believes that the cause for his/her success is a stable characteristic of him/herself (e.g., ability). Conversely, attributing a failure to exercise to internal/stable causes could be considered maladaptive for the same reason - the person perceives the cause of his/her failure to be an unchangeable (stable) part of himself/herself (internal). However, there are two reasons why the attributional styles of those who failed do not appear to be maladaptive. First, since their reported expectations for future exercise were high ($M=4.62$, $SD=2.4$), their perceived cause for failure did not appear to hinder their expectations for future exercise. Second, the fact that these participants attributed their failure to controllable causes could indicate that these participants believed they can change or overcome the cause of their failure, despite it being internal and stable. For instance, a person could attribute his/her exercise to laziness, which could be considered an internal and stable personality trait. However, since this person believes that laziness

can be overcome (i.e., controllable), it is not a barrier to engaging in exercise in the future.

The findings from the first analysis did not align with the other studies that were reviewed for the current research. Recall that the other studies referenced for this research (McAuley, et al., 1990; Schoeneman & Curry, 1990; Minifee & McAuley, 1998) identified a pattern of personal changeability among their participants. Yet, as was reported in Tables 2-4 and 2-6, the unsuccessful participants attributed the cause of their exercise failure during the study period to external, controllable, and unstable causes. This attributional pattern, where individuals attribute the cause of their failure to external causes is known as *self-serving bias* (Weary, 1978); it is usually made by people in an effort to preserve their self-esteem after experiencing failure. In other domains (e.g., education and sport), making self-serving attributions is usually considered an adaptive attributional pattern, as those who make self-serving attributions tend to attempt the task again (Seligman, Nolen-Hoeksema, Thornton, & Thornton, 1990). Given that the relationship between self-serving attributional patterns and exercise behavior has not previously been studied, further study of this proposed relationship is necessary.

While not the focus of the present study, it is interesting to note how the unsuccessful participants' attributions changed during the study period. Recall that at T1, the study participants, who were all unsuccessful in maintaining an exercise program, attributed their lack of exercise to internal, controllable, and unstable causes (see Table 2-3). This attributional pattern suggests that at T1, the participants' attributions did, in fact, reflect the pattern of personal changeability that was identified in the other studies reviewed for this work (Anderson, 1983, Minifee & McAuley, 1998; Schoeneman &

Curry, 1990). However, at T2, the unsuccessful participants no longer made internal, controllable, and unstable attributions, but instead, they attributed their failure to self-serving causes (i.e., external, controllable, and stable). Thus, it appears that, at least in the context of exercise behavior, individuals may attribute successive failures to different self-serving causes. In the present research, the initial attributions of these participants indicated that even though they failed, they believed the power to reverse this failure was in their control. However, when the participants experienced another failure (i.e., failed over the course of this study period), their attributions reflected a goal of preserving their self-esteem. Repeated failure to exercise can create cognitive dissonance and thereby pose a threat to one's self-esteem. The correlations reported in Table 2-3 also provide support for the idea that attributions are changeable over time. Specifically, the correlations between the time 1 and time 2 for the participants' locus (r=0.11) and stability (r=0.16) dimensions were not statistically significant. If the participants' causal attributions for their previous exercise behavior had any bearing on their attributions for their subsequent attempts at exercise, the correlations would be at least moderate in magnitude. This suggests that participants' perceived reasons for a later failure were independent of their initial attributions. Thus, attributions seem to change with situational experiences. How attributions change after experiencing successive failures and the ramifications of these changes, however, is an area for further exploration.

As suggested above, one other possible reason why exercise intenders may make self-serving attributions is to relieve the cognitive dissonance (Festinger, 1957) that could be brought on by their exercise failure. It has been proposed (Iso-Ahola, 2013) that exercise intenders who do not follow through on their intentions may experience

cognitive dissonance as their behavior is not consistent with their cognitions (i.e., intention to exercise). Making self-serving attributions could reduce people's dissonance by introducing new cognitions or rationalizations, a common way to reduce dissonance (Festinger, 1962; Iso-Ahola, 2013). Exercise intenders, for example, can reduce cognitive dissonance caused by their inactivity by invoking external factors (e.g., work or family commitments) rather than internal causes. Since the use of attributions to reduce dissonance has not been investigated in the exercise domain, future studies are needed to investigate not only the relationship between cognitive dissonance and the I-B gap, but also whether a strategic use of attributions is an effective means of reducing cognitive dissonance.

The exercise history variable – the number of prior failed attempts at exercise – was included to determine whether any of the study participants might have experienced learned helplessness (Maier & Seligman, 1976) in relation to their exercise behavior. In the context of the present research, learned helplessness describes a motivational state whereby an individual believes that any future efforts to exercise are futile because failure is inevitable; the manifestation of this motivational state would be seen in the control attributions (Grimes, 1981; Miller & Norman, 1979; Munton, 1985). Specifically, individuals who consistently make uncontrollable attributions for their failure may fall into a state of learned helplessness because they believe the cause of their failure is out of their control. In the context of the present study, learned helplessness would mean that individuals who had failed multiple times to regularly exercise may have experienced learned helplessness, which would lead to maladaptive attributions for their behavior (internal, uncontrollable, and stable). However, no such attributional pattern emerged in

the analyses. It follows from the learned helplessness theory that individuals experiencing learned helplessness would no longer signal an intention to exercise. As Martinko and Gardner (1982) have suggested, individuals experiencing this condition will cease to make any attempt to improve their situation, even when environmental changes can make success possible. Having already experienced many failures, an individual would almost certainly not signal an intention to exercise and thus would not have been eligible for the study.

The second hypothesis tested whether the attribution-based emotions and cognitions as predicted by Weiner's model would hold for exercise intenders. The results of the second analysis generally supported Weiner's proposed relationships between perceived outcome and emotions. The hypotheses predicting the attribution-dependent emotions were also largely supported as the results showed that Weiner's model accurately predicted competence, shame, and anger, but not pride. Lastly, the results supported the prediction that success attributed to stable causes would lead to higher expectations for future exercise.

There were two possible explanations for why Weiner's (1986) model's prediction regarding the pride emotion were not supported in this study. First, it may be that attributions, specifically the locus dimension (internal vs. external), are simply not good predictors of pride. Second, pride may primarily be influenced by the participants' mere perceptions of outcome rather than attributions for outcome. That is, a person's pride response is determined by his/her perceived success in exercise behavior rather than by his/her perceived reasons for success.

Given that the attribution-dependent emotional reactions proposed in Weiner's model appear to be generalizable to exerciser intenders (with the exception of *pride*), practitioners can use these findings to promote exercise behavior by encouraging clients to make specific attributions. For example, practitioners could encourage people to attribute their exercise success to internal (e.g., effort) rather than external causes (e.g., exercising with a personal trainer). By making such an attribution, people should, according to the theory, experience an increased sense of competence as it relates to their exercise behavior. The theory then predicts that this increased sense of competence should lead to further attempts at exercise.

The hypotheses for the third and fourth analyses were not confirmed. The results of the third analysis did not indicate that causal attributions moderated the I-B relationship. One possible interpretation of this finding is that while prior attributions influence motivation, they have little influence on actual exercise behavior. For example, while attributing a behavior to a stable cause influences a person's expectations for engaging in the behavior in the future, this attribution post-intention appears to have no effect on actual behavior. The fourth analysis demonstrated little improvement in variance explained in exercise behavior or the overall fit after integrating attribution constructs into the TPB model. Specifically, the only attribution that increased the explained variance in exercise behavior was control but the increase was negligible (3%) . Additionally, while the direct effect of the control attribution on exercise behavior was statistically significant, the overall model fit did not show a significant improvement over the TPB model. Therefore, it is difficult to definitively conclude that the control attribution would significantly change actual exercise behavior.

The findings from this study make contributions to the literature in three areas. First, the second analysis tested and confirmed aspects of Weiner's (1985) attribution theory on a sample of exercise intenders. Second, in terms of the relationship between attributions and exercise behavior, the first analysis revealed that (1) individuals who fell into the I-B gap made self-serving attributions as opposed to exhibiting a personally changeable attribution pattern, and (2) individuals who had not begun an exercise program attributed the causes of their behavior in a manner similar to successful individuals. Third, the research contributes to the literature concerning exercise behavior. Specifically, the results from the first study indicated that there were attributional differences *between* unsuccessful exercise intenders depending on why they failed. If there are attributional differences among unsuccessful exercise intenders (i.e., never started vs. inconsistent exercise), then it is likely that the reasons for exercise failure could also moderate other exercise-related psycho-social constructs (e.g., self-efficacy, attitude towards exercise).

From a more practical perspective, the finding that the unsuccessful participants were making self-serving attributions should enhance the chances of future enactment of the behavior (Weiner, 1985). Future studies need to specifically test this idea. Additionally, while the effects were small, the fourth analysis provided some evidence for the importance of the control attribution for one's exercise behavior. Given this finding, exercise practitioners should consider encouraging people to view the causes of their exercise failure as controllable, which could lead to adoptions of self-regulation techniques that can help them maintain long-term exercise.

The findings from these studies suggest future avenues for research in the causal attributions of exercisers. First, future research could measure and compare the attributions for different types of exercise intenders (e.g., intending to exercise so as to: improve physical appearance, improve overall health, improve cognitive function). Second, it would be worthwhile to test different attributional styles (combinations of attributions) as moderators rather than testing the attributions in isolation. Third, future studies should track the attributions of exercise intenders over time to identify any systematic changes in the long run. Finally, there may be better ways to integrate causal attributions into TPB or other intention-based models. For instance, causal attributions could be used as predictors of exercise intentions rather than as direct effects of intentions on exercise behavior. By doing this, it may be possible to improve the explanation of exercise behavior through intentions.

Chapter 3 – Study 2

Introduction

Attribution theory suggests that people are naïve scientists who are interested in understanding the causes of their behavior so that they can either replicate or avoid such behaviors in the future (Heider, 1958; Weiner, 1985). Weiner argues that this type of self-examination should focus on how people perceive (i.e., classify) the causes of their behavior along three dimensions: (1) locus-of-causality: whether a person believes the cause of a behavior was brought about by internal or external factors, (2) stability: whether the person believes the cause of his/her behavior is temporary or permanent, and (3) controllability: whether a person believes the cause of his/her behavior is within his/her control. How people perceive the causes along with these three dimensions can have a profound effect on their attitude, motivation, and future enactment of the behavior.

According to attribution theory, certain combinations of these dimensions (e.g., external, controllable, stable; internal, controllable, unstable) interact with the behavioral outcome (i.e., success or failure) to either boost (i.e., adaptive attributional style) or suppress (i.e., maladaptive attributional style) future motivation and enactment of a behavior. For example, people who miss their scheduled exercise class because of bad weather might classify bad weather as an external/uncontrollable/unstable cause for their failure. This cause is considered to be adaptive and should encourage future class attendance. Others may miss the same class because they do not believe that they have the necessary skill set to effectively perform the exercises presented in the class. Attributionally, if an individual from this latter group believes that exercise skill is a trait

that one either possesses or does not, the person has made a maladaptive attribution (i.e., internal, uncontrollable, and stable) for his/her exercise failure and would be less inclined to attend class in the future.

If certain attributional styles are more motivating than others, then one way to encourage behavior would be to re-orient a person's attributional style from maladaptive to adaptive. This type of behavioral intervention is known as an *attributional retraining* (AR) *intervention* (Perry et al., 1993; Stewart, Perry, Stupnisky, & Daniels, 2009) and it has shown been shown to be successful in enhancing motivation and behavior in a variety of domains (Heller & Ziegler, 1996; Rascle, Foll, & Higgins, 2008; Wilson & Linville, 1982). These AR interventions work by adjusting how people classify the causes of their behavior on the locus, stability, and control dimensions (McAuley et al., 1992). The dimensions are emphasized rather than the individual causes for a behavior because attribution theory argues that how a person perceives the cause (i.e., how he/she classifies the cause on the dimensions) is more important to future motivation and enactment of the behavior than the individual cause itself.

As an illustrative example, Beth and Sam both attribute their lack of exercise to a lack of time– a common reason for inactivity (Dishman, Sallis, & Orenstein, 1985). Beth may view a lack of time as a controllable issue that can be overcome by making creative adjustments to her daily routine to accommodate exercise (e.g., taking the stairs to her office instead of an elevator). Sam, however, may perceive a lack of time as an impediment to exercise that is out of his control (e.g., a demanding job that takes up all his free time). In Sam's situation, an AR intervention would try to reorient his perception that lack of time is an uncontrollable facet of his job that is interfering with his exercise.

The AR intervention might achieve this reorientation by suggesting creative ways to incorporate exercise into Sam's busy lifestyle, thereby encouraging the idea that Sam's time is within his control and he can fit exercise into his schedule. Essentially, the AR intervention would encourage Sam to think about lack of time as Beth does.

In general, AR interventions encourage individuals to see the causes of their failures as situational issues rather than viewing them as inherent personality traits. Specifically, AR interventions encourage people to attribute their failures to controllable, unstable, and external causes rather than uncontrollable, stable, and internal causes. If the AR intervention is successful in encouraging this viewpoint, the odds of engaging in the behavior in the future should increase.

The present research seeks to determine the efficacy of a one-time AR intervention in a sample of sedentary exercise intenders. The study was designed to determine the effect of the AR intervention on the participants' attributional styles and their exercise behavior in comparison with a control group. This particular AR intervention focused on reorienting the control and stability dimensions, as these dimensions have been shown to be related to positive exercise behaviors (Orbach, Singer, & Murphey, 1997; Stewart et al., 2009). Two hypotheses were developed for the study: (1) after applying an AR intervention, future perceptions of failure in exercise behavior would be accompanied by adaptive (i.e., controllable and unstable) attributions, and (2) participants who undergo an AR intervention would experience success in future exercise behavior to a greater extent than participants in a control group.

Method

Overview

The experiment utilized a pre-test/post-test randomized control study design. The study participants, who were recruited from a local Washington D.C. fitness company, were randomly assigned into either a treatment group or a control group (see *Participants and Design*). After randomization, the participants reported their demographic information, prior exercise behavior, and attitudes toward exercise. The participants then received either the experimental or nonexperimental treatment in a group workshop setting (see *Intervention Procedure*). The workshop consisted of participants viewing a videotaped message and reviewing a handout (see *Intervention Materials*). Six weeks after their assigned workshop, the study participants were re-contacted to provide some follow-up information on their exercise behavior. This information was then analyzed to determine if the treatment was effective.

Participants and Design

The study was approved by the University of Maryland's Institutional Review Board (IRB Number 1046388-2; see Appendix 5). Each participant gave written, informed consent prior to beginning the study protocol. The fitness company provided the IRB with a letter of consent specifying that it understood the study protocol and that participants would be recruited from its membership community. The sample size for the statistical tests that were used to analyze the data was calculated using G-Power. G-Power requires that the effect size, desired alpha level, and power are specified. A standard alpha level of 0.05 and a power of 0.8 were used as inputs. An effect size of 0.40 was used based on Haynes et al.'s (2009) review of AR studies in higher education.

Using these values as inputs, the estimated sample size for the treatment and control groups was 78 participants in each.

The partner fitness company with five locations and a client base approaching 2,000 individuals, agreed to support the study by offering its facility space to conduct the experiment and its membership pool to recruit participants. The company offered three centrally located sites in which to conduct the experiment. Each site has a large social area and the necessary equipment (e.g., tables, chairs, audio-visual equipment) required to conduct the study as designed.

The study participants were recruited between December 2017 and February 2018. This recruitment period was selected so as to increase the probability that sedentary individuals with high intentions to start exercising (i.e., those individuals making exercise-related New Year's resolutions) would respond. The company promoted the workshop by posting flyers in its facilities and by directly contacting its membership community through its online monthly newsletter. As an incentive, the company offered participants one free session with a personal trainer.

Members signaled their interest in participating in the study by signing up to attend a workshop at one of the three company's locations convenient to the participant. A few days before the workshop, the participants were sent a message reminding them that they had signed up to attend the event. The participants were then expected to show up at the facility on the evening that the experiment was scheduled.

The study participants were sedentary individuals who had signaled an intention to begin an exercise program in the coming weeks. Because there were no statistically significant differences found in the demographic and baseline psycho-social constructs

across the three sites, the treatment groups and control groups were combined into one treatment and one control group in all the analyses. Table 3-1 reports the demographic information and statistical tests comparing the treatment and control groups. As noted by the lack of statistical significance in the statistical tests comparing the treatment and control groups, the groups appear to be well balanced.

Table 3-1: Demographic Characteristics and Statistical Tests Comparing the Treatment and Control Groups (n=200)

Characteristics	Control (N=106) N (%)	Treatment (N=94) N (%)	Sig?
Gender			χ^2=0.85, NS
Female	79 (74)	69 (73)	
Male	27 (24)	25 (26)	
Age			χ^2=0.79, NS
18–20	10 (9)	9 (10)	
21–29	49 (46)	37 (39)	
30–39	32 (30)	35 (37)	
40–49	12 (11)	9 (10)	
50 or older	3 (3)	4 (4)	
Education			χ^2=0.73, NS
High school graduate	25 (23)	17 (18)	
Some college	16 (15)	20 (21)	
College graduate	24 (23)	19 (20)	
Some graduate school	19 (18)	19 (20)	
Completed graduate school	22 (21)	19 (20)	
Income			χ^2=0.13, NS
0–50K	15 (14)	8 (9)	
50–75K	11 (10)	22 (23)	
75–100K	21 (19)	14 (14)	
100–125K	13 (12)	16 (17)	
125–150K	14 (13)	9 (10)	
150–175K	12 (11)	13 (14)	
175K+	20 (18)	12 (13)	
Number of previous attempts at exercise in the past year			χ^2=2.05, NS
0	3 (3)	1 (1)	
1–3	41 (39)	24 (25)	
4–6	55 (52)	42 (45)	
7+	7 (7)	27 (29)	
Weekly exercise score	43.5 (33.4)	40.4 (27.2)	F=0.46, NS
Exercise intention	4.81 (0.3)	4.73 (0.3)	F=3.09, NS

NS=Not Significant

Measures

All psychological and behavioral measures used in this study were previously developed scales that have well-established reliabilities and validities. The means, standard deviations, Cronbach's alphas, and full scales for the psycho-social measures can be found in Appendix 3. The construct and criterion-related validities were examined in detail for the measures containing constituent sub-scales (i.e., intrinsic motivation inventory, exercise benefits and barriers, exercise affect, and social support).

Demographic Information

Demographic characteristics measured included the following: age, gender, race/ethnicity, highest level of education, and income (see Table 3-1).

Exercise History Information

Two variables were used to measure the participants' previous exercise behavior. The first measure – number of failed attempts to maintain an exercise program in the past year – was used as a covariate in several analyses. Respondents were asked the following question: "In the past year, approximately how many times have you intended to begin an exercise program, yet failed to start or maintain an exercise routine?" Participants selected one of four options (i.e., "0," "1-3," "4-6," or "7+") indicating the number of times they had attempted to exercise.

The second measure was Godin and Shephard's (1985) "simple method" to assess exercise behavior. Participants answered the following question: "Considering a 7-day period (a week), how many times on average do you do the following kind of exercise for more than 15 minutes during your free time?" Participants indicated the number of times

per week they engaged in strenuous exercise (heart beating rapidly, as with running, jogging, swimming, basketball, or biking), moderate exercise (not exhausting, as with tennis, walking, or badminton), and mild exercise (minimal effort). Participants' responses to these questions were weighted to give more value to more strenuous bouts of exercise (i.e., strenuous bouts of exercise were weighted by 9, moderate by 6, and light by 3) and then summed to generate a weekly exercise score. The scores for the sample ranged from 0 to 122. The mean score of 43.2 (see Table 3-1) at time 1 indicates low to moderately low weekly exercise behavior.

Intention to Exercise

Intention to exercise was measured by calculating the mean of three items adopted from Gonzalez (2012) (e.g., "I intend to begin regularly exercising in the next six weeks"). Participants then rated their intentions on a scale from 1 ("very unlikely") to 5 ("very likely"). The Cronbach's alpha value at baseline for this scale was 0.84 (see Appendix Table 3-2). As reported in Table 3-1, the mean score of 4.8 indicated, as expected, a high intention to begin exercising in the next six weeks.

Perceived Outcome

Similar to other attribution studies, a subjective measure of success was selected over an objective measure (Shields et al., 2005; Spink & Roberts, 1980). The argument for using a subjective measure of outcome over an objective measure is that success and failure are better interpreted as psychological states that are based on an individual's interpretation of an outcome rather than an objective definition of what constitutes a success or a failure. The attributional evaluation process is then done on the individual's perception of the outcome rather than an objective measure.

Perceived outcome for the participants' exercise behavior at the end of the study period was measured according to the participants' responses to a statement adopted from Ajzen (1985): "In the past six weeks, I have generally been able to successfully maintain a regular exercise routine." Participants indicated either "Yes" or "No" in response. To examine the concurrent validity of the perceived outcome measure, the point-biserial correlation coefficient was calculated for the relationship between perceived outcome and Godin and Shephard exercise behavior at follow-up and was found to be acceptable ($r(198)=0.69$, $p<.001$).

Causal Attributions

The revised Causal Dimensions Scale (CDS-II) (McAuley et al., 1992) was used to measure participants' attributions for the success or failure to engage in exercise over the six-week study period. The CDS-II asks participants to provide their own attribution for an outcome and codes that attribution along four causal dimensions: locus of causality, personal controllability, external controllability, and stability. The dimension of external controllability was not examined in this study because the intent was to test hypotheses from Weiner's (1985) theory, which is not concerned with the external controllability dimension. The CDS-II has been shown to have acceptable internal consistency and construct validity using similar populations (McAuley et al., 1992).

In the present study, participants indicated what they considered to be the primary reason for their success or failure in their exercise behavior. Then, using a nine-point Likert-type scale, participants rated the selected reason using nine items, with three items representing each of the dimensions of interest: locus of causality, personal controllability, and stability. Values for each of the dimensions were then summed with

higher scores indicating that attributions were more internal, controllable, and stable. The three dimensions demonstrated acceptable internal reliability with Cronbach's alphas of 0.72, 0.67, and 0.87 for locus, controllability, and stability respectively. Correlations between the items and the overall scale ranged from 0.52 to 0.89; these values were also considered acceptable (see Appendix Table 3-2).

Future Expectations

Future expectation about exercise behavior was assessed using the following question: "How certain are you that you will be able to engage in regular exercise over the next six weeks?" Responses ranged from 1 ("very uncertain") to 5 ("very certain").

Exercise Affect

Exercise affect was measured by having respondents rate their emotional experience with exercise (e.g., happy, sad, proud, guilty) over the past six weeks. A nine-point scale was used with lower scores indicating that respondents did not feel the specified emotional experience *at all* over the past six weeks and higher scores indicating that participants *strongly* felt the emotion. Cronbach's alpha was 0.94 for the positive affect and 0.90 for the negative affect. Individual items' correlations with the overall score ranged from 0.70 to 0.91.

The convergent and discriminant validities of the exercise affect scale were assessed using a factor analysis with a varimax orthogonal rotation. Factor analysis revealed two factors, one for positive affect and one for negative affect, which explained 30.1% of the variance in the 11-item scale. The Cronbach's alphas for the two factors are 0.89 for the negative affect and 0.94 for the positive affect factor (see Appendix Table 3-5) with the items measuring positive emotions all loading on the same factor and the

items related to the negative emotions loading on the other scale. The correlation coefficient between the two factors was calculated to assess divergent validity ($r=-0.12$, $p<.01$) and was found to be acceptable. Lastly, the discriminant and convergent validity of the scale was investigated by calculating the correlations between the two sub-scales and the weekly exercise score. The correlations were moderate in magnitude ($r=-0.18$, $p<.01$ for negative affect and weekly exercise; $r=0.24$, $p<.01$ for positive affect and weekly exercise) and the directions of the correlations were as expected (see Appendix Table 3-6).

Perceived Norm

Borrowing from Armitage (2005), three items were used to assess individuals' normative beliefs about exercise (e.g., "Most people who are important to me would approve of me exercising"). The mean of the three items represented the final subjective norm value. Responses were recorded on a seven-point scale, with a lower score indicating that a respondent disagreed with a normative statement. Cronbach's alpha for the perceived norm measure was 0.92. The individual items' correlations with the overall score ranged from 0.85 to 0.92 (see Appendix Table 3-2).

Perceived Behavioral Control

Two measures borrowed from Ajzen (1991) were used to collect data on perceived behavioral control. The first measure assessed an individual's capacity for exercise: "I am confident that I can exercise regularly for the next six weeks." The second measure assessed the individual's level of control related to his/her exercise behavior: "For me to exercise regularly over the next six weeks is up to me." Respondents indicated their level of agreement with both statements on a seven-point scale with lower scores

indicating a lower level of agreement with the statement. The mean of the two measures represented the final perceived behavioral control measure. Cronbach's alpha for the perceived behavioral control measure was 0.68 (see Appendix Table 3-2).

Attitude toward Exercise

This measure was taken directly from Crites (1994) and consists of three statements asking participants to assess their attitudes on a semantic differential (e.g., undesirable–desirable) toward exercise via a seven-point scale. The mean of the three statements represents the final measure for attitude towards exercise with lower numbers indicating a negative attitude toward exercise and higher numbers indicating a positive attitude toward exercise. Cronbach's alpha of 0.94 indicates high internal consistency for the measure. Correlations between the individual items and the overall score ranged from 0.92 to 0.95 (see Appendix Table 3-2).

Self-Efficacy

Two types of self-efficacy were measured in this study: task self-efficacy and maintenance self-efficacy. Task self-efficacy refers to an individual's confidence in his/her ability to perform the elemental aspects of an assignment (Rodgers, Hall, Blanchard, McAuley, & Munroe, 2002). In the present study, one question measured task self-efficacy. Borrowing from Bandura's (2006) principles for developing self-efficacy scales, participants were asked to rate their confidence level (on a scale of 1 to 5) in answer to the following: "On a scale of 1 to 5, please rate your confidence level in your ability to participate in a regular physical activity program over the next six weeks."

While it is expected that task self-efficacy is required to initiate exercise, signaling an intention to start exercising is not enough to maintain a long-term exercise

routine. Thus, a measure for maintenance self-efficacy was also utilized (Luszczynska & Schwarzer, 2003). Maintenance self-efficacy is defined as an individual's confidence in his/her ability to maintain a long-term behavior in the face of setbacks. Here, respondents used a five-point scale ranging from 1 ("not confident at all") to 5 ("very confident") to respond to six Likert-style statements (e.g., "I am confident that I can engage in exercise regularly over the next six weeks even if I cannot see any positive changes immediately") assessing their belief in their ability to maintain exercise behavior in the face of inclement weather, a lack of visible positive changes, and time-management issues. The mean of the six statements is a composite indicator of maintenance efficacy with lower scores indicating lower feelings of maintenance self-efficacy. Cronbach's alpha for maintenance self-efficacy was 0.82 (see Appendix Table 3-2).

Intrinsic Motivation

Intrinsic motivation was measured using the Intrinsic Motivation Inventory (IMI) (Teixeira, Carraça, Markland, Silva, & Ryan, 2012). The IMI is a multidimensional instrument which aims to assess participants' interest/enjoyment, perceived competence, effort, value, felt pressure and tension, perceived choice, and experience of relatedness in a given activity. The instrument used in this study was modified from the original version to only ask respondents about interest/enjoyment, competence, choice, and relatedness. Each dimension was measured by asking respondents to indicate their level of agreement with a series of Likert-style statements (e.g., "I enjoy exercise very much") using a seven-point scale ranging from 1 ("not true at all") to 7 ("very true"). Cronbach's alphas for the four IMI components ranged from 0.89 to 0.94, indicating high internal reliability

for the sub-scales. The individual items' correlations with the associated sub-scales all exceeded 0.75 (see Appendix Table 3-2).

The convergent validity of the IMI for our study participants was assessed using a factor analysis with a varimax orthogonal rotation. Factor analysis revealed four factors which explained 63.9% of the variance in the 16-item scale. The Cronbach's alphas for the seven factors ranged from 0.89 to 0.91, indicating high internal reliability (see Appendix Table 3-7). In addition to assessing the internal consistency, the correlations between the different factor scales with the overall IMI scales were found to be high (ranging from 0.85 to 0.93, $p<0.01$, see Appendix Table 3-8 for details). None of the correlations between the factors were found to be statistically significant, indicating satisfactory divergent validity of the scale. Lastly, criterion-related validity was assessed by calculating the correlation between weekly exercise score and the four subscales. Apart from the "Choice" factor, which was not statistically significant, the correlations were all statistically significant, positive, and generally moderate in magnitude (ranging from 0.03 to 0.28) (see Appendix Tables 3-7 & 3-8).

Action Planning/Control

Action planning was measured by having participants rate their level of agreement (ranging from 1 ("strongly disagree") to 5 ("strongly agree")) with three statements regarding the extent to which they plan their exercise (e.g., "Over a typical week, I have made a detailed plan regarding when to do my physical exercise") (Luszczynska & Schwarzer, 2003). Cronbach's alpha for action planning was 0.82. The individual items' correlations with their associated sub-scales ranged from 0.63 to 0.83 (see Appendix Table 3-2).

Action control was ascertained by having participants rate their level of agreement (ranging from 1 (“strongly disagree”) to 5 (“strongly agree”)) with six statements about how they have monitored their exercise habits over the past six weeks (e.g., “Over a typical week, I have monitored the amount of time and effort that I spent exercising”) (Sniehotta, Scholz, & Schwarzer, 2005). The mean of the items was taken to represent a final measure for action control. Cronbach’s alpha for action control was 0.88. The individual items’ correlations with their associated sub-scales ranged from 0.67 to 0.87 (see Appendix Table 3-2).

Benefits and Barriers

Exercise benefits and barriers were measured using an instrument developed by Sechrist (1987). The scale measures exercise benefits and barriers by having participants rate their level of agreement (ranging from 1 (“strongly disagree”) to 4 (“strongly agree”)) with 43 statements regarding their perception of the benefits (e.g., “Exercise increases my stamina”) and barriers (e.g., “My family members do not encourage me to exercise”) to exercise. The means of the items associated with benefits and barriers were taken to represent the final measures for perceived benefits and perceived barriers, respectively. The Cronbach’s alphas for exercise benefits and barriers were 0.85 and 0.81 respectively. The individual items’ correlations with their associated sub-scales ranged from 0.81 to 0.93 (see Appendix Table 3-2).

The convergent validity of Sechrist’s scale was assessed using a factor analysis with a varimax orthogonal rotation. Factor analysis revealed seven factors – three benefits and four barriers – which explained 35.9% of the variance in the 43-item scale. The Cronbach’s alphas for the seven factors ranged from 0.64 to 0.95, indicating

acceptable internal reliability. The correlation coefficients between the benefits and barriers ranged from -0.07 to 0.20, indicating acceptable divergent validity. Criterion-related validity was assessed by calculating the correlation between weekly exercise score and perceived benefits ($r=0.22$, $p<0.01$) and weekly exercise score and perceived barriers ($r=-0.14$, $p<0.01$). The direction, magnitude, and statistical significance of these correlations indicate meaningful criterion-related validity of the scale (see Appendix Tables 3-9 and 3-10).

Social Support

Social support for exercise was measured using three scales developed by Sallis et al. (1987). The three scales used identical items to assess the social support that our participants received from friends, family, and exercise companions. The scale worked by having participants rate how much social support they received from either friends, family members, or exercise companions on a scale of 1 ("never") to 5 ("very often"). For instance, one measure asked the respondent to: "Please rate how often any of your friends/family/exercise companions have said or done what is being described in the past six-weeks: Exercise with me." The means of the items associated with each mode indicated the degree of social support. The Cronbach's alphas for the family, friends, and exercise companion scales were 0.81, 0.82, and 0.94 respectively. Single item correlations with their associated scales ranged from 0.81 to 0.96 (see Appendix Table 3-2).

The convergent and discriminant validity of the social support scale for our study participants was assessed using a factor analysis with a varimax orthogonal rotation. Factor analysis revealed three factors – one factor for each type of social support – which

explained 67.9% of the variance in the 36-item scale. The Cronbach's alphas for the seven factors ranged from 0.81 to 0.92, indicating acceptable internal reliability (see Appendix Tables 3-11 and 3-12).

Intervention Procedure

To protect the confidentiality of its members, the fitness company supplied only the member IDs of those individuals who signed up for the study, rather than their names, email addresses, or any other personally identifiable intervention. The individuals were then randomly assigned into the treatment or control groups to create a total of six experimental sessions – one treatment and one control session for each of the three facilities.

Prior to attending their assigned sessions, the participants provided information regarding their exercise behavior and the other exercise-related psychosocial measures (see *Measures* section) using the online survey tool SurveyMonkey. All six sessions took place during the first week of February 2018, and each session lasted for approximately one hour. Each session was delivered by this researcher, under the supervision of one of the company's staff members.

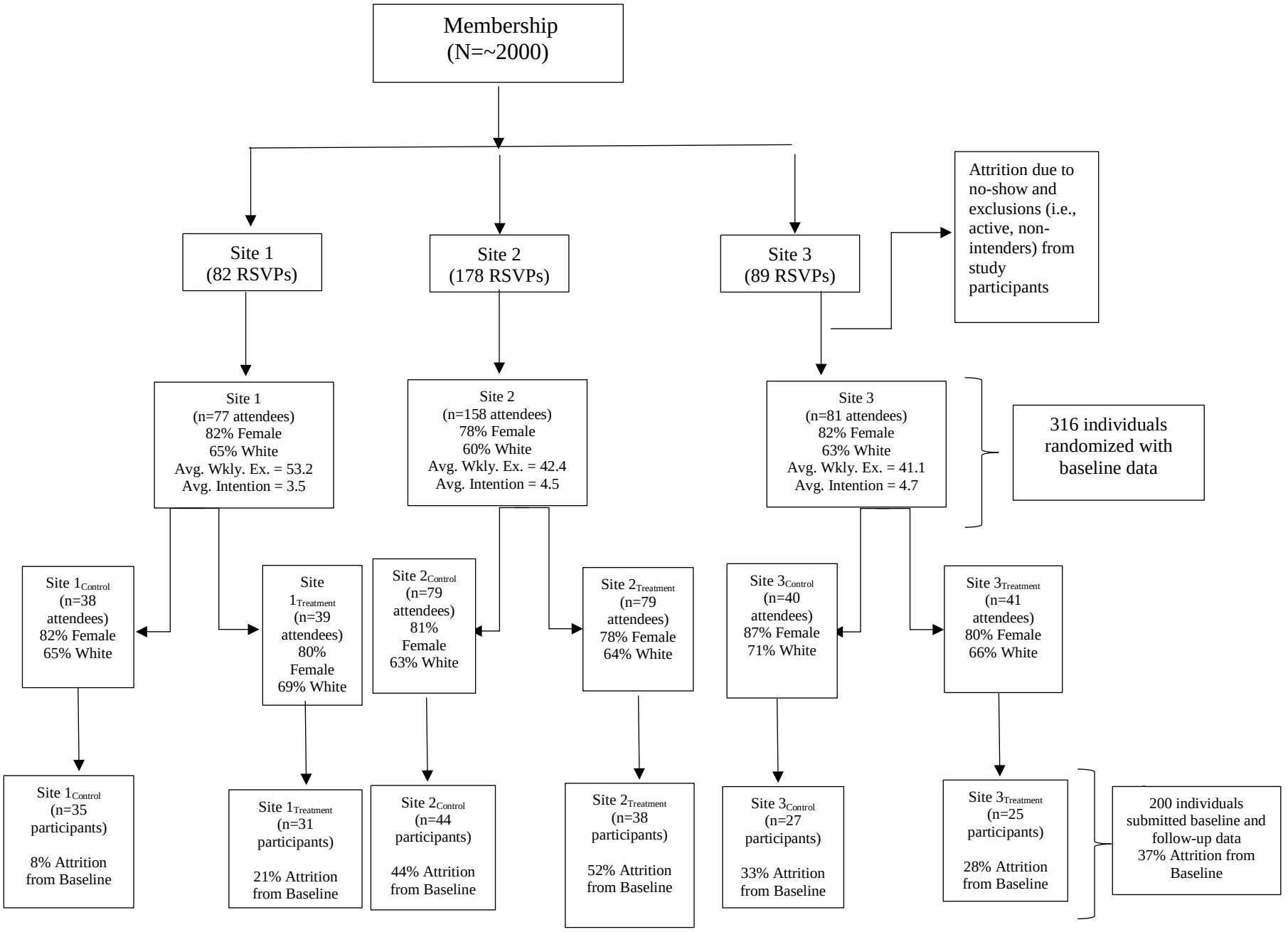
The six sessions were conducted in the same manner. When the participants arrived at their assigned location, they were greeted by this researcher and the staff member assigned to supervise the session. The participants then provided their informed consent and listened to a formal greeting and introduction by the company's staff member. The principle investigator then provided an overview of how we would spend the remaining time together. Specifically, the participants were told that they would be watching a four-minute video on which they would provide feedback before discussing a

handout related to exercise (see *Intervention Materials* section). The handouts used in the present study are provided in Appendix 2.

After hearing the evening's agenda, the participants were given an opportunity to ask questions and, should they choose, leave the workshop. The remaining participants viewed the video once and were provided with an opportunity to ask questions. After the video Q&A, the staff member then distributed the handout to the participants for their review and feedback. The handout portion of the session also lasted for about 10 minutes; this was then followed up by a brief 5-minute question and answer session. The participants in the treatment group then responded to a brief six-question survey that served as a manipulation check (see *Intervention Protocol* section, Table 3-2) to ensure the content of the video was properly received.

Six weeks after the experimental sessions were conducted, participants were emailed a second SurveyMonkey link and asked to provide information about their exercise behavior and exercise-related psychosocial information over the past six weeks. Figure 3-1 details the participants' recruitment and retainment throughout the experiment.

Figure 3-1: Participant Recruitment and Retainment, Study 2



Intervention Materials

The present research adopted many of Perry et al.'s (1993) recommendations for conducting a successful AR intervention when developing the intervention materials and protocol for this study. In particular, Perry et al.'s review suggested that: (1) one-time AR interventions were successful for studies involving older individuals (aged 18+), (2) efficacious interventions have used videotaped messaging, informational handouts, or a guided discussion with a facilitator (rather than individual sessions) to adjust maladaptive attributions, and (3) group settings can be effective environments when working with adults.

The materials for the treatment group were designed to encourage participants to attribute future exercise failure to *controllable and unstable* causes. This message was delivered through two mediums: a video and an informational handout. The video (see Appendix 4 for a description of the video) featured actors (the company's staff members) discussing the company and the services that it provides to its membership community. To stress the idea that exercise behavior is within an individual's control, the treatment group viewed three vignettes consisting of actors discussing how their frustration with their attempts to regularly exercise failed for reasons they felt were beyond their control (e.g., time management, family/social obligations, or dislike of exercise (McAuley et al., 1990; Minifee & McAuley, 1998; Schoeneman & Curry, 1990)). The vignettes then stressed how these barriers could be overcome by taking control of their exercise behavior. For instance, the actors discussed how time-management issues related to having too many work or family/social obligations could be overcome by creatively

incorporating exercise into their daily lives by arranging social events around exercise (e.g., playing basketball with friends rather than going to a bar, or exercising at a park with their children). In another vignette, the actors discussed how adopting self-regulation techniques (i.e., goal-setting, prioritizing, and self-monitoring) could help them take control of their exercise behavior even when they felt overwhelmed by other commitments.

The informational handout that was used in the intervention (see Appendix 2) also stressed that exercise behavior is controllable. The handout presented fictitious data suggesting that people who used self-regulation techniques tended to exercise more frequently and more consistently in comparison with people who did not use self-regulation, even when controlling for demands on their time. The handout also stressed that dislike of exercise – another common reason for physical inactivity – is temporary in nature and that consistent exercise can often lead to people developing an affinity towards exercise. Additionally, the handout contained several pairs of quotes in which statements about exercise failure containing maladaptive attributions were rewritten with an adaptive attributional focus. One quote, for instance, re-writes the statement "I dislike exercise and always have" (which could be considered an internal, uncontrollable, and stable cause for exercise failure) to: "I started out hating exercise, but after consistent participation, I started to dislike exercise less, and now I miss class when I can't attend."

To conduct a manipulation check, the present study adopted a commonly used procedure in AR interventions (Goncalo & Duguid, 2008; Weinberg, Hall, & Sverdlik, 2015). The participants were asked to answer five multiple-choice questions that were written to assess if they received the intervention's message. One such question, "My

exercise behavior is something I can control", was written to ensure that the participants had internalized the message that their exercise behavior is within their control, regardless of other obligations. Respondents would then rate their level of agreement with the statement on a scale of 1 ("completely disagree") to 5 ("completely agree"). The results for the manipulation check are presented in Table 3-2. The high mean scores for the manipulation check questions indicate that the treatment group participants understood the messaging of the presentation materials.

The control group also viewed a video message and received a handout (see Appendix 2). However, the control group's video featured only the portion of the video that provided general information about the company, its class descriptions, and biographies of the company's trainers. Moreover, instead of receiving the treatment group's handout, the control group was supplied with a handout detailing the same information seen in the video. Following the workshop, the participants were given the same set of manipulation check questions as did the control group. These results are also reported in table 3-2.

Table 3-2: Manipulation Check and Comparative Tests, Study Two (n=200)

Question	Control Group Mean (SD) N=106	Treatment Group Mean (SD) N=96	Statistical Significance
Based on what you heard in tonight's presentation, please rate your level of agreement (1=Strongly Disagree – 5=Strongly Agree) with the following:			
1) My exercise behavior is something I can control.	3.4 (0.6)	4.6 (0.3)	t(200)=18.2***
2) Self-regulation techniques such as prioritizing, time management, and self-monitoring can all help me become a more consistent exerciser.	1.3 (0.4)	4.2 (0.8)	t(200)=32.1***
3) Dislike of exercise is not permanent. In fact, the more I engage in exercise the more I learn to like it.	3.3 (0.7)	4.6 (0.2)	t(200)=18.2***
4) I can adjust my exercise routine if inclement weather inhibits me from engaging in my usual exercise routine.	2.9 (0.3)	4.1 (0.8)	t(200)=13.8***
5) The more I exercise, the more I develop exercise-related skills and knowledge.	3.2 (0.3)	4.7 (0.1)	t(200)=21.2***

***=p<.001

Analytical Procedure

The first research question concerned the effects of AR on an individual's attributional style. Specifically: do participants who undergo an AR intervention associate failure with more controllable and unstable attributions in comparison to a control group? This research question was answered by running two generalized linear models that used the target attributional dimensions of control and stability as the dependent variables, with the experimental group serving as the independent variable. Perceived outcome, the demographic variables, psycho-social constructs, and baseline attribution score served as covariates in the model.

The second research question, which is the crux of the study, investigated the effect of the AR intervention on perceptions of exercise behavior. Specifically, do participants who undergo an AR intervention perceive success in their subsequent exercise behavior to a greater extent than those participants who do not undergo an AR intervention? For this analysis, the participants' perceptions of success/failure with respect to exercise behavior were compared. Statistically, a z-test was used to compare the successful participants (as proportions of participants who perceived themselves as successful in their exercise behavior) in the treatment and control groups.

Results

Descriptive Statistics

Table 3-3 reports the means, standard deviations, and significance tests comparing the psycho-social constructs at baseline and follow-up, by the experimental group. The associated confidence intervals and effect sizes are presented in Appendix Table 3-13. Higher scores on the psycho-social constructs indicate that the participant had a relatively

strong association with that construct. High scores on the three attributional dimensions indicate that the participant tended to make internal, controllable, and stable attributions for his/her exercise behavior.

At baseline, statistically significant differences were found between the treatment and control groups in competence, relatedness, and barriers. The effect sizes associated with the differences in means for competence η^2=.014, 95% CI [0.02, 0.06], relatedness η^2=.035, 95% CI [0.02, 0.07], and perceived barriers η^2=.026, 95% CI [0.01, 0.08] are considered small (Kraemer & Thiemann, 1987).

At follow-up, 37% of the participants in the control group reported success in their exercise behavior (see *Measurements* section) in the past six weeks as compared to 46% of the treatment group. Statistically significant differences between the two groups were found for the control dimension with participants in the treatment group attributing their outcomes to more controllable causes than those in the control group. The effect size associated with this difference is small η^2=.022, 95% CI [0.01, 0.08]. The findings at follow-up indicate that while the intervention appears to have had a minor impact on the control dimension, this impact did not appear to be strong enough to change exercise behavior.

Table 3-3: Means, standard deviations for psychosocial constructs at baseline and follow-up, by experimental group (n=200)

	Baseline		Follow-Up	
Measure	Control (N=106) Mean (SD)	Treatment (N=94) Mean (SD)	Control (N=106) Mean (SD)	Treatment (N=94) Mean (SD)
% Perceiving Success in Exercise Behavior	0%	0%	37%+	46%+
Locus	16.67 (4.0)	15.88 (3.9)	20.23 (5.9)+	19.79 (6.2)+
Control	17.80 (4.3)	17.28 (4.1)	20.32 (6.7)+	22.23 (5.9)*+
Stability	11.30 (4.5)	11.42 (4.8)	13.75 (4.6)+	13.37 (5.5)+
Overall Affect	5.72 (3.2)	5.55 (2.9)	5.73 (3.4)	5.54 (2.8)
Exercise Efficacy	4.20 (1.0)	4.08 (1.1)	4.02 (0.6)	4.04 (0.6)
Task Efficacy	2.93(0.1)	2.94 (1.2)	3.92 (1.2)+	3.97 (1.1)
Maintenance Efficacy	3.53 (0.9)	3.44 (0.7)	3.36 (0.8)	3.39 (0.8)
Enjoyment	4.23 (1.1)	4.21 (1.1)	4.55 (0.9)+	4.50 (0.8)+
Choice	3.95 (1.2)	4.08 (1.3)	3.95 (0.9)	3.89 (0.9)
Competence	4.09 (0.9)	3.87 (0.81)*	4.30 (1.0)	4.23 (0.9)+
Relatedness	4.07 (1.1)	4.48 (1.0)*	4.37 (1.1)+	4.45 (1.0)
Planning	3.49 (0.7)	3.51 (0.8)	3.25 (0.6)+	3.18 (0.6)+
Awareness	3.20 (0.9)	3.34 (0.9)	3.16 (0.9)	3.22 (1.1)
Perceived Barriers	1.94 (0.4)	1.80 (0.5)*	1.59 (0.4)+	1.51 (0.4)+
Perceived Benefits	3.12 (0.4)	3.16 (0.4)	2.99 (0.3)+	3.05 (0.3)+
Social Support – Family	2.09 (1.0)	2.35 (1.3)	2.07 (1.0)+	2.28 (1.6)+
Social Support – Friends	1.04 (0.5)	0.96 (0.5)	0.97 (0.5)+	0.68 (0.9)+
Social Support – Ex.Comp.	2.25 (1.5)	2.3 (1.1)	2.26 (1.0)	2.15 (0.9)

*Statistically significant difference between experimental groups, $p<0.05$
+Statistically significant difference from corresponding baseline score, $p<0.05$

Table 3-3 also reports the results of the t-tests comparing the differences in the mean scores for the psycho-social constructs between baseline and follow-up. Participants in both groups made more internal, controllable, and stable attributions for their exercise behavior at follow-up than they did at baseline. Participants in both groups also reported increases in their enjoyment of exercise from baseline to follow-up. All the participants reported decreases in their perceptions of barriers to exercise, benefits of exercise, and exercise social support from their friends and family from baseline to follow-up. See Appendix-Table 3-13 for the confidence intervals and effect sizes associated with these differences.

Table 3-3a reports changes from baseline to follow-up in the participants' mean scores for the attributional dimensions, aggregated by experimental group. The data presented in Table 3-3a provide some evidence for the effectiveness of the AR intervention. Recall that the AR intervention targeted the control and stability dimensions by encouraging the participants in the treatment group to attribute their exercise failure to controllable and unstable causes. Table 3-3a shows that, for the control dimension, the increase in the treatment group's mean score from baseline to follow-up is greater than the mean score change for the corresponding control group. This finding indicates that the AR intervention appears to have had some success in reorienting the treatment group's control attribution. For the stability dimension, if the AR intervention was successful, the treatment group participants would have reported increasingly unstable causes for their failures. The data do not support this trend as the treatment group participants reported increasingly stable attributions (albeit to a lesser extent than the control group participants) for their exercise behavior between baseline and follow-up.

Table 3-3a: Confidence Intervals and Effect Sizes for Mean Differences Between Baseline and Follow-Up for Attributions, by Experimental Group (n=200)

	Control Group (N=106)		Treatment Group (N=94)		
Attributional Dimension	Δ Mean Score (SD) (95% CI)	Effect Size (95% CI)	Δ Mean Score (SD) (95% CI)	Effect Size (95% CI)	Difference in Effect Size (Treatment – Control)
Locus	3.63 (0.7) (2.2, 4.9)	0.70 (0.3,0.9)	3.91 (0.7) (2.4, 5.4)	0.75 (0.3, 0.9)	0.05
Control	2.52 (0.8) (1.0, 4.0)	0.44 (0.1,0.6)	4.95 (0.7) (3.5, 6.4)	0.97 (0.5,1.4)	0.53
Stability	2.45 (0.6) (1.2, 3.7)	0.54 (0.2,0.7)	1.95 (0.7) (0.6, 3.3)	0.37 (0.1,0.8)	-0.17

While looking at the mean score differences between baseline and follow-up is instructive, aggregating the means by perceived outcome and experimental group can

indicate if the intended AR message was internalized by the treatment group participants. If the AR message was internalized, then the unsuccessful participants in the treatment group should attribute their exercise failure to controllable and unstable causes to a greater extent than the unsuccessful participants in the control group.

Table 3-4 displays the means and standard deviations for the attributional dimensions by perceived outcome and experimental group at follow-up. The table reports that the only statistically significant difference regarding the attributional dimensions for the unsuccessful participants was observed in the locus dimension. Specifically, unsuccessful participants in the treatment group attributed their outcomes to external factors more so than the control group participants, $F(1,198)=2.22$, $p=0.044$, 95% CI [0.53, 3.82]; the associated effect size, however, is small, $\eta^2=.019$, 95% CI [0.01, 0.04]. Since locus was not one of the dimensions targeted in the intervention, this tendency appears to have happened without treatment. The successful participants who were exposed to the AR intervention attributed their success to controllable factors to a greater extent than the participants in the control group $F(1,198)=2.61$, $p=0.041$, 95% CI [0.53, 5.14]. The effect size associated with the F-test ($\eta^2=.031$, 95% CI [0.02, 0.06]) is considered small.

Table 3-4: Means, Standard Deviations for Three Attributional Dimensions at Follow-Up, by Perceived Outcome (n=200)

	Successful		Unsuccessful	
	Control (N=40)	Treatment (N=44)	Control (N=66)	Treatment (N=50)
Measure	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Locus	18.74 (6.5)	20.13 (6.0)	21.14 (5.4)	19.49 (6.5)*
Control	21.62 (7.1)	23.92 (5.9)*	19.53 (6.4)	20.75 (5.6)
Stability	13.14 (4.7)	12.86 (5.7)	14.11 (4.5)	13.83 (5.3)

Higher scores indicate a tendency toward internal/controllable/stable attributions

*Significant at p<.05 level

Linear Modeling Results

It is possible to control for the participants' attributional scores at baseline, psycho-social constructs, and demographics if the data are analyzed using linear models rather than just making mean comparisons. Appendix Table 3-14 reports the correlations between the psycho-social and outcome variables, none of which were statistically significant. The control and stability dimension scores measured at follow-up served as the dependent variables and the experimental group membership and perceived outcome served as the primary independent variable. The baseline score for the attributional dimensions was included in the model as a covariate. For the control dimension, the linear model revealed that the three predictors explained ~7% of the variance at follow-up (R^2=0.07, F(3,199)=5.41, p<.01). When controlling for perceived outcome and baseline score, the experimental group membership significantly predicted control attributions at follow-up ($\hat{\beta}$=0.14, p=.04) with the treatment group participants (M=22.24, SD=5.95) attributing their outcomes to controllable factors more so than participants in the control group (M=20.32, SD=6.71). Perceived outcome ($\hat{\beta}$=0.20, p<.01) and participants' baseline control score ($\hat{\beta}$=0.12, p=.05) also predicted the control dimension at follow-up with successful participants (M=22.82, SD=6.60) attributing their outcome to controllable causes more so than unsuccessful participants (M=20.06, SD=6.06). The interaction between experimental group and perceived outcome was not found to be statistically significant (p=0.54). As no other effects were significant, they are not presented here. The results of the modeling analysis indicate that the AR intervention was able to encourage the treatment group participants to make controllable attributions for their exercise behavior to a greater extent than those in the control group. However, the

non-significant interaction term indicates that the specific hypothesis associated with the first research question, that the unsuccessful participants in the treatment group would attribute their failure to controllable causes, was not supported by the data.

The results for the stability dimension are not presented as neither the overall model nor any of the predictors (i.e., perceived outcome, experimental group, or the other psycho-social constructs) were found to be statistically significant.

Effects of Attribution Retraining on Exercise Behavior

The second research question addressed the hypothesis that those participants who undergo an AR intervention would perceive themselves to be more successful in their exercise behavior than the participants in the control group. The data did not support the hypothesis that the intervention would have a positive effect, as the z-test used to compare the number of successful participants in the treatment (p=47%, SD=0.5) and control groups (p=38%, SD=0.5) did not differ significantly from one another ($Z(198) = 1.43$, $p=0.157$).

Discussion

The purpose of this study was to determine if a one-time AR intervention delivered in a group setting could successfully adjust maladaptive attributions for failure and lead to more exercise behavior. The study utilized a pre-test/post-test randomized control trial with a sample of 200 sedentary participants. The main hypotheses associated with the second study were that: (1) participants who underwent an AR intervention would attribute their future exercise failure to controllable and stable causes to a greater extent than those participants who did not receive the AR intervention, and (2) participants who underwent an AR intervention would perceive success in their exercise

behavior more so than participants who did not receive the AR intervention. The principle findings from the study were that: (1) when controlling for baseline score (attributions) and perceived outcome, participants in the treatment group attributed their outcomes to controllable causes more so than those in the control group, and (2) despite these increases in attributions of control, the AR intervention did not yield statistically significant increases in the number of successful participants in relation to the control group. Thus, while the AR appears to have successfully adjusted the control attributions, the data do not fully support either of the hypotheses.

Since the population of interest for this study was exercise intenders who may or may not act on this intention (i.e., bridge or fall into the intention-behavior (I-B) gap), attribution theory – which seeks to understand the perceived causes for an individual's success or failure in a behavior– was used as the theoretical framework to better understand why some individuals are unsuccessful in their exercise behavior. Additionally, since AR is a well-established intervention technique that is rooted in attribution theory (Heller & Ziegler, 1996; Rascle et al., 2008), it seemed reasonable to expect that this type of intervention would successfully encourage exercise behavior among intenders by manipulating their attributions. Because of the prior successes that AR interventions have had in other domains, the present study's mixed results were somewhat surprising.

The study's results demonstrate that it is possible to adjust the causal attributions of exercise intenders in the direction of the intended attributional messaging after only one feedback session. Therefore, the study results can be used by exercise practitioners when discussing with their clients the causes of their failures. Practitioners could help

their clients work through the control-related cognitions associated with exercise failure to encourage their clients to persevere in their exercise regimes even after a failure. Practitioners should encourage their clients to interpret the causes of their exercise failures as within their control and therefore surmountable. The intervention materials that were developed in support of this study could be used by practitioners to encourage these attributional styles. Specifically, distributing the information handouts to new clients would be a quick, cost-effective method to encourage adaptive attributional styles. Furthermore, new clients may be hesitant to spend their time viewing a video of vignettes about other people's exercise issues, irrespective of the vignette's salience to their own exercise issues. Informational handouts can always be reviewed by an individual on his/her own time or even quickly read in the presence of a practitioner who can answer a client's questions.

However, despite the AR intervention's success in adjusting attributions, these effects do not appear to have impacted the participants' actual exercise behavior. One possible reason for the AR intervention's ineffectiveness may be that the attributional make-up of the study participants was not conducive to an adjustment. In other AR studies, the participants were either new to the task at hand or were making (or susceptible to making) maladaptive attributions for their failure. For instance, in Wilson and Linville's (1982) study, the participants were college freshmen who were new to the rigors of higher learning and therefore susceptible to making maladaptive attributions (e.g., "I'm not smart enough for college"); in the basketball dribbling study (Orbach et al., 1997), the participants were young children who had no prior experience with dribbling a basketball; the Sarkasian (2007) study recruited participants who were

transitioning to later stages in life and might therefore have been susceptible to making maladaptive attributions about aging and what one is capable of doing when advancing in age. Given that ~90% of the present study's participants had made at least one prior attempt to maintain a regular exercise routine (see Table 3-1) and their baseline attributions were already trending toward adaptive (see Table 3-3), this study's sample may not have been ideal for testing the effectiveness of the AR intervention.

The obvious solution to this issue would be to recruit participants who are currently making maladaptive attributions for exercise failure. A second option would be to utilize a study design where the participants' attributions for failure are manipulated by the researcher. In these types of studies, the researcher would manipulate the participants' attributional style towards either maladaptive or adaptive attributions and then measure the impact on future exercise behavior (Legette, 1993; Orbach et al., 1997; Rascle et al., 2008). This type of study design, however, would require participants who did not have any preconceived notions about exercise and who would be susceptible to suggestions from a researcher on how to attribute exercise failure.

It is also likely that the frequency of intervention occasions impacted the results of the intervention. While the purpose of this study was to investigate the effects of a one-time intervention, future studies should investigate the efficacy of delivering the intervention message multiple times rather than just once. Even though Perry et al.'s (1993) review suggested that one-time AR interventions can be effective, it is possible that exercise encouragement requires delivering the AR message multiple times because exercise is a demanding behavior. Indeed, prior reviews of physical-activity interventions indicate that interventions which run for longer than just one session are effective in

increasing physical-activity behavior in the short term (Bij, Laurant, & Wensing, 2002; Conroy et al., 2017; Foster, Hillsdon, Thorogood, Kaur, & Wedatilake, 2005).

The size of the treatment group might also have negatively affected the results of the intervention. While Perry et al.'s review suggested AR interventions could be delivered in large group settings, other AR interventions have been delivered in smaller groups or even on an individual level (Robertson, 2000; Stewart et al., 2009). In an exercise environment where personal training is the dominant relationship between practitioners and clients, it might be effective to deliver messaging in a one-on-one environment. Ideally, a trainer/client relationship might be the most effective setting within which to reorient attributions, as a trainer can provide personalized, frequent guidance to a client on how best to think about failure (Abu-Omar et al., 2017; Bij et al., 2002; Heath et al., 2012). Since the costs associated with hiring a personal trainer can be prohibitive, and because small group (i.e., 3-4 people) interventions have been shown to be cost-effective (Roux et al., 2008), it would seem useful to test intervention effects in small groups.

Conclusions and Discussion

Summary

The present study was designed to investigate the causal attributions of exercise intenders. Two studies directed the investigation. The first study was guided by four analyses that were designed to explore several facets of the causal attributions of exercise intenders. The first analysis compared the causal attributions of those participants who were able to bridge the I-B gap (i.e., successful participants) with those participants who failed to bridge the gap (i.e., unsuccessful participants). The second analysis tested whether Weiner's (1985) model predicted exercise-related affect and cognitions on a sample of exercise intenders. The third analysis tested the moderating effects of causal attributions on the I-B relationship. Finally, the fourth analysis integrated a causal attribution construct into the well-established, intention-based model, the Theory of Planned Behavior (TPB). The second study tested the utility of a one-time attribution retraining (AR) intervention on a sample of sedentary individuals who had recently signaled an intention to begin exercising.

Neither of the two hypotheses associated with the first analysis were supported by the data. The first hypothesis – that those participants who fell into the I-B gap would make more maladaptive attributions for their behavior than successful participants – was not supported because the unsuccessful participants exhibited a self-serving attributional pattern (i.e., unstable, environmental attributions) for their failure, which is considered adaptive (Blaine & Crocker, 1993). The second hypothesis – that the unsuccessful participants would *not* exhibit a personal-changeability attributional tendency was also

not supported. While it was predicted and confirmed by the data that the unsuccessful participants would not exhibit a personal changeability attributional pattern, the hypothesis was not supported because the unsuccessful participants made an adaptive attributional pattern rather than the predicted maladaptive pattern.

The hypotheses associated with the second analysis were largely supported. Weiner's model was accurate in predicting that successful participants would experience more positive emotions (i.e., competence and pride) than unsuccessful participants and that unsuccessful participants would experience more shame than those participants who were successful. In terms of the attribution-dependent affective reactions, the hypotheses related to competence and shame were confirmed. The data also supported the hypothesis that participants who attributed their failure to controllable causes would experience increased feelings of anger over those participants who attributed their failure to uncontrollable causes. Lastly, the hypothesis predicting that those who attributed their success to stable factors would have higher expectations of success in their future exercise behavior than those who attributed success to unstable factors was also confirmed.

The data did not confirm the hypotheses associated with the third and fourth analyses. For the third analysis, none of the three attributional dimensions moderated the I-B gap. Similarly, for the fourth analysis, none of the three models that included a causal dimension construct fit the observed data better than the established TPB model. Additionally, the relationship between the causal attribution dimension and exercise behavior was significant only for the model including a control dimension.

The hypotheses associated with the second study were largely unsupported. The first hypothesis predicted that an AR intervention would encourage participants to make more adaptive attributions (i.e., controllable and unstable) for their failure in comparison to a control group. While the intervention appears to have successfully encouraged participants to make controllable attributions for their behavior, the stability dimension was unaffected by the AR. The second hypothesis – that participants in the treatment group would perceive success in their exercise behavior to a greater extent than participants in the control group – was unsupported. Thus, overall the AR intervention was not effective in changing exercise behavior by attributions.

Discussion

While the medical community and other health practitioners have identified several behaviors that promote good health (e.g., brushing one's teeth twice a day, engaging in 150 minutes of exercise per week), more work is needed to successfully encourage people to engage in healthy behaviors. Even those individuals with strong intentions to adopt or change a behavior can fail in their efforts; this is commonly referred to as the I-B gap. Despite the existence of the I-B gap, behavioral intention remains a valuable construct that is often used in theoretical models as a precursor to behavior (Ajzen, 1985; Miniard & Cohen, 1983). Thus, rather than dismissing the utility of intention as predictor of behavior altogether, a preferable strategy is to identify other constructs and/or theories that can explain why some individuals are able to translate their intentions into behavior. The present research was designed to investigate if a person's causal attributions influence exercise behavior. Because exercise intenders will either succeed or fail in their efforts to exercise, Weiner's (1985) attribution theory

showed promise as a theoretical framework to guide this research. The theory suggests that how a person perceives the cause of an outcome can directly impact future enactment of the behavior. Therefore, according to the theory, if an exercise intender's attributional style regarding his/her prior exercise behavior is considered adaptive, it should promote future exercise behavior.

The first analysis conducted for Study One measured and compared the causal attributions between exercise intenders who were able to bridge the I-B gap against intenders who were unable to do so. The findings from this analysis deepen our understanding of exercise intenders in two ways. First, as expected, the data indicated that the causal attributions differed between successful and unsuccessful exercise intenders. Because of these attributional differences, it was somewhat surprising that the attributions did not prove to be effective moderators of the I-B gap. Given this finding, in future analyses, rather than test the attributions individually, researchers could test *combinations* of the different attributions. Essentially, future tests could seek to determine if different *attributional styles* can effectively moderate the I-B gap. Second, the results from the first analysis also showed that the causal attributions for the unsuccessful participants varied depending on *why* they were unsuccessful (i.e., never started an exercise program or stopped exercising soon after starting). This finding has practical implications for developing AR interventions for exercise intenders. Table 2-4 showed that unsuccessful participants made self-serving attributions for their behavior, which are considered adaptive and therefore not susceptible to an AR intervention. However, recall that when the unsuccessful participants were split into two failure groups (see Table 2-6) the data showed that those participants who never started a program made

internal, controllable, and unstable attributions for their behavior – an attributional pattern that would appear to be ripe for adjusting through AR (e.g., an AR intervention that encourages participants to attribute their failure to external and unstable causes). Thus, by breaking the unsuccessful participants into two groups, a potential intervention strategy for exercise intenders becomes apparent.

The AR intervention from the second study appears to have successfully educated and retrained participants to reorient control attributions so that they should have, at least in theory, facilitated actual changes in exercise behavior. And while the AR intervention failed to change actual exercise behavior, this result may be a reflection on how difficult it is to get people to exercise regularly rather than an indication that attributions do not affect exercise behavior temporarily (Adams & White, 2003; Bij et al., 2002; Conroy et al., 2017). Put another way, if practitioners want to use AR to change behavior, it might be more prudent to deliver the AR message through multiple sessions in a small group or in a one-on-one setting rather than through a large workshop.

Collectively, the two studies indicate that the control dimension warrants further attention as a construct that may play a role in explaining the I-B relationship. There were two findings from the studies that led to this conclusion: (1) in the first study's fourth analysis, the only statistically significant effect occurred relative to the control attribution and (2) the AR intervention was able to effectively encourage the participants to attribute their behavior to controllable causes. That the control attribution was significant is not surprising given that action-control is a known moderator of the I-B gap (Sniehotta et al., 2005). Consequently, one could view the control dimension as the cognitive representation of the act of engaging in action-control-related activities and use it in

theoretical models that explain motivation or models that include both motivational and volitional stages (Schwarzer, 2001). In addition, because the AR intervention was able to adjust the control dimension, it appears to be a modifiable construct to target when developing exercise interventions, particularly for exercise intenders or those in the beginning stages of an exercise program. When discussing with clients the reasons for their inactivity, exercise practitioners could stress to their clients that exercise behavior is within their control. Practitioners could review their clients' causes for inactivity and suggest attributions that could facilitate exercise behavior.

Knowing that Weiner's model accurately predicted several affective and cognitive responses in exercise intenders, a natural extension of this research would be to investigate how to use these relationships to encourage exercise behavior. Recall attribution theory's contention that individuals who attribute success to internal causes experience feelings of competence. This proposition is consistent with another well-known theory of motivation: self-determination theory (Deci & Ryan, 1985). Self-determination theory proposes that competence is one of three factors (along with autonomy and relatedness) that fosters intrinsic motivation. Therefore, by encouraging individuals to attribute exercise success to internal causes (e.g., effort), people should feel an increased sense of competence about their behavior and thereby become more intrinsically motivated to exercise. Similarly, another usable finding for practitioners is that attributing success to stable factors yielded increased confidence in engaging in exercise in the future. Specifically, practitioners could avoid stressing unstable causes for success in exercise (e.g., attending a terminal exercise class, working with an expensive trainer) that might reduce future expectations for exercise and subsequent motivation.

Rather, by encouraging stable attributions for success, people will believe that their success is repeatable and will therefore become encouraged to continue exercising.

While not necessarily a limitation to the study, any future work on the attributional process, or any future study that investigates the psycho-social constructs related to exercise, could include somatic variables. By including such variables investigators would be able to see how attributions are impacted by an individual's physiological responses to exercise. Exercise is an activity that can cause varied levels of physical discomfort to people who engage in it. This physical discomfort may impact individuals' attributions in different ways. For instance, an individual whose exercise behavior causes him/her to rapidly tire may interpret such fatigue as an uncontrollable cause for his/her failure. However, without measuring exercise-related fatigue, it is difficult to see if such somatic variables are related to attributions. Individuals can exercise at different levels of intensity, and it is reasonable to think that these levels of intensity might have an impact their attributions. Intensity might also function as a valuable covariate in future analyses. Since people's perceptions of intensity could contribute to their exercise success/failure (e.g., novice exercisers who exercise at a higher intensity might be more likely to experience failures than those exercising at a lower intensity), incorporating exercise intensity as a control variable could provide valuable information on the relationship between attributions and exercise behavior.

There are threats to external validity in both studies. The participants for the first study were recruited from Amazon TurkPrime's panel of respondents. While the panel provides a reasonable cross-section of individuals within the United States from which to survey, the obvious limitation is that only individuals with internet access and who are

members of TurkPrime's panel would be available to be sampled for the study. In the second study, it is difficult to make the case that the results are generalizable to a larger population because the participant pool was drawn from a specific company's membership, which is skewed towards financially well-off, highly educated individuals who are not representative of the United States population. It is worth noting, in addition, that the second study's sample was heavily skewed towards female participants. Nevertheless, both studies have ecological validity in that they were conducted on real life individuals and not on college students. In particular, the participants recruited for the second study were members of a real-life exercise facility.

The primary threat to internal validity of the first study is the risk that the respondents could be filling out several hundred online surveys per day in order to make money rather than contribute to science (Bentley, Daskalova, & White, 2017). To mitigate this risk, several survey questions were reverse-coded to ensure that the respondents were actively answering the questions rather than just randomly selecting responses. The high Cronbach's alpha coefficients and single-item correlations did not indicate a substantial risk of low-quality data.

The second study has numerous threats to internal validity that are worth addressing. First, because the study was conducted in a real-word rather than in a controlled setting, there was ample opportunity for the participants to have different exercise experiences between baseline and follow-up data collection. The participants, for instance, could have exercised with a personal trainer, attended exercise classes, or exercised on their own. This risk, however, is mitigated by the instrument used to collect the participants' causal attributions. Specifically, the CDS-II instructed the participants to

provide their own outcome assessment (i.e., successful or unsuccessful), the cause of the outcome, and classification of this cause on the three dimensions irrespective of the specific type exercise the participants may have chosen to engage in. The attributional dimensions are used as variables in the subsequent analyses rather than the raw outcome cause or any other element unique to any one participant. Thus, the risk of different exercise experiences affecting the results is relatively small.

The second threat to internal validity worth mentioning is that the participants could have spoken to trainers and/or other staff members about the purpose of the study. While the staff members who were involved in the intervention were instructed to avoid discussing the purpose of the study with their clients, it is possible that the staff shared the goals of the study with their clients, which therefore may have impacted their responses on the follow-up survey. Third, repeated testing, especially considering the manipulation check questions, may have impacted the results. The participants may have deduced that the purpose of the experiment was to convince participants that their exercise behavior was controllable and answered the follow-up survey accordingly, thus inflating the effect that the AR intervention had on the control attribution. Fourth, although the manipulation check provided evidence that the participants internalized the attributional manipulation, it is possible that the participants accurately assessed the content of the AR materials without fully internalizing the content. There are two reasons, however, that suggest the manipulation was successful: first, the findings of the second study suggest that the control attribution was manipulated in the intended direction which in and of itself provides evidence that the control attribution was internalized; second, consistent with Goncalo and Duguid's suggestion (2008), the

experiment was based on attribution theory and prior research that has previously demonstrated that attributions are pliable. Goncalo and Duguid (2008) emphasize that causal attributions can be manipulated by cues (i.e., AR) that the actor will continue to consider as he/she encounters similar behaviors in the future.

Conclusions and Suggestions for Future Research

The goal of this research was to investigate if attribution theory could explain exercise behavior amongst exercise intenders. The theory largely supported the attribution-independent emotional responses to exercise behavior (see Figure 1-2, see page 10), and there was evidence supporting the model's predictions for the attribution-dependent affective and cognitive reactions to exercise behavior. The question of whether a person's attributional style leads to future exercise is less clear. There is some evidence resulting from this research to suggest that specific attributional styles did lead to further attempts at exercise. Specifically, at time 1, the study participants, who were all exercise intenders, attributed their prior exercise failure to internal, controllable, and unstable causes, which is considered an adaptive attribution for failure and did lead to further attempts at exercise. However, when considering the theory and the attribution retraining (AR) intervention together, the evidence is less clear. First, 54% of the first study's participants reported success in their exercise behavior at the end of the study period; this rate is generally in line with other reported success rates of exercise intenders irrespective of their attributional style. If making adaptive attributions led to increased exercise behavior, then the participants would have reported a higher success rate in their exercise behavior. Additionally, the results of the first study's third and fourth analyses and the entire second study provided little support for the explanatory power of

attributions for actual exercise behavior. It appears that while causal attributions can explain the cognitive and emotional reactions to exercise, the results showed limited changes in actual exercise behavior.

This lack of support for the theory's utility in encouraging exercise behavior is less of an indictment of the theory than an indication of how difficult it is to get people to bridge the intention-behavior gap. Because inactivity it is a well-known societal problem (Iso-Ahola, 2018), countless initiatives have been developed to encourage people to exercise. Despite these efforts, the exercise community has yet to identify a construct or intervention that guarantees exercise adherence. Thus, future exercise research should focus on one of two tracts: (1) the integration of different theories and (2) developing interventions that focus on shifting exercise behavior from conscious to non-conscious processes. Because attributions represent conscious deliberations, their influence may be limited to the beginning stages of exercise behavior, suggesting that attributions themselves will become nonconscious and automatic with repeated exercise, and as such will facilitate exercise adherence in the long run.

The first tract focuses on exercise research through the integration of different theoretical perspectives to generate new models to explain exercise behavior. These new models would then empirically be tested to determine if they show any improvement over the existing ones. A promising new area for research is how people process information in general, more specifically how exercise-related cognitions are processed consciously and nonconsciously (Iso-Ahola, 2017, 2018).

The second tract focuses on making exercise habitual rather than a deliberate act. It is generally accepted that people who can maintain an exercise program for five weeks

(Armitage, 2005) without a lapse hold increased odds of maintaining their exercise behavior over time. Unfortunately, getting people to consistently exercise for five consecutive weeks is not a trivial problem. Towards this end, Iso-Ahola (2017, 2018) has proposed a model suggesting that becoming a regular exerciser results from an individual moving from consciously processing exercise to non-conscious processing where exercise behavior is driven by situational cues. This transition of exercise behavior from conscious to non-conscious behavior is done in three stages: the first stage is characterized by the exerciser having to fully consciously process his/her exercise behavior (e.g., "should I" or "should I not"?), while he/she engages in minimal exercise; the second stage blends both conscious and nonconscious processing, and he/she is now occasionally exercising; in the third stage, the individual's exercise is largely guided by non-conscious processing and becomes fully or nearly automatic.

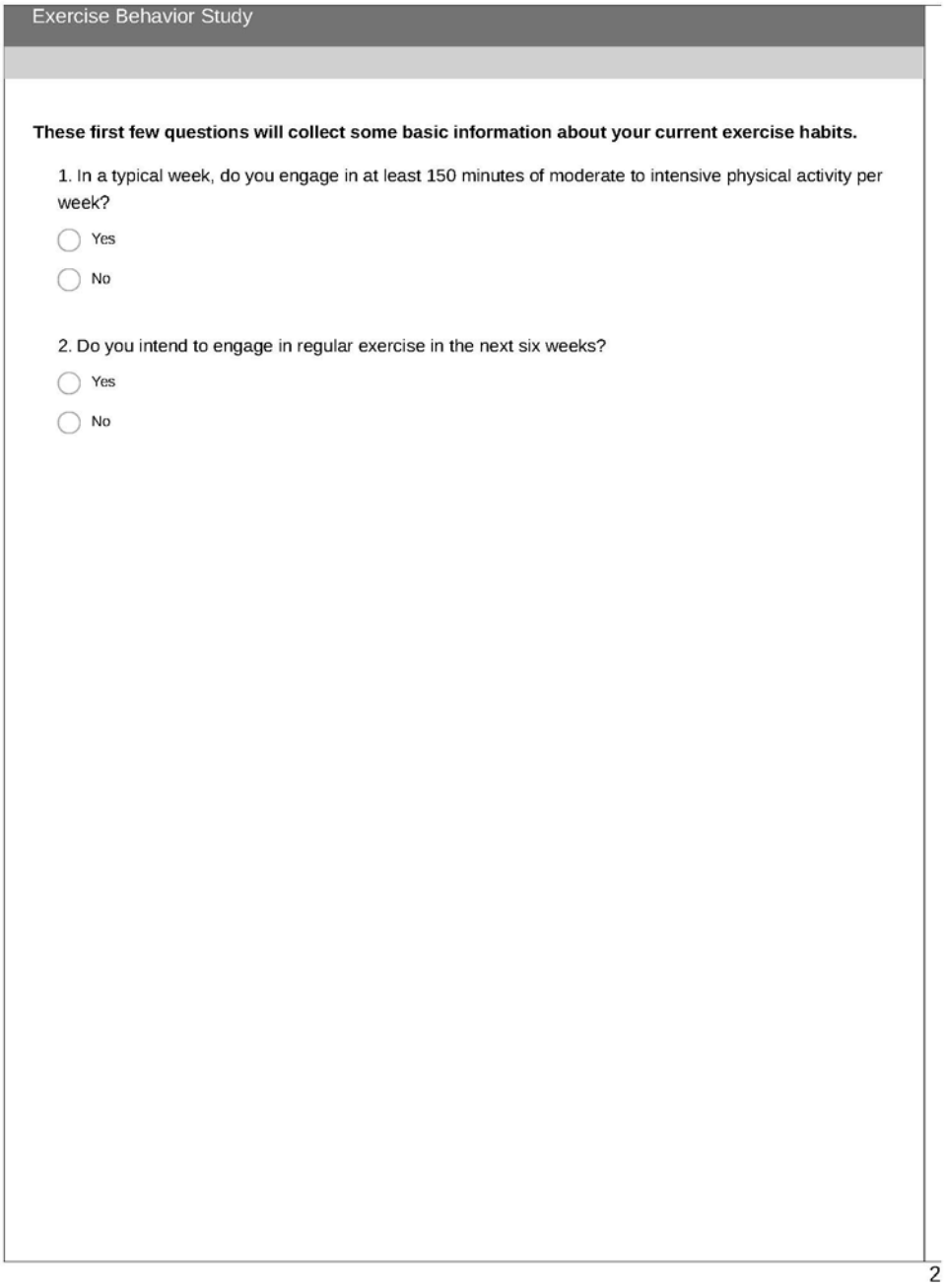
Using the Iso-Ahola model, practitioners should focus their efforts on moving their clients from one stage to the next. The model proposes that in the first stage, where conscious processing is dominant, people should devote time to developing an exercise infrastructure where participants seek to understand the *when*, *where*, *how*, and *with whom* components of exercise. It is reasonable to think that attributions could contribute to the infrastructure either by themselves or in concert with the implementation intentions that Iso-Ahola (2017, 2018) suggests are at the core of one's exercise infrastructure. Consider, for instance, a person who attributes his/her exercise failure to a lack of time which he/she considers to be an uncontrollable and stable cause. Knowing that lack of time is the primary cause for exercise failure, this person could

be consciously alert for opportunities to exercise that do not take a significant amount of time from his daily routine (e.g., climb stairs when possible, ride a bike home rather than take a cab). Similarly, a person who attributes his/her exercise failure to family obligations (which are considered by the person to be controllable and stable) could further refine his/her infrastructure by developing an implementation intention (the *how*) to help fit exercise into family-related demands rather than using them as an excuse. While these suggestions would need to be tested empirically, the idea of using attributions in concert with other interventions in the first stage has some face validity and should be further explored.

It has been found that implementation intentions are more effective than other psychological means in getting people to exercise in the initial stages of exercise engagement (Gollwitzer, 1999). At the same time, it is also known that implementation intentions themselves rapidly become nonconscious and automatic (Bargh, 2017; Iso-Ahola 2018). Thus, implementation intentions are both a conscious and nonconscious tool that plays a critical role in facilitating regular exercise. Sustained exercise is possible only when the cue-behavior link becomes sufficiently strong and automatic. Thus, the intention-behavior gap cannot be eliminated by conscious means, such as causal attribution interventions. Yet, these interventions can play an important role in the early stages of exercise programs.

Appendix One: Data Collection Instrument, Studies 1 and 2

Appendix one presents the data collection instrument that was used for both studies at T1. An almost identical instrument was used for T2; the only difference was that for the T2 instrument, respondents were instructed to report information on their exercise behavior and other associated constructs over the study period rather than "over a typical week".


Exercise Behavior Study

These first few questions will collect some basic information about your current exercise habits.

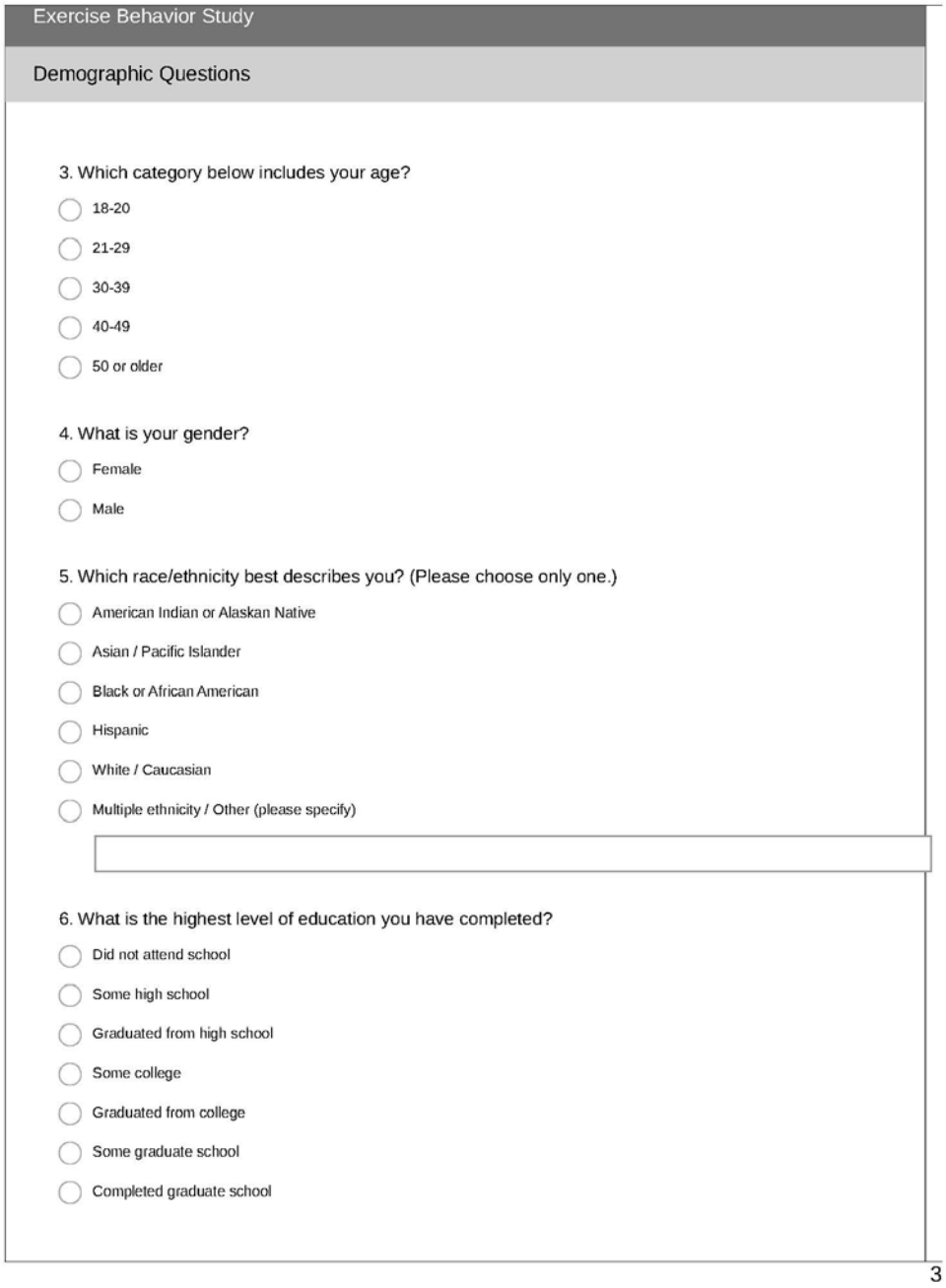
1. In a typical week, do you engage in at least 150 minutes of moderate to intensive physical activity per week?

- ◯ Yes
- ◯ No

2. Do you intend to engage in regular exercise in the next six weeks?

- ◯ Yes
- ◯ No

2



Exercise Behavior Study

Demographic Questions

3. Which category below includes your age?

- 18-20
- 21-29
- 30-39
- 40-49
- 50 or older

4. What is your gender?

- Female
- Male

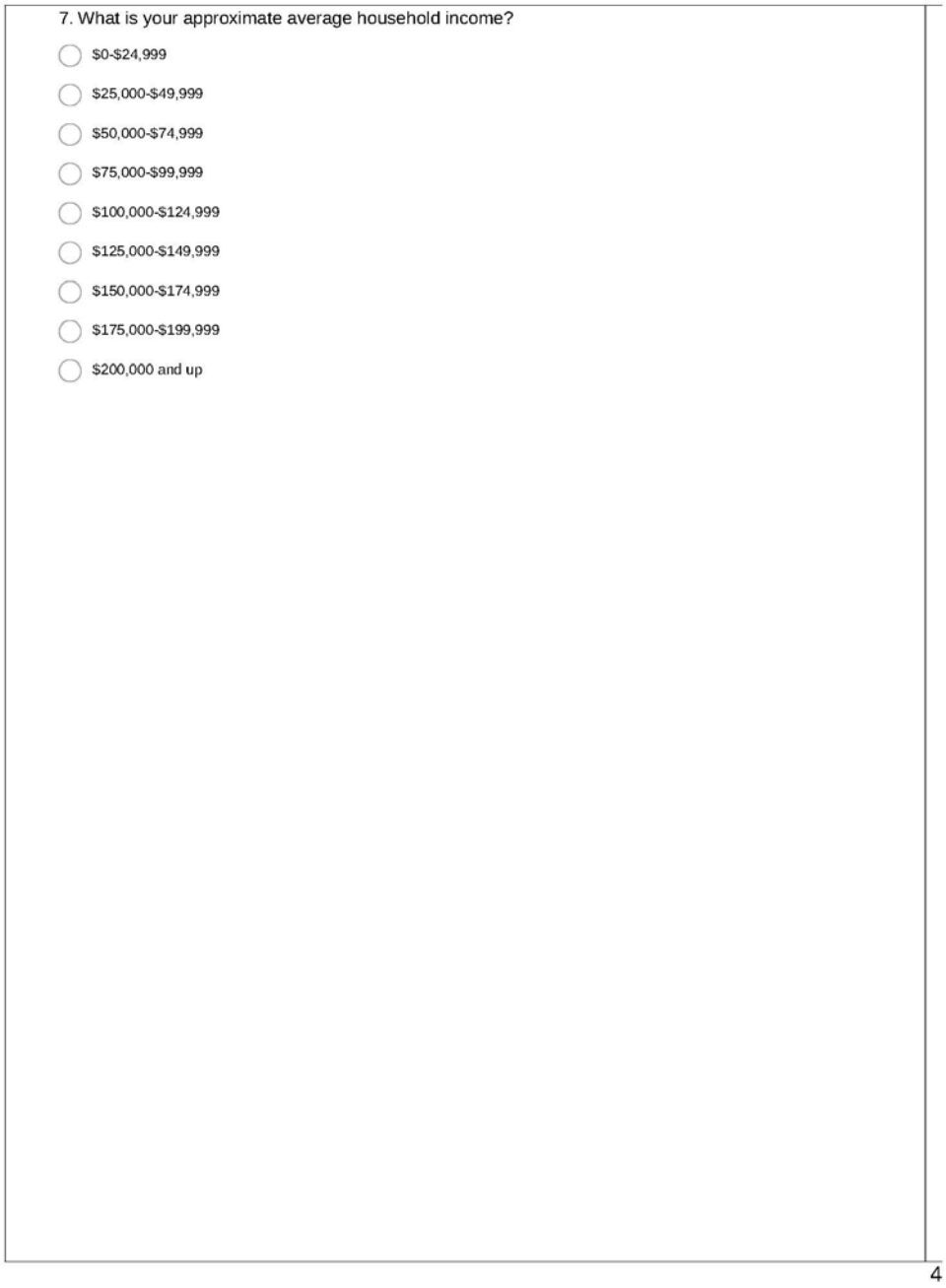
5. Which race/ethnicity best describes you? (Please choose only one.)

- American Indian or Alaskan Native
- Asian / Pacific Islander
- Black or African American
- Hispanic
- White / Caucasian
- Multiple ethnicity / Other (please specify)

6. What is the highest level of education you have completed?

- Did not attend school
- Some high school
- Graduated from high school
- Some college
- Graduated from college
- Some graduate school
- Completed graduate school

3


7. What is your approximate average household income?
$0-$24,999
$25,000-$49,999
$50,000-$74,999
$75,000-$99,999
$100,000-$124,999
$125,000-$149,999
$150,000-$174,999
$175,000-$199,999
$200,000 and up
4

Exercise Behavior Study

* 8. Considering a 7-day period (one week), how many times on the average do you do the following kinds of exercise for more than 15 minutes during your free time (write on each line the appropriate number)?

Strenuous exercise (i.e. running, jogging, hockey, football, soccer, squash, long distance biking)

Moderate exercise (i.e. fast walking, baseball, tennis, volleyball, easy swimming, easy biking)

Mild exercise (i.e. yoga, archery, bowling, golf, easy walking)

9. In the past year, approximately how many times have you intended to begin an exercise program, yet failed to start or maintain an exercise routine?

- 0
- 1-3
- 4-6
- 7+

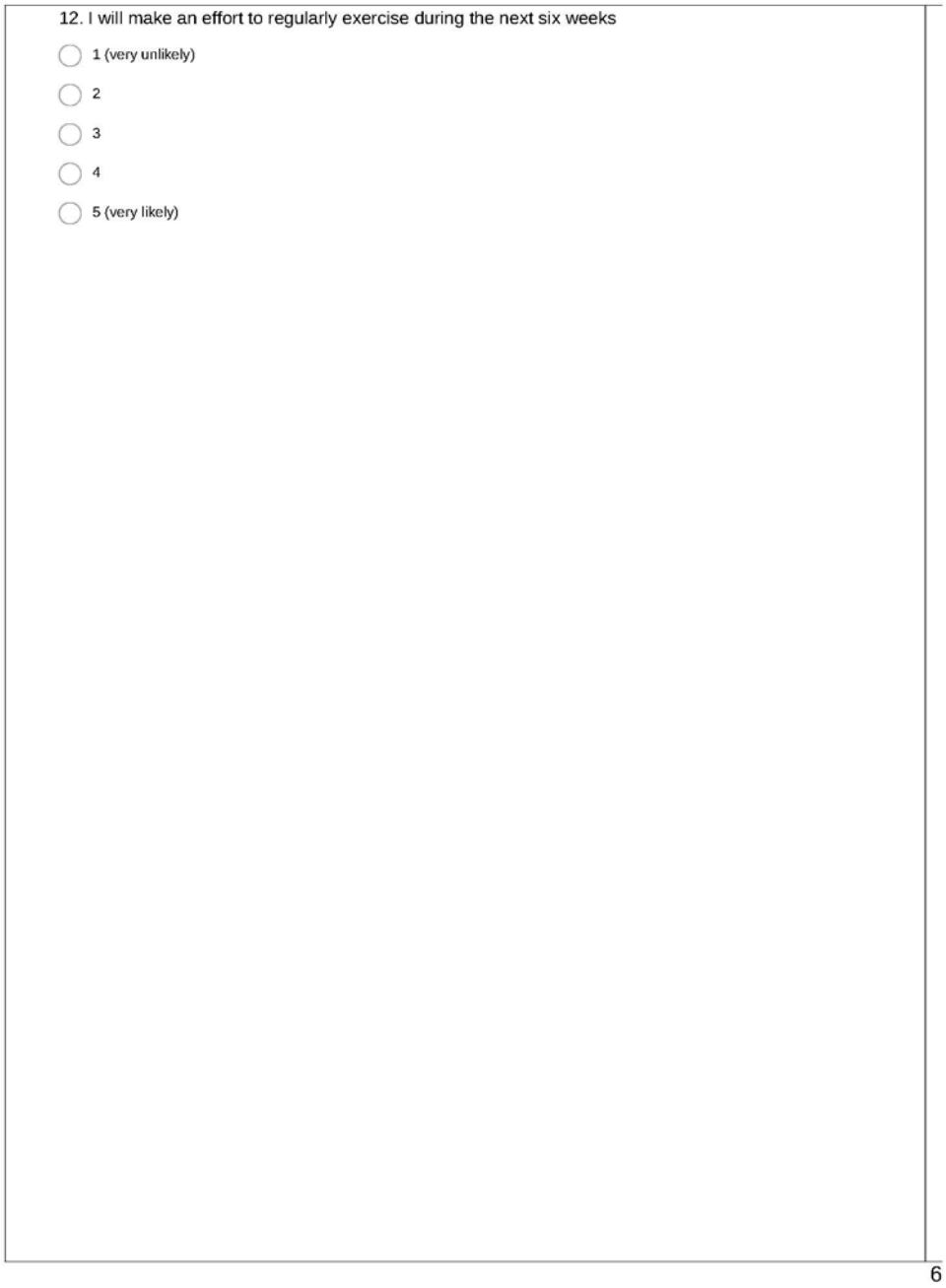
10. I intend to begin regularly exercising during the next six weeks

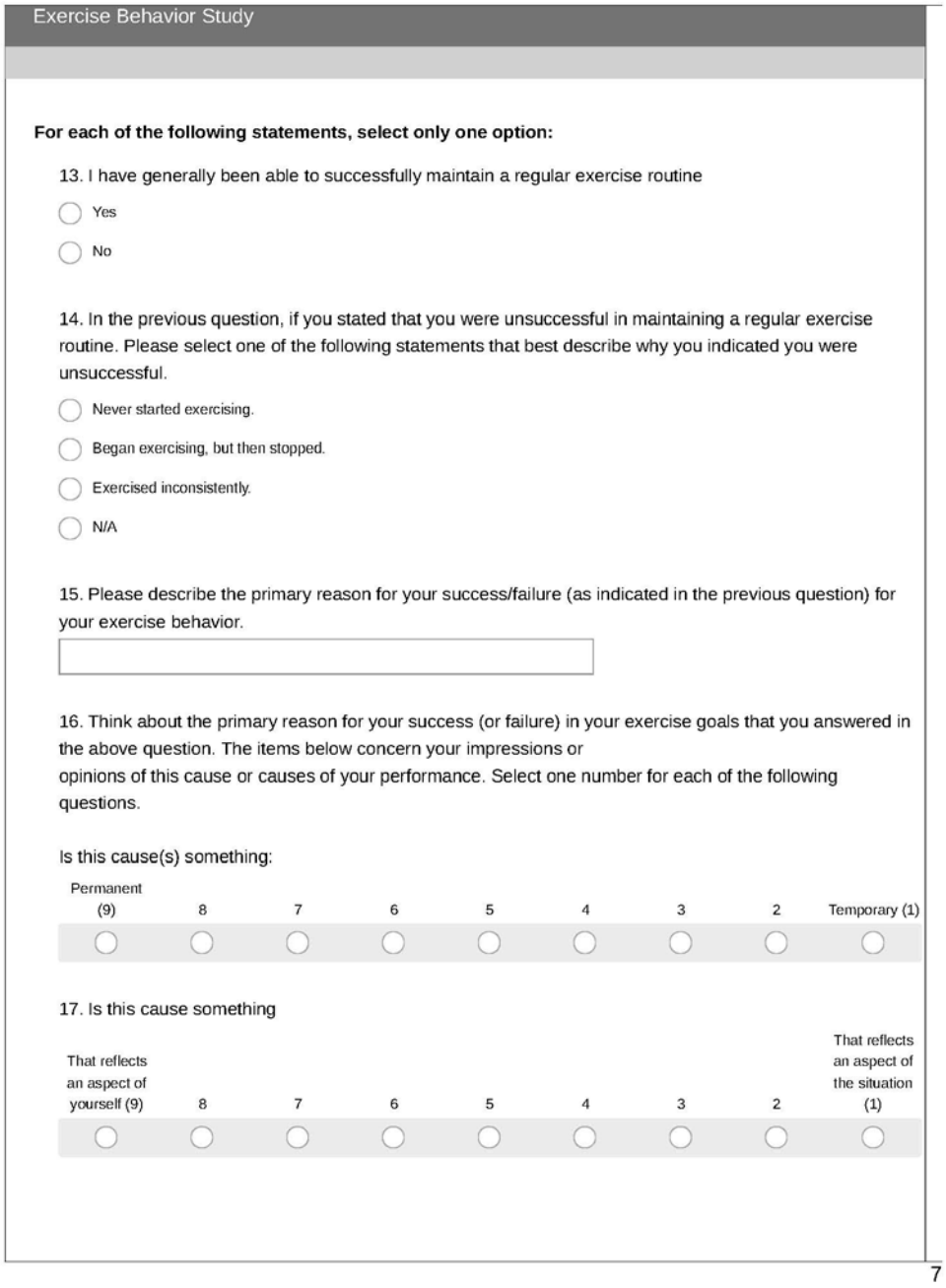
- 1 (very unlikely)
- 2
- 3
- 4
- 5 (very likely)

11. I will attempt to regularly exercise during the next six weeks

- 1 (very unlikely)
- 2
- 3
- 4
- 5 (very likely)

5


12. I will make an effort to regularly exercise during the next six weeks
1 (very unlikely)
2
3
4
5 (very likely)
6



Exercise Behavior Study

For each of the following statements, select only one option:

13. I have generally been able to successfully maintain a regular exercise routine

- ◯ Yes
- ◯ No

14. In the previous question, if you stated that you were unsuccessful in maintaining a regular exercise routine. Please select one of the following statements that best describe why you indicated you were unsuccessful.

- ◯ Never started exercising.
- ◯ Began exercising, but then stopped.
- ◯ Exercised inconsistently.
- ◯ N/A

15. Please describe the primary reason for your success/failure (as indicated in the previous question) for your exercise behavior.

16. Think about the primary reason for your success (or failure) in your exercise goals that you answered in the above question. The items below concern your impressions or opinions of this cause or causes of your performance. Select one number for each of the following questions.

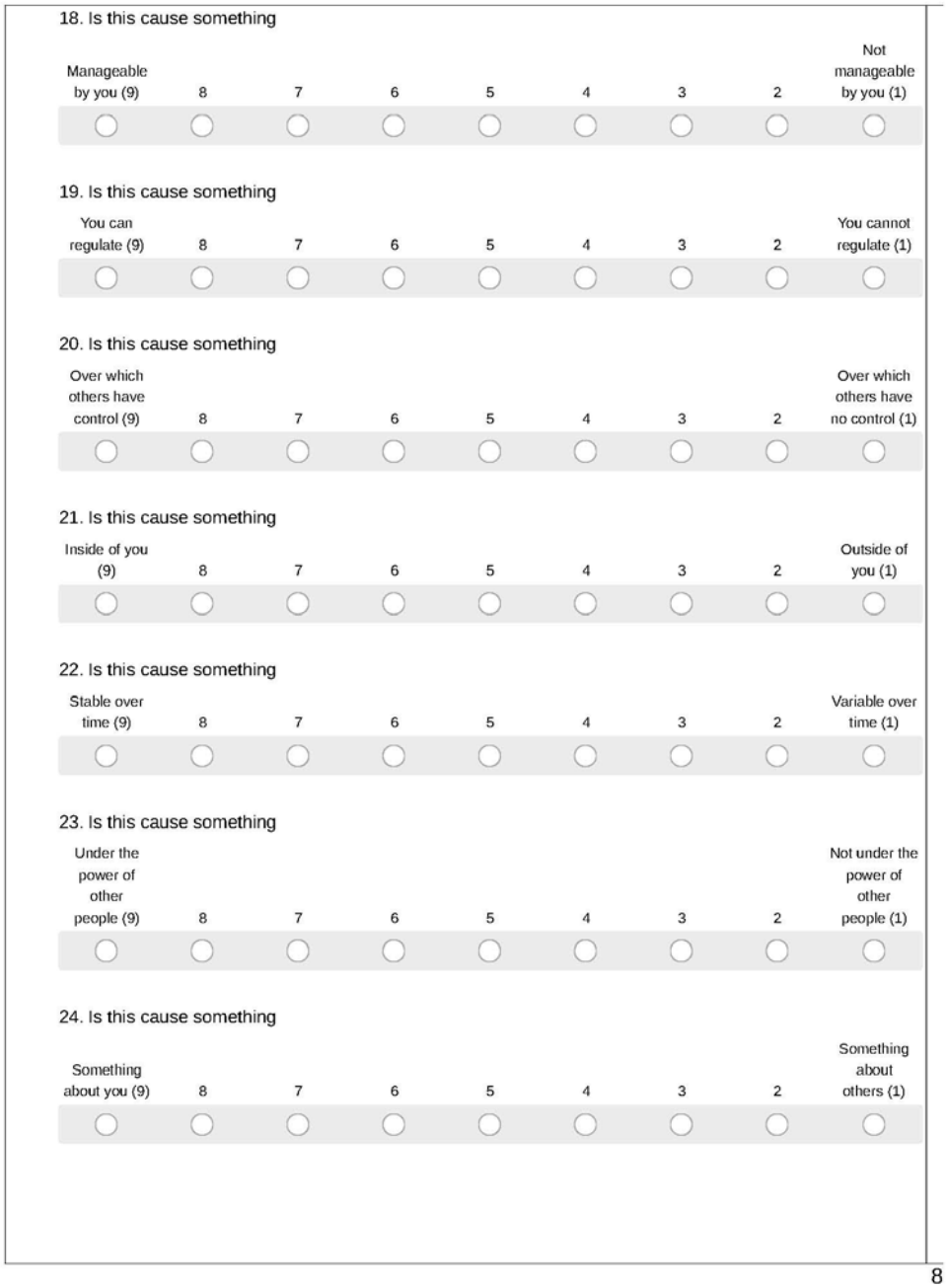
Is this cause(s) something:

Permanent (9)	8	7	6	5	4	3	2	Temporary (1)
◯	◯	◯	◯	◯	◯	◯	◯	◯

17. Is this cause something

That reflects an aspect of yourself (9)	8	7	6	5	4	3	2	That reflects an aspect of the situation (1)
◯	◯	◯	◯	◯	◯	◯	◯	◯

7



18. Is this cause something

Manageable by you (9)	8	7	6	5	4	3	2	Not manageable by you (1)
○	○	○	○	○	○	○	○	○

19. Is this cause something

You can regulate (9)	8	7	6	5	4	3	2	You cannot regulate (1)
○	○	○	○	○	○	○	○	○

20. Is this cause something

Over which others have control (9)	8	7	6	5	4	3	2	Over which others have no control (1)
○	○	○	○	○	○	○	○	○

21. Is this cause something

Inside of you (9)	8	7	6	5	4	3	2	Outside of you (1)
○	○	○	○	○	○	○	○	○

22. Is this cause something

Stable over time (9)	8	7	6	5	4	3	2	Variable over time (1)
○	○	○	○	○	○	○	○	○

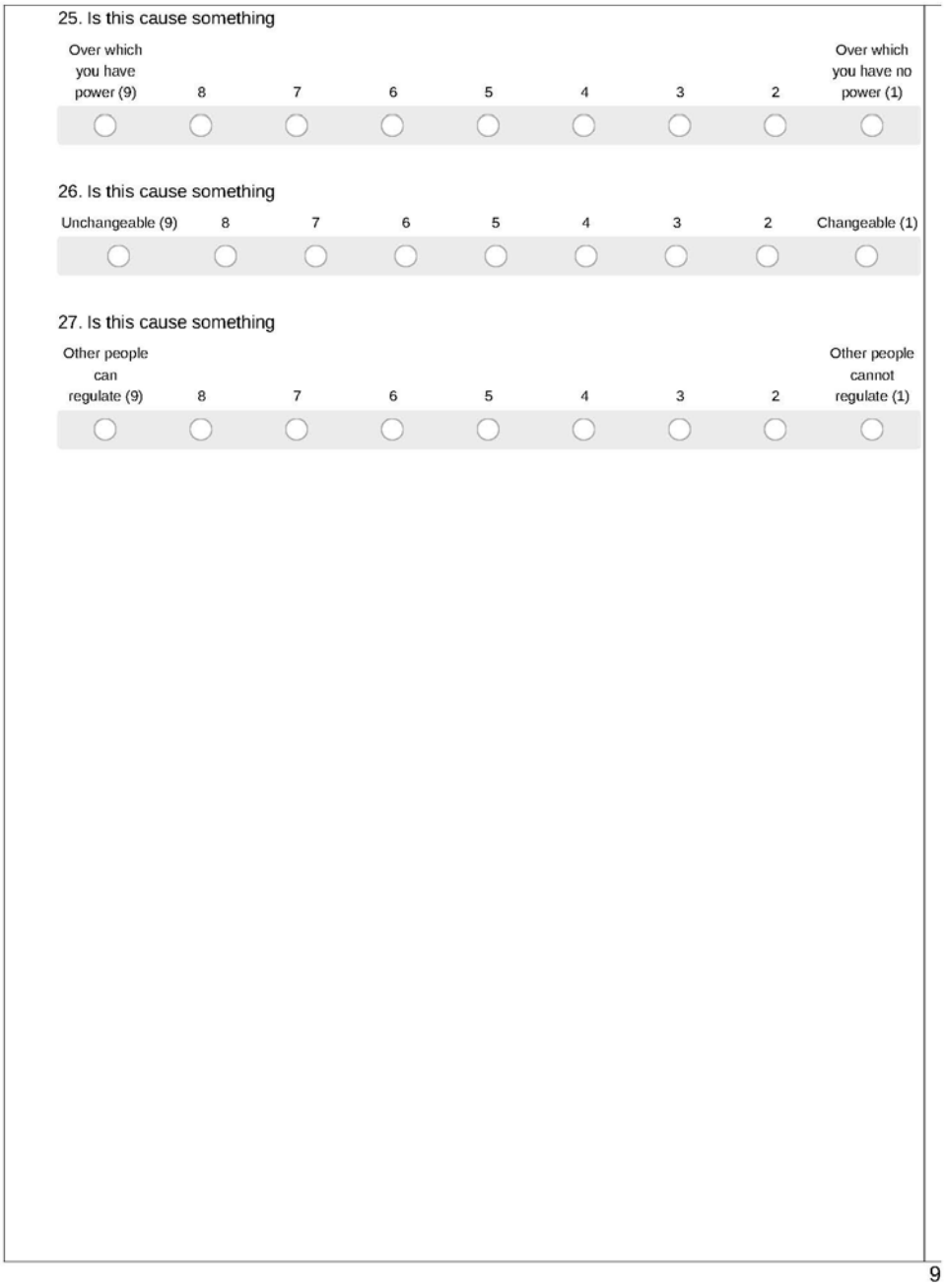
23. Is this cause something

Under the power of other people (9)	8	7	6	5	4	3	2	Not under the power of other people (1)
○	○	○	○	○	○	○	○	○

24. Is this cause something

Something about you (9)	8	7	6	5	4	3	2	Something about others (1)
○	○	○	○	○	○	○	○	○

8



25. Is this cause something

Over which you have power (9)	8	7	6	5	4	3	2	Over which you have no power (1)
○	○	○	○	○	○	○	○	○

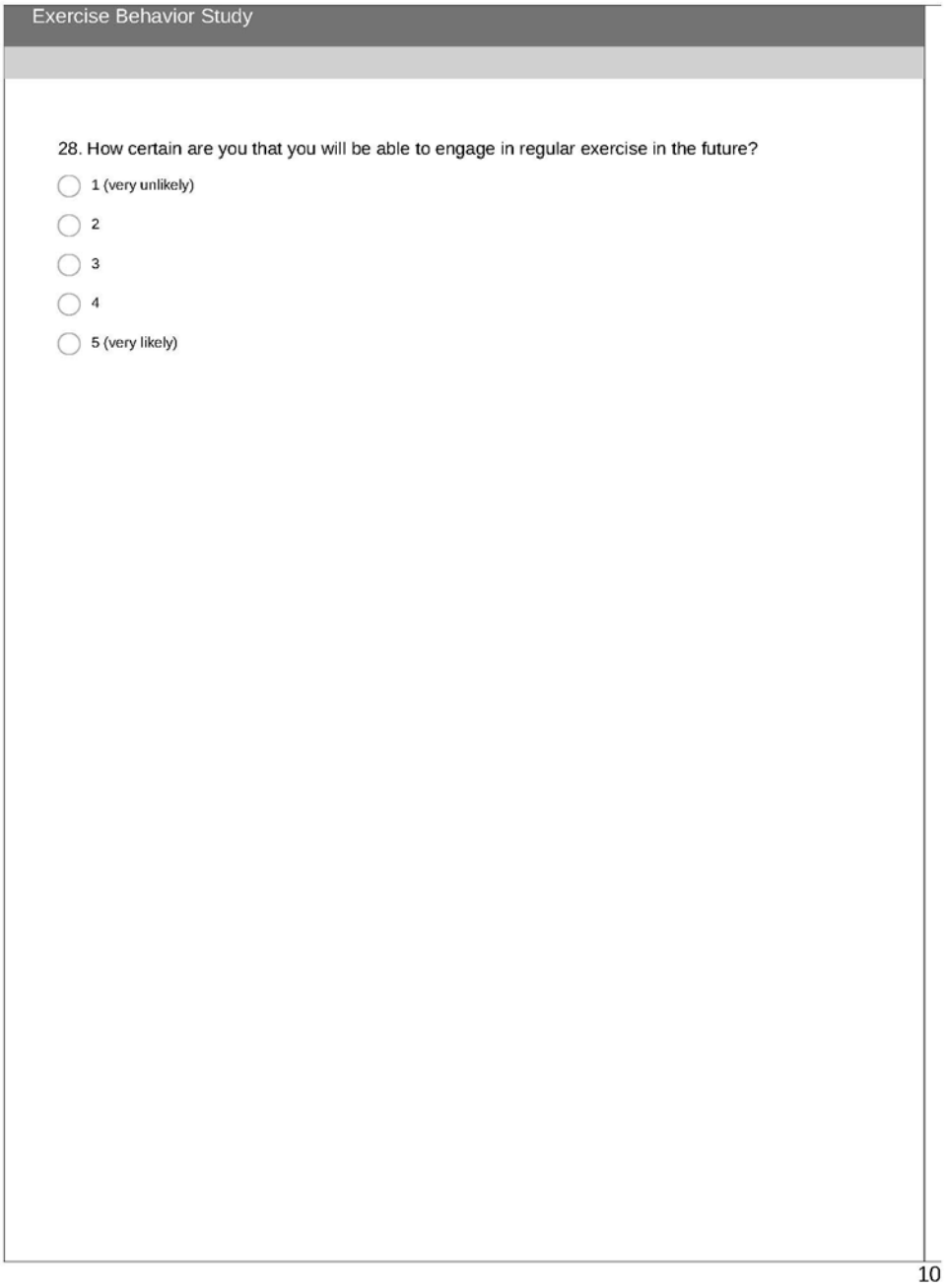
26. Is this cause something

Unchangeable (9)	8	7	6	5	4	3	2	Changeable (1)
○	○	○	○	○	○	○	○	○

27. Is this cause something

Other people can regulate (9)	8	7	6	5	4	3	2	Other people cannot regulate (1)
○	○	○	○	○	○	○	○	○

9

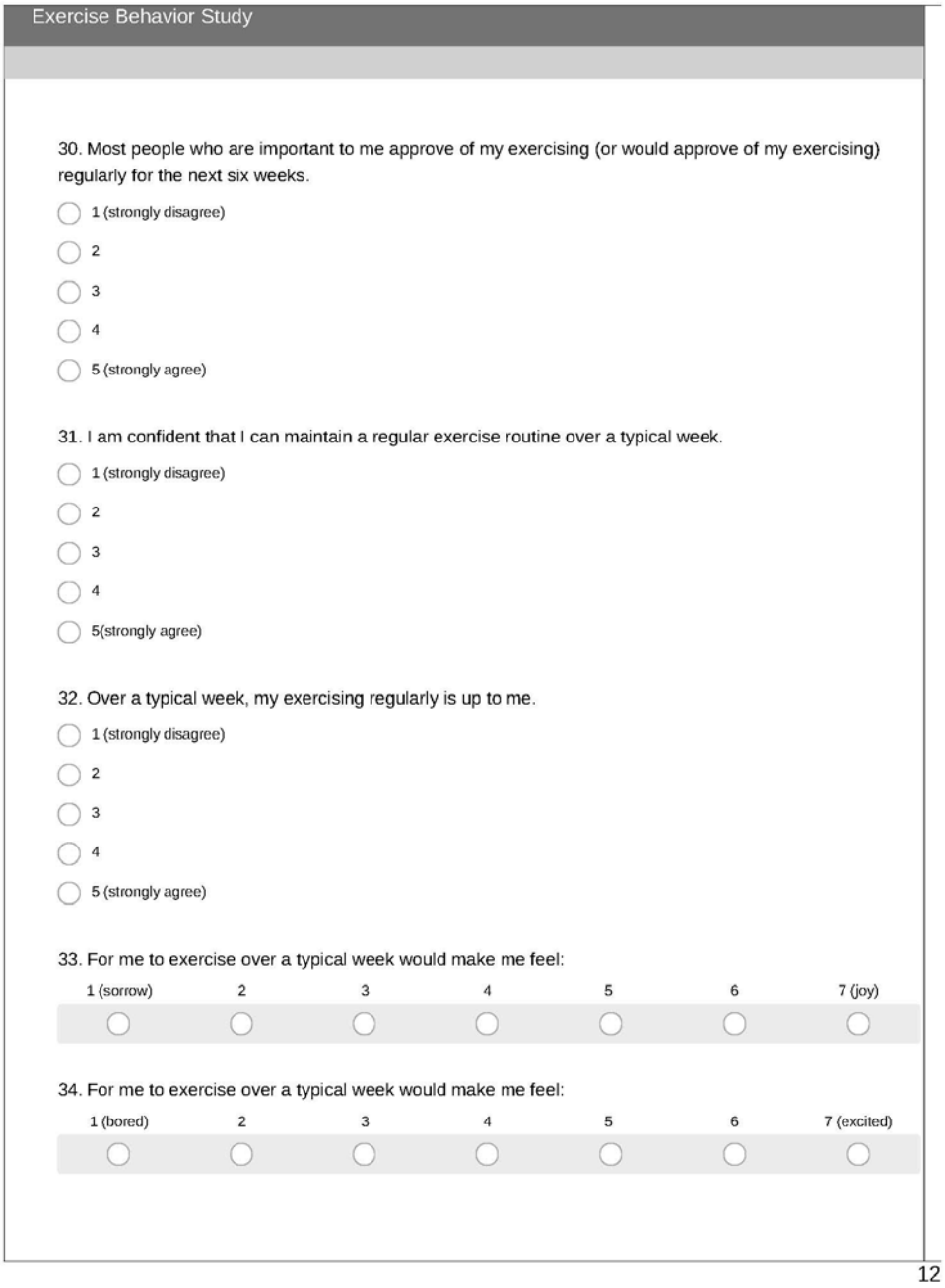

Exercise Behavior Study
28. How certain are you that you will be able to engage in regular exercise in the future?
1 (very unlikely)
2
3
4
5 (very likely)
10

Exercise Behavior Study

29. Instructions: Please indicate the extent to which you experience each of the following emotions as a function of your typical pattern of activity over a typical week.

	1 (do not feel at all)	2	3	4	5	6	7	8	9 (feel very much)
Happy	○	○	○	○	○	○	○	○	○
Ashamed	○	○	○	○	○	○	○	○	○
Pleased	○	○	○	○	○	○	○	○	○
Depressed	○	○	○	○	○	○	○	○	○
Competent	○	○	○	○	○	○	○	○	○
Guilty	○	○	○	○	○	○	○	○	○
Proud	○	○	○	○	○	○	○	○	○
Upset	○	○	○	○	○	○	○	○	○
Disappointed	○	○	○	○	○	○	○	○	○
Frustrated	○	○	○	○	○	○	○	○	○
Sad	○	○	○	○	○	○	○	○	○

11


Exercise Behavior Study

30. Most people who are important to me approve of my exercising (or would approve of my exercising) regularly for the next six weeks.

- 1 (strongly disagree)
- 2
- 3
- 4
- 5 (strongly agree)

31. I am confident that I can maintain a regular exercise routine over a typical week.

- 1 (strongly disagree)
- 2
- 3
- 4
- 5(strongly agree)

32. Over a typical week, my exercising regularly is up to me.

- 1 (strongly disagree)
- 2
- 3
- 4
- 5 (strongly agree)

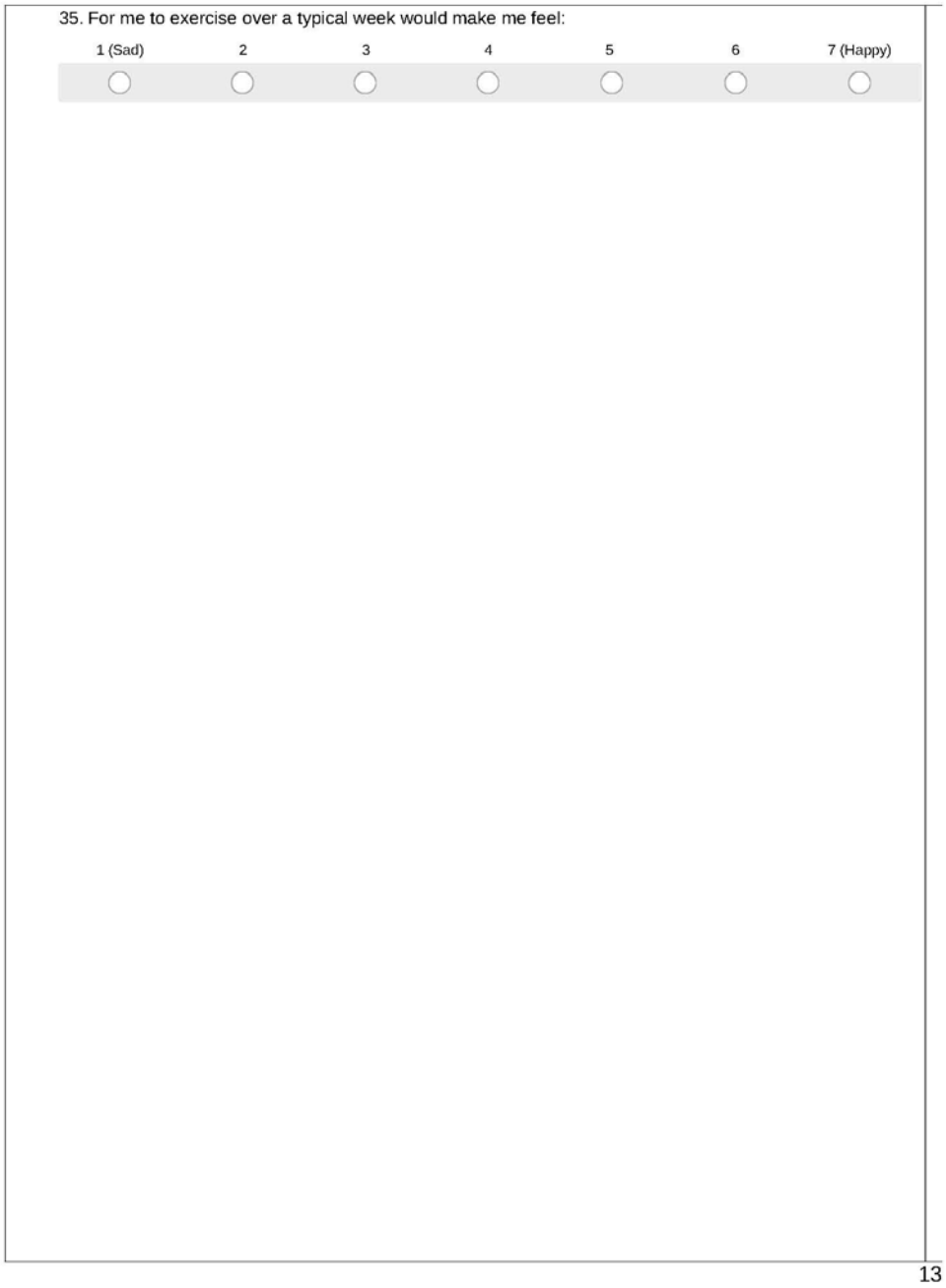
33. For me to exercise over a typical week would make me feel:

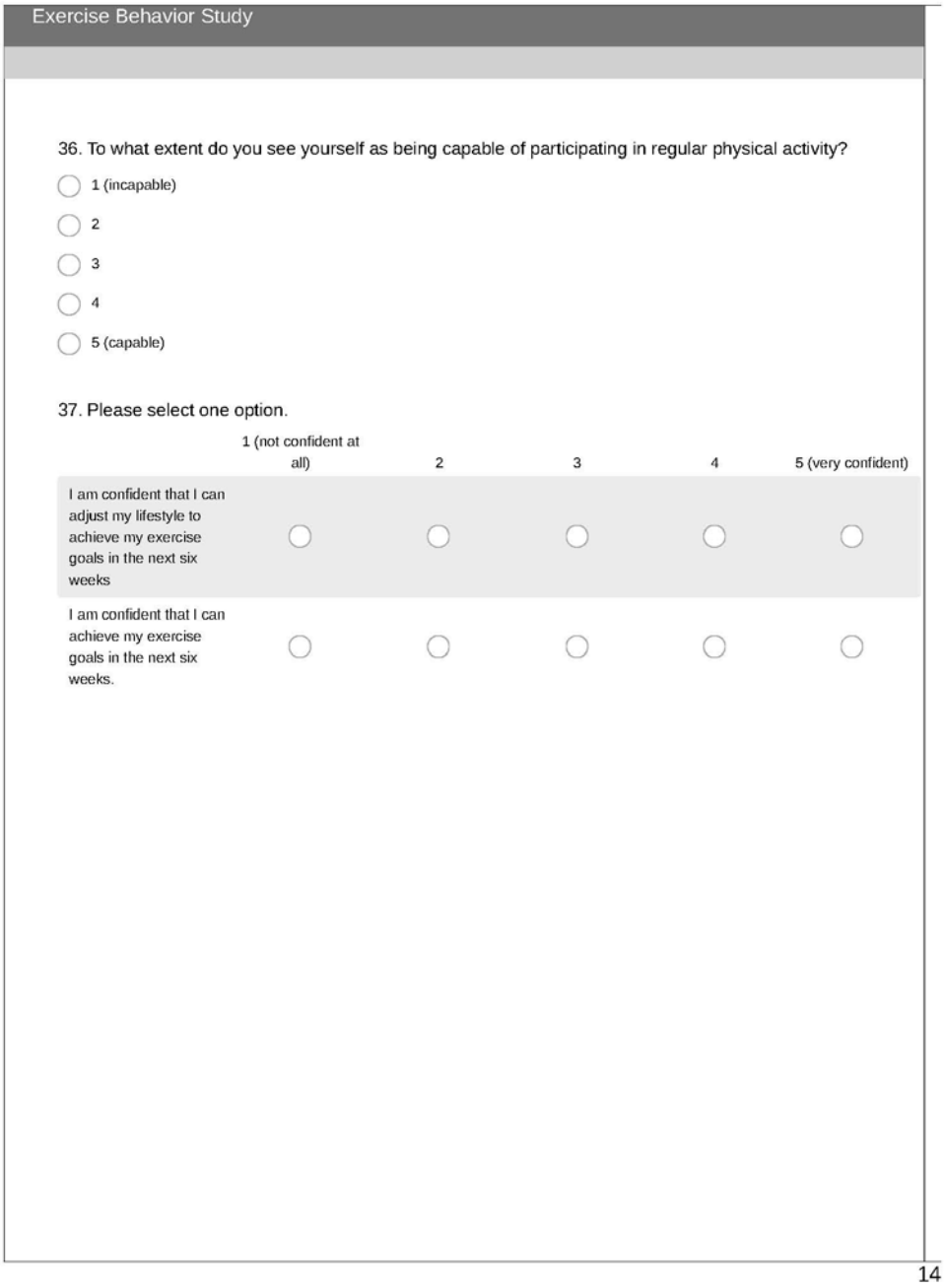
1 (sorrow)	2	3	4	5	6	7 (joy)
○	○	○	○	○	○	○

34. For me to exercise over a typical week would make me feel:

1 (bored)	2	3	4	5	6	7 (excited)
○	○	○	○	○	○	○

12


35. For me to exercise over a typical week would make me feel:
1 (Sad)
2
3
4
5
6
7 (Happy)
13



Exercise Behavior Study

36. To what extent do you see yourself as being capable of participating in regular physical activity?

- 1 (incapable)
- 2
- 3
- 4
- 5 (capable)

37. Please select one option.

	1 (not confident at all)	2	3	4	5 (very confident)
I am confident that I can adjust my lifestyle to achieve my exercise goals in the next six weeks					
I am confident that I can achieve my exercise goals in the next six weeks.					

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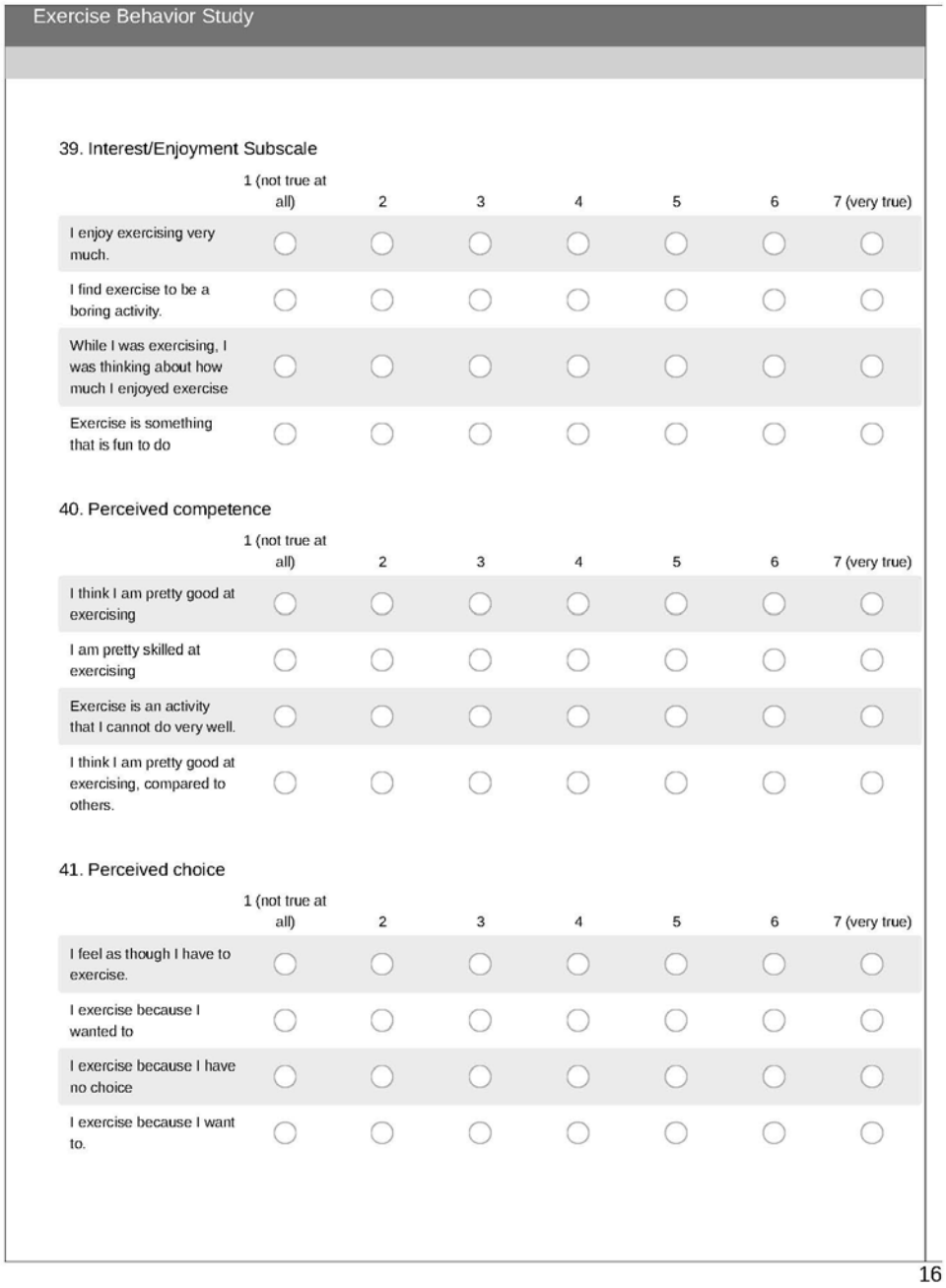
38. After having started engaging in regular exercise, it is important to maintain this behavior over a long period of time. How confident are you that you be able to maintain an exercise regime over a typical week?

	1 (not confident at all)	2	3	4	5 (very confident)
After having started engaging in regular exercise, it is important to maintain this behavior over a long period of time. How confident are you that you be able to maintain an exercise regime over the next six weeks?	○	○	○	○	○
I am confident to engage in exercise regularly over the next six weeks even if I cannot see any positive changes immediately.	○	○	○	○	○
I am confident to engage in exercise regularly over the next six weeks even if I am together with friends and relatives who are not physically active.	○	○	○	○	○
I am confident to engage in exercise regularly over the next six weeks even if the demands on my time increase.	○	○	○	○	○
I am confident to engage in exercise regularly over the next six weeks even if I am feeling tired or not in the mood to exercise.	○	○	○	○	○
I am confident to engage in exercise regularly over the next six weeks even if the weather is not conducive to exercise (e.g., raining, excessive heat).	○	○	○	○	○

15



Exercise Behavior Study

39. Interest/Enjoyment Subscale

	1 (not true at all)	2	3	4	5	6	7 (very true)
I enjoy exercising very much.	○	○	○	○	○	○	○
I find exercise to be a boring activity.	○	○	○	○	○	○	○
While I was exercising, I was thinking about how much I enjoyed exercise	○	○	○	○	○	○	○
Exercise is something that is fun to do	○	○	○	○	○	○	○

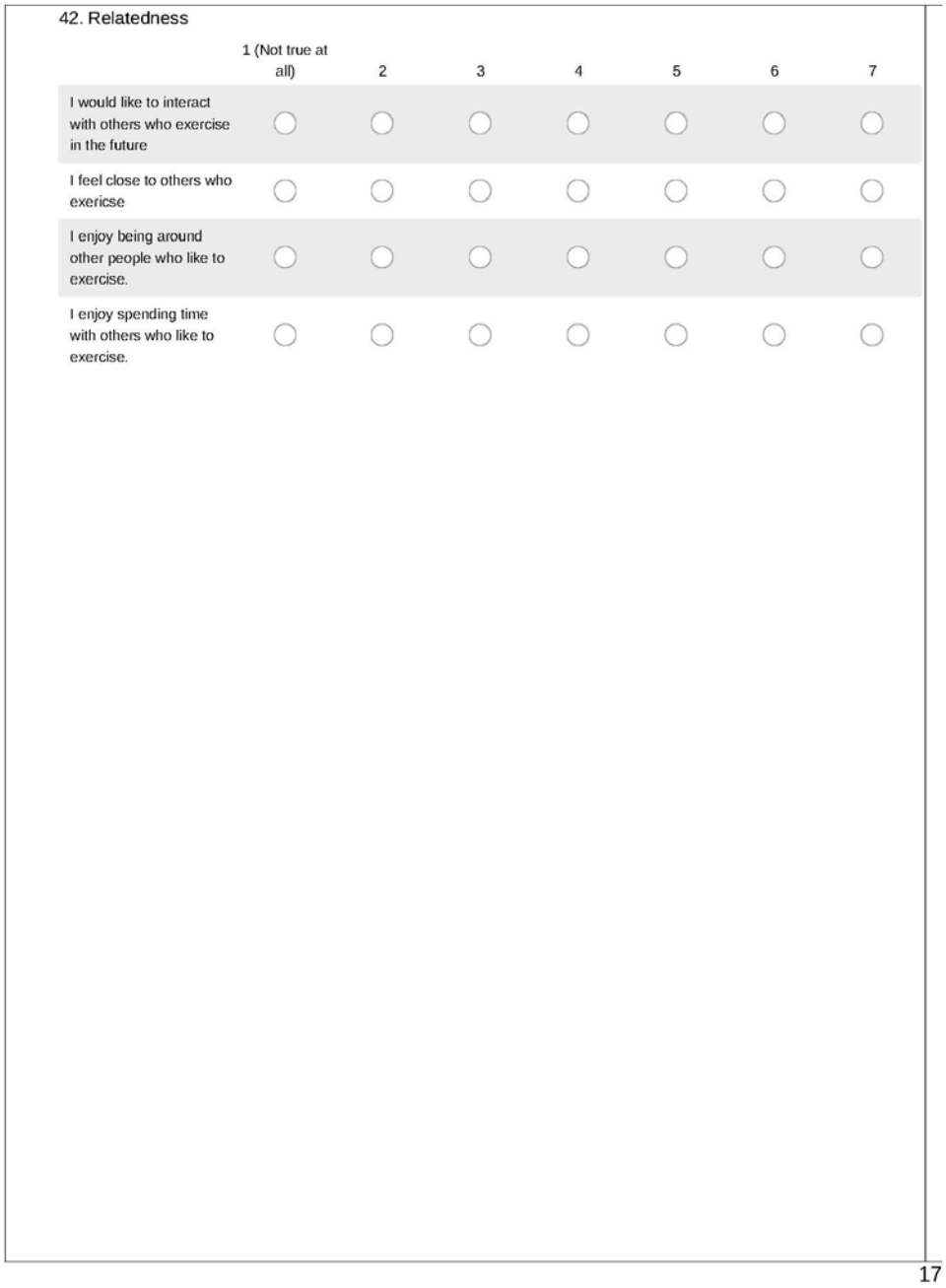
40. Perceived competence

	1 (not true at all)	2	3	4	5	6	7 (very true)
I think I am pretty good at exercising	○	○	○	○	○	○	○
I am pretty skilled at exercising	○	○	○	○	○	○	○
Exercise is an activity that I cannot do very well.	○	○	○	○	○	○	○
I think I am pretty good at exercising, compared to others.	○	○	○	○	○	○	○

41. Perceived choice

	1 (not true at all)	2	3	4	5	6	7 (very true)
I feel as though I have to exercise.	○	○	○	○	○	○	○
I exercise because I wanted to	○	○	○	○	○	○	○
I exercise because I have no choice	○	○	○	○	○	○	○
I exercise because I want to.	○	○	○	○	○	○	○

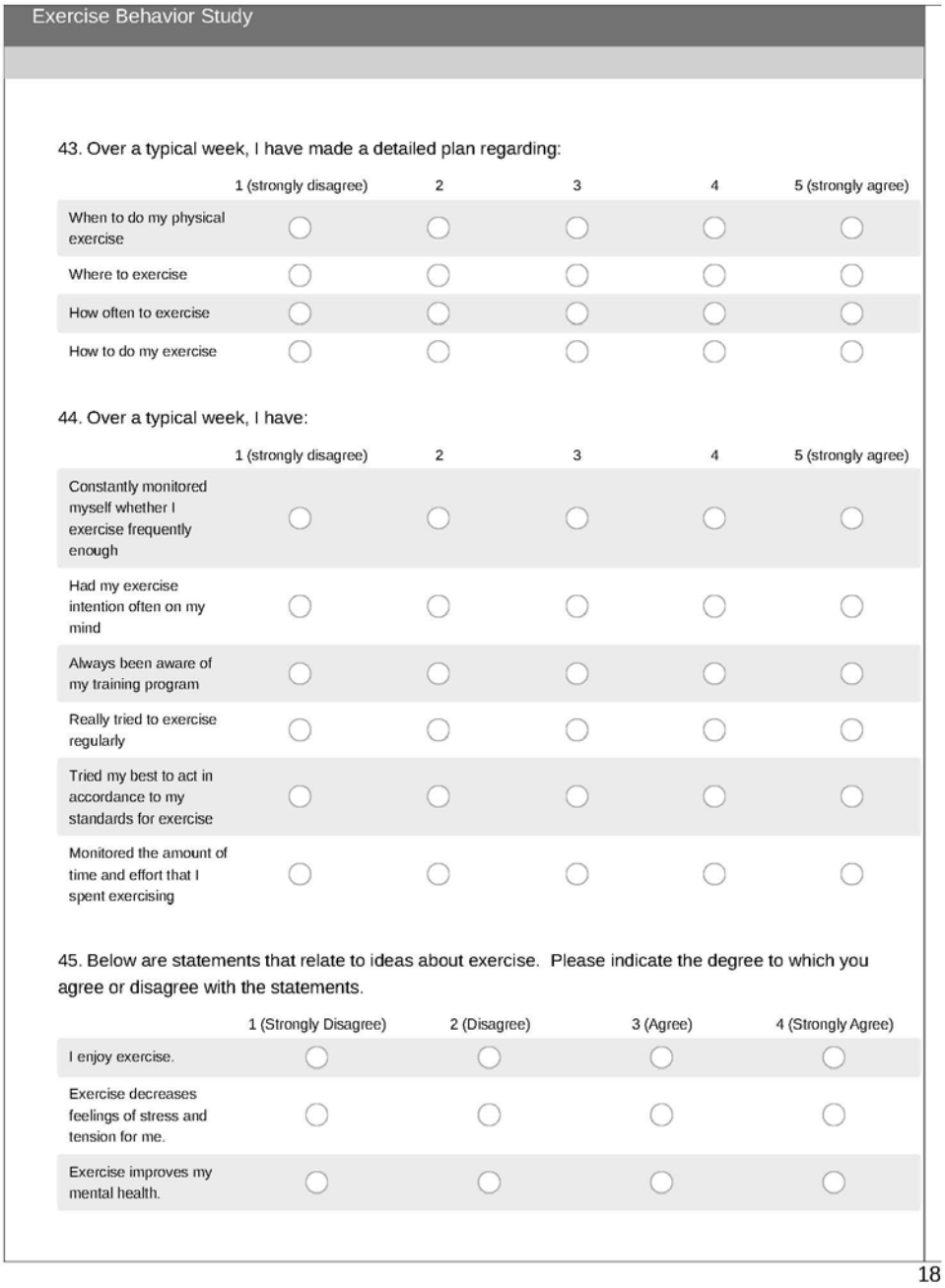
16



42. Relatedness

	1 (Not true at all)	2	3	4	5	6	7
I would like to interact with others who exercise in the future	○	○	○	○	○	○	○
I feel close to others who exericse	○	○	○	○	○	○	○
I enjoy being around other people who like to exercise.	○	○	○	○	○	○	○
I enjoy spending time with others who like to exercise.	○	○	○	○	○	○	○

17



Exercise Behavior Study

43. Over a typical week, I have made a detailed plan regarding:

	1 (strongly disagree)	2	3	4	5 (strongly agree)
When to do my physical exercise	○	○	○	○	○
Where to exercise	○	○	○	○	○
How often to exercise	○	○	○	○	○
How to do my exercise	○	○	○	○	○

44. Over a typical week, I have:

	1 (strongly disagree)	2	3	4	5 (strongly agree)
Constantly monitored myself whether I exercise frequently enough	○	○	○	○	○
Had my exercise intention often on my mind	○	○	○	○	○
Always been aware of my training program	○	○	○	○	○
Really tried to exercise regularly	○	○	○	○	○
Tried my best to act in accordance to my standards for exercise	○	○	○	○	○
Monitored the amount of time and effort that I spent exercising	○	○	○	○	○

45. Below are statements that relate to ideas about exercise. Please indicate the degree to which you agree or disagree with the statements.

	1 (Strongly Disagree)	2 (Disagree)	3 (Agree)	4 (Strongly Agree)
I enjoy exercise.	○	○	○	○
Exercise decreases feelings of stress and tension for me.	○	○	○	○
Exercise improves my mental health.	○	○	○	○

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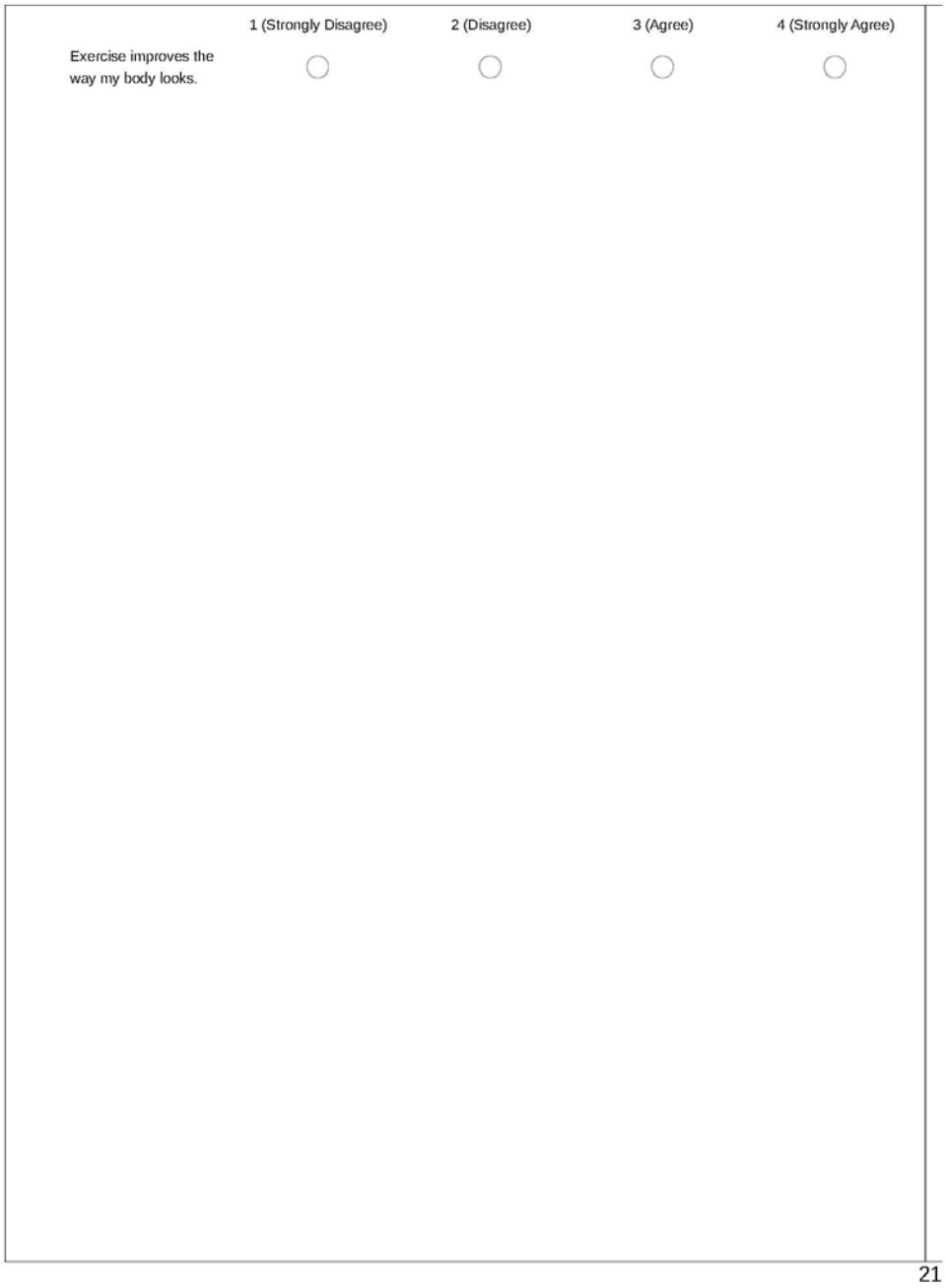
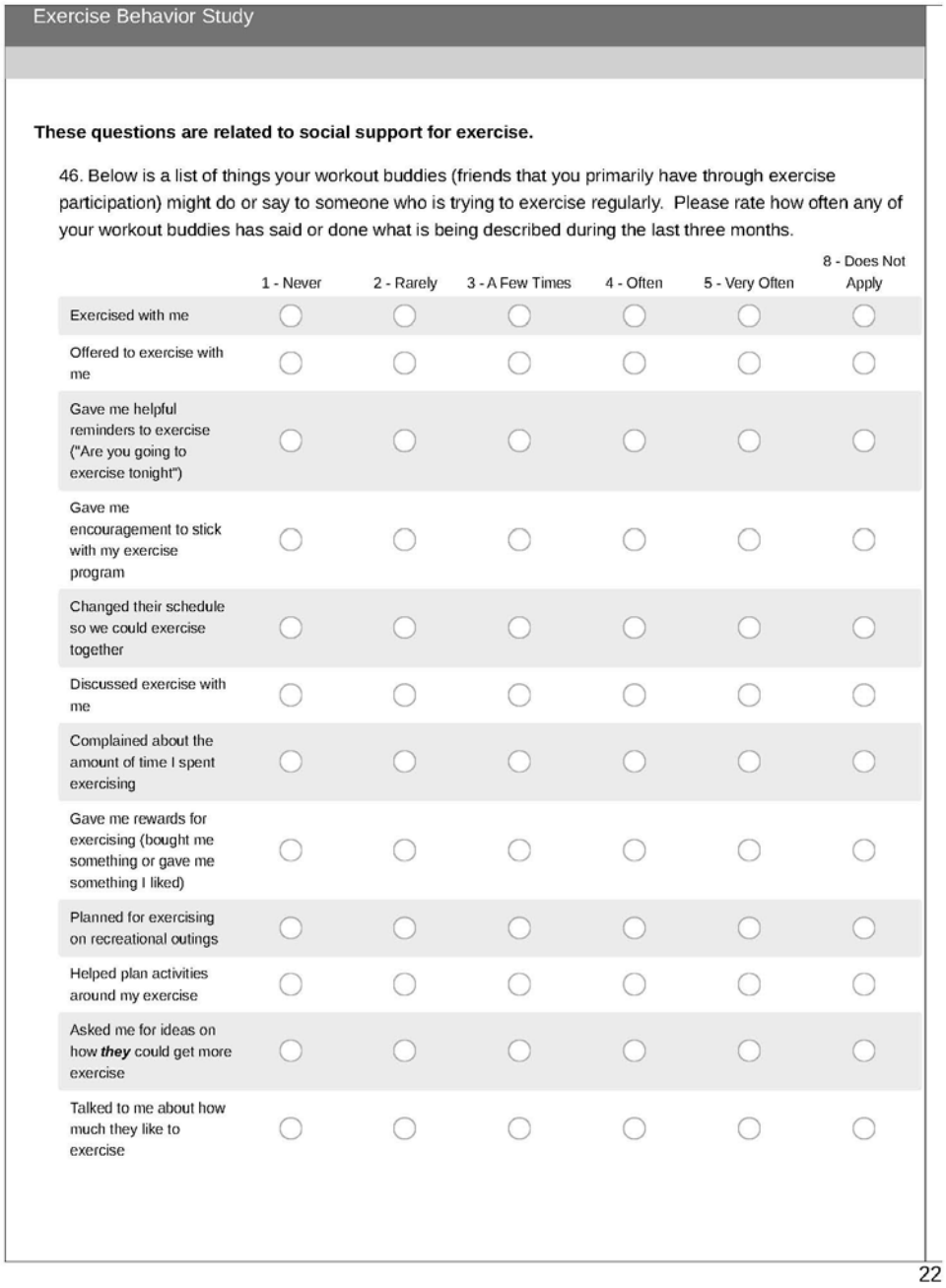
	1 (Strongly Disagree)	2 (Disagree)	3 (Agree)	4 (Strongly Agree)
Exercising takes too much of my time.	○	○	○	○
I will prevent heart attacks by exercising	○	○	○	○
Exercise tires me.	○	○	○	○
Exercise increases my muscle strength.	○	○	○	○
Exercise gives me a sense of personal accomplishment.	○	○	○	○
Places for me to exercise are too far away.	○	○	○	○
Exercise makes me feel relaxed.	○	○	○	○
Exercising lets me have contact with friends and persons I enjoy	○	○	○	○
I am too embarrassed to exercise.	○	○	○	○
Exercising will keep me from having high blood pressure	○	○	○	○
It costs too much to exercise.	○	○	○	○
Exercising improves functioning of my cardiovascular system.	○	○	○	○
I am fatigued by exercise.	○	○	○	○
I have improved feelings of well being from exercise.	○	○	○	○
My spouse (or significant other) does not encourage exercising	○	○	○	○
Exercise increases my stamina	○	○	○	○
Exercise increases my flexibility	○	○	○	○
Exercise takes too much time from family relationships	○	○	○	○

19

	1 (Strongly Disagree)	2 (Disagree)	3 (Agree)	4 (Strongly Agree)
My disposition is improved with exercise	○	○	○	○
Exercising helps me sleep better at night	○	○	○	○
Iw ill live longer if I exercise	○	○	○	○
I think people in exercise clothes look funny.	○	○	○	○
Exercise helps me decrease fatigue	○	○	○	○
Exercising is a good way for me to meet new people	○	○	○	○
My physical endurance is improved by exercising	○	○	○	○
Exercising improves my self-concept	○	○	○	○
My family members do not encourage me to exercise.	○	○	○	○
Exercise increases my mental alertness	○	○	○	○
Exercise allows me to carry out normal activities without becoming tired	○	○	○	○
Exercise improves the quality of my work.	○	○	○	○
Exercise takes too much time from my family responsibilities	○	○	○	○
Exercise is good entertainment for me	○	○	○	○
Exercise increases my acceptance by others	○	○	○	○
Exercise is hard work for me.	○	○	○	○
Exercise improves overall body functioning for me.	○	○	○	○
There are too few places for me to exercise	○	○	○	○

20


1 (Strongly Disagree)
2 (Disagree)
3 (Agree)
4 (Strongly Agree)
Exercise improves the way my body looks.
21



Exercise Behavior Study

These questions are related to social support for exercise.

46. Below is a list of things your workout buddies (friends that you primarily have through exercise participation) might do or say to someone who is trying to exercise regularly. Please rate how often any of your workout buddies has said or done what is being described during the last three months.

	1 - Never	2 - Rarely	3 - A Few Times	4 - Often	5 - Very Often	8 - Does Not Apply
Exercised with me	○	○	○	○	○	○
Offered to exercise with me	○	○	○	○	○	○
Gave me helpful reminders to exercise ("Are you going to exercise tonight")	○	○	○	○	○	○
Gave me encouragement to stick with my exercise program	○	○	○	○	○	○
Changed their schedule so we could exercise together	○	○	○	○	○	○
Discussed exercise with me	○	○	○	○	○	○
Complained about the amount of time I spent exercising	○	○	○	○	○	○
Gave me rewards for exercising (bought me something or gave me something I liked)	○	○	○	○	○	○
Planned for exercising on recreational outings	○	○	○	○	○	○
Helped plan activities around my exercise	○	○	○	○	○	○
Asked me for ideas on how ***they*** could get more exercise	○	○	○	○	○	○
Talked to me about how much they like to exercise	○	○	○	○	○	○

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47. Below is a list of things your family (or anyone living in your household) might do or say to someone who is trying to exercise regularly. Please rate how often anyone living in your household has said or done what is being described during the last three months.

	1 - Never	2 - Rarely	3 - A Few Times	4 - Often	5 - Very Often	8 - Does Not Apply
Exercised with me	○	○	○	○	○	○
Offered to exercise with me	○	○	○	○	○	○
Gave me helpful reminders to exercise ("Are you going to exercise tonight")	○	○	○	○	○	○
Gave me encouragement to stick with my exercise program	○	○	○	○	○	○
Changed their schedule so we could exercise together	○	○	○	○	○	○
Discussed exercise with me	○	○	○	○	○	○
Complained about the amount of time I spent exercising	○	○	○	○	○	○
Gave me rewards for exercising (bought me something or gave me something I liked)	○	○	○	○	○	○
Planned for exercising on recreational outings	○	○	○	○	○	○
Helped plan activities around my exercise	○	○	○	○	○	○
Asked me for ideas on how ***they*** could get more exercise	○	○	○	○	○	○
Talked to me about how much they like to exercise	○	○	○	○	○	○

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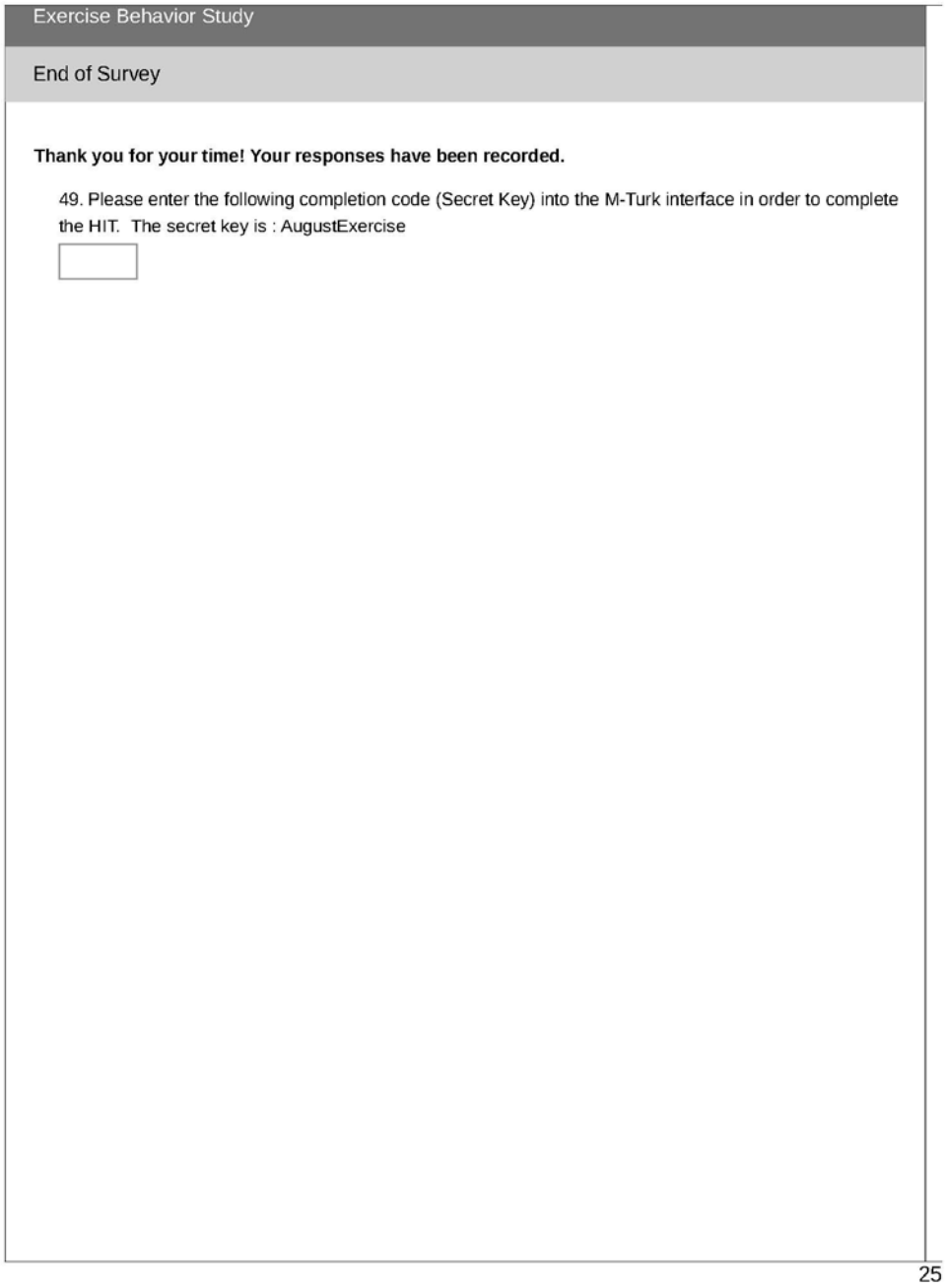
48. Below is a list of things your friends (friends, co-workers, acquaintances) might do or say to someone who is trying to exercise regularly. Please rate how often your friends have said or done what is being described during the last three months.

	1 - Never	2 - Rarely	3 - A Few Times	4 - Often	5 - Very Often	8 - Does Not Apply
Exercised with me	○	○	○	○	○	○
Offered to exercise with me	○	○	○	○	○	○
Gave me helpful reminders to exercise ("Are you going to exercise tonight")	○	○	○	○	○	○
Gave me encouragement to stick with my exercise program	○	○	○	○	○	○
Changed their schedule so we could exercise together	○	○	○	○	○	○
Discussed exercise with me	○	○	○	○	○	○
Complained about the amount of time I spent exercising	○	○	○	○	○	○
Gave me rewards for exercising (bought me something or gave me something I liked)	○	○	○	○	○	○
Planned for exercising on recreational outings	○	○	○	○	○	○
Helped plan activities around my exercise	○	○	○	○	○	○
Asked me for ideas on how ***they*** could get more exercise	○	○	○	○	○	○
Talked to me about how much they like to exercise	○	○	○	○	○	○

24


Exercise Behavior Study
End of Survey
Thank you for your time! Your responses have been recorded.
49. Please enter the following completion code (Secret Key) into the M-Turk interface in order to complete the HIT. The secret key is : AugustExercise
25

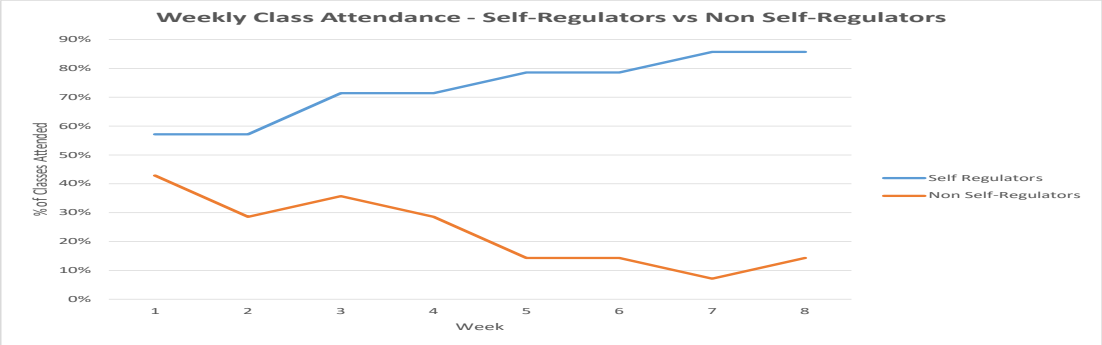
Appendix Two: Attribution Retraining Handouts

Treatment Group Handout

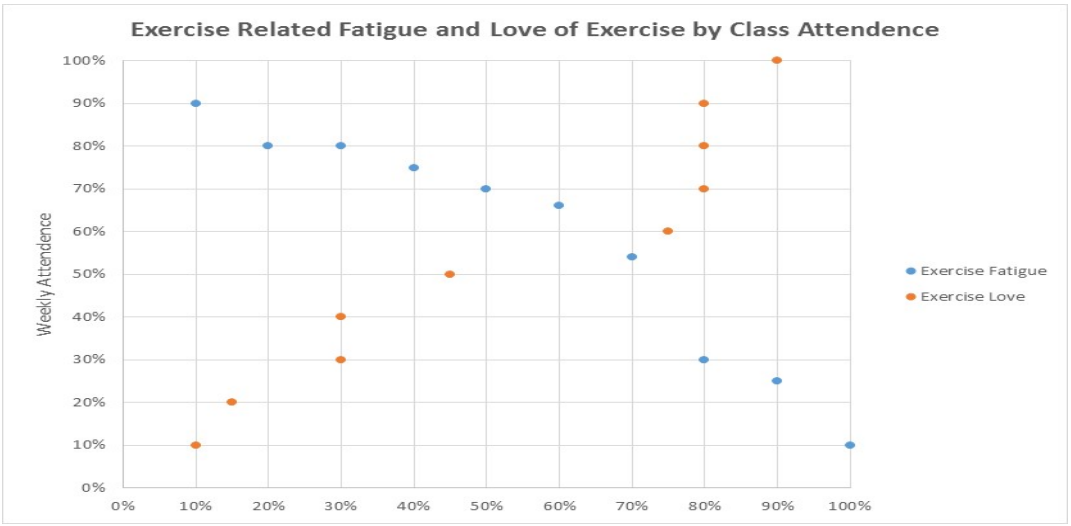
Rather than thinking about UNDESIRABLE, self-defeating thoughts like…	**Instead, practice thinking about more DESIRABLE thoughts, such as….**
Exercising is just too difficult	Exercising may be difficult at the start when you are not used to it, but with effort, persistence, and the help of SFC's instructors, anyone can learn how to perform and master exercise
I don't have the ability to improve my strength and endurance levels	Strength and endurance is something that can be controlled and changed. Your instructor can work with you to improve your strength and endurance levels
I feel helpless about improving my overall fitness levels.	Effort towards your exercise is something that you, along with the help of your instructor, have control over. By putting in the time and adopting strategies that help you prioritize exercise, you're bound to see improvement.
With my busy schedule, I NEVER have time to maintain a regular exercise program.	If you prioritize exercise, and set realistic exercise goals, and adopt time-management strategies, you can assuredly find time to exercise! Your trainer can work with you to establish these goals!
The pain and fatigue that I experience when exercising is unbearable. It makes me want to stop exercising.	Most people feel pain when they begin exercising. However, people who stick with their programs usually experience reduced exercise related fatigue as time goes on.

Many of the reasons for achieving success in maintaining an exercise program are under your control! Effort, strategy, and working with your trainer are all in your control and are far more important than inherent ability when it comes to maintaining exercise programs. Remember that pain and exercise related fatigue are temporary! Stick with your exercise program and you will experience less pain!

We promises to do everything we can to help you achieve your fitness goals! We know that by setting goals for exercise and using self-regulation techniques (e.g., self-monitoring, time management, prioritizing), you can become a regular exerciser! All you have to do is put in the effort and adopt the right strategies! Our instructors are ready to help you set goals and figure out which self-regulation techniques work best for you! Look at the graph below that shows the percentage of classes attended per week for those that use self-regulation techniques vs. those that don't. Self-regulators have better class attendance that actually increases over time!



By consistently attending class, you'll learn (as other clients have!) that exercise related fatigue and dislike of exercise are temporary! Attend class regularly and the fatigue you experience will get less and less and you'll learn to love exercise just like your classmates! This next chart shows that those that attend a higher percentage of classes per week experience less exercise related fatigue and enjoy exercise more than those that attend fewer classes!



Control Group Handout

Fitness Locations (Hours):

Class Descriptions

Barbell Blast – This is a high intensity class using barbells and bodyweight to develop both muscular strength and endurance as well as cardiorespiratory strength and endurance.

Body – This is a full body resistance training workout designed to sculpt your body from head to toe. We will guide you through high repetitions with low weight dumbbells and resistance bands to achieve maximum definition.

Vinyasa – Vinyasa is the perfect complement to any fitness routine, whether you are a runner, a powerlifter, or just looking to sculpt and tone your body. You will flow from one posture (asana) to the next in conjunction with your breath to build heat and flexibility. Vinyasa translate to breath synchronized movement and offers a wide variety of poses, sequences, and challenging positions.

ZUMBA Fitness – Zumba combines Latin dance moves with interval and resistance training for a full body, rhythmic workout. You'll move through salsa, merengue, cumbia, reggaetón, pop, and samba as you experience one of the most satisfying cardio workouts you've ever had.

Appendix Three: Appendix Tables

Appendix Table 3-1: Psychometric Properties for Study One Measures (n=952)

Variable	Measured Scale Description (Range)	Item Correlation with Overall Scale	Cronbach's Alpha
Intention to Exercise	***Mean of Associated Items (1–5)***	***N/A***	***0.82***
I intend to begin exercising over the next six weeks	Very Unlikely – Very Likely (1–5)	0.92	
I will make an effort to regularly exercise during the next six weeks	Very Unlikely – Very Likely (1–5)	0.95	
I will attempt to regularly exercise during the next six weeks	Very Unlikely – Very Likely (1–5)	0.91	
Causal Attributions			
Locus of Control Dimension	***Sum of Associated Items (3-27)***		***0.77***
Is the cause of your exercise behavior something that reflects an aspect:	Of the situation – Of yourself (1-9)	0.78	
Is this cause something:	Outside of you – Inside of you (1-9)	0.91	
Is this cause something:	About others – About yourself (1-9)	0.81	
Stability Dimension	***Sum of Associated Items (3-27)***		***0.65***
Is this cause something:	Temporary – Permanent (1-9)	0.83	
Is this cause something:	Variable over time – Stable over time (1-9)	0.69	
Is this cause something:	Changeable – Unchangeable (1-9)	0.78	
Control Dimension	***Sum of Associated Items (3-27)***		***0.92***
Is this cause something:	Not manageable by you – Manageable by you (1-9)	0.92	
Is this cause something:	You can regulate– You cannot regulate (1-9)	0.94	
Is this cause something:	Over which you have power – Over which you have no power (1-9)	0.92	
Future Expectations	***Single Item Question (1-5)***	***N/A***	***N/A***
How certain are you that you will be able to engage in regular exercise over the next six weeks?	Very unlikely – Likely (1-5)		
Exercise Affect			
Positive Affect	***Mean of Associated Items (1-9)***		***0.91***
Happy	Do not feel at all – Feel very much (1-9)	0.90	

Variable	Measured Scale Description (Range)	Item Correlation with Overall Scale	Cronbach's Alpha
Pleased	Do not feel at all – Feel very much (1-9)	0.91	
Competent	Do not feel at all – Feel very much (1-9)	0.85	
Proud	Do not feel at all – Feel very much (1-9)	0.86	
Negative Affect	***Mean of Associated Items (1-9)***		***0.93***
Ashamed	Do not feel at all – Feel very much (1-9)	0.78	
Depressed	Do not feel at all – Feel very much (1-9)	0.86	
Guilty	Do not feel at all – Feel very much (1-9)	0.77	
Upset	Do not feel at all – Feel very much (1-9)	0.87	
Disappointed	Do not feel at all – Feel very much (1-9)	0.89	
Frustrated	Do not feel at all – Feel very much (1-9)	0.86	
Sad	Do not feel at all – Feel very much (1-9)	0.86	
Perceived Norm	***Mean of Associated Items (1-5)***		***0.89***
Most people who are important to me would approve of me exercising	Strongly disagree – Strongly agree (1-5)	0.93	
Most people who are close to me think I should participate in regular physical activity	Strongly disagree – Strongly agree (1-5)	0.88	
People who are important me would disapprove of me engaging in physical activity	Strongly agree – Strongly disagree (1-5)	0.92	
Perceived Behavioral Control	***Mean of Associated Items (1-5)***		
I am confident I can maintain a regular exercise routine over a typical week.	Strongly agree – Strongly disagree (1-5)	0.82	
Attitude Toward Exercise	***Mean of Associated Items (1-7)***		***0.92***
For me to exercise over a typical week would make me feel:	Sorrow – Joy (1-7)	0.93	
For me to exercise over a typical week would make me feel:	Bored – Excited (1-7)	0.92	
For me to exercise over a typical week would make me feel:	Sad – Happy (1-7)	0.95	
Perceived Outcome	***Single Item Question***	***N/A***	***N/A***
In the past six weeks, I have been successful in maintaining a regular exercise routine.	Yes/No		

Appendix Table 3-2: Psychometric Properties for Study Two Measures (n=200)

Variable	Measured Scale Description (Range)	Item Correlation with Overall Scale	Cronbach's Alpha
Intention to Exercise	***Mean of Associated Items (1–5)***	***N/A***	***0.84***
I intend to begin exercising over the next six weeks	Very Unlikely – Very Likely (1–5)	0.90	
I will make an effort to regularly exercise during the next six weeks	Very Unlikely – Very Likely (1–5)	0.93	
I will attempt to regularly exercise during the next six weeks	Very Unlikely – Very Likely (1–5)	0.91	
Causal Attributions			
Locus of Control Dimension	***Sum of Associated Items (3-27)***		***0.72***
Is the cause of exercise behavior something that reflects an aspect:	Of the situation – Of yourself (1-9)	0.70	
Is this cause something:	Outside of you – Inside of you (1-9)	0.84	
Is this cause something:	About others – About yourself (1-9)	0.79	
Stability Dimension	***Sum of Associated Items (3-27)***		***0.67***
Is this cause something:	Temporary – Permanent (1-9)	0.81	
Is this cause something:	Variable over time – Stable over time (1-9)	0.52	
Is this cause something:	Changeable – Unchangeable (1-9)	0.82	
Control Dimension	***Sum of Associated Items (3-27)***		***0.87***
Is this cause something:	Not manageable by you – Manageable by you (1-9)	0.86	
Is this cause something:	You can regulate– You cannot regulate (1-9)	0.89	
Is this cause something:	Over which you have power – Over which you have no power (1-9)	0.84	
Future Expectations	***Single Item Question (1-5)***	***N/A***	***N/A***
How certain are you that you will be able to engage in regular exercise over the next six weeks?	Very unlikely – Likely (1-5)		
Exercise Affect			
Positive Affect	***Mean of Associated Items (1-9)***		***0.94***
Happy	Do not feel at all – Feel very much (1-9)	0.91	
Pleased	Do not feel at all – Feel very much (1-9)	0.92	
Competent	Do not feel at all – Feel very much (1-9)	0.83	
Proud	Do not feel at all – Feel very much (1-9)	0.88	

Variable	Measured Scale Description (Range)	Item Correlation with Overall Scale	Cronbach's Alpha
Pleased	Do not feel at all – Feel very much (1-9)	0.92	
Competent	Do not feel at all – Feel very much (1-9)	0.83	
Proud	Do not feel at all – Feel very much (1-9)	0.88	
Negative Affect	***Mean of Associated Items (1-9)***		***0.90***
Ashamed	Do not feel at all – Feel very much (1-9)	0.74	
Depressed	Do not feel at all – Feel very much (1-9)	0.82	
Guilty	Do not feel at all – Feel very much (1-9)	0.70	
Upset	Do not feel at all – Feel very much (1-9)	0.81	
Disappointed	Do not feel at all – Feel very much (1-9)	0.85	
Frustrated	Do not feel at all – Feel very much (1-9)	0.82	
Sad	Do not feel at all – Feel very much (1-9)	0.89	
Perceived Norm	***Mean of Associated Items (1-5)***		***0.92***
Most people who are important to me would approve of me exercising	Strongly disagree – Strongly agree (1-5)	0.85	
Most people who are close to me think I should participate in regular physical activity	Strongly disagree – Strongly agree (1-5)	0.88	
People who are important me would disapprove of me engaging in physical activity	Strongly agree – Strongly disagree (1-5)	0.92	
Perceived Behavioral Control	***Mean of Associated Items (1-5)***		***0.68***
I am confident I can maintain a regular exercise routine over a typical week.	Strongly agree – Strongly disagree (1-5)	0.77	
Over a typical week, exercising is entirely up to me.	Strongly agree – Strongly disagree (1-5)	0.80	
Attitude Toward Exercise	***Mean of Associated Items (1-7)***		***0.94***
For me to exercise over a typical week would make me feel:	Sorrow – Joy (1-7)	0.92	
For me to exercise over a typical week would make me feel:	Bored – Excited (1-7)	0.94	
For me to exercise over a typical week would make me feel:	Sad – Happy (1-7)	0.95	
Perceived Outcome	***Single Item Question***	***N/A***	***N/A***
In the past six weeks, I have been successful in maintaining a regular exercise routine.	Yes/No		

Variable	Measured Scale Description (Range)	Item Correlation with Overall Scale	Cronbach's Alpha
Self-Efficacy			
Task Self-Efficacy	***Single Item Question (1-5)***	***N/A***	***N/A***
Maintenance Self-Efficacy	***Mean of Associated Items (1-5)***		**0.82**
How confident are you that you will be able to maintain an exercise regime over the next six weeks?	Not Confident at All – Very Confident (1-5)	0.82	
I am confident to engage in exercise regularly over the next weeks even if I cannot see any positive changes immediately	Not Confident at All – Very Confident (1-5)	0.91	
I am confident to engage in exercise regularly over the next six weeks even if I am together with friends and relatives who are not physically active	Not Confident at All – Very Confident (1-5)	0.78	
I am confident to engage in exercise regularly over the next six weeks even if the demands on my time increase.	Not Confident at All – Very Confident (1-5)	0.84	
I am confident to engage in exercise regularly over the next six weeks even if I am feeling tired or not in the mood to exercise	Not Confident at All – Very Confident (1-5)	0.86	
I am confident to engage in exercise regularly over the next six weeks even if I the weather is not conducive to exercise (e.g., raining or excessive heat).	Not Confident at All – Very Confident (1-5)	0.83	
Intrinsic Motivation Inventory			
Interest/Enjoyment Subscale	***Mean of Associated Items (1-7)***		**0.91**
I enjoy exercising very much	Not True at All – Very True (1-7)	0.81	
I find exercise to be a boring activity	Not True at All – Very True (1-7)	0.75	
While I was exercising, I was thinking about how much I enjoyed exercise	Not True at All – Very True (1-7)	0.78	
Exercise is something that is fun to do	Not True at All – Very True (1-7)	0.89	
Perceived Competence	***Mean of Associated Items (1-7)***		**0.89**
I think I am pretty good at exercising	Not True at All – Very True (1-7)	0.79	
I am pretty skilled at exercising	Not True at All – Very True (1-7)	0.77	
Exercise is an activity that I cannot do very well	Not True at All – Very True (1-7)	0.81	
I think I am pretty good at exercising compared to others	Not True at All – Very True (1-7)	0.91	

Variable	Measured Scale Description (Range)	Item Correlation with Overall Scale	Cronbach's Alpha
Perceived Choice	***Mean of Associated Items (1-7)***		**0.90**
I feel as though I have to exercise	Not True at All – Very True (1-7)	0.81	
I exercise because I have no choice	Not True at All – Very True (1-7)	0.87	
I exercise because I want to	Not True at All – Very True (1-7)	0.92	
I exercise because I wanted to	Not True at All – Very True (1-7)	0.94	
Relatedness	***Mean of Associated Items (1-7)***		**0.89**
I would like to interact with others who exercise in the future	Not True at All – Very True (1-7)	0.87	
I feel close to others who exercise	Not True at All – Very True (1-7)	0.88	
I enjoy being around other people who like to exercise	Not True at All – Very True (1-7)	0.91	
I enjoy spending time with others who like to exercise	Not True at All – Very True (1-7)	0.92	
Action Control			
Action Control - Planning	***Mean of Associated Items (1-5)***		**0.82**
Over a typical week, I have made a detailed plan regarding: when to do my physical exercise.	Strongly Agree – Strongly Disagree (1-5)	0.79	
Over a typical week, I have made a detailed plan regarding: where to exercise.	Strongly Agree – Strongly Disagree (1-5)	0.81	
Over a typical week, I have made a detailed plan regarding: how often to exercise.	Strongly Agree – Strongly Disagree (1-5)	0.83	
Over a typical week, I have made a detailed plan regarding: how to do my exercise.	Strongly Agree – Strongly Disagree (1-5)	0.63	
Action Control – Maintenance	***Mean of Associated Items (1-5)***		**0.88**
Over a typical week, I have: constantly monitored myself whether I exercise frequently enough	Strongly Agree – Strongly Disagree (1-5)	0.67	
Over a typical week, I have: had my exercise intention on my mind	Strongly Agree – Strongly Disagree (1-5)	0.87	
Over a typical week, I have: always been aware of my training program	Strongly Agree – Strongly Disagree (1-5)	0.78	
Over a typical week, I have: really tried to exercise regularly	Strongly Agree – Strongly Disagree (1-5)	0.71	
Over a typical week, I have: tried my best to act in accordance to my standards for exercise	Strongly Agree – Strongly Disagree (1-5)	0.81	
Over a typical week, I have: monitored the amount of time and effort that I spent exercising	Strongly Agree – Strongly Disagree (1-5)	0.88	

Variable	Measured Scale Description (Range)	Item Correlation with Overall Scale	Cronbach's Alpha
Over a typical week, I have: tried my best to act in accordance to my standards for exercise	Strongly Agree – Strongly Disagree (1-5)	0.81	
Over a typical week, I have: monitored the amount of time and effort that I spent exercising	Strongly Agree – Strongly Disagree (1-5)	0.88	
Perceived Benefits and Barriers			
Perceived Benefits	***Mean of Associated Items (1 – 5)***		**0.85**
I enjoy exercise	Strongly Agree – Strongly Disagree (1-5)	0.85	
Exercise decreases feelings of stress and tension	Strongly Agree – Strongly Disagree (1-5)	0.83	
Exercising takes too much of my time.	Strongly Agree – Strongly Disagree (1-5)	0.84	
I will prevent heart attacks by exercising	Strongly Agree – Strongly Disagree (1-5)	0.81	
Exercise increases my muscle strength	Strongly Agree – Strongly Disagree (1-5)	0.88	
Exercise gives me a sense of personal accomplishment	Strongly Agree – Strongly Disagree (1-5)	0.83	
Exercise makes me feel relaxed	Strongly Agree – Strongly Disagree (1-5)	0.84	
Exercising lets me have contact with friends and persons I enjoy	Strongly Agree – Strongly Disagree (1-5)	0.83	
Exercising will keep me from having high blood pressure	Strongly Agree – Strongly Disagree (1-5)	0.81	
Exercising improves functioning of my cardiovascular system	Strongly Agree – Strongly Disagree (1-5)	0.76	
I have improved feelings of well-being from exercise	Strongly Agree – Strongly Disagree (1-5)	0.83	
Exercise increases my stamina	Strongly Agree – Strongly Disagree (1-5)	0.85	
Exercise increases my flexibility	Strongly Agree – Strongly Disagree (1-5)	0.83	
My disposition is improved with exercise	Strongly Agree – Strongly Disagree (1-5)	0.80	
Exercising helps me sleep better at night	Strongly Agree – Strongly Disagree (1-5)	0.77	
I will live longer if I exercise	Strongly Agree – Strongly Disagree (1-5)	0.92	
Exercise helps me decrease my fatigue	Strongly Agree – Strongly Disagree (1-5)	0.80	
Exercising is a good way for me to meet new people	Strongly Agree – Strongly Disagree (1-5)	0.77	
My physical endurance is improved by exercising	Strongly Agree – Strongly Disagree (1-5)	0.85	
Exercising improves my self-concept	Strongly Agree – Strongly Disagree (1-5)	0.77	
Exercise increases my mental alertness	Strongly Agree – Strongly Disagree (1-5)	0.87	

Variable	Measured Scale Description (Range)	Item Correlation with Overall Scale	Cronbach's Alpha
Exercising allows me to carry out normal activities without becoming tired	Strongly Agree – Strongly Disagree (1-5)	0.86	
Exercise improves the quality of my work	Strongly Agree – Strongly Disagree (1-5)	0.88	
Exercise is good entertainment for me	Strongly Agree – Strongly Disagree (1-5)	0.79	
Exercise increases my acceptance by others	Strongly Agree – Strongly Disagree (1-5)	0.77	
Exercise improves overall body functioning for me	Strongly Agree – Strongly Disagree (1-5)	0.87	
Exercise improves the way my body looks	Strongly Agree – Strongly Disagree (1-5)	0.91	
Perceived Barriers	***Mean of Associated Items (1 – 5)***		**0.81**
Exercising takes too much time	Strongly Agree – Strongly Disagree (1-5)	0.90	
Exercising tires me	Strongly Agree – Strongly Disagree (1-5)	0.88	
Places for me to exercise are too far away	Strongly Agree – Strongly Disagree (1-5)	0.85	
I am too embarrassed to exercise	Strongly Agree – Strongly Disagree (1-5)	0.83	
It costs too much to exercise	Strongly Agree – Strongly Disagree (1-5)	0.82	
I am fatigued by exercising	Strongly Agree – Strongly Disagree (1-5)	0.77	
My spouse (or significant other) does not encourage exercise	Strongly Agree – Strongly Disagree (1-5)	0.84	
Exercise takes too much time from family relationships	Strongly Agree – Strongly Disagree (1-5)	0.87	
I think people in exercise clothes look funny	Strongly Agree – Strongly Disagree (1-5)	0.88	
My family members do not encourage me to exercise	Strongly Agree – Strongly Disagree (1-5)	0.83	
Exercise takes too much time from my family responsibilities	Strongly Agree – Strongly Disagree (1-5)	0.81	
Exercise is hard work for me	Strongly Agree – Strongly Disagree (1-5)	0.85	
Social Support			
Social Support – Workout Buddy	***Mean of Associated Items (1-5)***		**0.92**
Exercised with me	Never – Very Often (1 – 5)	0.91	
Offered to exercise with me	Never – Very Often (1 – 5)	0.92	
Gave me helpful reminders to exercise	Never – Very Often (1 – 5)	0.92	
Gave me encouragement to stick with my exercise program	Never – Very Often (1 – 5)	0.91	
Changed their schedule so we could exercise together	Never – Very Often (1 – 5)	0.81	
Discussed my exercise with me	Never – Very Often (1 – 5)	0.95	
Complained about the amount of time I spent exercising	Never – Very Often (1 – 5)	0.67	
Gave me rewards for exercising	Never – Very Often (1 – 5)	0.71	

Variable	Measured Scale Description (Range)	Item Correlation w/ Overall Scale	Cronbach's Alpha
Planned for exercising on recreational outings	Never – Very Often (1 – 5)	0.82	
Helped plan activities around my exercise	Never – Very Often (1 – 5)	0.79	
Asked me for ideas on how they could get more exercise	Never – Very Often (1 – 5)	0.71	
Talked to me about how much they liked to exercise	Never – Very Often (1 – 5)	0.94	
Social Support – Family	***Mean of Associated Items (1-5)***		**0.84**
Exercised with me	Never – Very Often (1 – 5)	0.91	
Offered to exercise with me	Never – Very Often (1 – 5)	0.89	
Gave me helpful reminders to exercise	Never – Very Often (1 – 5)	0.91	
Gave me encouragement to stick with my exercise program	Never – Very Often (1 – 5)	0.92	
Changed their schedule so we could exercise together	Never – Very Often (1 – 5)	0.84	
Discussed my exercise with me	Never – Very Often (1 – 5)	0.81	
Complained about the amount of time I spent exercising	Never – Very Often (1 – 5)	0.72	
Gave me rewards for exercising	Never – Very Often (1 – 5)	0.81	
Social Support – Friends	***Mean of Associated Items (1-5)***		**0.81**
Exercised with me	Never – Very Often (1 – 5)	0.88	
Offered to exercise with me	Never – Very Often (1 – 5)	0.81	
Gave me helpful reminders to exercise	Never – Very Often (1 – 5)	0.71	
Gave me encouragement to stick with my exercise program	Never – Very Often (1 – 5)	0.73	
Changed their schedule so we could exercise together	Never – Very Often (1 – 5)	0.88	
Discussed my exercise with me	Never – Very Often (1 – 5)	0.91	
Complained about the amount of time I spent exercising	Never – Very Often (1 – 5)	0.92	
Gave me rewards for exercising	Never – Very Often (1 – 5)	0.85	

Appendix Table 3-3: Factor Loadings and Cronbach's Alphas for the Two Factor Loadings for the Exercise Affect Scale, Study One (n=952)

	Factor 1: Negative Affect Item Label (Rotated Factor Loading)	Factor 2: Positive Affect Item Label (Rotated Factor Loading)
Cronbach's Alpha	0.92	0.91
	Ashamed (0.68)	Happy (0.88)
	Depressed (0.79)	Pleased (0.82)
	Guilty (0.62)	Competent (0.69)
	Upset (0.89)	Proud (0.75)
	Disappointed (0.92)	
	Frustrated (0.79)	
	Sad (0.82)	

Appendix Table 3-4: Correlations between Weekly Exercise Score, Affect Measure, and Factors, Study One (n=952)

	Weekly Exercise Score	Positive Affect	Negative Affect	Factor 1: Negative Affect	Factor 2: Positive Affect
Weekly Exercise Score	1				
Positive Affect	0.34**	1			
Negative Affect	-0.21*	-0.49***	1		
Factor 1: Negative Affect	0.19*	0.15	0.01	1	
Factor 2: Positive Affect	0.27*	0.01	0.27**	-0.25**	1

***Significant at p<.001 level, **Significant at p<0.1 level, *Significant at p<.05 level

Appendix Table 3-5: Factor Loadings and Cronbach's Alphas for the Exercise Affect Scale, Study Two (n=200)

	Factor 1: Negative Affect Item Label (Rotated Factor Loading)	Factor 2: Positive Affect Item Label (Rotated Factor Loading)
Cronbach's Alpha	0.90	0.94
	Ashamed (0.67)	Happy (0.86)
	Depressed (0.77)	Pleased (0.89)
	Guilty (0.66)	Competent (0.71)
	Upset (0.87)	Proud (0.73)
	Disappointed (0.84)	
	Frustrated (0.83)	
	Sad (0.80)	

Appendix Table 3-6: Correlations for the Affect Scale, Study Two (n=200)

	Weekly Exercise Score	Negative Affect	Positive Affect	Factor 1: Negative Affect	Factor 2: Positive Affect
Weekly Exercise Score	1				
Positive Affect	0.24**	1			
Negative Affect	-0.18*	-0.53***	1		
Factor 1: Negative Affect	0.19*	-0.12	0.05	1	
Factor 2: Positive Affect	0.17*	0.03	0.22*	-0.12*	1

***Significant at p<.001 level, **Significant at p<0.1 level, *Significant at p<.05 level

Appendix Table 3-7: Factor Loading and Cronbach's Alphas for the Intrinsic Motivation Inventory Scale, Study Two (n=200)

	Factor 1: Exercise and Relatedness	Factor 2: Competence in Exercise	Factor 3: Enjoyment of Exercise	Factor 4: Exercise Choice
Cronbach's Alpha	0.89	0.90	0.89	0.91
	I would like to interact with others who exercise in the future (0.78)	I think I am pretty good at exercising (0.68)	I enjoy exercising very much (0.81)	I feel as though I have to exercise (-0.57)
	I feel close to others who exercise (0.81)	I am pretty skilled at exercising (0.43)	I find exercise to be a boring activity (-0.71)	I exercise because I wanted to (0.87)
	I enjoy being around other people who like to exercise (0.64)	Exercise is an activity I cannot do very well (-0.69)	When exercising, I think about how much I enjoy exercising (0.74)	I exercise because I have no choice (-0.76)
	I enjoy spending time with others who like to exercise (0.71)	I think I am pretty good at exercising compared to others (0.54)	Exercise is something that is fun to do (0.91)	I exercise because I want to (0.82)

Appendix Table 3-8: Correlations between Measurement Scale and Factors for the Intrinsic Motivation Inventory, Study Two (n=200)

	Weekly Exercise Score	Enjoyment Scale	Competence Scale	Choice Scale	Relatedness Scale	Factor 1: Exercise and Relatedness	Factor 2: Competence in Exercise	Factor 3: Enjoyment of Exercise	Factor 4: Exercise Choice
Weekly Exercise Score	1								
Enjoyment Scale	0.37**	1							
Competence Scale	0.36**	0.67*	1						
Choice Scale	0.13*	0.54*	0.44*	1					
Relatedness Scale	0.30*	0.57*	0.48*	0.29*	1				
Factor 1: Exercise and Relatedness	0.20*	0.32**	0.25*	0.12*	0.93***	1			
Factor 2: Competence in Exercise	0.28*	0.39**	0.89***	0.24*	0.20*	0.00	1		
Factor 2: Enjoyment of Exercise	0.25*	0.85***	0.33*	0.33*	0.26*	0.03	0.06	1	
Factor 4: Exercise Choice	0.03	0.22*	0.15*	0.74*	0.08	0.01	0.01	0.06	1

***Significant at p<.001 level, **Significant at p<0.1 level, *Significant at p<.05 level

Appendix Table 3-9: Factor Loading and Cronbach's Alphas for Barriers and Benefits Scale, Study Two (n=200)

	Factor 1: Physical Benefits of Exercise (Benefit)	Factor 2: Social Benefits of Exercise (Benefit)	Factor 3: Exercise Difficulty (Barrier)	Factor 4: Inconvenience (Barrier)	Factor 5: Time Barriers (Barrier)	Factor 6: Long Term Health Benefits (Benefit)	Factor 7: Non-Social Support (Barrier)
Cronbach's Alpha	0.95	0.83	0.80	0.75	0.82	0.75	0.64
	Exercise decreases feelings of stress and tension for me. (0.43)	I enjoy exercise. (0.15)	Exercise tires me. (0.38)	Places for me to exercise are too far away. (0.33)	Exercising takes too much of my time. (0.11)	I will prevent heart attacks by exercising (0.39)	My spouse (or significant other) does not encourage exercising (0.11)
	Exercise improves my mental health. (0.40)	Exercising lets me have contact with friends and persons I enjoy (0.30)	I am fatigued by exercise. (0.49)	I am too embarrassed to exercise. (0.11)	Exercise takes too much time from family relationships (0.35)	Exercising will keep me from having high blood pressure (0.50)	My family members do not encourage me to exercise. (0.03)
	Exercise increases my muscle strength. (0.11)	Exercising is a good way for me to meet new people (0.31)	Exercise is hard work for me. (0.43)	It costs too much to exercise. (0.20)			
	Exercise gives me a sense of personal accomplishment. (0.11)	Exercise improves my self-concept (0.07)		I think people in exercise clothes look funny. (0.08)			

Factor 1: Physical Benefits of Exercise (Benefit)	Factor 2: Social Benefits of Exercise (Benefit)	Factor 3: Exercise Difficulty (Barrier)	Factor 4: Inconvenience (Barrier)	Factor 5: Time Barriers (Barrier)	Factor 6: Long Term Health Benefits (Benefit)	Factor 7: Non-Social Support (Barrier)
Exercise makes me feel relaxed. (0.11)			There are too few places for me to exercise (0.45)			
I have improved feelings of well-being from exercise. (0.18)						
Exercise increases my stamina (0.15)						
Exercise increases my flexibility (0.15)						
My disposition is improved with exercise (0.21)						
Exercising helps me sleep better at night (0.06)						
I will live longer if I exercise (0.18)						
My physical endurance is improved by exercising (0.14)						
Exercise helps me decrease fatigue (0.05)						

Factor 1: Physical Benefits of Exercise (Benefit)	Factor 2: Social Benefits of Exercise (Benefit)	Factor 3: Exercise Difficulty (Barrier)	Factor 4 : Inconvenience (Barrier)	Factor 5: Time Barriers (Barrier)	Factor 6: Long Term Health Benefits (Benefit)	Factor 7: Non-Social Support (Barrier)
Exercise allows me to carry out normal activities without becoming tired (0.11)						
Exercise improves the quality of my work. (0.06)						
Exercise improves overall body functioning for me. (0.11)						
Exercise improves the way my body looks. (0.08)						
Exercising improves functioning of my cardiovascular system. (0.16)						

Appendix Table 3-10: Correlations between Weekly Exercise Score and Benefits and Barriers Scales and Factors, Study 2 (n=200)

	Weekly Exercise Score	Perceived Benefits	Perceived Barriers	Factor 1: Physical Benefits of Exercise (Benefit)	Factor 2: Social Benefits of Exercise (Benefit)	Factor 3: Exercise Difficulty (Barrier)	Factor 4: Inconvenience (Barrier)	Factor 5: Time Barriers (Barrier)	Factor 6: Long Term Health Benefits (Benefit)	Factor 7: Non-Social Support (Barrier)
Weekly Exercise Score	1									
Perceived Benefits	0.22*	1								
Perceived Barriers	-0.14*	-0.31*	1							
Factor 1: Physical Benefits of Exercise (Benefit)	0.09*	0.88*	-0.15*	1						
Factor 2: Social Benefits of Exercise (Benefit)	0.26**	0.45**	-0.09*	0.06	1					
Factor 3: Exercise Difficulty (Barrier)	-0.03	-0.09*	0.67***	-0.02	0.04	1				
Factor 4: Inconvenience (Barrier)	-0.22*	-0.10*	0.50**	0.02	-0.07	0.02	1			
Factor 5: Time Barriers (Barrier)	-0.01	-0.13*	0.55**	-0.01	-0.01	0.10*	0.03	1		
Factor 6: Long Term Health Benefits (Benefit)	0.16*	0.27*	-0.09*	0.08*	0.04	0.00	-0.03	-0.01	1	
Factor 7: Non-Social Support (Barrier)	-0.04	0.20*	-0.02	0.09*	-0.01	-0.01	0.02	0.03	-0.08	1

***Significant at p<.001 level, **Significant at p<0.1 level, *Significant at p<.05 level

Appendix Table 3-11: Factor Loadings and Cronbach's Alphas for the Social Support Scale, Study Two (n=200)

	Factor 1: Workout Buddy	Factor 2: Friend	Factor 3: Family
Cronbach's Alpha	0.92	0.81	0.84
	Workout Buddy: Exercised with me (0.18)	Friend: Exercised with me (0.16)	Family: Exercised with me (0.19)
	Workout Buddy: Offered to exercise with me (0.22)	Friend: Offered to exercise with me (0.14)	Family: Offered to exercise with me (0.23)
	Workout Buddy: Gave me helpful reminders to exercise (0.20)	Friend: Gave me helpful reminders to exercise (0.14)	Family: Gave me helpful reminders to exercise (0.13)
	Workout Buddy: Gave me encouragement to stick with my exercise (0.16)	Friend: Gave me encouragement to stick with my exercise (0.12)	Family: Gave me encouragement to stick with my exercise (0.10)
	Workout Buddy: Changed their schedule so we could exercise together (0.13)	Friend: Changed their schedule so we could exercise together (0.16)	Family: Changed their schedule so we could exercise together (0.17)
	Workout Buddy: Discussed exercise with me (0.15)	Friend: Discussed exercise with me (0.10)	Family: Discussed exercise with me (0.08)
	Workout Buddy: Complained about the amount of time I spent exercising (0.03)	Friend: Complained about the amount of time I spent exercising (0.06)	Family: Complained about the amount of time I spent exercising (0.03)
	Workout Buddy: Gave me rewards for exercising (0.02)	Friend: Gave me rewards for exercising (0.09)	Family: Gave me rewards for exercising (0.07)
	Workout Buddy: Planned for exercising on recreational outings (0.13)	Friend: Planned for exercising on recreational outings (0.14)	Family: Planned for exercising on recreational outings (0.09)
	Workout Buddy: Helped plan actives around my exercise (0.10)	Friend: Helped plan actives around my exercise (0.21)	Family: Helped plan actives around my exercise (0.13)
	Workout Buddy: Asked me for ideas on how they could get more exercise (0.05)	Friend: Asked me for ideas on how they could get more exercise (0.10)	Family: Asked me for ideas on how they could get more exercise (0.07)
	Workout Buddy: Talked to me about how much they like to exercise (0.10)	Friend: Talked to me about how much they like to exercise (0.11)	Friend: Talked to me about how much they like to exercise (0.10)

Table 3-12: Correlations between Weekly Exercise Score and Social Support Scales and Factors, Study 2 (n=200)

	Weekly Exercise Score	Social Support – Workout Buddy	Social Support – Friend	Social Support – Family	Factor 1: Workout Buddy Social Support	Factor 2: Friend Social Support	Factor 3: Family Social Support
Weekly Exercise Score	1						
Social Support – Workout Buddy	0.27*	1					
Social Support – Friend	0.04	0.26*	1				
Social Support – Family	0.28*	0.58**	0.14*	1			
Factor 1: Workout Buddy Social Support	0.19*	0.90***	0.22*	0.26*	1		
Factor 2: Friend Social Support	0.16*	0.36*	0.35**	0.27**	0.04	1	
Factor 3: Family Social Support	0.20*	0.29*	-0.05	0.92***	0.02	0.03	1

***Significant at p<.001 level, **Significant at p<0.1 level, *Significant at p<.05 level

Appendix Table 3-13: Statistical Tests for Differences in Construct Means at Baseline and Follow-Up, Study Two (n=200)

	Baseline				Follow-Up			
Measure	Control (N=106) Mean (SD) 95% CI	Treatment (N=94) Mean (SD) 95% CI	T-Test Result [95% CI for Diff in Means]	Effect Size [95% CI]	Control (N=106) Mean (SD) 95% CI	Treatment (N=94) Mean (SD) 95% CI	T-Test Result [95% CI for Diff in Means]	Effect Size [95% CI]
% Perceiving Success in Exercise Behavior	0%	0%	N/A	N/A	37%+	46%+		
Locus	16.67 (4.0)	15.88 (3.9)	-0.87		20.23 (5.9)	19.79 (6.2)	-0.41	
	(15.9, 17.4)	(15.1, 16.6)	(-2.0, 0.2)	N/A	(19.1, 21.3)	(15.8, 23.8)	(-1.8, 1.0)	N/A
Control	17.80 (4.3)	17.28 (4.1)	-0.52		20.32 (6.7)	22.23 (5.9)*	1.91	0.02
	(16.9, 18.6)	(16.4, 18.1)	(-1.7, 0.6)	N/A	(19.0, 21.6)	(17.7, 26.7)	(0.4, 3.4)	(0.0, 0.1)
Stability	11.30 (4.5)	11.42 (4.8)	0.12		13.75 (4.6)	13.37 (5.5)	-0.38	
	(10.4, 12.2)	(10.4, 12.4)	(-1.0, 1.3)	N/A	(12.9, 14.6)	(10.7, 16.1)	(-1.6, 0.8)	N/A
Overall Affect	5.72 (3.2)	5.55 (2.9)	-0.17		5.73 (3.4)	5.54 (2.8)	-0.20	
	(5.1, 6.3)	(4.9, 6.1)	(-1.2, 0.8)	N/A	(5.1, 6.4)	(4.4, 6.7)	(-1.2, 0.8)	N/A
Exercise Efficacy	4.20 (1.0)	4.08 (1.1)	-0.12		4.02 (0.6)	4.04 (0.6)	0.02	
	(4.0, 4.4)	(3.9, 4.3)	(-0.9, 0.7)	N/A	(3.9, 4.1)	(3.2, 4.9)	(-0.8, 0.8)	N/A
Task Efficacy	2.93 (0.1)	2.94 (1.2)	0.01		3.92 (1.2)	3.97 (1.1)	0.05	
	(2.8, 2.9)	(2.7, 3.6)	(-0.8, 0.8)	N/A	(3.7, 4.1)	(3.2, 4.8)	(-0.8, 0.9)	N/A
Maintenance Efficacy	3.53 (0.9)	3.44 (0.7)	-0.09		3.36 (0.8)	3.39 (0.8)	0.03	
	(3.4, 3.7)	(3.3, 3.6)	(-0.9, 0.7)	N/A	(3.2, 3.5)	(2.7, 4.1)	(-0.8, 0.8)	N/A
Enjoyment	4.23 (1.1)	4.21 (1.1)	-0.02		4.55 (0.9)	4.50 (0.8)	-0.05	
	4.0, 4.4)	(3.9, 4.4)	(-0.8, 0.8)	N/A	(4.3, 4.7)	(3.6, 5.4)	(-0.9, 0.8)	N/A
Choice	3.95 (1.2)	4.08 (1.3)	0.13		3.95 (0.9)	3.89 (0.9)	-0.06	
	(3.7, 4.2)	(3.8, 4.3)	(-0.7, 1.0)	N/A	(3.8, 4.1)	(3.1, 4.7)	(-0.9, 0.7)	N/A
Competence	4.09 (0.9)	3.87 (0.81)*	-0.29	0.01	4.30 (1.0)	4.23 (0.9)	-0.07	
	(3.9, 4.3)	(3.7, 4.0)	(-1.1, -0.5)	(0.02, 0.06)	(4.1, 4.5)	(3.4, 5.1)	(-0.9, 0.7)	N/A
Relatedness	4.07 (1.1)	4.48 (1.0)*	0.41	0.04	4.37 (1.1)	4.45 (1.0)	0.08	
	(3.9, 4.3)	(4.3, 4.7)	(0.1, 1.2)	(0.02, 0.07)	(4.2, 4.6)	(3.6, 5.3)	(-0.7, 0.9)	N/A
Planning	3.49 (0.7)	3.51 (0.8)	0.01		3.25 (0.6)	3.18 (0.6)	-0.07	
	(3.4, 3.6)	(3.3, 3.6)	(-0.8, 0.8)	N/A	(3.1, 3.4)	(2.5, 3.8)	(-0.9, 0.7)	N/A

Higher scores on the attributional dimensions indicate a tendency to make more internal/controllable/stable attributions
Higher scores indicate a higher association with the construct
***Significant at p<.001 level, **Significant at p<0.1 level, *Significant at p<.05 level

Appendix Table 3-13: Statistical Tests for Differences in Construct Means at Baseline and Follow-Up, Study Two (cont.)

	Baseline				Follow-Up			
Measure	Control (N=106) Mean (SD) 95% CI	Treatment (N=94) Mean (SD) 95% CI	T-Test Result [95% CI for Diff in Means]	Effect Size [95% CI]	Control (N=106) Mean (SD) 95% CI	Treatment (N=94) Mean (SD) 95% CI	T-Test Result [95% CI for Diff in Means]	Effect Size [95% CI]
Awareness	3.20 (0.9) (3.0, 3.4)	3.34 (0.9) (2.7, 4.0)	0.14 (-0.7, 0.9)	N/A	3.16 (0.9) (2.6, 3.8)	3.22 (1.1) (2.6, 3.9)	0.06 (-0.7, 0.9)	N/A
Perceived Barriers	1.94 (0.4) (1.9, 2.0)	1.80 (0.5)* (1.4, 2.2)	-0.14 (-0.2, -0.07)	0.03 (0.1, 0.1)	1.59 (0.4) (1.3, 1.9)	1.51 (0.4) (1.2, 1.8)	-0.08 (-0.9, 0.7)	N/A
Perceived Benefits	3.12 (0.4) (3.0, 3.2)	3.16 (0.4) (2.5, 3.8)	0.04 (-0.8, 0.8)	N/A	2.99 (0.3) (2.4, 3.6)	3.05 (0.3) (2.4, 3.7)	0.06 (-0.7, 0.9)	N/A
Social Support – Family	2.09 (1.0) (1.9, 2.3)	2.35 (1.3) (1.9, 2.8)	0.26 (-0.6, 1.1)	N/A	2.07 (1.0) (1.7, 2.5)	2.28 (1.6) (1.8, 2.7)	0.20 (-0.6, 1.0)	N/A
Social Support – Friends	1.04 (0.5) (0.9, 1.1)	0.96 (0.5) (0.8, 1.2)	-0.08 (-0.9, 0.7)	N/A	0.97 (0.5) (0.8, 1.2)	0.68 (0.9) (0.5, 0.8)	-0.29 (-1.1, 0.5)	N/A
Social Support -Exercise Companion	2.25 (1.5) (1.9, 2.5)	2.3 (1.1) (1.8, 2.8)	0.05 (-0.8, 0.9)	N/A	2.26 (1.0) (1.8, 2.7)	2.15 (0.9) (1.7, 2.6)	-0.11 (-0.9, 0.7)	N/A

Higher scores on the attributional dimensions indicate a tendency to make more internal/controllable/stable attributions
Higher scores indicate a higher association with the construct
***Significant at p<.001 level, **Significant at p<0.1 level, *Significant at p<.05 level

Appendix Table 3-13a: Statistical Tests for Differences in Construct Means between Baseline and Follow-Up, Study Two (n=200)

	Control				Follow-Up			
Measure	Baseline (N=106) Mean (SD) 95% CI	Follow-Up (N=106) Mean (SD) 95% CI	T-Test Result [95% CI for Diff in Means]	Effect Size [95% CI]	Baseline (N=94) Mean (SD) 95% CI	Follow-Up (N=94) Mean (SD) 95% CI	T-Test Result [95% CI for Diff in Means]	Effect Size [95% CI]
% Perceiving Success in Exercise Behavior	0%	37%***			0%	46%+		
Locus	16.67 (4.0) (15.9, 17.4)	20.23 (5.9)* (19.1, 21.3)	3.61(2.5, 4.4)	0.09 (.07, .11)	15.88 (3.9) (15.1, 16.6)	19.79 (6.2)*** (15.8, 23.8)	3.91(2.4, 4.4)	0.8 (.07, .12)
Control	17.80 (4.3) (16.9, 18.6)	20.32 (6.7)** (19.0, 21.6)	2.52 (1.9, 3.1)	0.05 (.02, .08)	17.28 (4.1) (16.4, 18.1)	22.23 (5.9)** (17.7, 26.7)	4.95 (2.3, 5.1)	0.05 (.01, .08)
Stability	11.30 (4.5) (10.4, 12.2)	13.75 (4.6)* (12.9, 14.6)	2.55 (1.4, 3.6)	0.07 (.03, 0.11)	11.42 (4.8) (10.4, 12.4)	13.37 (5.5)* (10.7, 16.1)	2.45 (1.4, 3.6)	0.07 (.03, 0.12)
Overall Affect	5.72 (3.2) (5.1, 6.3)	5.73 (3.4) (5.1, 6.4)	N/A	N/A	5.55 (2.9) (4.9, 6.1)	5.54 (2.8) (4.4, 6.7)	N/A	N/A
Exercise Efficacy	4.20 (1.0) (4.0, 4.4)	4.02 (0.6) (3.9, 4.1)	N/A	N/A	4.08 (1.1) (3.9, 4.3)	4.04 (0.6) (3.2, 4.9)	N/A	N/A
Task Efficacy	2.93 (0.1) (2.8, 2.9)	3.92 (1.2)** (3.7, 4.1)	0.99 (0.4, 1.4)	0.03 (.01, .05)	2.94 (1.2) (2.7, 3.6)	3.97 (1.1) (3.2, 4.8)	N/A	N/A
Maintenance Efficacy	3.53 (0.9) (3.4, 3.7)	3.36 (0.8) (3.2, 3.5)	N/A	N/A	3.44 (0.7) (3.3, 3.6)	3.39 (0.8) (2.7, 4.1)	N/A	N/A
Enjoyment	4.23 (1.1) 4.0, 4.4)	4.55 (0.9)* (4.3, 4.7)	0.32 (0.2, 0.4)	0.01 (.01, .02)	4.21 (1.1) (3.9, 4.4)	4.50 (0.8)** (3.6, 5.4)	0.29 (0.2, 0.4)	0.01 (.01, .02)
Choice	3.95 (1.2) (3.7, 4.2)	3.95 (0.9) (3.8, 4.1)	N/A	N/A	4.08 (1.3) (3.8, 4.3)	3.89 (0.9) (3.1, 4.7)	N/A	N/A
Competence	4.09 (0.9) (3.9, 4.3)	4.30 (1.0) (4.1, 4.5)	N/A	N/A	3.87 (0.81) (3.7, 4.0)	4.23 (0.9)* (3.4, 5.1)	0.36 (.21,.45)	0.03 (.01,.06)
Relatedness	4.07 (1.1) (3.9, 4.3)	4.37 (1.1)** (4.2, 4.6)	0.33 (0.2, 0.3)	0.01 (.01, .03)	4.48 (1.0) (4.3, 4.7)	4.45 (1.0) (3.6, 5.3)	N/A	N/A
Planning	3.49 (0.7) (3.4, 3.6)	3.25 (0.6)* (3.1, 3.4)	-0.24 (0.1, 0.3)	0.02 (0.01, 03)	3.51 (0.8) (3.3, 3.6)	3.18 (0.6)* (2.5, 3.8)	-0.33 (0.1, 0.3)	0.02 (0.01, 03)

Higher scores on the attributional dimensions indicate a tendency to make more internal/controllable/stable attributions
Higher scores indicate a higher association with the construct
***Significant at p<.001 level, **Significant at p<0.1 level, *Significant at p<.05 level

Appendix Table 3-13a: Statistical Tests for Differences in Construct Means between Baseline and Follow-Up, Study Two (cont.)

	Control				Treatment			
Measure	Baseline (N=106) Mean (SD) 95% CI	Follow-Up (N=106) Mean (SD) 95% CI	T-Test Result [95% CI for Diff in Means]	Effect Size [95% CI]	Baseline (N=94) Mean (SD) 95% CI	Follow-Up (N=94) Mean (SD) 95% CI	T-Test Result [95% CI for Diff in Means]	Effect Size [95% CI]
Awareness	3.20 (0.9) (3.0, 3.4)	3.16 (0.9) (2.6, 3.8)	N/A	N/A	3.34 (0.9) (2.7, 4.0)	3.22 (1.1) (2.6, 3.9)	N/A	N/A
Perceived Barriers	1.94 (0.4) (1.9, 2.0)	1.59 (0.4)* (1.3, 1.9)	-0.35(-.45, -.24)	0.09 (.07, .11)	1.80 (0.5) (1.4, 2.2)	1.51 (0.4)** (1.2, 1.8)	-0.3 (-.5, -.1)	0.09 (.07, .11)
Perceived Benefits	3.12 (0.4) (3.0, 3.2)	2.99 (0.3)* (2.4, 3.6)	-0.13 (-.20, -.06)	0.05 (.02, .08)	3.16 (0.4) (2.5, 3.8)	3.05 (0.3)* (2.4, 3.7)	-0.11 (-.15, -.07)	0.05 (.02, .08)
Social Support – Family	2.09 (1.0) (1.9, 2.3)	2.07 (1.0)* (1.7, 2.5)	-0.02 (-.03, -.01)	0.07 (.03, 0.11)	2.35 (1.3) (1.9, 2.8)	2.28 (1.6)* (1.8, 2.7)	-.07 (-.11, -.04)	0.07 (.03, 0.11)
Social Support – Friends	1.04 (0.5) (0.9, 1.1)	0.97 (0.5)* (0.8, 1.2)	-0.07 (-.1, -.04)	0.07 (.03, 0.11)	0.96 (0.5) (0.8, 1.2)	0.68 (0.9)** (0.5, 0.8)	-0.28 (-.33, -.23)	0.07 (.03, 0.11)
Social Support - Exercise Companion	2.25 (1.5) (1.9, 2.5)	2.26 (1.0) (1.8, 2.7)	N/A	N/A	2.3 (1.1) (1.8, 2.8)	2.15 (0.9) (1.7, 2.6)	N/A	N/A

Higher scores on the attributional dimensions indicate a tendency to make more internal/controllable/stable attributions

Higher scores indicate a higher association with the construct

***Significant at p<.001 level, **Significant at p<0.1 level, *Significant at p<.05 level

Appendix Table 3-14: Correlations Between Psycho-Social and Outcome Variables Used in Models, Study Two

Psycho-Social Construct	Control Dimension	Stability Dimension
Overall Affect	-0.05	-0.02
Exercise Efficacy	-0.07	0.03
Task Efficacy	-0.11	-0.04
Maintenance Efficacy	-0.05	0.04
IMI-Enjoyment	0.03	-0.05
IMI-Competence	-0.06	0.02
IMI-Choice	0.04	-0.12
IMI-Relatedness	0.06	-0.00
Action Control-Planning	0.11	-0.00
Action Control-Awareness	-0.01	0.07
Perceived Barriers	0.05	-0.04
Perceived Benefits	-0.02	0.06
Social Support - Family	0.04	0.08
Social Support - Buddy	-0.02	0.03
Social Support - Friend	0.13	-0.11

None of the correlations were statistically significant.

Appendix Four: Study 2 Vignette Descriptions

Intervention Group Vignettes

Vignette 1: Demanding Job

Actor 1: Potential customer who is struggling to maintain an exercise program due to his very demanding job.

Actor 2: Company staff member.

Major Talking Points:

1. Actor 1 is bothered by his inability to maintain an exercise program. He is thinking about joining the company to help him stay motivated.
2. Actor 1 believes that this inability is due to his job which is very stressful and takes up most of his time during the day. One of the results of his high stress job is that he feels that he does not have time to think about and plan for regular exercise.
3. Actor 1 also mentions that because his job is so high stress, he prefers to use his free time to watch TV, go to bars, and other social activity. This leaves him little time during the day to exercise.
4. Actor 2 listens to the potential customer's plight and makes the following suggestions.
    a. The company's operating hours range from the early morning (facilities open at 5:00 AM and close at 11:00 PM). Given these hours, clients have quite a bit of latitude to decide when they want to come to the gym. So even if the job has demanding hours, the company's hours of operation are so broad, he should be able to find early morning or late time to visit the gym.

b. A person need not exercise for hours to reap the benefits of exercise. Exercise research shows that a person only need to exercise for 150 minutes (moderate) per week. If you exercise vigorously, you need less (75 minutes). A person can get their exercise by coming to the gym, running stairs, walking or jogging to and from work, biking instead of driving, or even cleaning your house. All of these aforementioned can help you get the activity you need on your own time.
c. The company offers several classes at different times. By attending class, he need not plan for exercise. Just show up to one of the classes and let the trainer take care of the rest for you.
d. The trainers can work with you to design exercise plans that fit into your schedule. They can help you take control of your exercise behavior by helping you implement goal-setting techniques, strategies on what to do when other priorities conflict with your goals, and how you can keep track of your progress when you exercise.
e. The trainers can also help you identify specific barriers to your physical activity behavior and help you develop strategies to overcome these barriers. The trainers will sit down with you and help you create a detailed list of all the things that negatively impact your exercise behavior. Once the list is generated, your trainer will go through the list with you one by one to figure out the best way can overcome the barrier and take back control of your exercise.

Vignette 2: New mother

Actor 1: Woman who is struggling to maintain an exercise program due to the time constraints related to having a new baby.

Actor 2: Company fitness staff member

1. Actor 1 is bothered by her inability to maintain an exercise program because she has just a new baby.
2. Actor 1 believes that this inability is due to her new child which is very stressful and time consuming. She states that she has a clear case of baby-brain and can't think clearly about scheduling time to exercise. Her partner is the sole breadwinner in the family and he has to work, leaving him little time to help with the baby.
3. Actor 1 also mentions caring for the child takes so much time and mental effort that all she wants to do is eat and sleep when she has some time away from the child.
4. Actor 2 listens to the potential customer's plight and makes the following suggestions.
    a. The facility's operating hours range from the early morning (facilities open at 5:00 AM and close at 11:00 PM). Given these hours, clients have quite a bit of latitude to decide when they want to come to the gym. So, could the husband watch the child in the early mornings or evenings before he has to go to work so she can get in her daily exercise?
    b. A person need not exercise for hours to reap the benefits of exercise. Exercise research shows that a person only needs to exercise for 150 minutes (moderate) per week. If you exercise vigorously, you need less (75 minutes). A person can get their exercise by coming to the gym, running stairs, walking or jogging to and from

work, biking instead of driving, or even cleaning your house. All of these aforementioned can help you get the activity you need on your own time.

c. The company offers several classes at different times. By attending class, he need not plan for exercise. Just show up to one of the company's classes and let the trainer take care of the rest for you. This way, all you'll have to remember to do is show up to class. The company conveniently posts their class schedule on its website which you can check every day to figure out which classes you'd like to attend. Additionally, the company app can send you text reminders of the classes that you sign up for; thus, you won't forget to attend!

d. The company's staff psychologists can work with you to design exercise plans that fit into your schedule. They can help you take control of your exercise behavior by helping you implement goal-setting techniques, strategies on what to do when other priorities conflict with your goals, and how you can keep track of your progress when you exercise.

e. Staff psychologists can also help you identify specific baby – related / scheduling barriers to your physical activity behavior and help you develop strategies to overcome these barriers. The trainers will sit down with you and help you create a detailed list of all the things that negatively impact your exercise behavior. Once the list is generated, your trainer will go through the list with you one by one to figure out the best way can overcome the barrier and take back control of your exercise.

Vignette 3: Dislike of exercise

Actor 1: A potential customer who is struggling to start an exercise program due to his intense dislike of exercise.

Actor 2: A fitness staff member who is a certified exercise psychologist.

Major Talking Points:

1. Actor 1 is bothered by his inability to maintain an exercise program. He is thinking about joining the gym to help him stay motivated.
2. Actor 1 believes that this inability is due to his intense dislike of exercise. For him, even the thought of exercise puts him in a funk and he then starts to feel completed unmotivated to work-out.
3. He has tried to start an exercise program several times in the past few years. Invariably, however, he quickly begins to feel fatigued from his workout which makes him think that he's not cut out to regularly exercise. Also, he feels embarrassed and awkward around the gym since he feels like he doesn't know "how" to exercise. In turn, these thoughts only make him dislike exercise even more than he did prior to his trying to begin a program.
4. Actor 2 listens to the potential customer's plight and makes the following suggestions.
    a. The facility's operating hours range from the early morning (facilities open at 5:00 AM and close at 11:00 PM). Given these hours, clients have quite a bit of latitude to decide when they want to come to the gym. Therefore, if he feels uncomfortable working out in front of other people, he can come to the early morning or late hours where there are less people. This should make him feel less self-conscious when trying to figure out how to use the different exercise machines. Eventually, the self-

conscious feelings will dissipate and he can exercise at times that are more convenient to him than the early morning hours.

b. Feelings of fatigue and dislike of exercise usually diminish over time especially if one maintains a regular exercise routine. While most novice exercise experience these feelings, after a few weeks, the sensations of fatigue diminish, and people actually begin to appreciate the "tiredness" and "soreness" they feel from exercise.

c. The company offers several classes at different times. By attending these classes regularly, you begin to develop relationships with other people in the class. This form of social support will help you overcome your dislike of exercise because you'll begin to feel related to others in the class. Again, these feelings of dislike are temporary. But these feelings only go away if you stick with the program.

d. The trainers can work with you to design exercise plans that fit into your schedule. They can help you take control of your exercise behavior by helping you implement goal-setting techniques, strategies on what to do when other priorities conflict with your goals, and how you can keep track of your progress when you exercise.

e. The trainers can also help you identify specific barriers to your physical activity behavior and help you develop strategies to overcome these barriers. The trainers will sit down with you and help you create a detailed list of all the things that negatively impact your exercise behavior. Once the list is generated, your trainer will go through the list with you one by one to figure out the best way can overcome the barrier and take back control of your exercise.

f. The company's in-house exercise psychologists can help show you that dislike and fatigue of exercise are common feelings for novice exercisers. The psychologists

have several techniques at their disposal that can help you push through these feelings when they first come about.

Appendix Five: Institutional Review Board Materials

UNIVERSITY OF MARYLAND
INSTITUTIONAL REVIEW BOARD

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TO:	Darius Singpurwalla, MS
FROM:	University of Maryland College Park (UMCP) IRB
PROJECT TITLE:	[1046388-1] Attributions and the Intention Behavior Gap: Understanding and Retraining
REFERENCE #:	
SUBMISSION TYPE:	New Project
ACTION:	APPROVED
APPROVAL DATE:	August 9, 2017
EXPIRATION DATE:	August 8, 2018
REVIEW TYPE:	Expedited Review
REVIEW CATEGORY:	Expedited review category # 7

Thank you for your submission of New Project materials for this project. The University of Maryland College Park (UMCP) IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

Prior to submission to the IRB Office, this project received scientific review from the departmental IRB Liaison.

This submission has received Expedited Review based on the applicable federal regulations.

Note: The letter of support from the fitness center must be submitted via amendment and approved by the IRB prior to beginning any research at this site.

This project has been determined to be a Minimal Risk project. Based on the risks, this project requires continuing review by this committee on an annual basis. Please use the appropriate forms for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of August 8, 2018.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Unless a consent waiver or alteration has been approved, Federal regulations require that each participant receives a copy of the consent document.

Please note that any revision to previously approved materials must be approved by this committee prior to initiation. Please use the appropriate revision forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others (UPIRSOs) and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office. Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed.

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DATE: January 19, 2018

TO: Darius Singpurwalla, MS
FROM: University of Maryland College Park (UMCP) IRB

PROJECT TITLE: [1046388-2] Attributions and the Intention Behavior Gap: Understanding and Retraining
REFERENCE #:
SUBMISSION TYPE: Amendment/Modification

ACTION: APPROVED
APPROVAL DATE: January 19, 2018
EXPIRATION DATE: August 8, 2018
REVIEW TYPE: Expedited Review

REVIEW CATEGORY: Expedited review category # 7

Thank you for your submission of Amendment/Modification materials for this project. The University of Maryland College Park (UMCP) IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

Prior to submission to the IRB Office, this project received scientific review from the departmental IRB Liaison.

This submission has received Expedited Review based on the applicable federal regulations.

This project has been determined to be a Minimal Risk project. Based on the risks, this project requires continuing review by this committee on an annual basis. Please use the appropriate forms for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of August 8, 2018.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Unless a consent waiver or alteration has been approved, Federal regulations require that each participant receives a copy of the consent document.

Please note that any revision to previously approved materials must be approved by this committee prior to initiation. Please use the appropriate revision forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others (UPIRSOs) and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office. Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.

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