The Impact of Chronic and Situationally-Induced Regulatory foci on Exercise Outcomes

Submitted By

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Chapter 1

1.1 Thesis Overview

Physical activity is an important tool in combating various forms of chronic disease. Despite the health benefits of physical exercise, however, a large proportion of the population fails to engage in levels of exercise sufficient to guard against these diseases. Consequently, researchers have begun to explore programs and techniques that might facilitate physical activity in the general population. One of the topics of research that has captured recent attention in this area has been an examination of environmental influences on goal activation and pursuit. The aim of the study presented in this thesis was to explore this issue in relation to the activation and pursuit of regulatory foci discussed in regulatory focus theory (Higgins, 1997). More specifically, the study was focused on the effects of matching images to participants’ chronic regulatory (i.e., promotion or prevention) orientations. In regulatory focus theory (Higgins, 1997), a ‘promotion orientation’ refers to people who are concerned with success, whereas a ‘prevention orientation’ refers to those who tend to be concerned with failure. It was hypothesized that participants who viewed images that matched their chronic orientations would exercise harder (as indicated by higher heart rate readings), report lower rating of perceived exertion, have higher intention to engage in future exercise, and assign more monetary value to a similar 30 minute cycling class.

Participants were 126 undergraduates who viewed a set of images while pedaling on a stationary bike. Half of the participants viewed images that matched their chronic orientation, while others viewed images that did not match their chronic regulatory orientation. Images either depicted success or failure in a sports context (e.g., winning a tennis match or losing a basketball game). Participants’ perceived monetary value, intentions to participate in future exercise behavior, and rating of perceived exertion were assessed using follow up
questionnaires. Participants’ heart rates were monitored using heart rate monitors. During a separate session (at a time following the main protocol), participants were required to complete a set of questionnaires that included a measure of their chronic regulatory orientation and exercise motivation. Results indicated that matching images to participants’ chronic regulation did not result in any significant effect on attitudinal (i.e., intentions and perceived value) or behavioral (i.e., heart rate and rating of perceived exertion) measures. Therefore, there was no support for any of the hypotheses. A potential reason for the nonsignificant findings might be that the potency of the prime was not sufficient to activate a strong response among participants. Other possible interpretations are explored in the discussion, and future research opportunities are also identified.

The following chapter is a literature review that provides conceptual and empirical background in relation to the topic. Following the literature review, the study is presented in the form of a journal article (i.e., introduction, method, results, discussion).

1.2 Research Objectives

Data were collected in order to address the following issues:

1. To gain a deeper understanding of the effects of dissociation on exercise-related outcomes.

2. To determine if participants exposed to pictures that matched their chronic orientation differ in their exercise-related evaluations and behavior from those exposed to images that did not match their chronic regulatory orientation.
1.3 Terminology

The following terms are used repeatedly throughout this thesis. The definitions of the terms are provided below. The main text will provide further clarification for some of these terms.

**Message Tailoring:** Messages customized to an individual’s characteristic (Latimer, Brawley & Bassett, 2010)

**Chronic Regulatory Orientations:** A person’s disposition in relation to self-regulation, which is either promotion- or prevention-focused (Higgins, 1997).

**Regulatory Relevance:** Information presented addresses a person’s regulatory concern (Aaker & Lee, 2006).

**Promotion:** An orientation whereby a person focuses on the presence and absence of positive outcomes (Higgins, 1997).

**Prevention:** An orientation whereby a person focuses on the presence and absence of negative outcomes (Higgins, 1997).
Chapter 2

2.1 Introduction

People are often surrounded by a wealth of information no matter where they are. With the advent of the internet, as well as constant ‘mobilization’ of information through 3G networks and network compatible mobile computing devices, we find ourselves buried in a sea of information. Importantly, this ‘bombardment’ of information is present even when we are exercising on a treadmill or a spin bicycle. Indeed, individuals can often be seen reading a magazine, watching the television, or listening to music while dissociating from the exercise that they are performing. Dissociation represents an attentional focus that is unrelated to the experience of the exercise being performed (Goode & Roth, 1993; LaCaille, Masters, & Heath, 2004), and can refer to a conscious processing of either internal (e.g., daydreaming) or external stimuli (e.g., scenery) (Stevinson & Biddle, 1999).

A literature review by Masters and Ogles (1998) indicated that dissociation is typically related to greater endurance and lower perceptions of exertion among runners, and dissociation is generally induced by having participants listen to music, attend to features of the external environment, solve problems, or watch videos (Johnson & Siegel, 1987; LaCaille et al., 2004; Pennebaker & Lightner, 1980; Stanley, Pargman, & Tenenbaum, 2007). Despite these findings, it is not clear if the content of dissociation may impact exercise behavior in different ways. For example, would a person running on a treadmill run harder or longer if s/he saw a picture of a team winning or losing a match? To date, no study has investigated the potential consequences of varying dissociation content. However, research on message tailoring might be able to shed some light on how different content can impact exercise behavior. While dissociation can take place using different mediums, the following sections will focus on visual content unless otherwise indicated.
Message Tailoring

Message tailoring refers to the customization of a message based on a specific individual-difference characteristic (Kreuter, 2003; Latimer et al., 2010). A recent meta-analysis based on 57 studies supported the efficacy of tailored messages to invoke health behavior change (Noar, Benac, & Harris, 2007), and in 10 out of 12 physical activity messaging studies, tailored messages were found to result in more physical activity than a control message group (see Latimer et al., 2010). According to proponents of the Elaboration Likelihood Model (ELM; Petty & Cacioppo, 1986), tailoring can influence message effectiveness in a variety of ways. First, if a recipient’s motivation or ability to elaborate on a message is constrained in some way (such as when time to process the message is limited), matching characteristics of the message to the recipient could act as a simple adaptive cue (e.g., “this product is good because it relates to me”). Under high elaboration conditions, matching a message to an individual can lead to a bias in message processing (e.g., reacting more positively to arguments that are unclear). Tailoring might also enable the message recipient to see the strengths in arguments more clearly, or provide people with greater confidence in their thoughts about the message (Petty, Barden, & Wheeler, 2009). Finally, it is articulated in the ELM that tailoring can influence the extent of elaboration toward a message (Petty et al., 2009).

These message tailoring findings suggest that the content of information entering our field of vision can have varying effects on our exercise behavior through different possible mechanisms. An issue that has received little attention in the literature on tailoring is that of ‘goal tailoring’, which involves the customization of messages to match recipients’ pre-existing goals. Interestingly, a variety of environmental stimuli (not just advertisements) can activate goal-related content in memory, and such influence can even occur below the threshold of consciousness (see e.g., Banting, Dimmock, & Grove, 2011). Bargh and
Chartrand (1999) argued that repeated associations between the goal and the situation are the driving force for the automatic activation of the goal in that situation, and that this occurs without consciousness. Moreover, goals that have been activated without consciousness can drive behavior in much the same way as consciously regulated goals (Bargh & Chartrand, 1999). This issue is important for understanding the potential effects of dissociation during exercise, because by definition, physical activity is not consciously regulated while exercisers dissociate. Research and theory now indicates that material which is consciously attended to (e.g., magazines, television) during exercise can influence our exercise behavior and evaluations without our awareness. Bargh (1990) was the first to comment on this automaticity of goal activation and pursuit in his auto-motive model. His argument was unique insofar as he proposed that the entire goal process, from activation to pursuit, could operate without conscious intervention. A host of studies on goal priming have subsequently been undertaken to test the major tenets of the auto-motive model.

**Priming**

According to Higgins (1996), a prime represents any stimulus that nonconsciously activates a particular concept (e.g., a trait, stereotype, or goal) in a person’s mind. Priming studies focusing on stereotypes have demonstrated that individuals’ attitudes, evaluations and behaviors can be affected when they are primed with certain categories of people (e.g., the elderly). For example, a study by Lepore and Brown (1997) revealed that even though both high and low prejudice people had the same amount of stereotype knowledge, high prejudice people tended to rate a target person acting ambiguously more negatively when subliminally primed with words related to black people. In other studies, Bargh, Chen & Burrows (1996) showed that when primed with traits or stereotypes, people tended to act according to those traits or stereotypes. Specifically, their experiments revealed that when primed with the concept of rudeness, individuals were more likely to interrupt a conversation. In addition,
when primed with an elderly stereotype, individuals subconsciously walked slower down a corridor. Other studies have discovered similar findings that corroborate the effects of stereotype priming (Kawakami, Dovidio & Dijsterhuis, 2003; Macrae, Bodenhausen, Milne & Jetten, 1994). Yet priming is not solely bound to stereotypes, it is also applicable to goals.

Goal priming is the activation of goal concepts in a person’s mind, which increases the chances of goal-related behaviors being enacted (Crusius & Mussweiler, 2012). Goals can include “weight-loss”, “travel” or “completing my thesis.” In typical studies on goal priming, participants are first exposed to goal-related stimuli either below (i.e., subliminal priming) or above (i.e., supraliminal priming) the level of conscious perception. Then, in a subsequent task that participants believe is unrelated to the priming activity, various dependent variables are measured. Support for the auto-motive model is obtained if participants’ judgments and/or behavior in the subsequent task is/are influenced by the prime, without their awareness of the influence. For example, Aarts and Dijksterhuis (2000) found that when Dutch participants were primed with the goal to attend a lecture, the concept of ‘bicycle’ was automatically activated in habitual bicycle users. This finding shows that the behavioral representation of cycling (i.e. the means to reach the goal) is activated once information related to the concept of transport is presented. Furthermore, Aarts and Dijksterhuis’ work also indicates that goals themselves may be part of a semantic network that includes the context, the goal, and the action or behavioral representations that are central in the process of achieving the goal (Bargh & Gollwitzer, 1994; Kruglanski et al., 2002). For example, the goal of working out might be related to doing squats (action) while at the gym (context). Thus activation of one concept would inevitably activate those in the same network as well.

With particular relevance for the work presented in this thesis, there is evidence that nonconscious goal activation may be important in shaping exercise perceptions and behavior. For example, in a study by Hepler, Wang, and Albarracin (2012), participants who were
exposed to ‘active’ primes (i.e., action, active etc.) spent more time engaging in a stretching task in comparison to those who were exposed to ‘inactive’ primes (i.e., dormant, inert etc.).

Also, in a study by Banting et al. (2011), the afferent stage of priming, where associated memory structures are activated by the presentation of stimuli, and the efferent stage, where the responses to stimuli are observed by experimenters, were merged by having participants complete a priming task while they were simultaneously performing the outcome task.

Participants in the study were required to complete a scrambled sentence (i.e., priming) task while they were pedaling on a stationary bicycle. Interestingly, their results showed that participants primed with the concept of autonomy (i.e., choice, volition), as opposed to a no-prime group and a group primed with control (i.e., coercion, pressure), enjoyed the exercise more, exercised at a greater intensity, and reported a lower rating of perceived exertion.

Lastly, in a recent study by Magaraggia, Dimmock and Jackson (2014), participants who were primed with autonomy indicated longer intended exercise durations compared to participants who were in the neutral or control prime group.

Three processes, habits, opportunities, and behavior norms, have been described as explanations of how goal priming leads to overt behavior (Dijksterhuis, Chartrand, & Aarts, 2007). Habit, as described by Andrews (1903, p. 121), represents “a more or less fixed way of thinking, willing, or feeling acquired through previous repetition of a mental experience.” In the case of goal priming, repeated performing of a selected action during goal-relevant situations provides the practice in order for habits to be formed. Evidence for the association of goals with different means has been shown in various studies (e.g., Kruglanski et al., 2002; Markman & Brendl, 2000). This means that if an individual always controls him/herself when faced with food, as in the case of dieters, then that individual will habitually control his/her food intake when surrounded by food (and/or food-related stimuli). Opportunities, on the other hand, allow non-habitual responses to be activated in novel situations (Dijksterhuis
et al., 2007). Shah and Kruglanski (2003) found that when participants were primed with a task goal, better performance and greater persistence was observed among those who were also primed with an additional strong opportunity to perform the task. Lastly, behavioral norms are proposed to interact with automatic goal pursuit in a different manner compared to habits (Aarts & Dijksterhuis, 2003). Situational norms, which dictate appropriate behavior in a particular context (Fiske & Hendy, 1992), can be easily established via indirect experiences, and as such, situational norms should be activated in a goal-directed situation (Dijksterhuis et al., 2007). Aarts and Dijksterhuis (2003), for example, found that when exposed to an image of a library, participants automatically spoke at a lower volume.

It is important to note that individuals have a variety of goals within their mind at any time. These goals might be related to different parts of a person’s life and may be activated at different times. Depending on the cognitive resources available at that time (Shah, Friedman, & Kruglanski, 2002), proximal distance to achieving the goal, and emotions related to the goal (Louro, Pieters & Zeelenberg, 2010), one goal will supersede the other. For example, a university lecturer who is also a father-of-two might have work-related goals such as attaining tenure in the next 5 years, personal aspirations such as being able to run a marathon, and family-oriented goals such as being a good father and husband. However, these goals may be activated at different points in time. For instance, being in the office may activate work-related goals, but glancing at the picture of his family in his office might activate the goal of being a good father and husband. The lecturer’s behavior throughout a given day might vary significantly as a function of the activation of these different goal constructs. In the aforementioned example, a family photograph might activate a particular goal, but interestingly, few studies have been undertaken to explore the extent to which pictorial images can influence exercise-related goals and behavior. This is a particularly important issue in light of two important considerations. First, from a scholarly perspective, Bargh
(2006) suggested that it is time to begin to address ‘second generation questions’ in the area of priming, and he particularly encouraged research on the effects of primes in natural (i.e., complex, stimulus-rich) environments. Currently, popular approaches to priming involve internally valid and tightly controlled priming procedures (e.g., scrambled sentence tasks) in laboratories, and much is still to be learned about other forms of priming in non-laboratory settings. Second, from the perspective of health promotion practitioners, it would be interesting to learn whether exposure to images (via magazines, for example) can influence people’s exercise behavior.

**Images and Priming**

A number of studies have utilized pictorial stimuli to prime trait- or categorical-type information among participants. For example, Dell’Acqua and Grainger (1999) found that participants were faster and more accurate at categorizing target words when they were previously primed with images that fell into the same semantic category (e.g., an image of a dog followed by the target word ‘cat’). A more recent study discovered that participants were more likely to adopt risky behavior by betting more on a jackpot game if they were primed with an image of jackpot (Gibson & Zielaskowski, 2013). Other trait-typed studies found that participants tend to be more hostile when primed with images of a young African Americans (Bargh et al., 1996), performed poorer on a knowledge test when primed with images of blondes (Bry, Follenfant, & Meyer, 2008), and were more conformative when primed with an image of an accountant versus an image of a punk (Pendry & Carrick, 2001).

Despite the wealth of studies that have used images to prime traits and categorical concepts, few have actually used them to prime **goals**. One recent study attempted to prime the goal of dieting by means of a poster (Papies & Hamstra, 2010), and showed that restrained eaters in the prime condition ate fewer snacks when free snacks were offered to
them compared to unrestrained eaters in the prime condition. However, there were words included in the posters, and therefore it is not clear if the effects can be solely attributed to the images themselves. Related research on advertising has also documented behavioral changes when participants view pictorial advertisements in relation to behaviors such as reducing smoking (Wakefield et al., 2013), decreasing alcohol consumption during pregnancy (Bazzo et al., 2012), and increasing physical activities of daily living (Bull, Kreuter & Scharff, 1999). Taking all this information into consideration, it appears that there is potential for using images as stimuli for goal priming.

There is debate as to the mechanism for priming effects (including goal priming), but perhaps the most popular account relates to a spreading activation of concepts in the semantic network (e.g., Collins & Quillian, 1969). More specifically, in the case of goal priming, environmental stimuli (such as an image) could automatically activate goals, which subsequently activate goal-related behavioral representations in memory. Such proximity is likely to hinge upon repeated pairings (i.e., conditioning) between the concepts (i.e., the stimulus, the goal, and the behavior; Chartrand & Bargh, 2002). Thus, if an individual has possessed a long-standing goal to improve his or her fitness and strength, and has exercised vigorously and over an extended period to achieve this goal, then environmental stimuli associated with the goal should subsequently activate behavioral representations (Dijksterhuis et al., 2007). If, on the other hand, an individual appreciates improved fitness and strength, but the goal is neither particularly important nor a driver of his/her behavior, then stimuli that activates the (weak) goal is unlikely to produce behavioral effects. The importance of the goal and the extent to which goals drive behavior are therefore important considerations in determining the extent to which goal priming studies are likely to yield behavioral effects. In a broad sense, the ‘goal’ or ‘motive’ that is undertaken by an individual is somewhat
dependent on the regulatory focus orientation that he (or she) adopts. This issue of regulatory focus will be discussed next.

**Regulatory Focus Theory**

Regulatory focus theory, as described by Higgins (1997), indicates that people are chronically oriented to hold either a promotion or prevention goal orientation. *Promotion* oriented individuals are more concerned with goals of success, and look to improve or better themselves in some way. For example, such individuals look for better cardiovascular health, better general health, and good grades. In contrast, *prevention* oriented individuals are focused on goals of avoiding or preventing failures. Such individuals would be preoccupied with making sure that they avoid test failure, avoid weight gain, or avoid disease. According to Higgins (2000), individuals develop their orientation toward promotion or prevention in a manner similar to the way in which children become, for example, more optimistic or pessimistic, and tolerant or less tolerant. More specifically, Higgins (2000) proposed that an environment that focuses on either nurturance or security is emphasized by parent’s social regulation, and that these conditions foster either promotion or prevention goals among children. Nurturance is emphasized when child-caretaker interaction is primarily based on the presence and absence of rewards (e.g., giving a reward when an end state is met or removing the reward when the end state is not met). Security is emphasized when the interaction is primarily based on presence and absence of punishment (e.g., not criticizing when an end state is met and criticizing when end state is not met). These distinct regulatory socializations ‘inform’ children about how to interact in the world and create distinct regulatory orientations within them. Promotion focus, where the focus is on the presence and absence of positive outcomes, is fashioned when in a nurturing socialization environment. A prevention orientation, where the focus is on the presence and absence of negative outcomes, is fashioned in a security socialization environment.
Situationally-induced Regulatory Orientation

Regulatory orientations can also be induced temporarily by situations (Higgins, 2000). Similar to the way in which children are socialized, daily interactions with teachers, parents, or employers can make gains and non-gains or losses and non-losses salient. For example, when a teacher or employer talks about the gain or non-gain of a desirable outcome such as play time, monetary rewards, or a promotion, this activates the need to achieve and accomplish (promotion orientation). Conversely, if the focus is on the loss or non-loss of an undesirable outcome such as loss of play time, loss of monetary reward, or a demotion, then this activates the need for security (prevention orientation). Message framing in terms of these issues also has the ability to induce promotion and prevention orientations. Thus, both situational cues and message framing have the ability to influence orientation beyond that of individual characteristics (Higgins, 2000). However, effects due to activation of temporary orientations via environmental cues should not be as strong as chronic orientations. This is because chronic orientations are constructs that have been developed through years of socialization; as such, activation of such strong constructs should result in larger effects.

Means to an End

In Higgins’ (2000) regulatory fit theory he describes two different means that individuals can adopt in order to achieve their goals. An eagerness means is described as one where individuals actively search for ways to improve themselves to achieve their goals. For example, an eagerness means could involve the undertaking of extra readings for a university unit beyond what is required. In comparison, a vigilance strategy would be one where individuals actively look for ways to reach their goals by avoiding potential pitfalls. For example, an individual using vigilance means might ensure that they complete all the minimum requirements for their module. Aptly described by Higgins in signal detection
terms, an eagerness strategy involves *hits* and avoiding *misses*, whereas a vigilance strategy involves *correct rejections* and avoiding *false positives*. In his regulatory fit theory, Higgins suggests that there is a natural fit between promotion orientation and an eagerness strategy, because eagerness ensures the presence of positive outcomes and ensures against the absence of them. In contrast, a prevention orientation fits naturally with a vigilance strategy, because this strategy ensures the absence of negative outcomes and ensures against the presence of negative outcomes.

When individuals pursue promotion goals with eager means or prevention goals with vigilant means, they are said to experience ‘regulatory fit’ (Higgins, 2000), a state that is characterized by a feeling of ‘rightness’ about the action that is being carried out (Camacho, Higgins, & Luger, 2003). This feeling can then be transferred to subsequent evaluations and judgments of objects, messages, and even behaviors. Regulatory fit studies have shown that under conditions of fit people are willing to pay more for an item (Avnet & Higgins, 2003; Higgins, Freitas, Idson, Spiegel, & Molden, 2003), evaluate a message as more persuasive (Cesario, Grant, & Higgins, 2004; Lee & Aaker, 2004; Zhao & Pechmann, 2007), display increased interest in an activity (Higgins, Cesario, Hagiwara, Spiegel, & Pittman, 2010), increase food and vegetable intake (Latimer et al 2008b; Spiegel, Grant-Pillow, & Higgins, 2004; Study 2), increase test performance (Keller & Bless, 2006), and are more likely to submit a written report (Spiegel et al., 2004; Study 1).

Another concept that has been discussed in relation to regulatory focus is that of ‘regulatory relevance’. Regulatory relevance effects occur when messages match individuals’ regulatory concerns, thus influencing their attitudes (Aaker & Lee, 2006). For example, Aaker and Lee (2001) found that message content was recalled better and message strength was better differentiated when a persuasive appeal matched one’s self-regulatory focus. Specifically, in their series of four experiments, Aaker and Lee found that when primed with
an independent self-view, participants evaluated a website more positively, had higher brand affinity, and were more discerning to argument strength. This suggests that when faced with information that matches the chronic regulation of an individual, the information makes the chronic goal orientation more accessible. In turn, this increased accessibility seems to have an impact on the attitudes and evaluations of objects or behaviors.

The concepts outlined within regulatory focus and regulatory fit theories can be applicable to the pursuit of promoting physical activity. For example, a study by Latimer et al. (2008a) indicated that, when compared to participants who viewed health messages that did not match their regulatory focus orientations, participants who viewed health messages in the match condition had higher levels of physical activity participation and more positive feelings towards their physical activity behavior. While the study described above and a few other studies (e.g. Gallagher & Updegraaff, 2011) have identified some potential of regulatory focus theory to predict behavior, its full capacity in promoting physical activity has yet to be fully investigated.

2.2 Conclusion

Research thus far has indicated that environmental stimuli can influence goal activation and pursuit, and that such influence can occur above or below people’s conscious threshold. The finding that goals can be activated and pursued without consciousness is important for research on dissociation during exercise, in which the regulation of physical activity is, by definition, non-conscious. Research is needed to explore the extent to which attention to different stimuli in fitness settings, such as various pictorial images (from magazines, posters, etc.), can influence exercise-related outcomes. One framework that can be used as a theoretical backdrop for such research is that of regulatory focus theory (Higgins, 1997), in which it is articulated that people hold chronic orientations toward promotion (i.e.,
success and advancement) or prevention (i.e., security and avoiding loss). It is possible that exposing exercisers to images associated with success or failure might activate chronic orientations toward promotion or prevention, and subsequently affect their exercise and judgments of the exercise. This issue is explored in the study presented in the next chapter.


The Impact of Chronic and Situationally-Induced Regulatory foci on Exercise Outcomes
3.1 Abstract

The aim of this study was to investigate the effects of matching pictorial stimuli with individuals’ chronic regulatory orientation (promotion vs. prevention), with respect to ongoing exercise behavior and judgments. One hundred and twenty-six undergraduate students were asked to rate their chronic regulatory focus orientation after taking part in a cycling exercise session at a university fitness center. During the cycling session, success- or failure-related picture stimuli, which created a matched or unmatched condition with participants’ chronic orientations, were presented while participants cycled on a stationary bicycle. Dependent variables included heart rate, exercise duration, rating of perceived exertion, perceived value of a similar exercise session, and intentions to engage in future exercise. MANOVAs did not reveal any significant differences between matched and unmatched conditions for attitudinal or behavioral dependent variables. Key reasons for the lack of effect include the priming potency of the stimulus used or a breakdown between the goal-behavior link. It is recommended that in future, researchers seek to identify the most suitable behavioral representations of promotion or prevention goals as it would enable better selection of primes that could elicit stronger effects.
3.2 Introduction

In Australia, from 2001 to 2008, there was a general decrease in exercise participation and an increase in sedentary behavior (Australian Bureau of Statistics, 2011). In the United States in 2011, only one in five people met the aerobic and muscle strengthening guidelines set by the US government (Centre for Disease Control and Prevention; CDC, 2013). These statistics are alarming if one considers the potency of physical activity as a ‘weapon’ in fighting modern diseases such as cardiovascular disease, obesity and diabetes (Department of Sport and Recreation, 2008; CDC, 2011). In an effort to encourage physical activity, various countries have developed health promotion programs, such as “Live Longer!” and “Swap It, Don’t Stop It!” in Australia, and “Let’s Move!” in America. Academic research has also been stimulated on the topic of physical (in)activity, and some of this research has focused on how the environment might shape exercise-related behavior (e.g., Banting, Dimmock, & Grove, 2011).

With all the information surrounding us, many individuals tend to dissociate during exercise by reading a magazine, watching the television, or listening to music. Dissociation refers to attentional focus that is directed to things that are unrelated to the experience of the exercise being performed (Goode & Roth, 1993; LaCaille, Masters, & Heath, 2004), and can be internally (e.g., daydreaming) or externally focused (e.g., scenery). A literature review has indicated that by dissociating to stimuli such as music or videos, runners tend to exercise longer and have lower perceptions of exertion than runners who use associative cognitive strategies (Masters & Ogles, 1998). Unfortunately, research on association and dissociation in exercise has typically compared the effects of the two broad cognitive strategies. Literature on priming, however, has provided compelling evidence to suggest that different types of dissociation are likely to result in different effects on exercise, such as running speed and
rating of perceived exertion. Nevertheless, message tailoring research might shed some light on the relationship between message content and exercise behavior.

**Goal Priming**

Goal priming is the activation of goal concepts in a person’s mind, which increases the chances of goal-related behaviors being enacted (Crusius & Mussweiler, 2012). In his automotive model, Bargh (1990) proposed that the whole goal process, from activation to pursuit, could take place without conscious awareness. Various studies on goal priming have since supported the tenets of this model. Aarts and Dijksterhuis (2000), for example, found that when Dutch participants were primed with the goal to attend a lecture, the concept of bicycle was automatically activated in habitual bicycle users. This shows that goal related information, such as the context, the goal, and action related to achieving the goal, can be automatically activated once information related to the goal is presented (Bargh & Gollwitzer, 1994; Kruglanski et al., 2002). Recently, Banting et al. (2011) provided further support for the auto-motive model by undertaking a priming experiment in the context of exercise. A novel feature of their study was the merging in time of both the afferent (i.e., the prime) and efferent (i.e., outcomes of the prime) stages of priming. This was achieved by asking participants to cycle on a stationary bike while they completed a scrambled sentence task in which controlled motivation (i.e., coercion, pressure), autonomous motivation (i.e., choice, volition), or no particular motivation was primed. Findings indicated that priming groups differed significantly in a variety of exercise-related outcomes, such as rating of perceived exertion, percentage of heart rate maximum, and level of enjoyment, thus providing evidence that varying forms of dissociation can exert different effects on exercise behavior.

While there are some studies that have looked at effects of word primes on exercise outcome, few studies have been undertaken to explore the extent to which pictorial images
can have the same influence on exercise-related goals and behaviors. This is a particularly important issue in light of two important considerations. First, from a scholarly perspective, Bargh (2006) suggested that it is time to begin addressing ‘second generation questions’ in the area of priming, and he particularly encouraged research on the effects of primes in natural (i.e. complex, stimulus-rich) environments. Currently, popular approaches to priming involve internally valid and tightly controlled priming procedures (e.g. scrambled sentence tasks) in laboratories, and much is still to be learned about other forms of priming in non-laboratory settings. Second, from the perspective of health promotion practitioners, it would be interesting to learn whether exposure to images (via magazines, for example) can influence people’s exercise behavior. Empirical data in related areas indicate that such research might reveal interesting findings. For instance, Papies and Hamstra (2010) used a poster to prime dieting goals and found that when primed with the dieting poster, restricted eaters tended to snack less than unrestricted eaters. This shows that environmental stimuli such as posters are able to prime concepts such as dieting even in a stimulus rich environment. Similarly, related research on advertising has also documented behavioral changes when participants view advertisements in relation to behaviors such as reducing smoking (Wakefield et al., 2013), decreasing alcohol consumption during pregnancy (Bazzo et al., 2012), and increasing physical activities of daily living (Bull, Kreuter & Scharff, 1999). Taking all this information into consideration, it appears that there is potential for using images as stimuli for goal priming.

Images, or any other priming stimuli intended to activate goals, are only likely to exert behavioral effects to the extent that the stimuli is associated with goals that are important drivers of behavior. Thus, if an individual has possessed a long-standing goal to improve his/her health, and has exercise vigorously and over an extended period to achieve this goal, then environmental stimuli associated with the goal should subsequently (and
automatically) activate motor programs associated with exercise (Dijksterhuis, Chartrand, & Aarts, 2007). If, on the other hand, an individual appreciates improved health, but the goal is neither particularly important nor a driver of their behavior, then stimuli that activates the (weak) goal is unlikely to produce behavioral effects. Importance of the goal and the extent to which goals drive behavior are therefore important considerations in determining the extent to which goal priming studies are likely to yield behavioral effects. In the recent decades, researchers have begun to look at a new theory of motivation that would use priming as a primary means to activate its’ concepts.

**Regulatory Focus Theory**

Regulatory focus theory, as described by Higgins (1997), indicates that people have either a promotion or prevention goal orientations. *Promotion* oriented individuals are more concerned with goals of success, and look to improve or better themselves in any way. In contrast, *prevention* oriented individuals are focused on goals of avoiding or preventing failures. Chronic regulatory orientations are developed through years of socialization, and they drive behavior in many life domains (see Higgins, 1997). Important for the study presented in this chapter is evidence showing that messages tailored to one’s chronic regulatory orientation are more persuasive than messages addressing one’s non-chronic orientation. When this occurs (i.e. matching), people are willing to pay more for an item, because they feel a sense of ‘rightness’ in what they are doing, and the value of this feeling is transferred to an object or action (Higgins, Idson, Freitas, Spiegel & Molden, 2003). The term ‘regulatory relevance’ is given to situations in which messages matches one’s regulatory orientation, and substantial evidence has accrued to highlight the benefits of this type of tailoring. For example, Aaker and Lee (2001) found that message content was recalled better and message strength was better differentiated when a persuasive appeal matched participants’ self-regulatory focus. Specifically, in their series of four experiments, Aaker and Lee found
that when primed with an independent self-view regulation, participants who were provided with promotion-focused information, which is a match for independent self-view regulation, participants evaluated a website more positively, had higher brand affinity, and were more discerning to argument strength. Supporting this finding, Plessner and colleagues (2009) found that when compared to soccer players in the unmatched condition, soccer player who heard a task description that matched their chronic regulatory orientation tend to perform better in a subsequent penalty shooting task. Similar results have been found by other studies with regards to brand preference and purchase intentions (Hong & Zinkhan, 1995), level of processing (Maheswaran & Sternthal, 1990), and outcome evaluations (Bettman & Sujan, 1987). Taken together, this suggests that when faced with information that matches the chronic regulation of an individual, the information makes the chronic goal orientation more accessible. In turn, this increased accessibility seems to have an impact on the attitudes and evaluations of objects or behaviors as goal compatible information is seen as more important (Aaker & Lee, 2001).

**Current Study**

Research is needed to explore the extent to which attention to different stimuli in fitness settings can influence exercise-related outcomes. While various studies have looked at using messages to increase physical activity, little has been investigated with regards to the role that pictorial images (from magazines, posters, etc) play. Regulatory focus theory (Higgins, 1997) can be used as a framework and a theoretical backdrop for such research. Based on empirical findings from regulatory focus research, it is possible that, similar to how people are willing to pay more for a cup when a message matches their regulatory focus (Higgins et al., 2003), the transfer of value should also occur when participants view images that match their chronic regulatory focus orientations. This would lead them to positively evaluate the activity they are performing, which could result in an increase in output levels
and having more positive attitudes toward that activity. Therefore, it was hypothesized that compared to participants in an unmatched condition (i.e., chronic prevention focus paired with promotion images or chronic promotion focus paired with prevention images), those in matched conditions (chronic prevention focus paired with prevention images or chronic promotion focus paired with promotion images) would work harder on a stationary bike, as reflected by higher heart rate and increased duration of exercise, and have more positive attitudes towards exercise, as reflected by higher intention towards future exercise participation and reporting higher value perceptions of a similar 30 minute cycling class. In addition, similar to findings reported by Banting et al. (2011), it was hypothesized that due to the dissociative nature of the task they had to perform while cycling, participants may exercise harder without being consciously aware of it, and instead, the feeling of ‘rightness’ while viewing matched images would make them feel more comfortable, as reflected by lower RPE scores.

3.3 Methods

Pilot Studies

Twenty five undergraduate and postgraduate students (12 males, 13 females) from the School of Sport Science, Exercise and Health at the University of Western Australia were asked for their voluntary participation in an initial pilot investigation. Participants \(M_{age} = 22.72\) years, \(SD = 2.89\) years) were individually presented with 25 images designed to reflect either promotion (i.e., concepts related to winning, success, and achievement) or prevention (i.e., concepts related to mistakes, disappointment, and failure). Twelve participants were presented with prevention images and the other 13 were presented with promotion images. In an attempt to limit the activation of other concepts, the chosen images did not include famous people or have any other recognizable features (such as brand logos or team names). Participants were asked to write the first three things that came to their mind about each
image, and they were informed that what they wrote could reflect descriptors, emotions, and/or thoughts about the image. To ensure that there were no recognizable features in the images, participants were also asked to indicate if there was anything they recognized in each image. Each response provided by participants that corresponded to success (for promotion images) or failure (for prevention images) was given a point. Percentages were calculated based on the number of assigned points against the total item responses for that image. The eight most suitable images (with the highest percentage points) for prevention and promotion were utilized in the main study. The same method was employed to select neutral images; however, these images were chosen on the basis that they did not reflect promotion or prevention concepts (as indicated by participants’ responses). The final pool of images consisted of eight promotion, eight prevention, and four neutral images. These images can be seen in Appendix F.

Although the first pilot study provided evidence that the chosen images primed the correct concepts, there was a possibility that images associated with failure might evoke depressive mood states, and/or that success-related images might evoke more positive mood states (e.g., heightened vigor). Research indicates that mood is important in moderating one’s exercise experiences and judgments (Poole et al., 2011; Wang, 2011). Therefore, to determine if mood states were influenced by the images, further pilot work was conducted to test for potential mood changes as a function of viewing promotion versus prevention images. Specifically, 80 undergraduate participants (50 males, 30 females) from the School of Sports Science, Exercise and Health at the University of Western Australia were asked to complete the abbreviated version of the Profile of Mood States (POMS-A; McNair, Lorr, & Droppleman, 1971) scale before and after (i.e., on two occasions) viewing the images that were selected following the first pilot stage. The mean age of participants in this pilot study was 21.80 (SD = 3.66). To ensure that participants attended to the images, individuals were
asked to provide two written comments about each image. Results displayed in Table 1 indicated that, adjusting for multiple comparisons, analyses revealed no significant time-by-condition interaction effects.

Table 1

*Interaction Effects of 2 (time) x 2 (image condition) Mixed ANOVA Results for POMS-A*

<table>
<thead>
<tr>
<th>Subscale</th>
<th>$F$ (1, 78)</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
<td>0.15</td>
<td>0.70</td>
</tr>
<tr>
<td>Depression</td>
<td>1.04</td>
<td>0.31</td>
</tr>
<tr>
<td>Anger</td>
<td>0.89</td>
<td>0.35</td>
</tr>
<tr>
<td>Fatigue</td>
<td>4.37</td>
<td>0.04</td>
</tr>
<tr>
<td>Confusion</td>
<td>3.14</td>
<td>0.08</td>
</tr>
<tr>
<td>Vigor</td>
<td>4.57</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Bonferroni correction was used to obtain an adjusted significance level of 0.008. None of the subscales reached significance for the adjusted significance level.

There was only a main effect of time for fatigue, $F(1,78) = 36.26, p < .001$. However, this decrease in fatigue level was not accompanied by a significant increase in vigor, $F(1, 78) = 3.33, p = .07$. In fact, mean vigor decreased from before ($M = 7.81, SD = 3.50$) to after the image task ($M = 7.38, SD = 3.62$). This suggests that the significant main effect for fatigue may have occurred because the task was conducted at the end of a two hour lecture and therefore served as a break for the participants, rather than being caused by the images themselves. The lack of effects within the second pilot study indicated that the images did not have any effect on mood states, and therefore, that any differences on primary dependent variables observed during the primary protocol were unlikely to be attributed to mood-altering effects of the images.
Main Study

Participants.

One hundred and twenty-six undergraduate students (69 males, 57 females) from the school of Sport Science, Exercise and Health at the University of Western Australia were recruited from a kinesiology unit to participate in this study in return for course credit. The mean age of participants was 20.12 years ($SD = 2.57$). Prior to data collection, all participants were required to complete a Physical Activity Readiness Questionnaire (PAR-Q) to ensure that they were physically able to complete 30 minutes of cycling activity.

Materials and Measures.

Image Priming.

Participants were shown 12 images in either a promotion condition or a prevention condition, and these images were selected based on results from the pilot work. Eight of the images were either prevention or promotion oriented, while the remaining four were not related (neutral) to either orientation. This methodology is consistent with other work on motivational priming (e.g., Banting, Dimmock, & Grove, 2011), and was undertaken to ensure the activation of motivation, but to ensure against suspicion about the purpose of the experiment. In promotion and prevention conditions, participants were required to list any words that came to their mind when they viewed the images. Words could be descriptive (e.g., field, ball, hockey match), emotion-related (e.g., happy, sad, distressed), and/or evaluative (e.g., win, success, failure). Each image was printed in black and white on an A4 size sheet, and each page consisted of two images with lines under each image to allow participants to write their responses.
**Questionnaire Measures.**

*Regulatory Focus Questionnaire (RFQ).* To determine participants’ chronic regulatory orientation, the RFQ, developed and validated by Lockwood et al. (2002), was administered to participants. This questionnaire was administered four weeks after the main experiment. The measure consists of two subscales designed to measure chronic promotion and prevention orientations, and includes items such as: “In general, I am focused on preventing negative events in my life” (prevention), and “I typically focus on the success I hope to achieve in the future” (promotion). Both subscales have previously been shown by Lockwood et al. (2002) to be reliable (promotion $\alpha = 0.81$, prevention $\alpha = 0.75$), and correlate modestly with each other ($r = 0.17$, $p < 0.01$). Both scales demonstrated good reliability scores in this investigation (promotion $\alpha = 0.81$, prevention $\alpha = 0.82$). *Responses* to this questionnaire were made on a nine point scale anchored at 0 (*not at all true of me*) and 9 (*very true of me*).

*Heart Rate.* Heart rate was measured using Team Polar heart rate monitors. Information was downloaded using the Polar Team System and analyzed using Polar Team2 1.3.0.3 software. The monitor was strapped to participants’ chests to allow continuous recording of heart rate. Average heart rate was calculated for the following three time points: during the completion of the image task, after completion of the image task, and an average (pooled) score across both of these times. The reason for measuring heart rate during the completion and after completion of the image task is to determine if the effects (if any) is only evident while viewing those images or if it persisted once the images were no longer in their field of vision.

*Perceived Exertion.* Immediately after completing the exercise, Borg’s (1982) Rating of Perceived Exertion (RPE) scale was used to obtain rating of perceived exertion for each participant. Borg’s scale is commonly used to assess the intensity of exercise for young to middle-aged moderately fit individuals, and scores from this scale have been shown to
correlate highly with objective heart rate data ($r = 0.80-0.90$; Borg, 1982). The scale is anchored at 6 (no exertion at all) and 20 (maximal exertion), and in this study, participants were asked to indicate their general level of exertion for the cycling period.

**Exercise Duration.** Duration of exercise was measured from the time a participant began pedaling to the time he/she got off the spin bicycle.

**Intention.** Participants were asked to respond to the following statements to measure intention to engage in future exercise behavior: “I will try to exercise regularly over the next two weeks”, and, “I intend to exercise regularly over the next two weeks.” The items were measured on a seven-point Likert scale anchored at 1 (strongly agree) and 7 (strongly disagree). These items were used previously in a study by Banting et al. (2011) to measure intention to engage in future exercise behavior.

**Value Perception.** Two items were used to measure participants’ perceptions of monetary worth associated with the exercise session. The two items were, “In your opinion, how much do you think a 30 minute cycling class at the UWA fitness center is worth?”, and, “How much would you pay for a 30 minute cycling class at the UWA fitness center?” In line with existing research (e.g., Ajzen, Brown, & Rosenthal, 1996), participants were asked to write down a monetary value in response to each question, and for analysis purposes a single index was computed in order to reflect the ratio of perceived cost to the amount that individuals were willing to pay (i.e., by dividing the ‘willingness to pay’ amount by the cost estimate). For example, if a respondent believed that the cycling class would cost $10, but s/he would only be willing to pay $5, this resulted in a value perception of 0.5. Accordingly, a higher score on this variable was considered to indicate a more favorable valuation of the cycling class (i.e., that an individual was willing to pay a greater proportion of his/her estimated cost). The aim in creating this variable was to derive a relative index reflecting willingness to pay...
as a function of one’s total cost estimate, in order to control for potential underlying differences in the personal factors (i.e., personal wealth, price consciousness) that may have influenced both value ratings. A similar measure of value was utilized by Higgins et al. (2003).

**Exercise Participation.** Firstly, participants indicated if they were members of a recreation center or gym. Subsequently, the Godin Leisure-Time Exercise Questionnaire (LTEQ) (Godin & Shephard, 1985) was used to assess participants’ baseline level of voluntary leisure-time exercise engagement. Participants were told to exclude any required activity from university or sport commitments, and to only include structured, voluntary leisure-time activity. Participants were asked how many times they had participated in strenuous, moderate, and mild exercise for bouts of more than 15 minutes over the previous week. Total activity was calculated based on a weighted formula by Godin and Shepard (1985) (i.e., 9 x number of strenuous bouts + 5 x number of moderate bouts + 3 x number of mild bouts). The LTEQ has been previously used to measure undergraduate exercise participation (e.g., Jackson & Dimmock, 2012).

**Behavioural Regulation in Exercise Questionnaire (BREQ-2).** Students’ motivational regulations were assessed using the BREQ-2 (Markland & Tobin, 2004). This measure consists of 19 items across five subscales including amotivation (e.g., “I don’t see why I have to exercise”), external regulation (e.g., “I exercise because other people say I should”), introjected regulation (e.g., “I feel guilty when I don’t exercise”), identified regulation (e.g., “I value the benefits of exercise”), and intrinsic motivation (e.g., “I exercise because it’s fun”). The items are rated on a five-point Likert scale anchored at 0 (not true for me) and 4 (very true for me). Evidence of internal consistency has been demonstrated previously for measures derived from BREQ-2 subscales (e.g., 0.73-0.86; Markland & Tobin, 2004). A composite relative autonomy index (RAI) can be calculated by obtaining an average score for
each subscale, and then subsequently using these values in a weighted formula: (amotivation x -3) + (external regulation x -2) + (introjected regulation x -1) + (identified regulation x 2) + (intrinsic regulation x 3). Greater autonomous (relative to controlled) motivation is indicated by higher RAI scores. In order to use a RAI derived from the BREQ-2, however, it is important to establish that correlations between the subscales of the BREQ-2 correspond to a simplex pattern (e.g., Mullan & Markland, 1997). These correlations, shown in Table 2, displayed a simplex pattern if the sub-scale of amotivation were to be removed. Consequently, an RAI formula was used that excluded amotivation in line with existing research (e.g., Dimmock, Jackson, Clear, & Law, 2013): (external regulation x -2) + (introjected regulation x -1) + (identified regulation x 1) + (intrinsic regulation x 2).

Table 2

<table>
<thead>
<tr>
<th>Bivariate Correlations Between BREQ-2 Subscales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amotivation</td>
</tr>
<tr>
<td>Amotivation</td>
</tr>
<tr>
<td>External Regulation</td>
</tr>
<tr>
<td>Introjected Regulation</td>
</tr>
<tr>
<td>Identified Regulation</td>
</tr>
<tr>
<td>Internal Regulation</td>
</tr>
</tbody>
</table>

* p < .05, ** p < .01

Mood. The POMS-A questionnaire (McNair et al., 1971) was used to assess participants’ mood before and after cycling. This instrument contains 24-items across six subscales (i.e., anxiety, depression, anger, fatigue, confusion, and vigor), and each item is measured on a five point scale anchored at 0 (not at all) and 4 (extremely). This measure has previously been
validated for use on adult athlete populations (Terry, Lane, & Fogarty, 2003), though the purpose of its inclusion in the present study was simply to substantiate the bogus cover story for the investigation.

**Procedure.**

Upon receiving ethical approval for this study by the Human Research Ethics Office of The University of Western Australia, participants signed an informed consent form and completed the PAR-Q and POMS-A scale, on the day of the experiment. Subsequently, participants were each fitted with a Polar heart rate monitor in an exercise room, and were then assigned a bike number randomly. An image brochure and a pencil were strapped to the handlebars of the bike so that participants could undertake the image task while cycling. Participants were told that the aim of the study was to examine the effects of exercise on mood, and they were invited to cycle as fast as possible for 15 seconds before settling into a self-selected pace for a 30 minute period. Once participants had reached their self-selected pace, the researcher invited them to complete the image task over a five minute period. They were told that the image task was part of another student’s pilot work: “To help you kill time while cycling, we have attached a survey on the bike handle bar in-front of you. This survey is part of an honors student’s project. You will be given 5 minutes to complete the questionnaire. You may now begin with the survey.” The image task questionnaires were collected at the end of the five minute period, after which participants were allowed to continue with the cycling task without interruption.

At 20 minutes, the researcher informed participants that mood change was likely to have occurred, and participants were informed that they could stop cycling at any point. For those who decided to continue cycling, another reminder that they could cease cycling was offered at the 25 minute mark. Duration of cycling was recorded once participants indicated
that they wished to stop. At both the 20 minute and 25 minute time points, the researcher used a scripted dialogue to prevent any bias in the options being relayed to participants. At 30 minutes, any remaining cyclists were asked to stop. Regardless of when they stopped cycling, participants were immediately asked to complete the RPE scale, and heart rate monitors were removed. At that point, participants were also asked to complete intention items, value items, and the second POMS-A scale. Participants were then thanked and allowed to leave.

Participants’ chronic regulatory orientation and exercise motivation ratings (i.e., RFQ and BREQ-2) were measured in a laboratory four weeks after the main experimental protocol. A copy of the instructions to the participants can be found in Appendix E.

3.4 Results

Preliminary Analyses

Following data collection, participants who did not complete the RFQ, and any individuals displaying univariate outliers (three standard deviations from mean), were removed from the data file prior to analyses; 90 participants were retained after this screening protocol was completed. Participants were assigned to a matched or unmatched group according to whether their chronic regulatory focus provided a match (or mismatch) to the image condition to which they were exposed. Participants were split into chronic prevention or chronic promotion orientations based on their difference scores on the RFQ subscales (subtracting prevention scores from promotion scores) (see also Latimer et al., 2008b). A negative score indicated a dominant chronic prevention focus while a positive score indicated a dominant promotion focus. A MANOVA was conducted to explore if background differences existed on participants’ self-reported motivational orientations (i.e. RAI scores derived from BREQ-2) and leisure-time activity levels (i.e. LTEQ scores) according to match or unmatched conditions. Analysis revealed that there was no multivariate effect, $F_{2,85} = 0.44$, $p = 0.64$, $\eta^2_p = 0.01$, $\lambda = .99$, indicating that there were no background differences between
those in the match and unmatched conditions. An additional chi-square analysis was also performed to examine whether there were background differences in the frequency of gym membership between participants in the matched versus unmatched conditions. This analysis revealed that there were no significant differences in the number of gym members in either conditions, $\chi^2 (1, N = 90) = 0.17, p = 0.68$. In combination, both background analyses showed that participants in the different conditions did not display significant differences on exercise-related motivational regulations, time spent on leisure activities or gym membership. Exercise duration was excluded from subsequent analysis because only 2 participants actually ceased cycling before the 30 minute mark (all other participants cycled throughout the entire period).

**Main Analyses**

Before proceeding, dependent variables were separated into two groups. The first group of variables represented behavioral/exertion-related indices, and consisted of RPE, HR during the image task, HR after the image task, and overall HR for the whole experiment. The second group of measures consisted of intentions to engage in future exercise and value perceptions of a similar 30 minute cycling class, which were grouped together as they represented attitudinal measures. All dependent variables displayed adequate normality properties as seen in Table 3 below.
Table 3

*Descriptive Statistics of Dependent Variables*

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPE</td>
<td>12.39</td>
<td>2.21</td>
<td>-0.03</td>
<td>0.35</td>
</tr>
<tr>
<td>Heart Rate During</td>
<td>114.61</td>
<td>23.06</td>
<td>-0.22</td>
<td>-0.07</td>
</tr>
<tr>
<td>Heart Rate After</td>
<td>126.42</td>
<td>22.18</td>
<td>-0.17</td>
<td>-0.44</td>
</tr>
<tr>
<td>Heart Rate Pooled</td>
<td>124.36</td>
<td>20.94</td>
<td>-0.21</td>
<td>-0.32</td>
</tr>
<tr>
<td>Intent</td>
<td>6.37</td>
<td>0.93</td>
<td>-1.54</td>
<td>1.81</td>
</tr>
<tr>
<td>Value Proportion</td>
<td>0.73</td>
<td>0.38</td>
<td>-0.33</td>
<td>-0.58</td>
</tr>
</tbody>
</table>

A MANOVA was first conducted to determine whether ‘matched’ participants differed to ‘unmatched’ participants in terms of behavioral measures. All assumptions associated with the computation of a MANOVA (e.g. normality, independence, equal covariance etc.) were met. No significant multivariate effect was observed in this analysis, $F_{4, 71} = 0.49$, $p = 0.49$, $\eta^2_p = 0.05$, $\lambda = .95$. The observed power of this analysis was 0.26. A second MANOVA was conducted, this time to determine whether matched or unmatched groups differed according to scores on attitudinal variables. Once again, an absence of a significant multivariate effect indicated that there were no significant differences between conditions on any dependent variables, $F_{2, 86} = 0.27$, $p = 0.77$, $\eta^2_p = 0.01$, $\lambda = .99$. The power of this second analysis was 0.09.

Given the lack of significant results, auxiliary analyses were conducted to determine if there were any effects of condition (i.e. success or failure) or chronic regulatory focus (i.e. promotion or prevention). The first set of analyses were conducted to determine if being exposed to success or failure images had any effect on any of the dependent variables, while
the second set of analyses were conducted to determine if chronic regulatory focus had any bearing on any of the dependent variables. Separate MANOVAs were ran based on the same groups of behavioral and attitudinal measures as in the main analyses. No significant results were yielded from any of the analyses. Results of the analyses are shown in Table 4.

Table 4

<table>
<thead>
<tr>
<th>Results from Auxiliary Analyses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic Regulatory Focus</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Behavioral</td>
</tr>
<tr>
<td>Attitudinal</td>
</tr>
</tbody>
</table>

3.5 Discussion

The aim of this study was to determine if, compared to participants who viewed images that did not match their chronic regulatory orientations, individuals who saw images that matched their chronic regulatory orientation would exercise harder while feeling that it is easier and display more positive attitudes toward an exercise session. Specifically, it was hypothesized that compared to participants in unmatched condition, participants in the matched condition would work harder on a stationary bike, as reflected by higher heart rate and increased duration of exercise, have more positive attitudes towards exercise, as reflected by higher intentions toward exercise participation, as well as reporting higher value perceptions of a similar 30 minutes cycling class, and have lower rating of perceived exertion. However, neither of these hypotheses were supported by the data, which means neither groups worked harder nor did they have more positive attitudes as compared to the other. The
subsequent section will discuss the possible reasons for the failure of this experiment to support the hypotheses.

**Priming Stimuli**

One possible explanation for a lack of effects could be due to the images not being able to successfully prime promotion or prevention goals. Despite this potential limitation, efforts were made to ensure that this issue was not problematic. Specifically, priming images were chosen based on word primes that have been used previously by Lockwood et al. (2002), who successfully primed regulatory focus goals in their experiment. In addition, priming stimuli were pilot tested to ensure that the images portrayed the desired concept. As such, selected primes should have successfully primed the right goal orientation. Perhaps a more conceivable problem was that ‘a picture can paint a thousand words’, and that the images used in the study may well have primed a myriad of other concepts as well as promotion or prevention. For example, an image of a runner coming in first might have primed the concept of exercise as strongly as regulatory focus goals.

To check for these possibilities, responses that were given by participants next to each image were reviewed, and the vast majority of these responses corresponded to thoughts about promotion or prevention. That is, responses for promotion images reflected predominantly promotion thoughts (e.g., success, victory and win), whereas responses for prevention images reflected prevention thoughts (e.g., failure, loss and defeat). Based on this evidence, it is likely that the priming stimuli were suitable for their purpose.

**Goal – Behavior Link**

Another possible reason for the lack of a significant finding could be due to a suboptimal link between the goal activated and the representative behavior. As can be seen in
Figure 1 below, in a typical scenario, activation of a goal would lead to a behavioral outcome. However, if there is break in the goal-behavior link, then even if the goal was activated, the behavior would not occur.

Figure 1

Typical versus Broken Goal – Behavioral Link

There are two possible reasons as to why there could have been a break in the goal-behavior link. First, it could be possible that when chronic regulatory goal orientations are activated, the intended behavior did not change because that behavior is not associated with that goal. As shown in Figure 2, cycling on a stationary bicycle, or even exercise behavior in general, may not be a good representation/means of achieving prevention or promotion goals. Most regulatory focus studies have described various means such as increasing fruit and vegetable intake (Latimer et al., 2008b; Spiegel, Grant-Pillow & Higgins, 2004), and changing academic strategies (Lockwood et al., 2002) in order to achieve regulatory goals. This suggests that if academic tasks or fruit and vegetable intake were measured as dependent variables instead, an effect might have been more likely to be observed.
A second possible reason for the break in behavioral link could be due to a weak pairing between chronic regulatory goals and exercise behavior. As shown in Figure 3 below, it could be possible that upon activation of chronic regulatory goals, a diverse range of behaviors are primed as well.

Figure 3

*Multiple Goal – Behavior Links*

---

Solid lines indicate a strong link
Dashed lines indicate a weak link
Due to the wide array of activation possibilities, the strength of each resultant activation link becomes weaker than if there were only one or two possible behaviors. Thus, when a promotion or prevention image is presented, the accessibility to any behavior may be weaker due to activation being spread among the different means in the network, leading to a lack of actual behavioral output (Kruglanski et al., 2002). However, this explanation seems less likely because if it were true, the robust behavioral effects from other studies would not have been obtainable. Moreover, given that exercise was essentially the only behavior that could have been evoked in the context of this study, it was anticipated that exercise behavior would have varied in the present investigation.

**Priming Potency**

Although this study was not strictly a priming study, some methodological features of priming studies were included, such as using neutral images to reduce suspicion regarding the experiment, informing participants that the study was about mood, and informing participants that the images were part of another research student’s work. As such, this experiment contained key similarities with investigations on priming, and recently, debate has ensued in the academic fraternity about the general potency of priming manipulations. Various authors have tried to replicate classic priming studies and have failed to find effects that mirror the original works. For example, a study by Bem (2011) provided evidence for retroactive influence when his participants performed better at remembering words in a test if they practiced writing the words after the actual test. Subsequent replication attempts by three independent researchers at three different laboratories did not yield similar results (Ritchie, Wiseman, & French, 2012). Similarly, a replication attempt by Doyen and Colleagues (2012) failed to reproduce classic effects found by Bargh, Chen & Burrows (1996). Adding fuel to the fire, the discovery that Professor Diederik Stapel has published fraudulent data on priming over a number of years has cast even more doubt as to the credibility of priming.
research. This issue has become so significant in social psychology that Professor Daniel Kahneman, a Nobel prize-winner, has written an open e-mail to plead with priming researchers to create a replication ring to check each other’s results.

**Other Factors**

Lastly, instrumental issues might also have limited any potential effects in this study. First, the study was conducted in an enclosed spin class room and each participant was seated on a stationary bicycle facing the wall. This might make participants feel that they are in an artificial situation. Second, in order for participants to enter the room, they had to enter the gym and walk past gym users. This might have introduced a host of possible environmental factors to impact their subsequent behavior. Third, when completing the priming task, participants had to lean forward, write, and turn pages in order to complete the task booklet. This made completing the task uncomfortable and possibly difficult. Fourth, it was possible that as participants were students being given course credit for their participation in the experiment, the only salient goal in their mind might be on quickly finishing the experiment and therefore superseding any priming effect that was being invoked. Lastly, the lack of power in this study might be a potential reason for lack of effects. Perhaps having a bigger sample size might boost the power of the study yielding significant results. In combination, all of these factors could have undermined any priming effects that were being investigated.

**3.6 Future Directions**

Future researchers could consider creating their own promotion and prevention primes for their experiments to further increase internal validity. Though the images here were selected carefully and were screened through pilot testing, perhaps ‘stronger’ primes (e.g., more images) might have invoked a significant outcome. More work might also be conducted to identify the most common behavioral representation associated with promotion and
prevention goals. This will allow investigators to determine whether exercise behavior is the most ideal behavior to target using regulatory focus goal primes. It might be the case that exercise behavior is not strongly associated with promotion or prevention goals, meaning that promotion/prevention goal activation is unlikely to influence behavioral responses. Next, taking into consideration the methodological shortcomings of this study, future studies might consider conducting the experiment individually rather than as a class. Lastly, the priming task should be configured such that it would be easy for participants to complete.

3.7 Conclusion

In conclusion, results from the present study did not support the prior hypotheses. Those receiving images that matched their chronic regulatory orientation did not differ in a variety of exercise-related variables compared to those receiving unmatched images. It is impossible to determine the reasons for the failure to support the hypotheses. On reflection, however, it is conceivable that although the images did activate the desired goals, a breakdown in effects might have occurred in relation to the influence of the goals on behavior. Promotion or prevention goals might not be associated with exercise behavior and judgments for this sample, and even if they are associated, the relationship might be weak due to the general, broad nature of the goal. The study adds to the list of other similar investigations that have been unsuccessful in obtaining significant results, supporting the recommendation that more replication is necessary in order to test the robustness of priming effects.
3.8 References


Centre for Disease Control and Prevention (2013). *Adult participation in aerobic and muscle-strengthening physical activities — United States, 2011*. Retrieved from: [http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6217a2.htm?s_cid=mm6217a2_w](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6217a2.htm?s_cid=mm6217a2_w)


Appendix A

Information Sheet and Consent Form
The effect of exercise on mood
Subject Information Sheet —

Purpose
The aim of this procedure is to investigate the effect of exercise on mood. Specifically, this study will explore the ways in which exercise can influence mood by asking you to cycle for 30 minutes, and measuring your mood prior to and after cycling. Heart rate monitors will be fitted on you to monitor heart rate changes during the course of the activity. A questionnaire will also be administered at the end to explore what thoughts were generated while cycling.

Procedures
You were selected to participate in this study because of your involvement in the unit SSEH2270. Your participation is voluntary and if you do not wish to be involved you can simply observe the experimental procedures and complete a report at the end of the session. If you decide to participate, we will ask you to complete a short questionnaire, followed by a follow up questionnaire to be completed at the conclusion of the study.

Risks
There are no major risks associated with this research.

Benefits
Your involvement will allow you to connect lecture content to real world situations.

Confidentiality
Your participation will have no consequence on your success in this unit. Any information that is obtained in connection to this study and that can be identified with you will remain confidential and will not be accessible to any other parties except the primary investigator unless required by law. If you give us permission by signing the consent form, we plan to publish the results in research journals. In any publication of the findings, information will be presented in a way that you cannot be identified. The unit coordinator will not be given the results of individual participants.

Subject Rights
Upon completion of the study, we will give you the findings of the research as a whole. Participation in this research is voluntary and you are free to withdraw from the study at any time without prejudice. You can withdraw for any reason and you do not need to justify your decision. If you do withdraw we may wish to retain the data that we have recorded from you but only if you agree, otherwise your records will be destroyed. Your participation in this study does not prejudice any right to compensation that you may have under statute of common law.

The Human Research Ethics Committee at The University of Western Australia requires that all participants are informed that, if they have any complaint regarding the manner, in which a research project is conducted, it may be given to the researcher or, alternatively to the Secretary, Human Research Ethics Committee, Registrar’s Office, University of Western Australia, 35 Stirling Highway, Crawley, WA 6009 (telephone number 6488-3703). All study participants will be provided with a copy of the Information Sheet and Consent Form for their personal records.

You will be given a copy of this form to keep.
Research on the Effect of Exercise on Mood

— Consent Form —

I ___________________________ have read the information provided and any questions I have asked have been answered to my satisfaction. I agree to participate in this activity, realising that I may withdraw at any time without reason and without prejudice.

I understand that all information provided is treated as strictly confidential and will not be released by the investigator unless required to by law. I have been advised as to what data is being collected, what the purpose is, and what will be done with the data upon completion of the research.

I agree that research data gathered for the study may be published provided my name or other identifying information is not used.

__________________________                    ______________
Participant Signature                              Date

You will be given a copy of this form to keep.
Appendix B

Demographic Information
PART A: REASONS FOR ENGAGING IN EXERCISE

In this section we are interested in the reasons why you choose to engage, or not engage, in exercise (i.e. how you feel about exercise). Please indicate to what extent each of the following items is true for you. These questions refer to involvement in structured or planned exercise such as jogging, cycling, and swimming (they do not include feelings about organised sport). There are absolutely no right or wrong answers to these questions...

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Not true for me</th>
<th>Sometimes true for me</th>
<th>Very true for me</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I exercise because other people say I should</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>I feel guilty when I don’t exercise</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>I value the benefits of exercise</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4.</td>
<td>I exercise because it’s fun</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>5.</td>
<td>I don’t see why I should have to exercise</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td>I take part in exercise because my friends/family/partner say I should</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>I feel ashamed when I miss an exercise session</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>It’s important to me to exercise regularly</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>I can’t see why I should bother exercising</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10.</td>
<td>I enjoy my exercise sessions</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>11.</td>
<td>I exercise because others will not be pleased with me if I don’t</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>12.</td>
<td>I don’t see the point in exercising</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>13.</td>
<td>I feel like a failure when I haven’t exercised in a while</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>14.</td>
<td>I think it is important to make the effort to exercise regularly</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>15.</td>
<td>I find exercise a pleasurable activity</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>16.</td>
<td>I feel under pressure from my friends/family to exercise</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>17.</td>
<td>I get restless if I don’t exercise regularly</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>18.</td>
<td>I get pleasure and satisfaction from participating in exercise</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>19.</td>
<td>I think exercising is a waste of time</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
PART B: PERSONALITY

For each of the statements below, please indicate whether or not the statement is true of you generally.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Not very true of me</th>
<th>Very true of me</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. In general, I am focused on preventing negative events in my life.</td>
<td>1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>2. I am anxious that I will fall short of my responsibilities and obligations.</td>
<td>1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>3. I frequently imagine how I will achieve my hopes and aspirations.</td>
<td>1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>4. I often think about the person I am afraid I might become in the future.</td>
<td>1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>5. I often think about the person I would really like to be in the future.</td>
<td>1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>6. I typically focus on success I hope to achieve in the future.</td>
<td>1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>7. I often worry that I will fail to accomplish my academic goals.</td>
<td>1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>8. I often think about how I will achieve academic success.</td>
<td>1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>9. I often imagine myself experiencing bad things that I fear might happen to me.</td>
<td>1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>10. I frequently think about how I can prevent failures in my life.</td>
<td>1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>11. I am more oriented toward preventing losses than I am toward achieving gains.</td>
<td>1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>12. My major goal in school right now is to achieve my academic ambition.</td>
<td>1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
</tbody>
</table>
13. My major goal right now is to avoid becoming an academic failure.

14. I see myself as someone who is primarily striving to reach my “ideal self” - to fulfill my hopes, wishes, and aspirations.

15. I see myself as someone who is primarily striving to become the self I “ought” to be- to fulfill my duties, responsibilities, and obligations.

16. In general, I am focused on achieving positive outcomes in my life.

17. I often imagine myself experiencing good things that I hope will happen to me.

18. Overall, I am more oriented toward achieving success than preventing failure.

Please continue over the page...
PART C: DEMOGRAPHIC INFORMATION

Student number: _______________________________________

Age: ___________ years  Sex: male  female  (please circle)

Are you currently a member of a recreation centre or gym (please circle)?  Yes / No

Are you currently working for a fitness centre or gym (please circle)?  Yes / No

Your Current Exercise...

For the following questions we are interested in planned, structured leisure activity performed outside of structured sport commitments...

1. Over the previous 7 days (i.e., week), how many times did you do the following kinds of exercise for more than 15 minutes...

   A) **STRENUOUS EXERCISE** (sweating; heart beats rapidly)  ____________ times
      e.g., running, jogging, vigorous cycling, vigorous swimming

   B) **MODERATE EXERCISE** (light sweating; not exhausting)  ____________ times
      e.g., easy cycling, easy swimming

   C) **MILD EXERCISE** (no sweating; minimal effort)  ____________ times
      e.g., yoga, archery, golf, easy walking

Thank you for completing the questionnaire.
Appendix C

Pre-Experimental Questionnaire
Physical Activity Readiness (PAR-Q)

Becoming more active is very safe for most people, but if you're in doubt, please complete the questionnaire below. Some people should check with their doctor before they start becoming much more physically active. Start by answering the seven questions below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and are not used to being very active, definitely check with your doctor first.

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

If you answered YES to one or more questions, please advise the researcher as there may be a need for you to consult your doctor before participating in further exercise.

General Questions

1. Please provide your student number: ____________________________
2. Please indicate your gender: M / F
3. Please provide your age: ________
Current Mood

Below is a list of words that describe feelings that people have. Please read each one carefully. Then circle the answer which best describes HOW YOU FEEL RIGHT NOW. Make sure you answer every question.

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>A little</th>
<th>Moderately</th>
<th>Quite a bit</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panicky</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Lively</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Confused</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Worn Out</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Depressed</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Downhearted</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Annoyed</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Exhausted</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Mixed-up</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Sleepy</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Bitter</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Unhappy</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Anxious</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Worried</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Energetic</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Miserable</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Muddled</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Nervous</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Angry</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Active</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Tired</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Bad Tempered</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Alert</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Uncertain</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Appendix D

Post Experimental Questionnaire
1. Please provide your student no: ______________________

2. The rating scale below ranges from 6 to 20. Please circle the number below that best describes your average level of exertion while you were exercising.

<table>
<thead>
<tr>
<th>Exertion</th>
<th>RPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>no exertion at all</td>
<td>6</td>
</tr>
<tr>
<td>extremely light</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>8</td>
</tr>
<tr>
<td>very light</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td>light</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>12</td>
</tr>
<tr>
<td>somewhat hard</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>14</td>
</tr>
<tr>
<td>hard (heavy)</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>16</td>
</tr>
<tr>
<td>very hard</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>18</td>
</tr>
<tr>
<td>extremely hard</td>
<td>19</td>
</tr>
<tr>
<td>maximal exertion</td>
<td>20</td>
</tr>
</tbody>
</table>
### Intention

**Q1** I will try to exercise regularly over the next two weeks

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strongly Disagree</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Strongly Agree</strong></td>
</tr>
</tbody>
</table>

**Q2** I intend to exercise regularly over the next two weeks

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strongly Disagree</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Strongly Agree</strong></td>
</tr>
</tbody>
</table>

### Value

**Q3** In your opinion, how much do you think a 30 minute cycling class at UWA fitness center is worth?

*Amount in dollars: ________*

**Q4** How much would you pay for a 30 minute cycling class at UWA fitness center?

*Amount in dollars: ________*

### What do you think was the purpose of this experiment?

________________________________________

________________________________________

### Did you see a link between the different experimental tasks? If yes, please write down what you think was the link.

Yes | No

________________________________________
Below is a list of words that describe feelings that people have. Please read each one carefully. Then circle the answer which best describes HOW YOU FEEL RIGHT NOW. Make sure you answer every question.

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>A little</th>
<th>Moderately</th>
<th>Quite a bit</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panicky</td>
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You have come to the end of the questionnaire. Thank you for participating.
Appendix E

Instructions to Participants
Instruction 1

“The aim of this experiment is to determine how exercise affects mood. For this experiment, you will be asked to cycle for the duration of 30 minutes. As soon as I tell you to start, please pedal as fast as you can for 15 seconds before settling into a pace that you are comfortable with for the remaining time. I will let you know once the 15 seconds are up. Please do not interact with anyone for the remainder of the experiment as it may affect your heart rate readings.”

Instruction 2

“To help you kill time while cycling, we have a survey attached on the bike handle bar in-front of you. This survey is part of another honors student’s project. You will be given 5 minutes to complete the questionnaire. You may now begin with the survey.”

Instruction 3 (20min mark)

“It is now 20mins, according to research mood changes are expected after 20minutes. At this point you can choose to continue to cycle for the remaining 10minutes or use that time to rest and relax. The decision is up to you. If you wish to stop, please come to me and tell me your bike number. Thank you” (repeat at 25mins mark)

Instruction 4 (end of 30mins)

“It is now 30mins, everyone please stop cycling.”
Appendix F

Priming and Neutral Images
Promotion Images
Neutral Images