

The Effect of Mirrors on Women's Body Image  
and Affective Responses to Yoga

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## Abstract

Yoga is a promising strategy for promoting positive body image. However, certain social-environmental variables might undermine yoga's benefits. Previous research indicates that mirrors alter women's psychological responses to exercise, but the effects of practicing yoga with mirrors are unknown. The present study examined the effect of mirrors on women's state body image, affect, and self-efficacy in a yoga class. A secondary aim was to examine the effect of mirrors on social comparison and mindfulness. Potential moderators were also examined. Ninety-seven college-aged females were randomly assigned to complete a 60-minute beginner level yoga class in either a mirrored or non-mirrored setting. Surveys were completed prior to and immediately after class. As hypothesized, the non-mirrored condition had significantly lower state social physique anxiety (SPA) after yoga than the mirrored condition. The mirrored condition reported significantly higher appearance-based social comparison than the non-mirrored condition, and social comparison mediated the relationship between mirrors and state SPA. There were no significant moderator effects. Mirrors appeared to lead to higher levels of state SPA in the mirrored vs. non-mirrored condition by fostering appearance comparisons with other participants and the yoga instructor. To encourage internal body awareness and minimize appearance comparisons in yoga classes, instructors in mirrored studios may want to consider structuring classes so students face away from mirrors, and reminding students to focus on how poses feel rather than how they look. Additional research examining the longer-term psychological effects of regularly practicing yoga with mirrors is merited.

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## Chapter 1: Introduction

Young women in Western cultures are conditioned to believe their self-worth is contingent upon conforming to cultural standards of beauty and thinness (Harter, 1990; Stice & Shaw, 2002). Perceived discrepancies between one's actual body and the body ideal lead to body dissatisfaction, or *normative discontent* (Rodin, Silberstein, & Streigel-Moore, 1985). Large-scale surveys report that 46% of adolescent girls and 87% of college-aged women are dissatisfied with their current body size (Neighbors & Sobal, 2007; Neumark-Sztainer, Goeden, Story, & Wall, 2004). Objectification theory (Fredrickson & Roberts, 1997) provides an overarching framework for understanding how societal portrayals of women's bodies as objects of desire are internalized by women through a process known as self-objectification, which is associated with body dissatisfaction, depression, anxiety, and low self-esteem (Moradi & Huang, 2008). When Fredrickson and Roberts (1997) first introduced objectification theory, they proposed that women could actively reduce these negative consequences of self-objectification by positively engaging with their body through exercise.

Meta-analyses indicate that exercise has a small, but positive effect on body image (Campbell & Hausenblas, 2009; Hausenblas & Fallon, 2006; Reel et al., 2007). However, these positive effects can be undermined if exercise is performed for appearance-related reasons and provokes comparisons with internalized body ideals and/or other exercisers (Prichard & Tiggemann, 2012b; Strelan, Mehaffey, & Tiggemann, 2003). One social-environmental variable that may further magnify these negative effects is the presence of mirrors within the exercise environment (e.g., Martin Ginis, Jung, & Gauvin, 2003). Although researchers have examined women's affective and self-efficacy

responses to mirror exposure during acute bouts of aerobic and resistance exercise (e.g., Chmelo, Hall, Miller, & Sanders, 2009; Martin Ginis, Burke, & Gauvin, 2007), there is a need for experimental research that examines the effect of mirrors on women's self-objectification and body image responses to exercise.

### **Exercise and Body Image**

Body image is a multidimensional construct that is often conceptualized as a fairly stable trait, but it also has transient, state-like properties that can vary moment-to-moment in response to situational factors (Cash, 2004; Tiggemann, 2001). Most research has focused on changes in trait body image as the result of participation in longer-term exercise programs (e.g., Campbell & Hausenblas, 2009). However, a growing number of studies have demonstrated that a single exercise session can enhance state body image and positive affect (e.g., Fuller-Tyszkiewicz, Skouteris, & McCabe, 2013; Lepage & Crowther, 2010; Vocks, Hechler, Rohrig, & Legenbauer, 2009). This research area has been largely confined to aerobic and resistance exercise. Given the recent increase in the number of women participating in yoga (Birdee et al., 2008), additional studies examining body image and yoga are needed.

### **Yoga and Body Image**

Researchers have suggested that yoga might be an effective strategy for promoting positive body image among women (Impett, Daubenmier, & Hirschman, 2006; Neumark-Sztainer, 2013). Cross-sectional survey studies indicate that women who practice yoga report lower levels of self-objectification, body dissatisfaction, and appearance-related reasons for exercise than non-participants (Daubenmier, 2005; Prichard & Tiggemann, 2008). However, because previous studies have been

correlational and subject to self-selection bias, it cannot be inferred that yoga reduces self-objectification and body image concerns. Likewise, cross-sectional surveys and quasi-experimental studies have proposed that yoga's body image benefits are derived from mindfulness, internal body awareness, and non-competition (Daubenmier, 2005; Impett et al., 2006). However, these assertions have not been tested with randomized, experimental designs.

Only one published randomized controlled trial has directly compared yoga with another form of exercise (i.e., walking) and a wait-list control (Elavsky & McAuley, 2007a, 2007b). In this study, four months of either *Iyengar* yoga or walking significantly improved middle aged women's perceived body attractiveness and positive affect relative to a wait-list control. In general, yoga research has focused on the body image of older women with several years of yoga experience (e.g., Zajac & Schier, 2011). Therefore, findings cannot be generalized to younger women, who are more likely to self-objectify than older women (McKinley, 2006), or to beginner level students. Furthermore, given yoga's increased presence in fitness facilities (Thompson, 2013), research should examine how social-environmental variables within these settings might alter psychological responses to yoga. One social-environmental variable that may be particularly salient to women's body image during yoga is the presence of mirrors.

### **Yoga and Mirrors**

Within the objectification theory literature, fitness centers and mirrors have both been identified as situational variables that call attention to one's body as an object (e.g., Fredrickson & Roberts, 1997; Moradi & Huang, 2008; Prichard & Tiggemann, 2005). However, with the exception of Prichard and Tiggemann's (2012b) examination of the

effects of watching thin-ideal music videos during treadmill exercise, researchers have not examined whether potentially objectifying features of the exercise environment (e.g., mirrors) alter women's state self-objectification and body image responses to an acute bout of exercise. This is surprising, as researchers have examined the effect of mirrors on women's affective and self-efficacy responses to acute bouts of exercise (e.g., Chmelo et al., 2009; Katula & McAuley, 2001; Martin Ginis et al., 2003). In general, sedentary women randomly assigned to a bout of aerobic exercise with mirrors reported diminished improvements in positive affect relative to a non-mirrored condition (Focht & Hausenblas, 2006; Martin Ginis et al., 2003, 2007). Furthermore, a cross-sectional survey study found that participants who preferred aerobics classes without mirrors had a higher BMI and lower body esteem, on average, than participants who preferred mirrors (Prichard & Tiggemann, 2010). Previous research has only examined the psychological effects of mirror exposure during aerobic (i.e., stationary biking, treadmill, step aerobics) and resistance modes of exercise; it is unknown whether these findings can be generalized to yoga.

In regard to the use of mirrors in yoga, Daubenmier (2005) anecdotally stated, "mirrors are often excluded from yoga studios, in contrast to fitness centers and dance studios, in order to encourage movement based on internal awareness rather than outward appearance" (p.208). However, there is no empirical evidence to support or refute that practicing yoga with mirrors leads to heightened self-objectification and concomitant decreases in body satisfaction and positive affect. To address the aforementioned gaps in the literature, the present study used a randomized experimental design to examine the effect of mirrors on college-aged women's body image responses (i.e., state body image,

social physique anxiety, self-objectification) to a single session of yoga. Additionally, the present study explored other psychological responses to yoga that might be altered by the presence of mirrors (i.e., self-efficacy, affect, social comparison, mindfulness). Building upon previous research demonstrating that trait self-objectification, BMI, and exercise motives alter women's body image and affective responses to exercise (e.g., Fuller-Tyszkiewicz et al., 2013), the present study examined potential moderators of body image-related responses to yoga.

### **Purpose and Hypotheses**

**Primary Aim:** To examine the effect of mirrors on body image, self-efficacy, and affective responses to a 60-minute beginner level yoga session. Specifically, college-aged women were randomly assigned to complete a yoga session in either a mirrored or non-mirrored setting. State measures of body image, social physique anxiety, self-objectification, self-efficacy, and affect were administered before and after the yoga session.

**Related Hypothesis:** It was hypothesized that participants randomly assigned to the non-mirrored yoga condition would report higher state body satisfaction, positive affect, and self-efficacy than participants randomly assigned to the mirrored yoga condition. Additionally, participants in the non-mirrored condition would report lower state social physique anxiety, self-objectification, and negative affect than participants in the mirrored yoga condition.

**Secondary Aim:** To explore the effect of mirrors on appearance-related social comparisons and mindfulness during a yoga class. State measures of appearance comparisons and mindfulness were administered after the yoga session.

**Related Hypothesis:** It was hypothesized that participants randomly assigned to the mirrored yoga condition would report higher levels of social comparison and lower levels of mindfulness than participants randomly assigned to the non-mirrored yoga condition.

**Tertiary Aim:** To assess whether or not participants' BMI, weekly minutes of moderate-to-vigorous physical activity (MVPA), trait self-objectification, and reasons for exercise moderate the relationship between mirror condition and state body image responses to yoga. Measures of trait self-objectification and reasons for exercise were administered before the yoga session. Participants reported height, weight, and weekly minutes of MVPA after the yoga session.

**Related Hypotheses:** It was hypothesized that higher BMI, greater appearance-related reasons for exercise, and higher trait self-objectification would be related to lower state body image, higher state social physique anxiety, and higher state self-objectification after yoga within the mirrored condition. These relationships were hypothesized to be non-significant within the non-mirrored condition. Conversely, it was hypothesized that within both conditions, higher weekly minutes of MVPA and health/fitness reasons for exercise would be associated with more positive state body image, lower state social physique anxiety, and lower state self-objectification, regardless of the condition.

**Exploratory Aim 1:** To examine correlations between state body image concerns and other psychological responses to yoga (i.e., self-efficacy, affect, social comparison, mindfulness, and intentions).



**Related Hypotheses:** It was hypothesized that positive body image states (i.e., higher state body satisfaction, lower social physique anxiety, lower self-objectification) would be associated with more positive affective states, higher task self-efficacy for yoga, less appearance comparisons, higher levels of state mindfulness, and stronger intentions to engage in future yoga-related behaviors.

**Exploratory Aim 2:** To assess whether intentions to engage in future yoga-related behaviors differ between conditions. To explore psychosocial predictors of intentions (i.e., changes in body image concerns, affect, self-efficacy, mindfulness, appearance comparisons) and test whether these predictive relationships differ between conditions. Intentions were assessed after the yoga session.

**Related Hypotheses:** It was hypothesized that intentions would be lower in the mirrored condition than the non-mirrored condition. State body image, self-efficacy, positive affect, and mindfulness after yoga would positively predict intentions. Social physique anxiety, self-objectification, and appearance comparisons would negatively predict intentions, but to a greater extent within the mirrored condition than in the non-mirrored condition.

**Exploratory Aim 3:** To explore the relationships between self-reported frequency of mirror gazing, state body image concerns, self-efficacy, affect, social comparison, and mindfulness among participants randomly assigned to the mirrored condition. All of these measures were administered after the yoga session.

**Related Hypotheses:** It was hypothesized that frequency of mirror gazing would be positively associated with state social physique anxiety, self-objectification, physical exhaustion, and social comparison. Conversely, higher frequency of mirror gazing was

hypothesized to be associated with lower levels of state body satisfaction, self-efficacy, positive affect, and mindfulness.

**Exploratory Aim 4:** To examine whether the personal-level characteristics of participants who typically prefer non-mirrored settings for group exercise classes differ from participants who prefer or have no preferences for mirrors in these settings.

**Related Hypothesis:** Based on the findings of Prichard and Tiggemann (2010), it was expected that participants who typically preferred no mirrors would be less physically active; have lower health/fitness reasons for exercise; and have higher BMI, trait self-objectification, and appearance-related reasons for exercise than participants who preferred or had no preferences regarding mirrors in group exercise settings.

## Chapter 2: Review of the Literature

The majority of college aged women (87%) in the U.S. report dissatisfaction with their body size or appearance (Neighbors & Sobal, 2007). These high rates of body image concerns are often attributed to extreme sociocultural pressures for women to be thin (Stice & Shaw, 2002). According to objectification theory, the media and other social institutions sexually objectify the female body, conditioning women to believe that health, happiness, and self-worth are contingent upon obtaining an attractive, thin body (Fredrickson & Roberts, 1997). Internalization of these messages leads to self-objectification and self-surveillance behaviors, or habitually monitoring and evaluating one's body in relation to cultural ideals (Fredrickson & Roberts, 1997; Stice & Shaw, 2002). Women's perceived discrepancies between their actual bodies and the thin body ideal are linked with body dissatisfaction and negative affect, which are referred to as *normative discontent* (Anton, Perri, & Riley, 2000; Rodin et al., 1985).

Body image is a multi-dimensional construct that encompasses body-related self-perceptions, attitudes, feelings, and behaviors (Cash, 2004). Research has traditionally focused on body image's dimensional traits, which are one's typical ways of thinking, feeling, and behaving in regard to one's body (Cash, 2011). However, according to Cash's (2011) cognitive behavioral model of body image, women's perceptions and evaluations of their bodies are also affected by proximal events and processes. For example, situations that call attention to one's body, such as wearing a swimsuit in public, gazing at one's physique in the mirror, or looking at media portrayals of the thin ideal, can increase the salience of appearance in the short term (i.e., *state* body image). The extent to which these events elicit state body dissatisfaction predicts increases in trait

body image concerns over the long-term (Cash, 2011). These body image concerns are especially prevalent among adolescent girls and young women, and are associated with an increased risk for anxiety, mood disturbance, low self-esteem, and eating pathology (Davison & McCabe, 2005; McKinley, 2006; Paxton, Neumark-Sztainer, Hannan, & Eisenberg, 2006; Stice & Shaw, 2002; Tiggemann & Lynch, 2001; Tiggemann, 2004).

When women view their bodies as objects through the lens of society, they may attempt to alleviate body image-related distress by engaging in behaviors to reduce perceived discrepancies between the *real* and *ideal* body-self (Duncan, 1994). Although exercise is a promising strategy for promoting positive body image and affect among women (Campbell & Hausenblas, 2009; Reed & Ones, 2006), these benefits may be undermined when women exercise for appearance-based reasons in settings that facilitate self-objectification and social comparison (Homan & Tylka, 2014; Prichard & Tiggemann, 2005, 2008; Strelan et al., 2003; Vinkers, Evers, Adriaanse, & de Ridder, 2012). An integration of Cash's (2011) cognitive-behavioral model of body image, objectification theory (Fredrickson & Roberts, 1997), and social comparison theory (Festinger, 1954), provides insight into the ways in which sociocultural, personal, and environmental factors interact to influence women's physical self-perceptions and well-being. When applied specifically to the exercise domain, these frameworks can be utilized to understand the paradoxical relationships between body image concerns and exercise, and subsequently guide the development of strategies to empower women to positively appreciate their bodies through participation in physical activity.

## **Objectification Theory**

Fredrickson and Roberts' (1997) objectification theory provides a framework for understanding how Western society's sexual objectification of women is internalized by women and subsequently transformed into a myriad of mental health concerns. Sexual objectification is defined as, "The experience of being treated *as a body* (or collection of body parts) valued predominantly for its use to (or consumption) by others" (Fredrickson & Roberts, 1997, p.174). According to this theory, exposure to sexually objectifying media images and social encounters leads women and girls to believe that self-worth is contingent upon being physically attractive and conforming to the feminine body ideal (Fredrickson & Roberts, 1997). Thus, they are conditioned to view their body from an outsider's perspective, continuously monitoring and evaluating their appearance in relation to culturally prescribed ideals.

This internalized view of the self as an object is known as self-objectification (Fredrickson & Roberts, 1997). Breines, Crocker, and Garcia (2008) described self-objectification as, "an awareness of how the body appears to others, often to the exclusion of awareness of internal body states" (p.584). Fredrickson and Roberts (1997) proposed that, over time self-objectification leads to body dissatisfaction, appearance anxiety, reduced internal body awareness, and decreased ability to experience flow (i.e., joyful immersion in a task; Csikszentmihalyi, 1990). These negative psychological states lead to disordered eating, depression, and sexual dysfunction. Research demonstrates that objectification theory can be used to understand women's mental health across a wide spectrum of ethnic/racial backgrounds and sexual orientations (for a review see Moradi & Huang, 2008).

When women view themselves as objects, they engage in body surveillance (i.e., habitual monitoring of physical appearance), which leads to body shame if they perceive themselves to fall short of internalized cultural standards of attractiveness and thinness (McKinley & Hyde, 1996). Body surveillance is often conceptualized as the behavioral manifestation of self-objectification (Fitzsimmons-Craft, 2011; Moradi & Huang, 2008). Self-objectification and body surveillance are adversely related to various psychological and behavioral outcomes, such as: Social physique/appearance anxiety, body dissatisfaction, body shame, body esteem, negative affect, engagement with the present moment, vitality, depressed mood, self-esteem, and disordered eating (Breines et al., 2008; Calogero, 2004; Frederick, Forbes, Grigorian, & Jarcho, 2007; Noll & Fredrickson, 1998; Strelan et al., 2003; Tiggemann & Kuring, 2004; Tiggemann & Lynch, 2001).

### **Social Comparison and the Circle of Objectification**

More recently, researchers have integrated objectification theory with Festinger's (1954) social comparison theory to propose a "circle of objectification" in which women not only objectify themselves, but also objectify other women (Fitzsimmons-Craft, 2011; Lindner, Tantleff-Dunn, & Jentsch, 2012; Strelan & Hargreaves, 2005; Tylka & Sabik, 2010). According to social comparison theory (Festinger, 1954), individuals tend to compare themselves with others when evaluating their own abilities, appearance, or other attributes. Appearance comparisons may be either upward (i.e., comparing oneself to other women who are judged to be more physically attractive than oneself) or downward (i.e., comparing oneself to women judged to be less attractive or more deficient in a certain quality than oneself) in nature (Lindner et al., 2012). Women are more likely than men to make self-critical, upward comparisons to media ideals and female peers (Franzoi

et al., 2011; Strahan, Wilson, Cressman, & Buote, 2006). These upward appearance comparisons are associated with body dissatisfaction and appearance anxiety among women (Thompson, Heinberg, & Altabe, 1999).

Research has consistently found that appearance comparisons provoke and reinforce young women's body image concerns. A meta-analysis found a large overall effect for social comparison and women's body dissatisfaction ( $d = 0.83$ ), and observed that this relationship was stronger among younger women than older women (Myers & Crowther, 2009). Furthermore, Leahey, Crowther, and Mickelson (2007) reported that female college students reported increases in negative affect, body dissatisfaction, and obligatory exercise motivation after engaging in upward appearance comparisons. The studies outlined below suggest that the seeds of self-objectification and normative discontent are planted in childhood, increase in salience during adolescence, and come into full bloom during emerging adulthood.

### **Self-Objectification: Developmental Considerations**

Beginning in elementary school, girls' perceived physical appearance becomes the strongest determinant of global self-worth (Harter, 1990). Harter (1990) observed that perceived physical attractiveness remained the most salient contributor to both physical and global self-worth in adulthood. These findings are especially relevant for women, who are taught at a young age that physical attractiveness is synonymous with overall self-worth (John & Ebbeck, 2008; Levy & Ebbeck, 2005; Mendelson, Mendelson, & White, 2001).

Emerging adulthood (18-25 years of age) is a time of identity exploration associated with the developmental tasks of establishing intimacy (Erikson, 1959) and

individual achievement (Arnett, 2006), both of which are related to appearance for women. Because the focus on appearance is intensified in a college setting (Fitzsimmons-Craft, 2011), it is not surprising that body dissatisfaction increases from early adolescence into emerging adulthood (Bucchianeri, Arikian, Hannan, Eisenberg, & Neumark-Sztainer, 2013). Feminist scholars have argued that increases in body dissatisfaction during emerging adulthood are related to our culture's obsession with youthful beauty, which conditions women of reproductive age to view their bodies as a form of social capital (Fredrickson & Roberts, 1997).

According to objectification theory (Fredrickson & Roberts, 1997), young women in Western, youth-obsessed cultures are more likely to self-objectify than older women. Research has demonstrated that young adult women report higher levels of self-objectification, body surveillance, body shame, and eating disorder risk than middle-aged women (McKinley, 2006; Tiggemann & Lynch, 2001). Relationships between body surveillance, body shame, and body esteem are also stronger among younger women than middle-aged women (McKinley, 2006). As women transition into middle and older adulthood, they begin to focus more on the functionality of their bodies, and therefore become less anxious about their appearance (Tiggemann & Lynch, 2001).

Because self-objectification and body dissatisfaction negatively affects both physical and mental health, it is important to identify strategies to reduce self-objectification and promote body satisfaction among young women. There is growing support that exercise, assuming it is not performed solely for appearance-related reasons (Homan & Tylka, 2014; Prichard & Tiggemann, 2008; Strelan et al., 2003; Vinkers et al.,



2012), can be an effective modality for enhancing body image and positive affect (Campbell & Hausenblas, 2009; Reed & Ones, 2006).

### **Exercise Participation and Trait Body Image: Meta-Analytic Findings**

When discussing strategies for reducing self-objectification and promoting positive embodiment among women, Fredrickson and Roberts (1997) specifically recommended participation in physical activity. According to three meta-analyses, exercise programs have a positive effect ( $MES = 0.29 - 0.45$ ) on body image (Campbell & Hausenblas, 2009; Hausenblas & Fallon, 2006; Reel et al., 2007). These meta-analyses examined various participant and intervention characteristics as potential moderators, although heterogeneity of designs, measures, and findings preclude the ability to draw concrete conclusions. In general, effect sizes indicated that women and overweight/obese individuals experienced the largest improvements in body image in response to exercise program participation; aerobic and anaerobic exercise yielded equally positive effects; and duration, length, and frequency of the programs did not moderate the effect of exercise on body image. Interestingly, in a subset of 29 group exercise studies, effects were greater for female-only group exercise programs than for co-ed programs (Reel et al., 2007).

In addition to providing a quantitative summary of the effect of exercise on trait body image, Hausenblas and Fallon (2006) identified methodological limitations of prior research. Based on these limitations, they recommended that future researchers utilize theory-driven intervention strategies, select valid measures of body image, examine the effect of acute exercise on state body image, and assess moderators and mediators.

### **Factors Related to Exercise and Trait Body Image**

While meta-analyses report that exercise positively affects body image, less is known about the mechanisms and moderators that influence this effect. Martin Ginis, Bassett-Gunter, and Conlin's (2012) review of thirteen studies identified improvements in self-efficacy, objective fitness, and perceived fitness as potential mechanisms. However, they cautioned that studies only measured changes in these variables relative to changes in body image; researchers did not utilize mediation analyses. Thus, Martin Ginis et al. (2012) recommended that researchers use prospective designs to directly test theory-derived constructs as mechanisms and moderators. Potential moderators of women's body image responses to exercise include BMI and appearance-related reasons for exercise. When women's motives for exercise are driven by a desire to improve physical appearance, they may not experience the full spectrum of exercise's body image benefits (e.g., Fuller-Tyszkiewicz, Reynard, Skouteris, & McCabe, 2012; Strelan et al., 2003).

Appearance-related motives for exercise (e.g., lose weight, enhance physical attractiveness) have been found to mediate the effect of self-objectification on body satisfaction, body esteem, and self-esteem (Strelan et al., 2003). Among female aerobics class participants, appearance-related motives for exercise partially mediated the negative relationship between body esteem and disordered eating symptoms (Vinkers et al., 2012). Similarly, Homan and Tylka (2014) found that although undergraduate women's exercise frequency was positively associated with body appreciation and internal body orientation, these positive relationships were weaker among women who endorsed weight and shape reasons for exercise. In a prospective study with new enrollees at a fitness center, women who had high appearance-related motives for exercise displayed significantly greater

increases in self-objectification over time than women who exercised for mood and enjoyment (Prichard & Tiggemann, 2012a).

An integration of the aforementioned theoretical frameworks and research findings suggests it is important to investigate the short-term effects of a single exercise bout on state body image, self-objectification, and self-efficacy, and to identify factors (e.g., appearance motives for exercise) that either undermine or enhance these effects. Findings from these acute exercise studies could be used to improve the effectiveness of interventions to promote positive body image among women.

### **Acute Exercise and State Body Image**

Body image is typically conceptualized as a fairly stable trait, but it also possesses transient, state-like properties that can vary moment-to-moment in response to different contextual factors (Cash, 2011; Tiggemann, 2001). Cash (2001) proposed that proximal events and processes that increase self-focused attention and body surveillance (e.g., wearing revealing clothing, mirror gazing) activate state body image concerns. Likewise, settings that call attention to one's body as an object (e.g., trying on a swimsuit in front of a mirror, an objectifying gaze from a male) can provoke state self-objectification, body shame, and appearance anxiety (Calogero, 2004; Fredrickson, Roberts, Noll, Quinn, & Twenge, 1998). One way of coping with body image-related distress is avoidance of settings or activities that are high in perceived evaluative threat. For example, women with high social physique anxiety, or the "anxiety that people experience in response to others' evaluations of their physiques" (Hart, Leary, & Rejeski, 1989, p. 94), might avoid exercising in public fitness facilities (Spink, 1992).

Cash's (2011) cognitive-behavioral model of body image explicitly includes exercise as a stimulus that can increase awareness of body image states in the short term. However, most research has assessed changes in trait body image as a result of sustained exercise participation (e.g., Campbell & Hausenblas, 2009). Very few studies have examined the effect of a single exercise session on state body dissatisfaction, self-objectification, or social physique anxiety. Acute exercise studies are a time-efficient strategy for testing theories and identifying variables that can be targeted by researchers to improve the effectiveness of interventions. Furthermore, body image, self-efficacy, and affective responses to an acute bout of exercise play a role in decisions regarding intentions to engage in future exercise (Raedeke, Focht, & Scales, 2007; Williams et al., 2008), and may accumulate over time to improve physical self-worth and global self-esteem (Sonstroem, Harlow, & Josephs, 1994). The following studies have laid the groundwork for this line of research by establishing that a single session of exercise positively enhances state body image, and by providing preliminary evidence regarding social and environmental factors that modify the strength of this relationship.

In one of the earliest studies examining the effect of acute exercise on state body image, McInman and Berger (1993) assessed female aerobic dance class participants' physical self-concept and mood before and after a 60-minute aerobic dance class. Regardless of their level of trait social physique anxiety, participants displayed positive changes in mood and perceived physical appearance from pre- to post-test. Although this study demonstrated that aspects of physical self-concept respond to acute exercise, its results should be interpreted with caution because group membership was self-selected rather than randomly assigned.

In a subsequent examination of the effects of acute exercise on state body image, Fallon and Hausenblas (2005) investigated whether moderate intensity exercise would help minimize negative affective and state body image responses to viewing pictures of the “ideal” female body. Active, college-aged women were randomly assigned to engage in 30 minutes of either treadmill exercise or quiet rest, and to view either neutral images or media depictions of the thin female body ideal. Findings revealed that regardless of group assignment, participants experienced higher body dissatisfaction and depressed mood after viewing the thin ideal pictures than after viewing the neutral images (Fallon & Hausenblas, 2005). These results indicated that the psychological benefits of exercise were not protective against adverse reactions to viewing the thin ideal. However, a limitation of this study was its use of a single-item scale for body dissatisfaction.

Vocks and colleagues (2009) examined body image and mood effects of a single exercise session among 65 highly active women using the Body Image States Scale (BISS; Cash, Fleming, Alindogan, Steadman, & Whitehead, 2002) to measure changes in attitudinal body image. Participants were photographed prior to and after each 60-minute experimental session, which consisted of reading a newspaper or exercising on a stationary bike in a fitness center. Participants viewed the photographs on a computer program that distorted their image to 80% or 120% of actual dimensions, and were instructed to manually alter the dimensions until the images depicted their “actual” body shape and how their body “felt” in the present moment. Relative to the control condition, exercise led to significant reductions in body dissatisfaction ( $d = -0.50$ ) and increases in positive mood ( $d = 0.64$ ). Participants perceived their body to feel slimmer after exercise than after the newspaper control condition (Vocks et al., 2009). Limitations of this study

included differential dropout between the two conditions, lack of generalizability to less active women, and lack of an exercise-specific measure of affect. Despite the limitations of Vocks et al. (2009), it is one of the only randomized experiments to examine the effect of an acute exercise session on state body image.

While randomized controlled studies (e.g., Vocks et al., 2009) represent the “gold standard” of research designs, more recent studies have used ecological momentary assessment (EMA) to examine fluctuations in body image during participants’ daily routines and exercise sessions (Fuller-Tyszkiewicz et al., 2013; Lepage & Crowther, 2010). In comparison to laboratory-based experiments, EMA has higher external validity because participants exercise in their typical, preferred exercise environments.

In Lepage and Crowther’s (2010) EMA study, 61 active undergraduate women wore electronic pagers for 10 days. During this time period, they were instructed to complete measures of affect and state body dissatisfaction whenever the pager beeped and after completing an exercise session. Analyses revealed that women’s state body dissatisfaction scores were lower and affect was more positive after exercise than at the random pager signals, regardless of baseline levels of trait body dissatisfaction (Lepage & Crowther, 2010). Trait body dissatisfaction moderated the effect of exercise motives (weight/appearance and health/fitness) on post-exercise state body dissatisfaction.

Among participants with low trait body dissatisfaction, health/fitness motives for exercise were associated with lower state body dissatisfaction. However, among participants with high trait body dissatisfaction, both weight/appearance and fitness/health motives for exercise were related to higher state body dissatisfaction. This suggests that when women are unhappy with their current body shape and fitness level, a session of exercise may

remind them that they fall short of both fitness and appearance ideals (Lepage & Crowther, 2010). Limitations of this study were that researchers did not assess pre-exercise levels of affect and state body dissatisfaction, thus precluding any causal inferences. Additionally, they did not assess whether different exercise types, dosage, or social-environmental characteristics influenced body image and affective responses to exercise.

Similar to Lepage and Crowther's (2010) ecological momentary assessment (EMA) study, Fuller-Tyszkiewicz et al. (2013) outfitted 37 undergraduate women with a Personal Digital Assistant (PDA) for a week and asked them to report state body dissatisfaction with the BISS (Cash et al., 2002) immediately after exercise sessions and at random times during the day (i.e., when prompted by the PDA). In alignment with Lepage & Crowther's (2010) findings, analyses revealed that BISS scores were significantly higher after exercise bouts than after random assessments. Interestingly, low BISS scores at random assessments predicted subsequent engagement in exercise. Individuals appeared motivated to engage in exercise when they felt dissatisfied with their appearance.

Additionally, Fuller-Tyszkiewicz and colleague's (2013) analyses of potential moderators revealed that women who were younger, who had a lower BMI, who exercised more frequently, and who reported lower trait self-objectification reported the highest levels of post-exercise body satisfaction. These findings contradict Campbell and Hausenblas' (2009) meta-analytic findings indicating that older, overweight, and body dissatisfied individuals displayed the greatest improvements in trait body image over time. Among individuals who are less fit or who experience bodily/emotional discomfort

during exercise, an acute bout of exercise may not provide the same encouraging feedback as longer-term programs that positively influence both perceived and objective changes in body composition and fitness (Martin Ginis et al., 2012). Fuller-Tyszkiewicz et al. (2013) interpreted these findings to suggest that individuals who are overweight or who have body image concerns may engage in upward social comparisons and negative self-evaluations during exercise, thus undermining potential body image benefits. This interpretation merits further investigation through experimental studies that examine the impact of social comparison on exercise-induced changes in state body image.

While Fuller-Tyszkiewicz et al. (2013) and Lepage and Crowther's (2010) EMA studies provide insight regarding *who* benefits the most from self-initiated exercise in naturalistic settings, they did not examine potential mediators that would address *how* acute exercise improves state body image. They also did not examine the potential moderating effects of exercise setting. In contrast with demographic variables (e.g., BMI) or psychological traits (e.g., body esteem), social-environmental and contextual factors can be easily modified to potentially maximize short-term psychological benefits, thus increasing the likelihood that individuals with body image concerns will adhere to a program long enough to experience changes in fitness and physical self-perceptions.

Although exercise participation is typically associated with positive changes in physical self-perceptions, non-experimental survey studies have suggested that exposure to objectifying stimuli (e.g., revealing exercise attire, fitness magazines, mirrors) within public fitness facilities may intensify women's body image concerns, disordered eating risk, and self-objectification (Greenleaf, 2005; Prichard & Tiggemann, 2012a; Prichard & Tiggemann, 2005, 2008). Within the objectification theory literature, fitness centers have



been identified as objectifying environments that encourage women to engage in appearance-related comparisons with other female exercisers (Prichard & Tiggemann, 2008). Therefore, it is important to examine how social-environmental variables within the fitness environment increase social comparison, self-evaluations of physical appearance, and state self-objectification. As previously mentioned, heightened levels of state self-objectification are related to negative affect, social physique anxiety, and body image concerns (Breines et al., 2008; Calogero, 2004; Fredrickson et al., 1998). Thus far, only one known study has used an experimental design to investigate the effects of the exercise environment on state self-objectification (SO) during an acute bout of exercise.

In this randomized experiment, Prichard and Tiggemann (2012b) examined women's state SO, mood, and body satisfaction responses to watching music videos using a 2 (watching a thin-ideal person vs. appearance-neutral images in music videos) X 2 (15 minutes of walking on a treadmill vs. quiet rest on a treadmill) design. Visual analogue scales (VAS) were completed immediately before and after the 15-minute experimental session. Analyses revealed that although there were significant main effects of exercise condition and video type on SO, the interaction effect was not significant (Prichard & Tiggemann, 2012b). Participants reported significantly lower levels of SO after exercise than after quiet rest, and reported higher SO in response to thin-ideal versus appearance-neutral music videos. Mood states were also uniformly improved after exercise in comparison with quiet rest. There was a significant interaction effect for one aspect of state body satisfaction. Participants who watched the thin-ideal videos during exercise reported higher levels of perceived physical attractiveness than participants who watched thin-ideal videos during quiet rest.

One limitation of Prichard and Tiggemann's (2012b) study was its lack of external validity; all conditions were performed in a laboratory setting. Responses may have been different in settings higher in perceived evaluative threat, such as public fitness facilities. Furthermore, because this was a highly active sample of young women, results may have been different if they had been performing exercise that was more representative of their typical exercise behaviors (e.g., higher intensity, longer duration). Prichard and Tiggemann (2012b) suggested that future studies should use more naturalistic settings to examine the effects of different exercise modes and other potentially objectifying stimuli on female exercisers' state self-objectification. They specifically recommended that researchers examine whether mirrors cause women to self-objectify during exercise (Prichard & Tiggemann, 2012b).

### **Mirrors**

Mirrors are common fixtures in fitness facilities, and are typically featured in rooms intended for weight lifting, dance, martial arts, and group exercise classes (Lynch, Chalmers, Knutzen, & Martin, 2009). The American College of Sports Medicine's (ACSM, 1997) facility guidelines recommend that exercise classrooms feature mirrors on at least two walls to provide exercisers with visual feedback regarding form and technique for skill enhancement and injury prevention. From an observational learning perspective, seeing one's self perform a task in the mirror should theoretically enhance self-efficacy and promote learning through self-modeling and mastery feedback (Bandura, 1986; McCullagh & Weiss, 2001). However, evidence regarding the instructional value of mirrors in exercise and dance settings has been mixed.

In support of mirrors as a pedagogical tool, Dearborn and Ross (2006) found that experienced dance students who initially learned a dance phrase in front of a mirror performed significantly better than a non-mirrored group at a learning retention test. However, other studies have suggested that less experienced individuals may not accrue these benefits during skills acquisition. For example, Sewall, Reeve, and Day (1988) reported that two groups of weight lifters who learned a power clean lift with or without a mirror demonstrated similar improvements in technique and performance. In Lynch and colleagues' (2009) study, beginner level Pilates students assigned to a mirrored or non-mirrored classroom for eight weeks of Pilates classes displayed comparable improvements in the execution of an intermediate-level pose. The authors suggested that visual feedback from the mirror did not enhance acquisition of proper alignment to a greater degree than feedback provided by kinesthetic or proprioceptive cues.

Although dance and fitness facilities provide mirrors as tools for instructional and performance feedback, researchers have contended that the visual feedback provided by mirrors can elicit negative thoughts and emotions (e.g., Martin Ginis et al., 2003). Research regarding aversive responses to mirror gazing is largely informed by Duval and Wicklund's (1972) theory of objective self-awareness. Research derived from this theory has demonstrated that mirrors elicit self-focused attention and negative affect among women and individuals with body dysmorphia or eating disorders (Mor & Winquist, 2002; Vocks, Legenbauer, Wächter, Wucherer, & Kosfelder, 2007; Windheim, Veale, & Anson, 2011). The following section will focus on theory and research concerning the effects of mirrors on women's affect and physical self-perceptions in laboratory, dance, and exercise settings.

**The psychological effects of mirrors in laboratory settings.** According to the theory of objective self-awareness (OSA; Duval & Wicklund, 1972), attention oscillates between focusing on specific aspects of the self (objective self-awareness: OSA) and focusing outwardly on the environment and tasks (subjective self-awareness: SSA). While OSA is self-focused, SSA is task-focused. Similar to objectification theory, this theory proposes that when individuals focus on themselves as objects, they evaluate themselves in comparison to standards or ideals. If an individual perceives a high degree of discrepancy between the actual and ideal self, he/she will experience negative affect. It is theorized that individuals will be motivated to escape this discomfort through attempts to reduce discrepancies, immersion in distracting tasks (e.g., exercise), or avoidance of stimuli that elicit OSA (Duval & Wicklund, 1972). Examples of stimuli that encourage OSA include listening to a recording of one's voice, viewing photographs of one's self, or seeing one's reflection in the mirror. Mirrors are the most commonly used tool for manipulating OSA in experiments, especially when researchers are interested in affective responses to evaluations of physical appearance (Mor & Winquist, 2002).

There is considerable support for utilizing mirrors to elicit OSA in experiments (Mor & Winquist, 2002). For example, Carver and Scheier (1978) found that when women performed a sentence completion task in front of a mirror, they wrote significantly more self-focused responses than women in a non-mirrored control condition. However, because the experimental conditions did not include a performance standard for comparison, mirror exposure did not induce negative affect (Carver & Scheier, 1978). Conversely, Mor and Winquist's (2002) meta-analysis revealed a medium effect ( $d = 0.41$ ) of OSA on negative affect in experimental studies. This relationship was

especially strong ( $d = 0.97$ ) in more recent studies that used mirrors to manipulate OSA in female or clinical samples (Mor & Winquist, 2002).

Women are particularly sensitive to the negative effects of OSA (Mor & Winquist, 2002), especially when their attention is directed toward physical attractiveness and body shape/size. An integration of Duval and Wicklund's (1972) theory of OSA with Fredrickson and Robert's (1997) objectification theory provides a framework for understanding women's adverse responses to mirror gazing. This framework suggests that when women self-objectify and engage in self-surveillance behaviors (Fredrickson & Roberts, 1997), such as mirror checking, they subsequently experience body shame and social physique anxiety (Calogero, 2004). Similar to the aforementioned OSA studies, researchers have utilized mirrors to experimentally manipulate self-objectification.

In Fredrickson and colleagues' (1998) seminal study of objectification theory, undergraduate women and men were randomly assigned to either try on a swimsuit (self-objectifying) or a sweater (neutral) in a changing room in front of a mirror. After changing back into their street clothes, participants completed a math test and a "taste test" of cookies. Afterward, they completed measures of self-objectification and body shame. It was found that women in the swimsuit condition reported higher levels of state self-objectification and body shame, displayed more eating restraint, and performed worse on a math test than the women who tried on the sweater. These effects were not observed among male participants. A similar study by Gapinski, Brownell, and Lafrance (2003) demonstrated that women who tried on a swimsuit in front of a mirror experienced higher levels of self-objectification, anxiety, and negative affect than women who tried on a sweater in front of a mirror. While these studies were extreme in their manipulations

of self-objectification, they do provide insight into women's immediate, adverse psychological responses to self-objectification or OSA.

More recently, Windheim et al. (2011) empirically tested the effect of mirror gazing duration on women's self-consciousness and negative affect. The sample was comprised of 25 healthy controls and 25 participants with body dysmorphic disorder (BDD; an obsession with perceived flaws in specific body parts or overall appearance that leads to heightened distress and impaired functioning; American Psychiatric Association, 2013). Participants with BDD and the healthy controls reported significant increases in distress and self-focused attention after sitting in front of a mirror. Both groups reported significantly stronger urges to look away from the mirror in the 10 minute condition versus the 25 second condition. Furthermore, Mulkens and Jansen (2009) found that women with low body satisfaction reported decreases in perceived attractiveness after gazing in a mirror. One limitation of these studies is they were conducted in a laboratory setting, which may not generalize to real world settings, such as dance studios and fitness facilities.

**The psychological effects of mirrors in dance settings.** Mirrors are commonly featured in dance studios to aid learning and to help students view their performance from an audience perspective (Radell, Adame, Cole, & Blumenkehl, 2011). When viewed through the lens of objectification theory, this internalization of an audience (i.e., an outsider) perspective is akin to self-objectification (Fredrickson & Roberts, 1997). Radell and colleagues (2011) found that female college students who took a 14-week beginner's level ballet class in either a mirrored or non-mirrored dance studio displayed similar improvements in performance. Within the same study, highly proficient students who

trained in the non-mirrored studio reported significantly greater improvements in body satisfaction over the course of the semester than highly proficient students in the mirrored studio. This effect was not observed among less proficient students. Authors alluded to Duval and Wicklund's (1972) theory of objective self-awareness to suggest that in the presence of mirrors, highly proficient performers, who would presumably be more likely to have internal standards for proper technique than less-skilled performers, became self-conscious of their flaws, thus leading to negative self-evaluations.

In a mixed-methods study by Reel, SooHoo, Jamieson, and Gill (2005), 107 female college dancers reported their body image and weight-related concerns within the dance environment. One-hundred percent of the dancers reported that looking at their reflection in the mirror was a source of stress. Ninety-four percent of the dancers indicated that they compared their bodies to other dancers, suggesting that mirrors facilitate body dissatisfaction through social comparisons. These findings echo Fredrickson and Robert's (1997) assertion that self-objectification reduces women's ability to experience flow or engagement with the present moment.

While these studies suggest that mirrors influence the body image of dancers, the findings of Radell et al. (2011) and Reel et al. (2005) should be interpreted with caution given the nonrandomized study designs. It is also unclear whether findings regarding mirror usage in dance, which is a performing art, can be generalized to acute exercise. However, the findings of these dance studies suggest that it is worthwhile to examine the effect of mirrored exercise environments on women's body image concerns and appearance-based social comparisons.

**The psychological effects of mirrors in exercise settings.** Due to the high prevalence of mirrors in fitness facilities and their potential to elicit objective self-awareness, a number of researchers have studied the effect of mirrors on self-efficacy, self-presentational concerns, and affect during exercise. The majority of these studies have utilized experimental designs to manipulate women's exposure to mirrors during acute exercise, with the exception of Prichard and Tiggemann's (2010) mixed-methods research with female aerobics participants.

In Prichard and Tiggemann's (2010) mixed-methods study, 579 highly active female aerobics participants from female-only fitness centers completed surveys examining self-surveillance, body image, and preference for mirrors in aerobics classrooms. The 18% of participants who did not like mirrors reported significantly lower body esteem, higher levels of disordered eating, and higher BMI than women who liked or did not mind the presence of mirrors during group aerobics. Even after controlling for BMI, women who did not like mirrors had lower levels of body esteem than the other mirror preference groups. In the qualitative follow-up study, 20 participants from the original sample participated in focus groups. Participants who disliked the mirrors reported they did not like to be able to see their lack of physical coordination, however, the majority agreed that the mirrors were useful for correcting technique and motivating oneself to exert more effort. These results indicate that although women find mirrors useful, women with a high BMI and/or poor body image may prefer to exercise without mirrors. While Prichard and Tiggemann (2010) suggested that future research should use experimental designs to examine the impact of mirrors on women's body image responses to exercise, the bulk of the following experimental studies only indirectly



addressed this research question by focusing on the effect of mirrors on the theoretically relevant constructs of self-efficacy, anxiety, affect, and social comparison.

In the first published study to systematically examine the effect of mirrors on self-efficacy responses to acute exercise, Katula, McAuley, Mihalko, and Bane (1998) recruited 34 moderately active college students (16 men and 18 women) to complete 20 minutes of moderate intensity exercise on three different occasions in a counterbalanced order: (a) treadmill exercise in a laboratory, (b) treadmill exercise in a laboratory facing a full-length mirror, and (c) self-selected mode of exercise in one's typical exercise setting. During an orientation session, participants completed trait measures of physical self-efficacy and social physique anxiety (SPA). Immediately before initiating exercise in each of the three conditions, participants rated their exercise self-efficacy (EXSE) on a scale from 0% to 100% in their ability to complete 10 minutes, 20 minutes, ...60 minutes of moderate intensity exercise.

Women's exercise self-efficacy (EXSE) was significantly lower than men's EXSE in the mirrored condition (Katula et al., 1998). This gender difference was not observed in the other two conditions. Regression models indicated that when preparing to exercise in a setting that was high in perceived evaluative threat (i.e., in front of a mirror), individuals who had lower levels of perceived physical self-efficacy, higher levels of SPA, and who were less aerobically fit reported lower levels of EXSE. This finding provides support for the theory of objective self-awareness (OSA; Duval & Wicklund, 1972); the mirror initiated a self-evaluative process whereby women became self-aware of their general physical abilities and felt less confident in their ability to accomplish the current task. The primary limitation of this study was that the researchers only measured

EXSE before exercise. Because performance accomplishments, such as completing a challenging exercise session, are the strongest sources of self-efficacy beliefs (Bandura, 1977), subsequent research has built upon the work of Katula et al. (1998) by examining whether the presence of mirrors alters pre- to post-exercise changes in self-efficacy.

Katula and McAuley (2001) examined the effect of exercising with and without a mirror on EXSE beliefs of 43 highly active college-aged women. In a repeated measures, counter-balanced design with 24 hours in between each exercise session, participants completed 20 minutes of moderate intensity exercise on a laboratory treadmill in front of a mirror and without a mirror. EXSE was measured at four time points: Baseline (prior to randomization), pre-test, immediately post-test, and 20 minutes post-test. Results indicated that participants reported no significant changes in EXSE from pre-to post-test. Conversely, when exercising in front of a mirror, participants displayed significant increases in EXSE from baseline to post-test. A significant between-setting difference in EXSE was observed at 20 minutes post-test; participants reported significantly higher EXSE in the mirrored condition than in the non-mirrored condition. Exercising in front of a mirror enhanced active women's self-efficacy beliefs above and beyond the feelings of mastery obtained from completing the exercise session.

At first glance, Katula and McAuley's (2001) findings appear to contradict Katula et al. (1998) and the theory of OSA (Duval & Wicklund, 1972). Katula and McAuley (2001) conceded that because this was a highly active sample of young women, 20 minutes of moderate intensity exercise may not have been of a sufficient duration or intensity to provide mastery feedback. More specifically, they were probably already confident in their ability to accomplish more intense exercise. Therefore, Katula and

McAuley (2001) hypothesized that mirror-induced OSA enhanced pre-existing feelings of mastery and provided visual feedback (similar to a self-modeling effect) to enhance EXSE (Bandura, 1977). While these results suggest that mirrors magnify active women's current efficacy beliefs rather than uniformly undermine them, other researchers have identified the importance of further examining the psychological effects of mirrored exercise among women with self-presentational or body image concerns.

Focht and Hausenblas (2003; 2004; 2006) addressed the limitations of Katula and McAuley (2001) by examining the effect of mirrors on state anxiety, perceived evaluative threat, and affect among 30 inactive women with high social physique anxiety (SPA). In a repeated measures, counterbalanced design, participants completed three 20-minute conditions: (a) stationary biking in a private, non-mirrored laboratory; (b) stationary biking in a public, mirrored fitness facility ("naturalistic setting"); and (c) quiet, non-mirrored rest. Affect and state anxiety were measured pre-, during, and at four time points (5, 60, 120, 180 minutes) post-test.

Participants rated the mirrored, naturalistic setting higher in perceived evaluative threat than the other conditions (Focht & Hausenblas, 2003). Anxiety increased during exercise in the naturalistic setting, especially among participants who perceived the highest levels of evaluative threat (Focht & Hausenblas, 2004). Although there were significant reductions in anxiety from pre-test to five minutes post-test within both exercise conditions, the anxiolytic effects of exercise persisted longer after non-mirrored exercise (120 minutes) than mirrored exercise (less than 60 minutes). Focht and Hausenblas' (2006) subsequent analyses indicated that although exercise in both settings led to immediate post-test improvements in positive engagement and revitalization,

increases in positive engagement persisted longer in the non-mirrored setting than in the naturalistic setting. Additionally, within the naturalistic setting, participants reported decreases in tranquility during exercise. There were no significant changes in physical exhaustion over time in either exercise condition.

In summary, Focht and Hausenblas (2003, 2004, 2006) found that inactive, high SPA women perceived a mirrored, public exercise environment to be high in evaluative threat, experienced increased anxiety and less positive affect during exercise, and had shorter-lived improvements in anxiety and positive affect from pre- to post-test relative to exercise in a private, non-mirrored laboratory environment. However, because the naturalistic setting featured two self-focusing, anxiety-provoking stimuli (i.e., a mirror and the presence of male exercisers), the specific impact of the mirror on participants' affective responses is unclear. Additionally, the researchers did not measure self-efficacy, precluding the ability to compare their findings with previous research regarding more active women's self-efficacy responses to mirrored exercise (Katula & McAuley, 2001).

In a study designed to better elucidate the specific effect of mirrors on both affective and self-efficacy responses to exercise, Martin Ginis et al. (2003) randomly assigned 58 sedentary women to complete a single 20-minute session of moderate intensity stationary cycling in a laboratory facing either a mirrored or non-mirrored wall. Exercise in the mirrored condition led to reductions in positive engagement and tranquility, and diminished improvements in revitalization and physical exhaustion relative to the non-mirrored condition. In other words, the mirror undermined the affective benefits of exercise. Participants reported significant increases in exercise self-efficacy (EXSE) from pre- to post-test in both conditions, suggesting that for sedentary

women, simply completing an exercise session was sufficient for increasing EXSE. Effects did not differ as a function of baseline trait body image, but women with high body image concerns experienced significant increases in physical appearance state anxiety (PASA) after exercise in both conditions. The authors speculated that exercise amplified PASA through increased awareness of bodily discomfort and low fitness. Whereas the presence of other exercisers in Focht and Hausenblas' (2003) naturalistic condition confounds the ability to attribute their results specifically to mirror exposure, the high internal validity of the Martin Ginis et al. (2003) study design compromises the generalizability of the results to real-world settings in which women exercise in the presence of others.

To partially address the limitations of the Martin Ginis et al. (2003) and Focht and Hausenblas (2003) studies, Martin Ginis et al. (2007) randomly assigned 92 sedentary female university students to 20 minutes of moderate intensity cycling in one of four laboratory conditions: (a) alone/mirrored, (b) group/mirrored, (c) alone/non-mirrored, or (d) group/non-mirrored. Group conditions consisted of two to four participants cycling side-by-side. Participants in the group/mirrored condition reported significantly smaller pre- to post-test increases in revitalization than the other conditions. The group/mirrored condition was the only condition to display significant increases in physical exhaustion from pre- to post-test. While both group conditions engaged in more appearance- and fitness-based social comparisons than the alone conditions, only the group/mirrored condition reported higher appearance self-consciousness than the referent group (alone/non-mirrored). Contrary to the researchers' predictions, there were no significant between-group differences between the non-mirrored and mirrored group conditions for

social comparison, self-consciousness, or perceived social evaluation. The authors concluded that the mirrored group exercise setting negatively impacted sedentary women's affective states through a combination of increased self-awareness and social comparison.

Contrary to Focht and Hausenblas (2003), Martin Ginis et al. (2007) did not find any between-setting differences in perceived evaluative threat. Whereas Focht and Hausenblas' (2003) naturalistic setting included female *and* male exercisers unaffiliated with the study, the Martin Ginis et al. (2007) group conditions were in a laboratory with all-female participants. Limitations of the Martin Ginis et al. (2007) study included the small sample sizes of the group conditions (both were  $n = 19$ ) and the use of non-validated, single-item measures of social comparison and self-consciousness. Furthermore, the four studies reviewed thus far all utilized 20 minutes of moderate intensity treadmill exercise or stationary cycling for their exercise stimuli. For these repetitive, low-skilled aerobic activities, mirrors provide minimal feedback on technique or proper execution of skills. These observations, in addition to the fact that exercisers in fitness facilities are more likely to encounter mirrors in resistance training areas or group exercise classes, informed the design of the next three studies.

Raedeke and colleagues (2007) randomly assigned 99 female undergraduate students with high social physique anxiety to one of four group step aerobics conditions: (a) mirror/health, (b) no mirror/health, (c) mirror/appearance, and (d) no mirror/appearance. All classes were 40-45 minutes in duration and taught by the same instructor, who gave either health-related cues (e.g., "let's get fit and healthy") or appearance cues (e.g., "stand tall, you'll look five pounds lighter"; Raedeke et al., 2007,

p.469). The instructor wore baggier attire for the health-oriented classes and more revealing, form-fitting attire in the appearance-oriented classes.

Participants in the health-related conditions reported significantly more positive affect, enjoyment, and intentions to participate in future classes than participants in the appearance-oriented classes (Raedeke et al., 2007). The presence of mirrors had no effect on affective responses to exercise. Neither mirrors nor leadership style had an effect on self-efficacy, perhaps because participants had high self-efficacy at baseline. The authors concluded that within a group step aerobics class, high SPA females used mirrors as an instructional tool to focus on their choreography and movements, thus avoiding the potentially negative effects of social comparisons and appearance evaluations. However, researchers did not measure frequency or motives for mirror usage, and did not assess social comparison or self-presentational concerns.

In a similar study, Lamarche, Gammage, and Strong (2009) randomly assigned 51 active female university students to engage in a 20-minute step aerobics class in either a mirrored or non-mirrored condition. The classes in both conditions were similar in size ( $n = 6$  to  $8$ ) and taught by the same instructor, who used standardized instructional cues. Analyses revealed there were no between-group differences in state social anxiety or self-presentational efficacy. Participants reported significant decreases in state social anxiety (i.e., concerns that the instructor and other exercisers were negatively evaluating their physique, coordination, and fitness) and increases in self-presentational efficacy (i.e., confidence in one's ability to present oneself as a physically fit and competent person) from pre- to post-test in both conditions. Similar to Raedeke et al. (2007), these findings only apply to young, active females. Furthermore, researchers did not measure task self-

efficacy, trait body image, or affect. Therefore, these findings cannot be interpreted relative to previous mirrored exercise studies.

As previously mentioned, mirrors are commonly featured in spaces designated for resistance training to provide visual feedback regarding proper technique and form. Using a counterbalanced design, Chmelo and colleagues (2009) conducted a study in which 32 active women completed two resistance training sessions (mirrored and non-mirrored) in a campus recreation center. Partitions were set up so participants would not have contact with other exercisers. There were no between-setting differences in affective responses to resistance training; however, participants did report significant increases in pleasant and activated affect over time in both settings. In relation to the theory of objective self-awareness (OSA; Duval & Wicklund, 1972), Chmelo et al. (2009) suggested that using mirrors for task-relevant information encouraged external focus on the task itself, or subjective self-awareness. Therefore, because the exercisers used the mirrors for technique rather than for self-critique of appearance, mirror exposure did not elicit negative affect. However, the authors did not directly measure attentional focus or self-objectification. Also, findings cannot be generalized to sedentary, overweight, and body dissatisfied individuals.

Although researchers refer to mirrors as objectifying stimuli, they have not experimentally tested whether mirrors alter the effects of acute exercise on state body image or state self-objectification. This is surprising, as mirrors are often cited as one of the reasons why female exercisers have higher levels of self-objectification in fitness facilities than in other exercise settings (Prichard & Tiggemann, 2005, 2010, 2012; Strelan et al., 2003). For example, Prichard and Tiggemann (2008) stated:



Fitness centers provide an atmosphere in which women's bodies are on display, and there is also an extreme emphasis on weight loss and what the body should look like. Female participants, in particular, are often surrounded by a *plethora of mirrors*, posters that depict the ideal body, and other women's bodies (often in tight, revealing clothing) with which to compare themselves, within classes that offer to tone and sculpt bodies to perfection- all aspects which suggest that fitness centers are objectifying in nature (p. 856-857).

Furthermore, the reviewed studies only examined the psychological effects of mirror exposure during aerobic (i.e., stationary biking, treadmill, step aerobics) and resistance modes of exercise. There is a need for research that examines whether a similar or different pattern of effects would be observed among women practicing alternative modes of exercise, such as yoga, in mirrored environments.

### **Yoga: Mind-Body Exercise**

The practice of yoga among U.S. adults aged 18-44 has doubled within the past decade, from 6.3% in 2002 to 11.2% in 2012 (Clarke, Black, Studdman, Barnes, & Nahin, 2015). Yoga's rising popularity has generated research interest in examining its health benefits. ACSM guidelines recommend engaging in neuromotor exercises (e.g., yoga) two to three times per week to enhance balance, flexibility, coordination, and proprioception (Garber et al., 2011). Because yoga classes are now offered in 75-80% of U.S. health clubs, YMCAs, and group exercise studios (Schroeder & Donlin, 2013), many women are presumably practicing yoga in mirrored facilities.

In relation to objective self-awareness and objectification theories, yoga's emphasis on mindfulness may encourage subjective self-awareness (SSA), or focusing on

one's actions and bodily sensations rather than one's physical appearance (Duval & Wicklund, 1972). SSA is similar to the experience of *flow* (Csikszentmihalyi, 1990), in which individuals are completely immersed in the present moment and the task at hand. According to Fredrickson and Roberts (1997), self-objectification reduces internal body awareness and flow. Conversely, yoga can promote flow, SSA, and internal body awareness through its emphasis on mindfulness. Yoga instructors commonly encourage students to direct attention toward breath, feel each movement, and observe without judgment (Smith, 2007). Furthermore, yoga may help cultivate a healthier relationship with one's body by promoting embodiment, or "an awareness of and responsiveness to bodily sensations" (Impett et al., 2006, p. 40). Research is needed to determine whether the presence of mirrors in yoga classes disrupts mindfulness by eliciting self-objectification, social comparison, and self-evaluation.

Given yoga's rising popularity, its increased presence in commercial fitness facilities, and its integration into a growing number of eating disorder prevention and treatment programs (Neumark-Sztainer, 2013), there is a need for experimental research that examines the psychological effect of practicing yoga with mirrors. To further contextualize and set the stage for this specific line of inquiry, the following review of the literature will outline key concepts related to the practice of modern postural yoga in the U.S. and summarize research findings regarding yoga and body image.

### **Modern Postural Yoga in the U.S.**

Yoga's roots can be traced back to ancient India. In Sanskrit, the word *yoga* has many meanings, but it is most often translated as a practice that "yokes" or "unites" the mind, body, and spirit (Salmon, Lush, Jablonski, & Sephton, 2009). Yoga is comprised of

several practices, but modern postural yoga is derived from *hatha yoga*, the physical practice. Modern postural yoga practices (e.g., *vinyasa*, *Iyengar*, *ashtanga*) feature *asanas* (physical postures), *pranayama* (breath control), and meditation (Varenne, 1976). Many of the yoga poses that are practiced today are appropriated from various modes of exercise, such as gymnastics, wrestling, and bodybuilding (Singleton, 2010). There are over 20 different styles of postural yoga; these styles vary widely in physical intensity and the degree to which they emphasize physicality and spirituality (Cowen & Adams, 2007; Mees, 2005).

In addition to building strength, flexibility, endurance, and balance (Cowen, 2010; Garber et al., 2011; Tran, Holly, Lashbrook, & Amsterdam, 2001), yoga encourages unification of the mind and body through breath awareness, internal focus, and meditation. For example, the *vinyasa* style of yoga links breath, dynamic movement, and meditation to encourage mindfulness (Smith, 2007). Mindfulness is characterized by internal focus, non-judgmental awareness of bodily feelings, and being grounded in the present moment (Smith, 2007). Instructors encourage students to focus on the breath to quiet anxious thoughts and to bring attention back to the present (Kennedy & Yoke, 2009). Students are further encouraged to notice how they feel in each pose in the current moment and to refrain from judging one's self in relation to others or internalized standards. Smith (2007) argued that this engagement with the body and mind is a "mode of self-inquiry and self-encounter" (p.40) that separates yoga from purely physical exercise.

As previously mentioned, yoga has grown in popularity in the U.S. over the past decade, especially among young women. It is estimated that 82% of U.S. yoga

participants are women and 63% are between the ages of 18 and 44 (Sports Marketing Surveys USA, 2012). A review of complementary and alternative medicine use reported that yoga participation rates were higher among college students than the general population (Nowak & Hale, 2012). Nationwide surveys consistently report that yoga participants in the U.S. are predominantly Caucasian, college-educated females (Birdee et al., 2008; Clarke et al., 2015).

Because young women are at higher risk for self-objectification, social physique anxiety, body shame, and body dissatisfaction than older women and men (Davison & McCabe, 2005; Fitzsimmons & Bardone-Cone, 2011; McKinley, 2006; Tiggemann & Lynch, 2001), it is important to examine whether participation in yoga can reduce these body image concerns. Building upon previous research demonstrating that women who exercise primarily for weight loss and appearance-related reasons report high levels of body dissatisfaction and self-objectification (Prichard & Tiggemann, 2005; Strelan et al., 2003), researchers have investigated whether women's underlying motives for practicing yoga influence their body image.

### **Yoga and Body Image**

Researchers have proposed that yoga fosters positive embodiment, and encourages women to focus on how their body feels rather than how it looks in relation to internalized ideals of feminine beauty and thinness (Daubenmier, 2005; Impett et al., 2006; Prichard & Tiggemann, 2008). Many of these studies draw upon objectification theory as a theoretical framework (Fredrickson & Roberts, 1997). Because of yoga's emphasis on positive embodiment, it has been integrated into prevention and treatment programs for eating disorders (Carei, Fyfe-Johnson, Breuner, & Brown, 2010; Douglass,

2013; McIver, O'Halloran, & McGartland, 2009; Neumark-Sztainer, 2013; Scime, Cook-Cottone, Kane, & Watson, 2006).

While preliminary findings from observational and small-scale intervention studies suggest yoga can help reduce eating disorder risk and promote positive body image, Neumark-Sztainer (2013) has recommended that researchers utilize randomized, controlled designs to improve the methodological strengths of this research area. Similar to Martin Ginis and colleagues' (2012) critique of the general exercise and body image literature, Neumark-Sztainer (2013) identified gaps in the yoga literature regarding dose-response and potential mechanisms underlying yoga's effects on body image. Although the majority of the following studies on yoga and body image use non-randomized designs, and are thus riddled with self-selection biases, they do provide a springboard for more methodologically rigorous experimental studies.

Initial support for yoga's body image benefits comes from cross-sectional survey studies that compare the psychological profiles of yoga participants to non-participants. Prichard and Tiggemann (2008) recruited 571 females (ages 18-71; *M* age = 36) from group exercise classes to complete surveys related to exercise behaviors, self-objectification, motives for exercise, and body image. Women who practiced yoga were more likely to endorse health and fitness-related motives for exercise, reported fewer appearance motives, and reported lower levels of self-objectification than women who engaged solely in cardiovascular exercise. Yoga participants' underlying motives for exercise partially mediated the inverse relationship between yoga participation and self-objectification.

In a similar study, Zajac and Schier (2011) recruited 138 female aerobics and yoga class participants (ages 17-67; *M* age = 28) from fitness centers and yoga studios in Poland and Canada to examine whether exercise motives and negative body-related emotions differed as a function of cultural background (Canadian vs. Polish) and exercise mode (aerobics vs. yoga). Regardless of cultural background, yoga participants reported higher levels of positive health and stress management motives for exercise than aerobics participants. Additionally, yoga participants were less likely to endorse weight-management motives than aerobics participants. Weight-management motives predicted negative body-related emotions.

In another cross-sectional survey study, Daubenmier (2005) explored between-group differences in self-objectification, body awareness, body responsiveness, appearance satisfaction, and disordered eating among female yoga participants ( $n = 43$ ), step aerobics class participants ( $n = 45$ ), and a non-yoga/non-aerobics comparison group ( $n = 51$ ). Analyses revealed that female yoga participants reported lower levels of self-objectification, greater appearance satisfaction, higher body awareness, and higher body responsiveness than non-participants. Participants who practiced yoga also reported lower levels of disordered eating symptoms than participants who attended step aerobics classes. Daubenmier (2005) additionally reported that hours of yoga per week were inversely associated with self-objectification. After controlling for age, years of yoga experience were positively associated with appearance satisfaction. In support of yoga as an activity for encouraging positive embodiment, higher levels of body responsiveness predicted lower levels of self-objectification, higher levels of body satisfaction, and reduced risk for disordered eating among yoga participants.

Although these cross-sectional survey studies provide preliminary support for yoga's positive effects on body image and self-objectification, their findings should be interpreted with caution (Daubenmier, 2005; Prichard & Tiggemann, 2008; Zajac & Schier, 2011). Due to self-selection bias, causation cannot be inferred. One plausible explanation of these results is that women who choose to practice yoga also tend to have more health-related motives for exercise and are less preoccupied with external appearance than non-participants. Furthermore, results cannot be generalized to beginner level yoga students. Also, studies were inconsistent in their use of valid and reliable surveys.

Building upon the findings of these cross-sectional survey studies, Impett et al. (2006) utilized a single group pretest-posttest design to examine psychological responses to a two-month *Anusara* yoga immersion program. The program consisted of four sessions per week. Fifteen of the 19 original participants (14 females, 1 male;  $M$  age = 35) completed both pretest and posttest measures. Additional measures of affect and body image were completed weekly. Female participants reported a significant decrease in self-objectification from pre- to post-test. Weekly hours of yoga positively predicted self-acceptance. Analyses of weekly data revealed that during weeks when participants practiced more frequently, they experienced decreases in negative affect and significantly higher levels of positive affect and body awareness. Limitations of Impett et al. (2006) included the lack of a control group, lack of random assignment, and small sample size. Similar to previous studies, the findings cannot be generalized beyond experienced yoga participants ( $M = 5.5$  years of experience).

Based on an extensive search of the literature, there is only one randomized experimental study that has examined the effect of yoga on body image. Elavsky and McAuley (2007a, 2007b) randomly assigned 164 sedentary, middle-aged women ( $M$  age = 50) to four months of Iyengar yoga, walking, or wait-list control. At the conclusion of the four-month study period, both the walking and yoga conditions displayed significantly greater improvements on perceived body attractiveness than the waitlist control group. When the three conditions were combined together, reduced body fat percentage was the only significant predictor of perceived body attractiveness. Out of all the physical self-concept domains, only perceived physical condition and body attractiveness made significant contributions to physical self-worth. Whereas physical activity participation, exercise self-efficacy, and BMI significantly predicted perceived physical condition at the two-year follow-up, only reductions in BMI were found to significantly predict perceived body attractiveness (Elavsky, 2010).

In light of the negative psychological outcomes associated with exercising for appearance and weight loss reasons (e.g., Strelan et al., 2003; Vinkers et al., 2012), it is interesting that Elavsky and McAuley (2007a) found that reductions in BMI drove the improvements in perceived body attractiveness. However, findings also suggest that improvements in physical self-worth can be made even if weight loss does not occur. Specifically, efforts to increase exercise self-efficacy (EXSE) may positively influence physical self-worth through perceived increases in physical condition. Therefore, it is alarming that the women in the yoga group reported lower EXSE at the end of the initial trial and at two-year follow-up than the walking group (Elavsky, 2010). Because other researchers have found EXSE to positively predict women's physical self-acceptance and



general self-esteem (Levy & Ebbeck, 2005), it is important to examine variables that influence women's self-efficacy for yoga. Elavsky's (2010) findings lend further support to the importance of identifying variables (e.g., mirrors) that influence body image, self-efficacy, and affective responses to yoga. The limitation of this study is that it included mostly White, middle-aged women. Additionally, body awareness, self-objectification, and mindfulness were not examined.

Acute exercise research has noted that post-exercise improvements in state body image are accompanied by increases in positive affect and decreases in negative affect (e.g., Lepage & Crowther, 2010; Prichard & Tiggemann, 2012; Vocks et al., 2009). Because affective responses to a single bout of exercise predict individuals' future exercise intentions and long-term exercise adherence (Raedeke et al., 2007; Williams et al., 2008), it is important to examine women's affective and body image-related responses to an acute bout of yoga. Although there is a gap in the literature regarding the effects of yoga on state body image and self-efficacy, a few studies have investigated affective responses to a single bout of yoga.

### **Yoga and Affect**

In one of the first studies to measure short-term affective responses to yoga in comparison with other modes of exercise, Berger and Owen (1988) recruited college students who were enrolled in semester-long courses in beginner level yoga, conditioning, fencing, and swimming. Participants completed the Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1971) and a state anxiety measure immediately before and after their respective activity at three different time points in the semester. Yoga students reported significant short-term improvements in tension, depression,

anger, fatigue, and confusion from pre- to post-test. Whereas yoga students reported significant reductions in state anxiety after a single class, students in the swimming, fencing, and conditioning classes did not report short-term reductions in anxiety.

Building upon their 1988 study, Berger and Owen (1992) recruited male and female students from a yoga, swimming, and lecture-control class to complete the POMS before and after an individual class session on three different occasions during the semester. In comparison with the lecture-control class, participants in the yoga and swimming classes reported significantly greater short-term improvements in anger, confusion, tension, and depression. Also, greater improvements in mood predicted higher attendance rates throughout the semester, suggesting that the affective benefits of exercise motivated students to attend class more often. This finding supports Williams and colleagues' (2008) assertion that positive affect during exercise encourages adherence. Whereas female yoga students reported significantly greater decreases in fatigue from pre- to post-test than the female swimming students, female swimmers reported greater pre-to post-test increases in vigor than the female yoga students.

One major limitation of the Berger and Owen (1988, 1992) studies is that participants self-selected their activity groups and, therefore, causation cannot be inferred. It is possible that the differential mood benefits were due to pre-existing differences in exercise motives and personality traits. Although Berger and Owen (1988, 1992) theorized that yoga's emphasis on deep abdominal breathing, muscle relaxation, non-competition, and internal awareness positively affected mood and anxiety, they did not directly measure these variables.

Another major limitation of the previous studies by Berger and Owen (1988, 1992) is their use of the POMS. Researchers have criticized the POMS because it is not an exercise-specific measure and it is skewed toward assessing negative mood states (McAuley & Courneya, 1994). Since the POMS (McNair et al., 1971) only assesses one positive affective state (i.e., vigor), it cannot capture the wide breadth of positive feelings that might arise in response to exercise. Therefore, exercise-specific measures of affect, such as the Exercise-Induced Feeling Inventory (EFI; Gauvin & Rejeski, 1993), are more appropriate for studying affective responses to yoga.

Research with the EFI suggests that, in comparison with other forms of exercise, yoga induces higher tranquility. Szabo, Mesko, Caputo, and Gill (1998) used the EFI and Subjective Exercise Experiences Scale (McAuley & Courneya, 1994) to compare 174 active adults' affect after a self-selected mode of exercise (aerobic dance, strength-training, martial arts, or tai-chi/yoga) or a music appreciation control. Yoga and tai chi were combined together as a "low physical exertion" exercise for between-group analyses. After controlling for pre-test affect and perceived exertion, the yoga/tai chi group reported significantly higher post-test scores on the EFI tranquility subscale than all of the other exercise groups. Post-exercise levels of positive affect were not significantly different from participants' affective responses to music.

Similar to the aforementioned limitations of Berger and Owen (1988, 1992), a major limitation of Szabo et al. (1998) was that participants self-selected the exercise mode. Therefore, results may have been influenced by self-selection bias and pre-conceived notions regarding the psychological benefits of the chosen exercise activities. Meaningful interpretations of these results are further compromised by the problematic

"lumping together" of yoga and tai chi. Despite its limitations, this study does provide preliminary evidence that yoga enhances positive affect, and that it may instill higher levels of tranquility and calmness than other forms of exercise.

Improving upon the previous three studies' reliance on active college students and self-selected exercise modes, Bryan, Zipp, and Parasher (2012) conducted a study in which adults (ages 34-65) were randomly assigned to either 10 weeks of beginner level yoga or a wait-list control. The yoga participants reported significant increases in exercise self-efficacy and overall MVPA relative to the control. Unfortunately, Bryan et al. (2012) only measured affect after (but not before) each yoga class, and did not examine whether there were changes in post-yoga affect over the course of the intervention. Instead, they reported participants' mean affective responses to yoga for nine of the 12 EFI items for the entire 10 weeks, inexplicably omitting participants' average responses for three items (i.e., calm, relaxed, and energetic). Based on the available data, it is unclear whether increases in self-efficacy over time predicted increases in positive affective responses to yoga.

An emerging line of research has begun to examine potential biopsychosocial mechanisms underlying the affective benefits of yoga, such as reductions in cortisol and biomarkers of inflammation (Kiecolt-Glaser et al., 2011). Kiecolt and colleagues (2011) utilized a repeated measures experimental design to examine 50 female participants' (25 yoga novices and 25 yoga experts; *M* age = 41) affective, endocrine, and inflammatory responses to three 75-minute experimental sessions: Iyengar restorative yoga, low-intensity treadmill walking (heart rate matched to yoga), and a video control condition. Analyses revealed that positive affect was significantly increased after yoga, decreased

after the video control, and unchanged after the walking condition. Yoga experts and novices reported similar improvements in positive affect. Affective responses to yoga were unrelated to changes in anti-inflammatory or endocrine levels. While Kiecolt-Glaser et al. (2011) were unable to identify the specific physiological mechanisms underlying affective responses to yoga, other researchers have proposed that yoga increases positive affect through its emphasis on mindfulness (Mackenzie, Carlson, Ekkekakis, Paskevich, & Culos-Reed, 2013).

### **Yoga and Mindfulness**

Although the mental health benefits of practicing yoga are often anecdotally or qualitatively attributed to the cultivation of internal awareness or mindfulness (e.g., Berger & Owen, 1988, 1992; Daubenmier, 2005), there is surprisingly little empirical research on yoga's effects on trait or state mindfulness (Mackenzie et al., 2013). Mindfulness is a non-judgmental engagement with the present moment, similar to Csikszentmihalyi's (1990) concept of flow. Because Fredrickson and Roberts (1997) proposed that self-objectification reduces the ability to experience flow, it is hypothesized that yoga might counteract the negative psychological consequences of self-objectification by encouraging mindfulness. In fact, yoga is referred to as *mindfulness in motion* in Kabat-Zinn's (1990) mindfulness-based stress reduction program.

The importance of examining yoga's effect on mindfulness, and identifying variables that alter this effect, is supported by studies that have found mindfulness to be correlated with positive mental health outcomes. For example, Brown and Ryan (2003) found both trait and state mindfulness to be positively associated with perceived autonomy and pleasant affect. In support of examining mindfulness within the framework

of objectification theory (Fredrickson & Roberts, 1997), a cross-sectional survey study with 1287 Dutch women ( $M$  age = 49) observed a positive relationship between trait mindfulness and body satisfaction, and found that individuals who were more mindful engaged in less body comparisons with other women (Dijkstra & Barelds, 2011).

In regards to yoga-specific research, a survey-based correlational study with beginner level ( $n = 24$ ) and advanced ( $n = 28$ ) yoga participants ( $M$  age = 44) found that advanced participants reported significantly higher levels of trait mindfulness and lower levels of perceived stress than beginners; higher levels of mindfulness were related to lower levels of stress (Brisbon & Lowery, 2011). In an examination of a seven-week yoga program for cancer survivors ( $M$  age = 53), Mackenzie and colleagues (2013) observed increases in positive affect and various facets of mindfulness from pre- to post-intervention. Although mindfulness was related to lower mood disturbance, lower stress, and higher adherence to the yoga program, the results of this study should be interpreted with caution given its non-experimental design (i.e., participants self-selected into the program and there was not a control group).

None of the aforementioned studies used randomized experimental designs to examine the effects of yoga on mindfulness. Because participants in these studies tended to be middle-aged women engaging in gentle, restorative forms of yoga, it is unclear whether increases in mindfulness would be observed for more vigorous, fitness-based styles of yoga (e.g., vinyasa) or among young women. Because young women are more likely than older women to self-objectify and engage in social comparisons with fellow exercisers, it is important to examine whether they experience increases in mindfulness and decreases in self-objectification as a result of yoga participation (Greenleaf,

McGreer, & Parham, 2006; Lindner et al., 2012; Martin Ginis et al., 2007). Furthermore, there are gaps in the literature regarding the effects of a single yoga class on state mindfulness, and whether certain social environmental variables, such as the presence of mirrors, would disrupt mindfulness through elicitation of state self-objectification or objective self-awareness (Duval & Wicklund, 1972).

### **Yoga and Mirrors**

Daubenmier (2005) stated, “mirrors are often excluded from yoga studios, in contrast to fitness centers and dance studios, in order to encourage movement based on internal awareness rather than outward appearance” (p.208). However, many commercial studios, such as Bikram Yoga and CorePower, feature mirrors to help students obtain proper alignment (Choudhury, 2012; CorePower, 2014). To date, no published studies have examined the psychological effects of practicing yoga with mirrors. This is an important area to explore given the effect mirrors can have on body image concerns, self-objectification, self-efficacy, affect, and social comparison (e.g., Katula & McAuley, 2001; Martin Ginis et al., 2003, 2007; Mor & Winqvist, 2002; Mulken & Jansen, 2009; Reel et al., 2011), and the common use of mirrors in yoga facilities (Choudhury, 2012; CorePower, 2014). Given the increased practice of yoga and its focus on healthy body image and affect, experimental studies are needed that examine the effect of mirrors during yoga on body image. There is also a need for research that explores how demographic variables (e.g., BMI), psychological traits (e.g., trait self-objectification), and cognitive processes (e.g., social comparison) might alter this effect.

## Summary and Conclusions

Few studies have examined the effect of acute exercise on state body image concerns (Fallon & Hausenblas, 2005; Lepage & Crowther, 2010; Prichard & Tiggemann, 2012b; Vocks et al., 2009). The existing body of research suggests that participating in a single session of exercise enhances body satisfaction, particularly among young, active females (Fuller-Tyszkiewicz et al., 2013). However, no published studies have examined whether a single session of yoga improves body image and reduces self-objectification. Given the emerging use of yoga in eating disorder prevention and treatment programs (Neumark-Sztainer, 2013), it is imperative that researchers examine ways to enhance the body image benefits associated with practicing yoga. Offering mirror-free spaces may be one way to reduce women's self-objectification and promote positive body image during yoga.

Mirrors are commonly used in psychology studies to evoke objective self-awareness and self-objectification among women (Fredrickson et al., 1998; Mor & Winquist, 2002). Past exercise research has only examined psychological responses to mirrors during aerobic and resistance exercise (e.g., Chmelo et al., 2009; Lamarche et al., 2009). Therefore, the current study examined whether mirrors would alter psychological responses to yoga. The reviewed exercise studies found that although mirrors undermined sedentary and low active women's positive affective and self-efficacy responses to aerobic exercise, not all women responded negatively to the presence of mirrors (Katula et al., 1998; Katula & McAuley, 2001; Lamarche et al., 2009; Martin Ginis et al., 2007, 2003). Although research with female dancers suggested that mirrors exacerbate trait body image concerns (Radell et al., 2011; Reel et al., 2005), there is a lack of



experimental research that has specifically examined the effect of mirrors on state body image during exercise. Of the reviewed studies, Martin Ginis and colleagues' (2003) experiment was the only exercise study to directly examine the effect of mirrors on state body image. These researchers only measured physical appearance state anxiety, which is just one facet of body image. Therefore, the present study measured changes in state body image and social physique anxiety. Additionally, although researchers (e.g., Prichard & Tiggemann, 2008; Strelan et al., 2003) referred to mirrors as objectifying stimuli within fitness facilities, they did not empirically test this hypothesis. The present study addressed this knowledge gap by testing whether mirrors increased state self-objectification during yoga.

Furthermore, previous researchers hypothesized that the presence of mirrors during group exercise classes would lead to body dissatisfaction and negative affect through appearance comparison (Martin Ginis et al., 2007; Reel et al., 2005). According to the "circle of objectification," objectifying stimuli (i.e., mirrors) should elicit self-objectification and social comparison (i.e., objectification of other women). Therefore, the present study improved upon previous research by using a valid and reliable measure to examine the effect of mirrors on women's appearance comparisons during yoga. Furthermore, because self-objectification and objective self-awareness have been hypothesized to disrupt flow or mindfulness (Fredrickson & Roberts, 1997), the present study examined whether mirrors negatively affected state mindfulness during yoga.

There is an additional need for research that examines whether personal-level characteristics moderate women's psychological responses to yoga and mirrors. Prichard and Tiggemann (2010) found that women who disliked mirrors during group aerobics

classes also tended to have lower body esteem and higher BMI. Therefore, the present study examined whether women's BMI and other variables related to body image (e.g., MVPA, reasons for exercise, trait self-objectification) moderated the effect of mirrors on psychological responses to yoga.

While longer-term exercise participation is theorized to enhance body image through self-efficacy and perceived/objective improvements in fitness (Martin Ginis et al., 2012), the potential mechanisms underlying the effect of acute exercise on state body image concerns are unclear. A few studies have found exercise-induced changes in state body image to be accompanied by increases in affect (Lepage & Crowther, 2010; Prichard & Tiggemann, 2012b; Vocks et al., 2009), but there is a need for experimental research that directly measures whether cognitive (e.g., social comparison and mindfulness), self-efficacy, and affective responses to exercise are associated with exercise-induced changes in state body image. Given the positive associations between mindful body awareness and other aspects of body image among yoga participants (e.g., Daubenmier, 2005), the present study measured the relationship between state mindfulness and body image responses to yoga and mirrors. The present study not only examined the relationships between cognitive, affective, and state body image responses to yoga and mirrors, but also examined whether these psychosocial responses predicted intentions to engage in future yoga-related behaviors. This line of inquiry draws upon previous research that found affective responses to exercise predicted future exercise intentions and behaviors (e.g., (Kwan & Bryan, 2010; Raedeke et al., 2007; Williams et al., 2008).

## Chapter 3: Method

### Overview of Design

The primary aim of this experimental study was to examine the effect of mirrors on body image, self-efficacy, and affective responses to a 60-minute beginner level yoga session. Specifically, college-aged women ( $n = 97$ ; ages 18-25) were randomly assigned to complete a yoga session in either a mirrored or non-mirrored setting. Participants completed psychosocial measures before and after the yoga session. This study was approved by the University of Minnesota's Institutional Review Board (IRB) and was registered with approval number 1406P51365 (see Appendix A).

### Participants and Inclusion/Exclusion Criteria

Participants were recruited through in-class presentations, flyers on campus, a college-wide listserv email, and social media (see Table 1). Word-of-mouth recruitment also took place; several individuals heard about the study from friends.

Table 1

#### *Methods of Recruitment*

Recruitment Method	Screened ( $n = 251$ )	Final Sample ( $n = 97$ )	Non-Completers ( $n = 154$ ) <sup>a</sup>
In-Class Presentation	107 (42.6%)	40 (41.2%)	67 (43.5%)
College Listserv Email	64 (25.5%)	25 (25.8%)	39 (25.3%)
Friend Referral	42 (16.7%)	15 (15.5%)	27 (17.5%)
Flyer	35 (13.9%)	17 (17.5%)	18 (11.7%)
Facebook	3 (1.2%)	0 (0.0%)	3 (1.2%)

<sup>a</sup>Participants who did not complete the study because they were ineligible, were not interested after receiving a study schedule, or did not attend their scheduled session.

The study was advertised as an examination of women's thoughts and feelings toward a beginner level yoga class. Recruitment materials specified that only women between the ages of 18 and 25 who were beginner level yoga students were eligible for participation. We recruited this particular demographic group because young adult women are more likely to self-objectify (i.e., worry about their appearance) and exercise for appearance-related reasons than older women (Fredrickson & Roberts, 1997; McKinley, 2006; Prichard & Tiggemann, 2008). Exclusion criteria included: (a) current pregnancy; (b) history of chest pain, musculoskeletal injuries, and/or any other health condition that may limit their ability to safely participate in exercise; and (c) intermediate or advanced level of yoga expertise.

Of the 251 individuals who completed the on-line screening questionnaire, 202 met the inclusion/exclusion criteria (see *Figure 1*). Sixty-six individuals were no longer interested in completing the study after receiving a scheduling email. A total of 136 women were randomized and scheduled to attend a yoga class in either the mirrored ( $n = 75$ ) or non-mirrored ( $n = 61$ ) condition. Since there was only one condition (mirrored or non-mirrored) per experimental session, participants were randomized prior to being assigned to the date of their session.

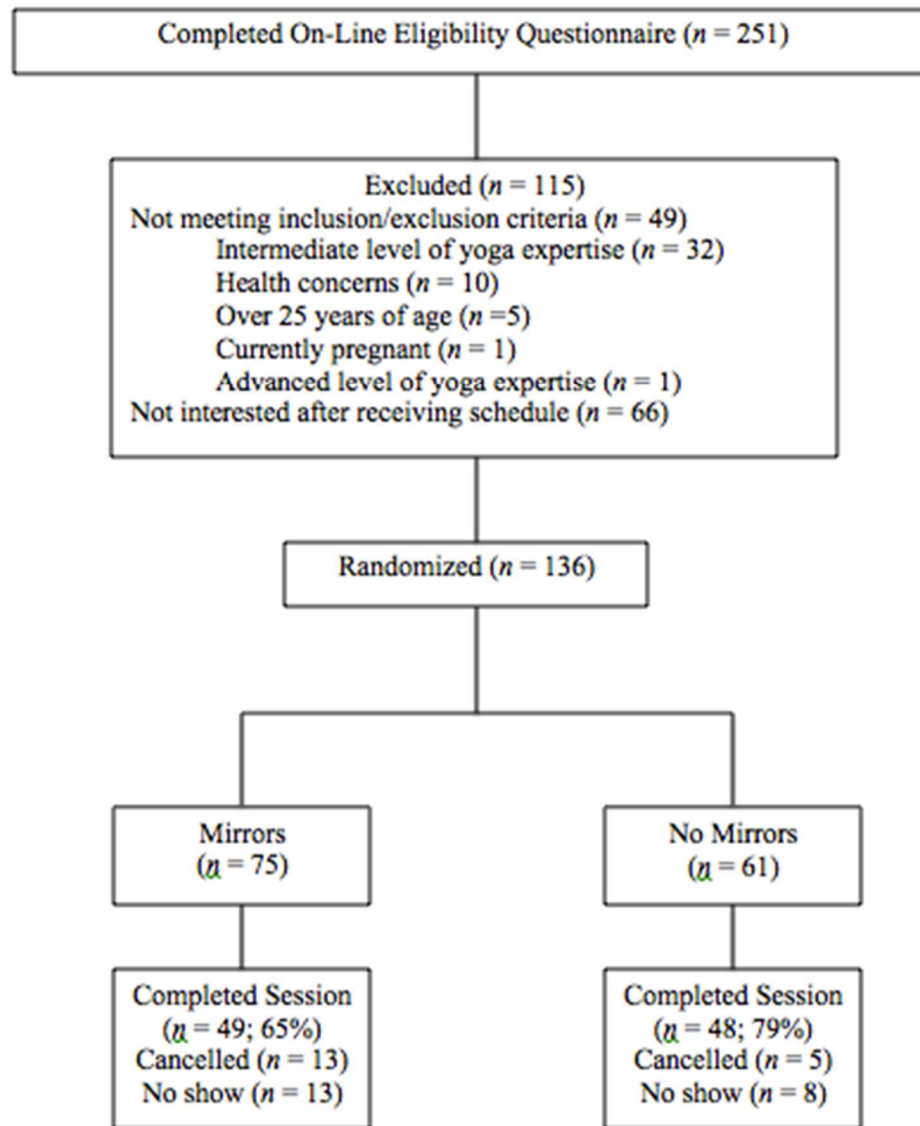


Figure 1. Flow of participants from September 2014 – November 2014.

### Measures

Participants completed the following trait and state-based measures immediately prior to and following participation in their respective yoga sessions (see Table 2).

**Trait-based measures.** The following personal-level characteristics and psychological traits were assessed immediately prior to the yoga class.

***Trait self-objectification.*** Trait self-objectification was assessed using the eight-item Objectified Body Consciousness Scale- Surveillance subscale (OBCS-S; McKinley & Hyde, 1996). Body surveillance, or habitual monitoring of one's physical appearance from an outsider's perspective, is a behavioral manifestation of self-objectification (Moradi & Huang, 2008). A number of researchers have used the OBCS-S to assess relationships between trait self-objectification and variables such as body esteem, appearance motives for exercise, and eating disorder risk (Fuller-Tyszkiewicz et al., 2013; Moradi & Huang, 2008; Prichard & Tiggemann, 2005). Participants indicate their responses to items (e.g., "During the day, I think about how I look many times") on a seven-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). McKinley and Hyde (1996) reported the OBCS-S subscale to be both reliable and valid, as demonstrated by Cronbach's alphas ranging from .79 to .89, negative correlations with body esteem, and positive associations with disordered eating and internalization of cultural body standards. The OBCS-S demonstrated good internal consistency in the current investigation, with a Cronbach's alpha of .86.

Table 2

*Measures and Data Collection Time Points*

Variable	Instrument name	Pre	Post
Trait self-objectification	Objectified Body Consciousness Scale: Surveillance subscale	X	
Exercise motives	Reasons for Exercise Inventory: Appearance and Health/Fitness subscales	X	
State body image	Body Image States Scale	X	X
State social physique anxiety	State Social Physique Anxiety Scale	X	X
State self-objectification	State Self-Objectification Questionnaire	X	X
Task self-efficacy for yoga	Task Self-Efficacy; Pilates Self-Efficacy Scale	X	X
Affect	Exercise-Induced Feeling Inventory	X	X
Social comparison	State Appearance Comparison Scale		X
Mindfulness	State Mindful Attention Awareness Scale		X
Intentions	Intentions to Engage in Yoga		X
Mirror usage	Frequency of Mirror Gazing Visual Analogue Scale		X
Mirror preferences	Preference for Mirrors in Group Exercise/Yoga		X
BMI	Self-reported height and weight		X
Exercise participation	Godin Leisure Time Exercise Questionnaire		X

***Exercise motives.*** Underlying motives for exercise participation were assessed with 16 items from the Reasons for Exercise Inventory (REI; Silberstein, Striegel-Moore, Timko, & Rodin, 1988). The full REI evaluates seven motivational domains: weight control, physical attractiveness, health, fitness, enjoyment, mood, and body tone. To increase ease of interpretation and to address intercorrelations between scales, previous researchers have collapsed the seven subscales into three distinct motivational domains: Appearance-related (weight control, body tone, attractiveness), health/fitness, and

enjoyment/mood improvement (Prichard & Tiggemann, 2005, 2008; Strelan et al., 2003).

Consistent with previous research on exercise motives and self-objectification, we only assessed appearance-related (9 items) and health/fitness-related (7 items) motives for exercise (O'Hara, Cox, & Amorose, 2014).

Participants indicated the personal importance of each item on a scale ranging from 1 (*not at all important*) to 7 (*extremely important*). Initial psychometric testing of the REI subscales reported high internal reliability, with alpha coefficients ranging from .67 - .81 (Silberstein et al., 1988). Strelan et al. (2003) reported high internal reliabilities (Cronbach's alphas of .91) for both appearance and health/fitness domains. In general, research has found appearance-related reasons for exercise to be inversely associated with body esteem, and positively correlated with body image disturbance and self-objectification (Cash et al., 1994; Prichard & Tiggemann, 2005, 2008; Strelan et al., 2003). Cronbach's alphas in the current investigation demonstrated good inter-item reliability with .88 for the appearance subscale and .79 for the health/fitness subscale.

**State-based measures of body image, self-efficacy, and affect.** Participants completed the following state measures immediately before and after the yoga session.

***State body image.*** The Body Image States Scale (BISS; Cash et al., 2002) is a six-item scale that examines evaluative and affective body image states. Participants indicate how they feel, at the current moment, about their: (a) overall physical appearance, (b) body size and shape, (c) weight, (d) physical attractiveness, (e) looks relative to how they usually feel, and (f) appearance in relation to the average person (Cash et al., 2002). Responses are rated on a nine-point, bipolar, Likert-type scale. High mean scores on the BISS are interpreted as more positive body image states, whereas lower scores reflect



more negative body image concerns. In Cash and colleagues' (2002) initial psychometric tests of the BISS with 174 college students, the BISS detected changes in body image in response to body image-salient information and imagined situational contexts. The BISS was also significantly correlated with BMI ( $r = -.53$ ) and various trait measures of body image concerns (e.g., dissatisfaction, objectified body consciousness). The BISS also demonstrated moderate retest reliability after two to three weeks ( $r = .69$ ). Internal consistency of the BISS was previously reflected in alphas of .77 (Cash et al., 2002) and .85 (Vocks et al., 2009). The internal consistency of the BISS within the current study was .79 at pre-test and .80 at post-test.

***State social physique anxiety.*** The State Social Physique Anxiety Scale (S-SPAS; Martin Ginis, Murru, Conlin, & Strong, 2011) is a nine-item adaptation of Hart and colleagues' (1989) Social Physique Anxiety Scale, which conceptualized SPA as a general tendency to worry about others negatively evaluating one's body. Martin Ginis et al. (2011) developed the S-SPAS to detect changes in SPA that occur in response to physique-salient social situations, such as a group exercise class. Responses are rated on a five-point Likert-type scale (1 = *not at all*; 5 = *a great deal*). Items 5 ("I feel comfortable with how fit my body appears to others") and 8 ("I feel relaxed when it is obvious that other people in the room are looking at my physique/figure") are reverse scored prior to calculating a total scale score. Higher total scale scores are indicative of higher state SPA. Martin Ginis et al. (2011) compiled and analyzed data from four separate studies with young women ( $n$ s ranging from 44 to 80) to provide support for the S-SPAS' construct validity and reliability. The S-SPAS demonstrated convergent validity through significant correlations with BMI ( $r$ s = .29 - .38) and measures of state body

image concerns including the BISS ( $r = -.63$ ;  $r = -.70$ ) and the Physical Appearance State Anxiety-Weight Scale ( $r = .65$ ; Reed, Thompson, Brannick, & Sacco, 1991). In support of the scale's discriminative validity, women reported significantly higher S-SPAS scores ( $d = 0.97$ ) after completing a strength training class in the presence of male versus female onlookers (Martin Ginis et al., 2011). Furthermore, the S-SPAS was found to be more responsive to situational changes in SPA than the trait SPAS (Hart et al., 1989), and had reliability coefficients ranging from .70 - .93 (Martin Ginis et al., 2011). The reliability coefficients for the S-SPAS in the current study were .86 at pre-test and .87 at post-test.

***State self-objectification.*** Researchers have used various experimental manipulations to produce heightened levels of state, or situational, self-objectification (SO) among women, such as trying on a swimsuit in front of a mirror (Fredrickson et al., 1998) or anticipating an interaction with a male stranger (Calogero, 2004). Previously used measures of state SO, such as the Ten Statements Test (Fredrickson et al., 1998), were designed to be administered to participants after an experimental manipulation. To detect *changes* in state SO that occur in response to objectifying stimuli or experimental manipulations, Prichard and Tiggemann (2012b) adapted Noll and Fredrickson's (1998) trait-based Self-Objectification Questionnaire into a ten-item visual analogue scale (VAS) measure, the State Self-Objectification Questionnaire (S-SOQ). The S-SOQ assesses the extent to which individuals are currently preoccupied with appearance (objectified) versus functional (non-objectified) characteristics of their bodies.

Participants indicated on a 10 cm line (a VAS anchored by *not at all* and *very much*) how important each of the five competency-based attributes (physical coordination, strength, physical fitness, health, and energy level) and five appearance-

based attributes (weight, sex appeal, firm/sculpted muscles, physical attractiveness, and measurements) were to them “right now” by drawing a vertical line in the appropriate location (Prichard & Tiggemann, 2012b). Items were scored by using a ruler to measure the positioning of the vertical lines on each VAS to the nearest millimeter. Total scores were first calculated by subtracting the sum of the competency-based items from the appearance-based items. This score was then divided by five to yield S-SOQ scores ranging from -100 to +100. Higher, positive scores indicated higher state SO. Initial construct validity of the S-SOQ was demonstrated in a study that detected higher levels of SO among women who were exposed to media images of the thin ideal during exercise (Prichard & Tiggemann, 2012b). However, further studies are needed to establish its psychometric properties. Within the current study, Cronbach’s alphas for the competency-based items were .83 at baseline and .85 at post-test. The appearance-based items had alphas of .80 at pre-test and .84 at post-test.

***Task self-efficacy for yoga.*** Task self-efficacy (SE) is “an individual’s confidence in the ability to perform the elemental aspects of a task” (Rodgers & Sullivan, 2001, p.743). Task SE for yoga was assessed with four items adapted from the Task SE subscale of the Multidimensional Self-efficacy for Exercise Scale (Rodgers, Wilson, Hall, Fraser, & Murray, 2008; Rodgers, Hall, Blanchard, & Munroe, 2002; Rodgers & Sullivan, 2001) and one item adapted from the Pilates Self-Efficacy Scale (PSE; Caldwell, Harrison, Adams, & Triplett, 2009). Reliability and validity of the Task SE items have been established within college and community-based samples, with Cronbach’s alphas consistently above .70, adequate two-week test-retest reliability ( $r = .78$ ), significant correlations with exercise intentions, and an ability to differentiate

between exercisers and “non-intending” non-exercisers (Murray, Rodgers, & Fraser, 2009; Rodgers et al., 2008; Rodgers et al., 2002; Rodgers, Murray, Courneya, Bell, & Harber, 2009; Rodgers & Sullivan, 2001).

The Task SE instructions and items were modified to be specific to yoga (e.g., “complete your exercise using proper technique” was changed to “complete the yoga poses using proper technique”). Instructions prompted, “Indicate how confident you are that you can perform each of these activity-related tasks during a 60-minute yoga class.” Following the prompt, “How confident are you that you can...”, participants responded to items such as “follow directions from a yoga instructor” on a scale ranging from 0% (*not at all confident*) to 100% (*completely confident*). This methodology is consistent with Bandura’s (1986) recommendations for measuring self-efficacy.

In line with Rodgers and colleagues’ (2008) suggestion to supplement general exercise-related task SE items (e.g., “pace yourself to avoid over-exertion”) with more task-specific SE items, one additional item deemed appropriate for assessing yoga SE (i.e., “focus completely on coordinating your breath with body movements) was adapted from the Pilates Self-Efficacy scale (PSE; Caldwell et al., 2009). Although Pilates and yoga differ from one another, they are both mind-body forms of exercise that emphasize internal body awareness and link breath with movement (Neumark-Sztainer et al., 2011). Caldwell et al. (2009) reported that the PSE had face validity (i.e., reviewed by experienced Pilates participants), yielded high internal consistency (Cronbach’s alpha = .94), and was significantly correlated with self-regulatory efficacy ( $r = .36$ ). Furthermore, scores on the PSE increased significantly over the course of a semester-long Pilates

course (Caldwell et al., 2009). The Cronbach's alphas for the 5-item Task SE for Yoga scale in the current study were .79 at pre-test and .83 at post-test.

**Affect.** The Exercise-Induced Feeling Inventory (Gauvin & Rejeski, 1993) is a 12-item measure of four distinct feeling states: Positive Engagement (e.g., “enthusiastic”), Revitalization (e.g., “refreshed”), Physical Exhaustion (e.g., “tired”), and Tranquility (e.g., “calm”). Participants indicated the degree to which they were currently experiencing each item on a five-point scale ranging from 0 (*do not feel*) to 4 (*feel very strongly*). The EFI has factorial validity, demonstrates concurrent validity with other categorical measures of affect, and its subscales have high internal consistency (Gauvin, Rejeski, & Norris, 1996; Gauvin & Rejeski, 1993; Raedeke et al., 2007). Unlike more general measures of affect, such as the Profile of Mood States (McNair et al., 1971), the EFI was specifically developed to assess feelings that occur in response to an acute bout of exercise. Therefore, it was piloted and initially validated with samples of exercise participants (Gauvin & Rejeski, 1993). The EFI is an intuitive choice for the current study because researchers have previously utilized it to measure affective responses to yoga (Bryan et al., 2012; Szabo et al., 1998) and mirrored exercise (Focht & Hausenblas, 2006; Martin Ginis et al., 2003, 2007; Raedeke et al., 2007). The four EFI subscales demonstrated adequate inter-item reliability in the current study: Positive Engagement (pre-test alpha = .80; post-test alpha = .84), Revitalization (pre-test alpha = .72; post-test alpha = .80), Tranquility (pre-test alpha = .84; post-test alpha = .83), and Physical Exhaustion (pre-test alpha = .76; post-test alpha = .69).

**Post-test surveys.** Participants completed the following measures immediately after the yoga session.

***Social comparison.*** Participants reported the extent to which they engaged in appearance-based social comparisons during yoga with the State Appearance Comparison Scale (SACS; Herbozo & Thompson, 2010). The SACS consists of three items that assess frequency of thinking about one's own appearance and comparing one's physical appearance to other research participants on a scale from 1 (*no comparison*) to 7 (*a lot of comparison*). Similar versions of the scale have been used to detect the extent to which exposure to media portrayals of the thin-ideal elicit social comparisons (Tiggemann & McGill, 2004; Tiggemann & Slater, 2004). For the purposes of the current study, two similarly worded items were added to assess frequency of appearance comparisons to the yoga instructor. Tiggemann and McGill (2004) found that SACS scores were significantly higher among women who were instructed to focus on the physical appearance of thin-ideal media advertisements than among women who were instructed to focus on non-appearance aspects of the advertisements. Higher SACS scores were related to negative mood, body dissatisfaction, and weight anxiety (Tiggemann & McGill, 2004; Tiggemann & Slater, 2004). The SACS has acceptable internal consistency with previously reported Cronbach's alphas of .76 (Herbozo & Thompson, 2010) and .91 (Tiggemann & McGill, 2004). The Cronbach's alpha for the SACS within the current study was .87.

***State mindfulness.*** Mindfulness (i.e., non-judgmental engagement with the present moment) during the yoga class was assessed using the state Mindful Attention Awareness Scale (state MAAS; Brown & Ryan, 2003). The state MAAS consists of five items adapted from the trait version of the MAAS (Brown & Ryan, 2003); both versions have been shown to be reliable and valid instruments for assessing mindfulness among

college students and adults. The state MAAS is correlated with the trait version but exerts independent effects on measures of psychological well-being (autonomy and affect), demonstrating its incremental validity (Brown & Ryan, 2003). The state MAAS has high internal consistency (Cronbach's alpha = .92; Brown & Ryan, 2003). The instruction set and items can be adapted to assess recent (e.g., past hour) or current experiences of mindfulness. The developer of the MAAS (K.W. Brown, personal communication, February 9, 2014) approved the current study's modifications of the instructions and items (e.g., "I was doing *something* without paying attention" was changed to "I was doing the *poses* without paying attention"). Participants indicated the degree to which they experienced each item during the yoga class on a seven-point scale ranging from 0 (*not at all*) to 6 (*very much*). Items were then reverse-scored and summed for a total score; higher scores reflect higher levels of mindfulness. The state MAAS was found to have adequate internal consistency in the current study (alpha = .75).

***Intentions.*** Intentions to engage in yoga-related behaviors were assessed with four items adapted from Bryan and Rocheleau (2002). Participants indicated how likely they expected to engage in the following behaviors within the next three months: Talk to their friends about yoga, acquire yoga-related equipment, go to a facility to do yoga, or practice yoga three or more times per week. Response options ranged from 1 (*not at all likely*) to 7 (*very likely*), with higher mean scale scores indicating higher intentions. Bryan and Rocheleau (2002) reported high coefficient alphas for this scale, ranging from .80 for aerobic exercise to .87 for resistance training. Internal consistency for the adapted scale within the current study was slightly lower, but still acceptable, with a Cronbach's alpha of .75.

***Mirror usage.*** Participants in the mirrored condition self-reported how often they gazed in the mirrors at their own reflections and the reflections of others by writing an “X” on two separate 10 cm visual analogue scales (VAS) anchored by 0% (*never*) and 100% (*all of the time*). The instructions and the VAS format were adapted with permission from the Mirror Gazing: Cognition and Affect Rating Scale (K. Windheim, personal communication, November 13, 2013), which was developed to assess mirror checking behaviors among individuals with body dysmorphic disorder.

***Mirror preferences.*** Participants in both conditions were asked to indicate their typically preferred locations for mirrors in group exercise and yoga classes by checking a box next to the following response options: Front of the room, side of the room, back of the room, anywhere/don’t mind, and nowhere/prefer no mirrors (adapted from Prichard & Tiggemann, 2010). Prichard and Tiggemann (2010) developed this measure to assess women’s preferences for mirrors in aerobics classes.

***BMI.*** Participants’ self-reported height and weight were used to calculate BMI ( $\text{kg/m}^2$ ) via the Centers for Disease Control (CDC) BMI Calculator ([http://www.cdc.gov/healthyweight/assessing/bmi/adult\\_bmi/english\\_bmi\\_calculator/bmi\\_calculator.html](http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/english_bmi_calculator/bmi_calculator.html)).

***Exercise participation.*** Participants completed a modified version of the Leisure Time Exercise Questionnaire (LTEQ; Godin & Shephard, 1985; McGuire, Neumark-Sztainer, & Story, 2002) to assess participation in strenuous (e.g., running, soccer), moderate (e.g., baseball/softball, fast walking), and light intensity (e.g., stretching, bowling) physical activity (PA). In its original form, the LTEQ prompts respondents to write down the number of times (frequency) “on the average” during a “typical week”



they engage in the three categories of PA for more than 15 minutes at a time (Godin & Shephard, 1985). Although this version of the LTEQ has been found to be both reliable and valid (e.g., Godin, 2011; Jacobs, Ainsworth, Hartman & Leon, 1993; Miller, Freedson, & Kline, 1994; Sallis, Buono, Roby, Micale, & Nelson, 1993), it has since been modified for children and adolescents to assist with accurate recall and to calculate total minutes of moderate to vigorous physical activity (MVPA) per week (McGuire et al., 2002; Kipp, 2012; Smith, 1999). McGuire et al. (2002) found adequate test-retest reliability for the modified LTEQ ( $r = .63$  for strenuous;  $r = .52$  for moderate). This modified version was used for the current study to assess participants' minutes of MVPA during a typical week within the past month (McGuire et al., 2002; Smith, 1999).

Consistent with Smith's (1999) recommendations for aiding PA recall, participants used a grid-matrix (Monday-Sunday) to indicate frequency and duration of exercise for each day. A similar grid-matrix strategy was previously used to aid recall and assess PA levels among adult women (Prichard & Tiggemann, 2012b; Prichard & Tiggemann, 2008). After completing the grid, participants summed their weekly totals for each PA intensity category and checked one of the corresponding boxes for each category: None; less than  $\frac{1}{2}$  hour per week;  $\frac{1}{2}$  to 2 hours per week; two  $\frac{1}{2}$  to 4 hours per week; 4  $\frac{1}{2}$  to 6 hours per week; or more than 6 hours per week (McGuire et al., 2002). The responses were re-coded to 0, 0.3, 1.3, 3.3, 5.3, and 8 hours per week, respectively. Total minutes of MVPA were computed by summing the responses for moderate and strenuous activity and then multiplying by 60.

***Yoga experience.*** Participants reported whether or not they currently practiced yoga (i.e., within the past 12 months). Individuals who responded "yes" were then

prompted to report how many months or years they had been practicing yoga and to indicate average number of hours per week.

## **Procedures**

**Recruitment and eligibility screening.** Participants were recruited through in-class presentations, flyers on campus, a college-wide listserv email, friend referrals, and social media during September and October 2014 (as shown in *Figure 1*). Recruitment presentations and materials introduced the study as an investigation of women's thoughts and feelings during yoga, and specified that participation would entail attending one 60-minute group yoga class and completing a series of questionnaires before and after the class for a total time commitment of two hours (see Appendix B).

Interested individuals were emailed a link to a Qualtrics online screening questionnaire to determine eligibility (see Appendix C). The screening questionnaire assessed age (must be between the ages of 18 and 25 to be eligible), relevant demographic information (e.g., academic major, race/ethnicity), and level of yoga expertise (must identify as a beginner level yoga student to be eligible). Questions from the Physical Activity Readiness Questionnaire (Thomas, Reading, & Shephard, 1992) assessed potential health contraindications (e.g., chest pain, bone or joint problems) to exercise.

**Randomization.** The researcher used a "coin flipper" computer program (<http://www.random.org/coins/>) to generate a randomization scheme. This scheme assigned eligible participants to one of two 60-minute yoga class conditions: Mirrored (heads) or non-mirrored (tails). The primary investigator emailed each eligible participant a list of session dates and times that were contingent upon group assignment. Individuals

were asked to indicate their top three preferred study sessions. In the event that the provided time slots did not work for a potential participant, they were placed on a waitlist. In order to ensure that all participants would be able to see the instructor and mirrors (in the mirrored classroom), the target class size for each session was 10. Because researchers anticipated a 70% attendance rate, a maximum of 12 participants were scheduled for each session. Once 12 participants were signed up for a session, it was considered full and no longer offered on lists provided to incoming participants. In the event that participants cancelled or rescheduled their session, the researcher contacted wait-listed participants for the available slots.

**Class setting.** Two group fitness classrooms (one mirrored and one non-mirrored) were reserved for a total of 12 experimental sessions during October and November 2014 at the Student Recreation and Wellness Center (SRC). The rooms were adjacent to one another, and were identical except for the presence of a mirrored wall in one room. Yoga mats were provided by the SRC. Each room was rented for six sessions. Class times were dependent on room availability and the yoga instructor's schedule. Therefore, classes took place in the morning (10 a.m.) or afternoon (12:00 p.m. and 3:00 p.m.).

**Pre-test survey administration.** One week and one day prior to each experimental session, the researcher emailed participants reminding them to report to the Physical Activity and Sport Science (PASS) laboratory wearing comfortable clothing for "bending and stretching" during yoga. Participants were encouraged to bring their own water bottles and towels. Upon arrival at the PASS laboratory, participants read and signed a consent form, and were verbally reminded that any information provided during

the course of the study would remain anonymous and confidential (see Appendix D). At this time, the researcher explained to participants that there would be a video camera set up in the yoga classroom to record the instructor to ensure teaching quality and consistency, and reassured them that their images would not appear in the camera frame. The researcher then passed out the pre-test survey packets and asked participants to refrain from speaking to one another during completion of the surveys (see Appendix E for pre-test surveys). The pre-test survey packet was comprised of trait-based (REI, OBCS-S) and state-based measures of body image (BISS), social physique anxiety (S-SPAS), self-objectification (S-SOQ), Task Self-Efficacy (SE) for Yoga, and affect (EFI). The order of the surveys was randomized.

Once participants completed the pre-test measures ( $M = 11$  minutes), the researcher escorted the group to the reserved group fitness classroom in the SRC. Prior to the group's arrival to the classroom, the study's yoga instructor placed the participants' yoga mats in one to two rows, depending on the number of participants, facing the front wall or mirror. She placed her own mat in between the students' mats and the front wall to ensure that students would be able to see the mirrors (if in the mirror condition) and her demonstrations of the poses. The instructor set up the video camera on a tripod at the front of the classroom and angled it so that only the instructor's mat appeared in the frame. The instructor greeted participants upon their arrival to the classroom, and asked them to sit on one of the mats to begin class. To avoid altering the behaviors and experiences of the participants, the researcher remained in close vicinity to the classroom, but did not stay in the room to observe class.

**Yoga class procedures.** The yoga instructor had a Registered Yoga Teacher 200 hour certification (RYT 200) from the Yoga Alliance. A female, rather than a male, instructor was purposefully recruited to teach the classes because previous studies have demonstrated women's social physique anxiety and self-objectification are heightened in the presence of males (Calogero, 2004; Kruisselbrink, Dodge, Swanburg, & Macleod, 2004; Martin Ginis et al., 2011). Furthermore, the researcher was interested in whether mirrors would encourage women to engage in appearance comparisons with other female yoga participants, including the instructor. The same instructor led all of the sessions for both conditions, and was not informed of the specific hypotheses of the study.

The primary investigator, who has a YogaFit Level I teaching certification, collaborated with the instructor to create a standardized sequence of poses for a beginner level vinyasa style yoga class (see Appendix F). The pace, intensity, class structure, and music were the same for both conditions. The instructor followed a semi-structured script to provide instructional cues for the standardized sequence of poses (see Appendix G). After memorizing the sequence and familiarizing herself with the script, the instructor conducted a practice session for the research team prior to randomization of the first participant. Feedback from the research team, which was comprised of three yoga beginners, led to slight modifications of the class structure (e.g., the inclusion of resting postures after vigorous sequences).

The yoga sessions were structured in accordance with the YogaFit Three Mountain class format, which is consistent with group exercise standards and guidelines (Shaw et al., 2007). In a YogaFit vinyasa style class, physical poses are linked together in specific sequences to promote strength, flexibility, endurance, and balance. Special

emphasis was placed on coordinating movements with breath, and the instructor offered modifications to poses to ensure all students could safely and comfortably participate.

The YogaFit vinyasa style of yoga was chosen for the current study because it is designed specifically for fitness settings (Shaw et al., 2007), and is commonly offered at university recreation centers. This style is more fitness-oriented than spiritual/classical styles of yoga. Many poses are referred to in English rather than Sanskrit, making the classes more accessible to beginner level students. Therefore, this style of yoga was deemed appropriate for this study's setting (SRC) and target population (young women with limited yoga experience).

The yoga instructor led participants through the following Three Mountain class format (Shaw et al., 2007): A warm-up phase (Mountain I), sun salutations (Valley I), strength-building poses (Mountain II), single-legged balancing poses (Valley II), deep stretching (Mountain III), and Savasana (Final Relaxation). The average duration of the yoga sessions was 58 minutes.

**Post-yoga survey administration.** Following the yoga class, the researcher escorted the participants back to the PASS laboratory to complete the post-test measures. According to a meta-analysis of affective responses to acute exercise (Reed & Ones, 2006), exercise-induced changes in affect typically occur immediately after cessation of exercise and remain significantly elevated for up to 20 to 30 minutes post-exercise. This finding, in combination with the methodology of similar previous studies (e.g., Martin Ginis et al., 2003, 2007; Raedeke et al., 2007), supports the appropriateness of administering the post-test measures within 10 minutes of the yoga class.

At the beginning of the post-test assessment, the researcher provided verbal instructions for completing the LTEQ grid-matrix and its corresponding items. Participants then completed a survey packet containing state-based measures of body image (BISS), social physique anxiety (S-SPAS), self-objectification (S-SOQ), self-efficacy, and affect (EFI). Additionally, participants reported the degree to which they engaged in appearance comparisons (SACS) and mindfulness (state MAAS) during the yoga class. Participants in both conditions were asked to report their intentions to engage in yoga-related behaviors in the future, typically preferred locations for mirrors in group exercise classes, and height and weight. Participants in the mirrored condition completed additional questions regarding how often they gazed at their own reflection and the reflections of others in the mirrors during the yoga session. Surveys administered only at post-test can be found in Appendix H. Upon completion of post-test surveys ( $M = 12$  minutes), participants were thanked for their time and compensated with either \$10 ( $n = 88$ ) or extra credit ( $n = 9$ ) for their participation.

**Quality control.** Two research assistants who were uninvolved with data collection and who were unaware of the study hypotheses watched video footage of the yoga instructor from six randomly selected sessions. The assistants, who were in a yoga instructor certification program, used a checklist (see Appendix F) to assess whether the instructor adhered to the standardized sequence of poses. They confirmed that the instructor taught the same poses in all of the six reviewed videos, and there were only four instances in which a minor discrepancy in the standardized sequence of poses occurred (e.g., two poses were performed in reverse order). They also timed the duration

of each section of class (e.g., Mountain I), and confirmed that the duration of each section was roughly equivalent across sessions.

### **Data Analysis**

A power analysis with an alpha value of .05 and expectation of a small to moderate effect size ( $d = 0.40$ ) yielded a suggested sample size of  $N = 84$ . However, given the lack of research on the effect of mirrors and/or yoga on state body image concerns, a more conservative sample size ( $N = 90$ ) was chosen as the target sample size.

After the completion of data collection in November 2014, data were entered into SPSS 22.0 and screened for missing values. A total of 10 items were missing at random, comprising less than 5% of the total dataset. These values were replaced using an expectation-maximization (EM) algorithm. One participant did not complete the OBCS-S and REI, and another participant did not complete the post-yoga task SE. Data from these two participants were omitted from analyses that included those specific measures. An examination of histograms, measures of central tendency, and measures of skewness and kurtosis revealed that, overall, data met the assumption of univariate normality. The majority of skewness and kurtosis values were below 2.0, with the exception of post-test state self-objectification (kurtosis = 2.18). Due to the presence of two outliers, state mindfulness scores bordered on non-normality (skewness = -1.04; kurtosis = 1.93). These outliers were excluded in the second series of exploratory analyses because they created a significant relationship between the Mindfulness X Condition interaction and intentions.

Descriptive analyses of the demographic questionnaires were conducted (age, race/ethnicity, academic major, yoga experience, weekly minutes of MVPA, and BMI). A series of independent-samples t-tests were conducted to detect potential between-group



differences on demographic and pre-test measures (OBCS-S, REI, BISS, S-SPAS, S-SOQ, Task SE for Yoga, and EFI).

**Primary aim analyses.** A 2 (Time: Pre and Post) X 2 (Condition: Mirrored and Non-Mirrored) repeated measures multivariate analysis of variance (MANOVA) was conducted to test the primary hypothesis regarding the effect of mirrors on state body image (BISS), social physique anxiety (S-SPAS), self-objectification (S-SOQ), task SE for yoga, and affect (EFI). In the event of significant main and interaction effects in the MANOVA, follow-up repeated measures analyses of variance (RM ANOVAs) were conducted to determine which dependent variables contributed to the significant effects. A Bonferroni-adjusted critical *P*-value of .00625 was calculated by dividing the alpha of .05 by the number of dependent variables (i.e., eight) to reduce the risk of a type-I error. Cohen's *d* effect sizes were calculated to measure the magnitude of between-group differences ( $M_{\text{Non-Mirrored}} - M_{\text{Mirrored}} / \text{Pooled } SD_{\text{post-test}}$ ) and within-group differences ( $M_{\text{post-test}} - M_{\text{pre-test}} / \text{Pooled } SD$ ). Effect sizes were interpreted relative to Cohen's (1992) guidelines: Effect sizes of .20 are small, .50 are medium, and .80 are large.

**Secondary aim analyses.** To address the secondary hypothesis, a one-way multivariate analyses of variance (MANOVA) investigated whether appearance comparisons (SACS) and mindfulness (state MAAS) differed between the mirrored group and non-mirrored group. Significant findings from the MANOVA were followed up with univariate ANOVAs. The Bonferroni correction was used to adjust the critical *P*-value value to .025 (i.e., alpha of .05 was divided by two).

**Tertiary aim analyses.** For the tertiary hypothesis, three separate hierarchical linear regression analyses tested whether BMI, weekly minutes of MVPA, trait self-

objectification, appearance reasons for exercise, and health/fitness-related reasons for exercise moderated the relationship between mirror condition and state body image responses to yoga (i.e., state body image, social physique anxiety, and self-objectification). Interaction terms were created by multiplying each continuous predictor variable (e.g., BMI) by the dichotomous Condition variable (i.e., mirrored vs. non-mirrored). In order to be considered a moderator, a variable's interaction term was required to be significantly related to the dependent variable (e.g., post-test state body image) after controlling for other main and interaction effects (Baron & Kenny, 1986).

**Exploratory aims analyses.** First, bivariate correlation analyses were conducted to examine relationships between post-test body image states (BISS, S-SPAS, S-SOQ) and other psychological responses to yoga (i.e., self-efficacy, affect, appearance comparisons, mindfulness). For the second set of exploratory analyses, a one-way ANOVA examined whether intentions to engage in future yoga-related behaviors differed between conditions. Additionally, hierarchical multiple regression analyses examined psychosocial correlates of intentions and tested whether these relationships differed between conditions. Third, bivariate correlations were conducted to determine whether self-reported frequency of mirror gazing was associated with psychological responses to yoga (mirrored-condition only). Finally, a one-way between-group MANOVA examined whether participants who typically preferred no mirrors in group exercise classes differed from participants who typically preferred or had no mirror preferences (i.e., BMI, weekly minutes of MVPA, trait self-objectification, and exercise motives).

## Chapter 4: Results

### Recruitment

Recruitment occurred in September and October of 2014 (see Figure 1). Female university students ( $n = 136$ ) were randomized to attend a yoga class in either the mirrored ( $n = 75$ ) or non-mirrored ( $n = 61$ ) condition. Following randomization, 18 participants notified the researcher that they would be unable to attend their session due to illness or scheduling conflicts. An additional 21 participants missed their session with no prior notice. A chi-square analysis found attendance rates did not significantly differ between conditions (65% vs. 79%;  $p = .087$ ). A final sample of 97 participants provided consent and completed the study (Mirrors:  $n = 49$ ; No Mirrors:  $n = 48$ ). The 12 sessions ranged in size from three to 11 participants, with an average class size of 8.08 ( $SD = 2.31$ ). An independent samples t-test revealed no significant difference in average class size between the mirrored and non-mirrored conditions,  $t(10) = 1.42, p = .91$ .

### Demographics

The final sample consisted of predominantly Caucasian (70.1%), young-adult ( $M = 20.71$ ;  $SD = 2.04$ ) females ( $n = 97$ ) who were from a large Midwestern university. Participant characteristics are summarized in Table 3. Independent t-tests and chi-square analyses revealed no significant differences between the two experimental groups on demographic variables, body mass index (BMI), weekly minutes of MVPA, or amount of yoga experience. The racial/ethnic make-up of this sample was representative of the participating university's demographics. Participants reported 48 different academic majors. The three most commonly cited majors were Kinesiology (18.6%), Psychology (7.2%), and Child Psychology (6.2%).

Table 3

*Participant Characteristics*

Characteristic	Total sample ( <i>n</i> = 97)	Non-Mirrored ( <i>n</i> = 48)	Mirrored ( <i>n</i> = 49)
Age (average in years)	20.71 (2.04)	20.75 (1.95)	20.67 (2.14)
Race/Ethnicity (%)			
White/Caucasian	70.1%	75.0%	65.3%
Asian	17.5%	12.5%	22.4%
Black/African-American	6.2%	4.2%	8.2%
Hispanic	4.1%	4.2%	4.1%
Other	1.0%	2.0%	0.0%
Don't know/refuse	1.0%	2.0%	0.0%
Year in School (%)			
1 <sup>st</sup> Year	9.3%	6.3%	12.2%
2 <sup>nd</sup> Year	24.7%	29.2%	20.4%
3 <sup>rd</sup> Year	28.9%	29.2%	28.6%
4 <sup>th</sup> Year	13.4%	10.4%	16.3%
5 <sup>th</sup> Year and Above	4.1%	4.2%	4.1%
Graduate School	18.6%	18.8%	18.4%
Not Applicable	1.0%	2.1%	0.0%
BMI	23.17 (3.41)	23.06 (3.23)	23.27 (3.61)
BMI Status (%)			
Underweight	6.2%	8.3%	4.1%
Normal	69.1%	66.7%	71.4%
Overweight	18.6%	18.8%	18.4%
Obese	6.2%	6.3%	6.1%
Weekly Minutes of MVPA	298.70 (179.63)	308.88 (188.82)	288.73 (171.52)
Days per Week of MVPA	4.55 (1.96)	4.50 (1.89)	4.59 (2.04)

As shown in Table 3, this was a highly active sample, with only 6.2% of participants reporting no minutes of MVPA during a typical week within the previous month. The majority of participants had little to no yoga experience, with over half of the participants reporting that they had not practiced yoga within the past 12 months (see Table 4). Of the 47 participants who currently practiced yoga, the majority had practiced for less than 12 months and for less than one hour per week.

Table 4

*Yoga Experience*

Characteristic	Total sample ( <i>n</i> = 97)	Non-Mirrored ( <i>n</i> = 48)	Mirrored ( <i>n</i> = 49)
<b>Amount of Yoga Experience</b>			
None	51.5%	52.1%	51.0%
Less than 1 Month	11.3%	8.3%	14.3%
1-6 Months	16.5%	14.6%	18.4%
6-12 Months	8.2%	10.4%	6.1%
1-3 Years	7.2%	6.3%	8.2%
More than 3 Years	5.2%	8.3%	2.0%
<b>Weekly Hours of Yoga</b>			
0 Hours	51.5%	52.1%	51.0%
Less than 1 Hour	34.0%	35.4%	32.7%
1-2 Hours	13.4%	5.2%	8.2%
3-5 Hour	1.0%	2.1%	0.0%

**Personal Traits and Potential Confounding Variables**

Participants reported moderately high levels of trait self-objectification on the Objectified Body Consciousness Scale- Surveillance subscale (OBCS-S;  $M = 4.54$ ,  $SD = 1.03$ , potential range = 1-7). According to the Reasons for Exercise Inventory (REI),

participants tended to report higher health and fitness reasons for exercise ( $M = 5.49$ ,  $SD = 0.83$ ) than appearance-related reasons for exercise ( $M = 4.83$ ,  $SD = 1.12$ ); however, the mean scores for both subscales were above the mid-point of the scale (potential range = 1-7).

Independent samples t-tests revealed no significant between-group differences at pre-test on any of the trait measures (OBCS-S, REI subscales) or state-based measures of body image, self-efficacy, or affect. Correlations between participant characteristics (i.e., BMI, MVPA), trait measures, and pre-test state measures are shown in Table 5. Of note, trait self-objectification (OBCS-S) had strong positive relationships with appearance reasons for exercise, state social physique anxiety, and state self-objectification (SO), and had weak to moderate negative relationships with MVPA, health/fitness reasons for exercise, and state body image. BMI had a weak, positive relationship with state social physique anxiety and a moderate negative relationship with state body image; a higher BMI was associated with higher state SPA and lower state body satisfaction at pre-test. Whereas appearance motives for exercise had strong positive relationships with state SPA and state SO, and a strong negative relationship with state body image, health and fitness reasons for exercise had a weak positive relationship with Positive Engagement and a moderate negative relationship with state SO. In other words, appearance motives were associated with greater body image concerns, and health/fitness motives were associated with more positive body image and affect.

Table 5

*Correlation Matrix for Personal Traits and Pre-Test State Measures*

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. BMI	–											
2. MVPA	.10	–										
3. OBCS-S	-.12	-.26*	–									
4. Appear REI	.07	-.09	.57*	–								
5. Health REI	-.01	.22*	-.30*	.11	–							
6. BISS	-.33*	.05	-.27*	-.39*	.08	–						
7. S-SPAS	.28*	-.16	.45*	.52*	-.06	-.57*	–					
8. S-SOQ	.02	-.36*	.62*	.61*	-.33*	-.31*	.41*	–				
9. Task SE	.06	.14	-.02	.07	.09	.07	-.06	-.09	–			
10. EFI: Positive	-.12	.06	-.16	-.04	.26*	.21*	-.18	-.23*	.00	–		
11. EFI: Revitalize	-.11	.01	-.06	.04	.17	.18	-.08	-.07	.13	.72*	–	
12. EFI: Tranquil	.08	.17	.03	.09	.05	.00	-.12	-.13	.16	.36*	.43*	–
13. EFI: Exhaust	.02	.22*	-.08	-.12	.06	.01	-.10	-.08	-.09	-.01	-.16	-.21*

*Notes.* \* $p \leq .05$ . BMI = body mass index. MVPA = minutes of moderate to vigorous physical activity. OBCS-S = Objectified Body Conscious Scale- Surveillance. Appear REI = appearance reasons for exercise. Health REI = health/fitness reasons for exercise. BISS = Body Image States Scale. S-SPAS = State Social Physique Anxiety Scale. S-SOQ = State Self-Objectification Questionnaire. SE = Self-Efficacy for Yoga. EFI = Exercise-Induced Feeling Inventory. Positive = Positive Engagement. Revitalize = Revitalization. Tranquil = Tranquility. Exhaust = Physical Exhaustion.

**Primary Aim: State Body Image, Self-Efficacy, and Affect**

Means and standard deviations for pre- and post-test scores for the primary dependent variables are presented in Tables 6-8. Effect sizes (Cohen's  $d$ ) are provided to illustrate between-group differences in post-test measures and the magnitude of change from pre- to post-test within each condition. One participant in the mirrored condition did not complete a post-test task SE survey, therefore, the sample size for the following multivariate analysis of variance was  $n = 96$ .

A 2 (Time: Pre and Post) X 2 (Condition: Mirrored and Non-Mirrored) repeated measures multivariate analysis of variance (MANOVA) for state body image concerns (BISS, S-SPAS, S-SOQ), task SE for yoga, and affect (EFI) revealed significant main effects of Time, Wilks'  $\lambda = .18$ ,  $F(8,87) = 48.17$ ,  $p < .001$ , and Condition, Wilks'  $\lambda = .82$ ,  $F(8,87) = 2.36$ ,  $p = .024$ . The Time X Condition interaction approached significance, Wilks'  $\lambda = .84$ ,  $F(8,87) = 2.02$ ,  $p = .053$ . Follow-up repeated measures analyses of variance (RM ANOVAs) were conducted to determine which dependent variables contributed to the interaction effect.

**Body image.** A follow-up RM ANOVA for the State Social Physical Anxiety Scale (S-SPAS) revealed a significant Time X Condition interaction,  $F(1,94) = 7.43$ ,  $p = .008$ ,  $\eta^2 = .07$ . Post-hoc t-tests indicated that S-SPAS scores did not differ between conditions at pre-test, however, there was a significant between-group difference in S-SPAS scores at post-test. The mirrored condition had higher state social physique anxiety after yoga than the non-mirrored condition. Post-hoc paired t-tests found that S-SPAS scores significantly decreased from pre- to post-test within both the non-mirrored and



mirrored conditions. In sum, although participants within both conditions reported a significant decline in state SPA, S-SPAS scores were significantly lower after yoga in the non-mirrored condition than in the mirrored condition.

The follow-up RM ANOVA for state self-objectification (S-SOQ) showed only a significant main effect of Condition. S-SOQ scores were significantly lower in the non-mirrored condition than in the mirrored condition.

Finally, the follow-up RM ANOVA for the Body Image States Scale (BISS) found only a main effect of Time. Both the mirrored and non-mirrored conditions showed significant improvement in positive state body image (BISS) from pre- to post-test.

Table 6

*Descriptive Statistics and Effect Sizes for State Body Image over Time by Condition*

Variable	Condition	Pre	Post	Condition Cohen's <i>d</i>	Time Cohen's <i>d</i>
		<i>M (SD)</i>	<i>M (SD)</i>		
BISS				0.14	
	Non-Mirrored	5.38 (1.25)	5.73 (1.25)		0.20
	Mirrored	5.09 (1.12)	5.56 (1.23)		0.40
S-SPAS				-0.68	
	Non-Mirrored	23.88 (7.14)	17.81 (5.02)		-0.98
	Mirrored	25.25 (6.57)	22.29 (7.79)		-0.41
S-SOQ				-0.40	
	Non-Mirrored	-14.48 (17.76)	-15.43 (14.23)		-0.06
	Mirrored	-7.90 (16.31)	-9.96 (12.89)		-0.14

*Notes.* BISS = Body Image States Scale. S-SPAS = State Social Physique Anxiety Scale. SO = State Self-Objectification Questionnaire. Standard deviations are in parentheses.

**Task self-efficacy.** The follow-up repeated measures ANOVA for task self-efficacy (SE) for yoga only showed a main effect of Time. Task SE for yoga significantly increased from pre- to post-test for both conditions.

Table 7

*Descriptive Statistics and Effect Sizes for Self-Efficacy over Time by Condition*

Variable	Condition	Pre	Post	Condition Cohen's <i>d</i>	Time Cohen's <i>d</i>
		<i>M (SD)</i>	<i>M (SD)</i>		
Task SE				0.25	
	Non-Mirrored	76.67 (14.34)	81.71 (12.41)		0.26
	Mirrored	73.00 (13.24)	78.33 (14.10)		0.39

*Note.* SE = Self-Efficacy for Yoga. Standard deviations are in parentheses.

**Affect.** Follow-up repeated measures ANOVAs for each of the four Exercise-Induced Feeling Inventory (EFI) subscales (Positive Engagement, Revitalization, Tranquility, and Physical Exhaustion) revealed no significant interaction effects. A post-hoc t-test revealed a main effect of Condition for only one of the subscales: Positive Engagement. Positive Engagement scores were higher in the mirrored condition than in the non-mirrored condition (see Table 8). There was a significant main effect of Time for all four EFI subscales (see Table 8). Participants within both conditions reported significant increases in positive affect and decreases in negative affect after yoga.

Table 8

*Descriptive Statistics and Effect Sizes for Affect over Time by Condition*

Variable	Condition	Pre	Post	Condition Cohen's <i>d</i>	Time Cohen's <i>d</i>
		<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )		
Positive				-0.41	
	Non-Mirrored	1.65 (0.77)	1.95 (0.81)		0.38
	Mirrored	1.92 (0.79)	2.28 (0.79)		0.46
Revitalize				-0.22	
	Non-Mirrored	0.99 (0.72)	2.23 (0.85)		1.57
	Mirrored	1.29 (0.74)	2.40 (0.71)		1.52
Tranquil				-0.20	
	Non-Mirrored	1.93 (0.93)	2.89 (0.72)		1.33
	Mirrored	2.02 (0.78)	3.03 (0.68)		1.09
Exhaustion				-0.15	
	Non-Mirrored	1.69 (0.92)	1.01 (0.68)		-0.72
	Mirrored	1.78 (0.96)	1.16 (0.75)		-0.61

*Note.* Positive = Positive Engagement. Revitalize = Revitalization. Tranquil = Tranquility. Exhaustion = Physical Exhaustion. Standard deviations are in parentheses.

**Secondary Aim: Appearance Comparison and Mindfulness**

A one-way MANOVA indicated significant between-group differences in appearance-related social comparison (SACS) and state mindfulness (state MAAS) scores, Wilks'  $\lambda = .86$ ,  $F(2,94) = 7.59$ ,  $p = .001$ ,  $\eta^2 = .14$ . A follow-up t-test revealed that participants in the mirrored condition ( $M = 3.55$ ,  $SD = 1.42$ ) engaged in significantly higher levels of social comparison during yoga than participants in the non-mirrored condition ( $M = 2.60$ ,  $SD = 0.97$ ). The effect size was large ( $d = .78$ ). Another follow-up t-test found that post-test state mindfulness scores did not significantly differ between the mirrored ( $M = 21.33$ ,  $SD = 5.18$ ) and non-mirrored ( $M = 21.77$ ,  $SD = 4.97$ ) conditions.

**Tertiary Aim: Moderator Analyses**

For the tertiary hypothesis, separate hierarchical multiple regression analyses tested whether personal-level characteristics of BMI, weekly minutes of MVPA, and psychological traits (i.e., trait self-objectification, appearance reasons, and health/fitness-related reasons for exercise) moderated the relationship between mirror condition and post-test state body image concerns (i.e., state body image, social physique anxiety, and self-objectification).

**Moderators of state body image (BISS).** The interaction model explained a significant amount of variance in BISS,  $F(11,84) = 2.16, p = .024, R^2 = .22$ . Results of the hierarchical regression analyses are shown in Table 9. Within the main effects model, BMI was significantly related to post-test BISS ( $t = -2.75, p = .007$ ). However, within the interaction model, neither BMI nor BMI X Condition were significantly related to BISS. None of the independent variables moderated the relationship between mirror condition and state body satisfaction.

Table 9

*Regression Analyses Testing Moderators of State Body Image*

Independent variables	$R^2$	$B$	$SE B$	$\beta$
<i>Main Effects Model</i>				
	.19			
Condition		0.00	0.21	.00
BMI		-0.09	0.03	-.27*
MVPA		0.00	0.00	-.08
OBCS-S		-0.18	0.14	-.17
Appear REI		-0.20	0.13	-.21
Health REI		0.11	0.14	.09
<i>Interaction Model</i>				
	.22			
Condition		1.91	2.86	.51
BMI		-0.07	0.05	.17
MVPA		0.00	0.00	.35
OBCS-S		0.04	0.21	.85
Appear REI		-0.34	0.18	.06
Health REI		0.20	0.26	.45
BMI X Condition		-0.05	0.07	.50
MVPA X Condition		0.00	0.00	.61
OBCS-S X Condition		-0.45	0.30	.13
Appear REI X Condition		0.33	0.27	.23
Health REI X Condition		-0.11	0.32	.74

*Notes.* \*  $p < .05$ . BMI = body mass index. MVPA = minutes of moderate to vigorous physical activity. OBCS-S = Objectified Body Consciousness Scale- Surveillance. Appear REI = appearance reasons for exercise. Health REI = health/fitness reasons for exercise.

**Moderators of state social physique anxiety (S-SPAS).** Results of the hierarchical regression analyses testing potential moderators of post-test S-SPAS scores are summarized in Table 10. Interaction terms did not explain a significantly greater

amount of variance in S-SPAS scores than the main effects model, however, the overall interaction model was significant,  $F(11,84) = 3.89, p < .001, R^2 = .34$ .

Table 10

*Regression Analyses Testing Moderators of State Social Physique Anxiety*

Independent variables	$R^2$	$B$	$SE B$	$\beta$
<i>Main Effects Model</i>				
	.30			
Condition		3.37	1.24	.25*
BMI		0.49	0.18	.24*
MVPA		0.00	0.00	-.09
OBCS-S		1.70	0.83	.25*
Appear REI		1.08	0.74	.18
Health REI		0.18	0.83	.02
<i>Interaction Model</i>				
	.34			
Condition		-15.66	16.42	-1.14
BMI		0.18	0.29	.09
MVPA		-0.01	0.01	-.15
OBCS-S		1.26	1.18	.19
Appear REI		0.61	1.02	.10
Health REI		0.55	1.52	.07
BMI X Condition		0.52	0.39	.90
MVPA X Condition		0.01	0.01	.13
OBCS-S X Condition		1.05	1.70	.37
Appear REI X Condition		0.79	1.56	.30
Health REI X Condition		-0.54	1.84	-.22

*Note.* . \* $p \leq .05$ . BMI = body mass index. MVPA = minutes of moderate to vigorous physical activity. OBCS-S = Objectified Body Consciousness Scale- Surveillance. Appear REI = appearance reasons for exercise. Health REI = health/fitness reasons for exercise.

Condition was significantly related to post-test S-SPAS scores in the main effects model ( $t = 2.72, p = .008$ ); state SPA was higher after yoga in the mirrored condition than in the non-mirrored condition. However, the main effect of Condition was no longer significant in the interaction model. Likewise, both BMI ( $t = 2.65, p = .009$ ) and trait self-objectification ( $t = 2.03, p = .045$ ) were significantly related to post-test S-SPAS scores in the main effects model, but were no longer related to state SPA in the interaction model.

**Moderators of state self-objectification (S-SOQ).** Two extreme outlier cases were excluded from the hierarchical linear regression analysis because they created a significant relationship between the Appear-REI X Condition interaction term and state self-objectification. Interaction terms did not explain a significantly greater amount of variance in post-test S-SOQ scores than the main effects model (see Table 11), however, the interaction model explained a significant amount of the variance in state self-objectification,  $F(11,82) = 8.29, p < .001, R^2 = .53$ . None of the independent variables of interest moderated the relationship between mirror condition and post-test S-SOQ scores. Within both the main effects and interaction models, appearance-related reasons for exercise ( $t = 5.11, p < .001$ ) and health/fitness reasons for exercise ( $t = -2.02, p = .047$ ) were significantly related to post-test S-SOQ scores. Within both conditions, greater appearance-related reasons for exercise were associated with higher state self-objectification after yoga, whereas health and fitness reasons for exercise were inversely associated with S-SOQ scores.

Table 11

*Regression Analyses Testing Moderators of State Self-Objectification*

Independent variables	$R^2$	$B$	$SE B$	$\beta$
<i>Main Effects Model</i>				
	.50			
Condition		2.53	1.84	.11
BMI		-0.14	0.28	-.04
MVPA		-0.01	0.01	-.09
OBCS-S		1.72	1.24	.15
Appear REI		6.13	1.12	.56*
Health REI		-2.82	1.27	-.19*
<i>Interaction Model</i>				
	.53			
Condition		-2.60	24.90	-.11
BMI		0.11	0.44	.03
MVPA		-0.01	0.01	-.09
OBCS-S		-0.16	1.76	-.01
Appear REI		8.28	1.62	.75*
Health REI		-4.89	2.43	-.33*
BMI X Condition		-0.41	0.58	-.41
MVPA X Condition		0.00	0.01	.02
OBCS-S X Condition		3.70	2.53	.75
Appear REI X Condition		-4.03	2.39	-.88
Health REI X Condition		3.10	2.88	.73

*Note.* \* $p \leq .05$ . BMI = body mass index. MVPA = minutes of moderate to vigorous physical activity. OBCS-S = Objectified Body Consciousness Scale- Surveillance. Appear REI = appearance reasons for exercise. Health REI = health/fitness reasons for exercise.



**Exploratory Aim 1: Relationships between Post-Test State Measures**

Bivariate correlations investigated relationships between post-test state body image concerns and other psychosocial responses to yoga (i.e., affect, self-efficacy, social comparison, mindfulness, and intentions). Correlation coefficients are shown in Table 12. As expected, the state body image measures (BISS, S-SPAS, S-SOQ) were correlated with one another. Appearance comparison was inversely correlated with state body satisfaction (BISS), and positively correlated with self-objectification and social physique anxiety (SPA). Additionally, SPA was inversely correlated with task SE and mindfulness. The three state body image measures were not significantly correlated with affective states.

Table 12

*Correlation Matrix for Post-Test State Measures*

Variable	1	2	3	4	5	6	7	8	9	10
1. BISS	–									
2. S-SPAS	-.48*	–								
3. S-SOQ	-.29*	.23*	–							
4. Task SE	.15	-.21*	-.02	–						
5. EFI: Positive	.19	-.04	-.15	.27*	–					
6. EFI: Revitalize	.09	.04	-.07	.33*	.79*	–				
7. EFI: Tranquil	.07	.07	-.04	.21*	.57*	.62*	–			
8. EFI: Exhaust	.02	.19	-.02	-.06	.07	-.02	.13	–		
9. Comparison	-.28*	.67*	.33*	-.08	-.01	.10	.03	.12	–	
10. Mindfulness	.15	-.33*	-.04	.30*	.21*	.29*	.21*	-.29*	-.28*	–
11. Intentions	.08	.20*	-.09	.25*	.28*	.28*	.23*	-.05	.16	.16

*Notes.* \* $p \leq .05$ . BISS = Body Image States Scale. S-SPAS = State Social Physique Anxiety Scale. S-SOQ = State Self-Objectification Questionnaire. SE = Self-Efficacy for Yoga. EFI = Exercise-Induced Feeling Inventory. Positive = Positive Engagement. Revitalize = Revitalization. Tranquil = Tranquility. Exhaust = Physical Exhaustion. Comparison = State Appearance Comparison Scale. Mindfulness = State Mindful Attention Awareness Scale.

## Exploratory Aim 2: Intentions

Overall, participants reported moderately high intentions to engage in future yoga-related behaviors ( $M = 4.49$ ,  $SD = 1.27$ ). A one-way ANOVA indicated no significant between group differences in intentions to attend future yoga classes, buy yoga equipment, and talk to friends about yoga. As shown in Table 12, bivariate correlation analyses indicated that intentions were positively correlated with post-test positive affect, self-efficacy, and S-SPAS scores.

Hierarchical regression analyses indicated that both the main effects model,  $F(11,82) = 3.68$ ,  $p < .001$ ,  $R^2 = .33$ , and the interaction model,  $F(11,84) = 2.61$ ,  $p = .001$ ,  $R^2 = .41$ , explained a significant amount of the variance in intentions. The interaction model did not explain significantly more variance than the main effects model, and none of the interaction terms were significantly related to intentions (see Table 13). Within the interaction model, both appearance comparison ( $t = 2.44$ ,  $p = .017$ ) and changes in Positive Engagement ( $t = 3.11$ ,  $p = .003$ ) were positively related to intentions. Within both conditions, participants who engaged in more appearance comparisons and who displayed larger increases in Positive Engagement reported higher intentions to participate in future yoga-related behaviors.

Table 13

*Regression Analyses: Intentions to Engage in Yoga*

Independent variables	$R^2$	$B$	$SE B$	$\beta$
<i>Main Effects Model</i>				
	.33			
Condition		-0.29	0.26	-.12
BISS		0.18	0.18	.12
S-SPAS		-0.02	0.02	-.09
S-SOQ		0.00	0.01	-.00
Task SE		0.01	0.01	.10
EFI: Positive		0.79	0.22	.47*
EFI: Revitalize		-0.23	0.19	-.15
EFI: Tranquil		0.19	0.14	.14
EFI: Exhaust		0.26	0.13	.20*
Comparison		0.25	0.10	.27*
Mindfulness		0.04	0.03	.16
<i>Interaction Model</i>				
	.41			
Condition		-0.93	1.73	-.39
BISS		-0.03	0.33	-.02
S-SPAS		-0.00	0.04	-.01
S-SOQ		-0.01	0.02	-.08
Task SE		0.03	0.02	.29
EFI: Positive		0.93	0.30	.54*
EFI: Revitalize		-0.19	0.30	-.13
EFI: Tranquil		0.18	0.22	.13
EFI: Exhaust		0.41	0.23	.31
Comparison		0.47	0.19	.51*
Mindfulness		-0.01	0.05	-.02
BISS X Condition		0.24	0.42	.13
S-SPAS X Condition		-0.03	0.05	-.11

Table 13 Continued

Independent variables	$R^2$	$B$	$SE B$	$\beta$
S-SOQ X Condition		0.02	0.03	.12
Task SE X Condition		-0.03	0.02	-.21
EFI: Positive X Condition		-0.22	0.46	-.10
EFI: Revitalize X Condition		0.04	0.44	.03
EFI: Tranquil X Condition		0.01	0.30	.04
EFI: Exhaust X Condition		-0.18	0.29	-.12
Comparison X Condition		-0.32	0.24	-.55
Mindfulness X Condition		0.06	0.06	.58

*Notes.* \* $p \leq .05$ . Two extreme outlier cases were excluded from the analysis because they created a significant relationship between the Mindfulness X Condition interaction and intentions.

### **Exploratory Aim 3: Mirror Gazing**

On average, participants in the mirrored condition ( $n = 49$ ) reported using the mirrors to gaze at their own reflections 52.7% of the time ( $SD = 25.02$ , range: 5% - 97.5%) during the yoga class. Participants reportedly gazed at others' reflections in the mirror 23.2% of the time ( $SD = 19.64$ , range = 0% - 72.5%). Frequency of gazing at one's own reflection was positively related to appearance comparison ( $r = .44$ ,  $p = .002$ ).

### **Exploratory Aim 4: Mirror Preferences**

Eight participants (8.2%) typically preferred non-mirrored group exercise settings. A MANOVA suggested significant between-group differences (Prefer No Mirrors vs. Prefer/Have No Mirror Preference) in personal-level characteristics (i.e., BMI, MVPA, OBCS-S, appearance reasons, and health/fitness reasons for exercise),  $F(5,90) = 2.36$ ,  $p = .047$ ,  $\eta^2 = .12$ . The follow-up t-test revealed that participants who preferred no mirrors

reported lower health/fitness reasons than participants who preferred or had no mirror preference ( $d = 0.82$ ). Descriptive statistics are shown in Table 14.

Table 14

*Personal Characteristics by Typical Mirror Preference Group*

Variable	No Mirrors ( $n = 8$ )		Mirrors ( $n = 88$ )	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
BMI	25.18	4.15	23.02	3.31
MVPA	213.00	221.57	309.00	174.11
OBCS-S	4.97	1.03	4.50	1.03
Appear REI	5.44	0.85	4.78	1.13
Health REI*	4.93	0.64	5.54	0.84

*Notes.* \* $p \leq .05$ . BMI = body mass index. MVPA = minutes of moderate to vigorous physical activity. OBCS-S = Objectified Body Consciousness Scale- Surveillance. Appear REI = appearance reasons for exercise. Health REI = health/fitness reasons for exercise.

### **Post-Hoc Exploratory Aim: Mediation Analysis**

A synthesis of the main results suggested that appearance-related social comparison should be examined as a potential mechanism underlying the relationship between mirrors and state social physique anxiety (SPA). As previously mentioned, the mirrored condition reported higher post-test SPA and appearance-related social comparisons than the non-mirrored condition. Furthermore, appearance comparison had a strong positive relationship with post-test State Social Physique Anxiety Scale (S-SPAS) scores. Therefore, regression analyses examined whether appearance comparison mediated the relationship between mirrors and post-test S-SPAS scores, controlling for pre-test S-SPAS scores (Baron & Kenny, 1986).

Results from the mediation analysis are summarized in Figure 2. All four criteria for mediation outlined by Baron and Kenny (1986) were met. Condition (mirrors) was related to appearance comparison (criteria 1;  $B = 0.95$ ,  $SE = 0.25$ ,  $t = 3.86$ ,  $p < .001$ ), condition was related to post-test state SPA (criteria 2;  $B = 3.57$ ,  $SE = 1.01$ ,  $t = 3.53$ ,  $p = .001$ ), and appearance comparison was associated with post-test S-SPAS (criteria 3;  $B = 2.62$ ,  $SE = 0.35$ ,  $t = 7.43$ ,  $p < .001$ ). Pre-test S-SPAS was controlled for in criteria 2 and 3. In regard to the fourth criteria, when condition, appearance comparison, and pre-test S-SPAS were regressed onto post-test state SPA, the relationship between condition and post-test SPA became non-significant ( $B = 1.46$ ,  $SE = 0.91$ ,  $t = 1.60$ ,  $p = .112$ ). Furthermore, the overall regression for the mediation model was significant,  $F(3, 93) = 56.62$ ,  $p < .001$ ,  $R^2 = .65$ . Therefore, appearance comparison mediated the relationship between mirrors and post-test S-SPAS scores. Mirror exposure led to heightened levels of state SPA within the mirrored condition relative to the non-mirrored condition by facilitating greater appearance comparisons with other participants and the instructor.

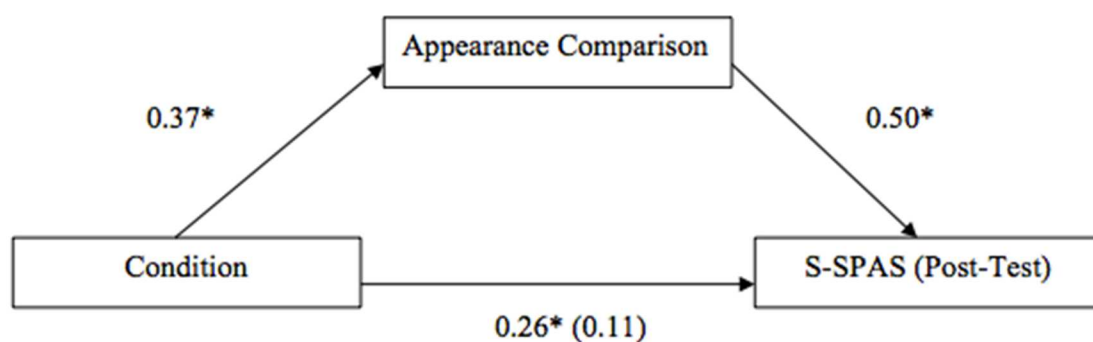


Figure 2. Mediator analysis results. Standardized regression coefficients are reported outside of the parentheses. The standardized regression coefficient between condition and post-test state SPA, controlling for appearance comparison and pre-test SPA, is in parentheses. \*  $p < .05$ .

## Chapter 5: Discussion

The primary purpose of this experiment was to examine the effect of mirrors on young women's state body image, self-efficacy, and affective responses to a 60-minute beginner level group yoga class. Second, between-group differences in appearance-related social comparison and mindfulness were investigated to gain insight into potential cognitive mechanisms underlying psychological responses to yoga in mirrored environments. Third, personal-level characteristics (e.g., BMI) were examined as moderators of the relationship between mirror condition and state body image, social physique anxiety (SPA), and self-objectification. Results partially supported the main hypotheses, which were informed by objectification theory (Fredrickson & Roberts, 1997), the theory of objective self-awareness (Duval & Wicklund, 1972), and social comparison theory (Festinger, 1954). Most notably, findings indicated that mirrors affected the variables most relevant to the social-environmental context of a group yoga class: state social physique anxiety and appearance-related social comparison. Participants reported higher state social physique anxiety and were more likely to compare their physical appearance with other females in a yoga class if there were mirrors present than in if there were no mirrors.

### Primary Aim

**State body image.** Contrary to the primary hypothesis, mirrors did not affect state body image (i.e., body satisfaction). This is the first known study to examine the effect of mirrors on state body image during exercise. Therefore, direct comparisons with previous exercise research cannot be made. However, previous researchers found that women with low trait body satisfaction reported decreases in perceived attractiveness after gazing in a



mirror while seated (Mulken & Jansen, 2009). Similarly, highly proficient ballet students who trained with mirrors over the course of a semester reported smaller improvements in trait body satisfaction than students who trained without mirrors (Radell et al., 2011). Radell et al. (2011) suggested that the dancers had a critical eye for proper technique, and were thus self-critical when evaluating themselves in the mirrors.

The null findings might be partially attributed to the characteristics of the current sample, which included beginner level yoga participants with relatively high levels of state body satisfaction at pre-test ( $M = 5.23$  out of 9 on the Body Image States Scale; Cash et al., 2002). According to Cash's (2011) cognitive-behavioral model of body image, proximal events and processes that call attention to one's body, such as mirror exposure, should impact state body image concerns. However, a single session of mirror exposure may not have been a strong enough stimulus to affect state body satisfaction, particularly among participants who felt positively about their bodies at pre-test. It is also possible that the state body image benefits of yoga counteracted the potentially negative effects of mirrors.

Participants displayed significant improvements in state body image from pre- to post-test, regardless of group assignment. Effect sizes were small to moderate ( $d = 0.20$  for non-mirrored and  $d = .40$  for mirrored). This finding complements previous research on the state body image benefits of a single bout of aerobic exercise (Fallon & Hausenblas, 2005; Fuller-Tyszkiewicz et al., 2013; Lepage & Crowther, 2010; McInman & Berger, 1993; Vocks et al., 2009). Furthermore, this is the first known experimental study to report that a single session of yoga enhances state body image. Previous yoga and body image research had either focused on changes in trait body image over time

(e.g., Elavsky & McAuley, 2007a; Impett et al., 2006), or used non-experimental survey designs to compare trait body image of yoga participants to non-participants (e.g., Daubenmier, 2005; Prichard & Tiggemann, 2008; Zajac & Schier, 2011). Therefore, the present findings add to the literature by demonstrating that beginner level participants can experience significant improvements in state body image in response to a yoga class.

**State social physique anxiety.** In support of the primary hypothesis, participants randomized to the non-mirrored condition reported significantly lower state social physique anxiety (SPA) after yoga than participants in the mirrored condition. The effect size was moderately strong ( $d = -0.68$ ), suggesting a meaningful between-group difference. These findings suggest that participants were more worried about others negatively evaluating their physique during yoga in the mirrored room than in the non-mirrored room.

Although previous researchers did not examine the effect of mirrored exercise on state SPA per se, they have investigated the effect of mirrors on changes in state anxiety, state social anxiety, and physical appearance state anxiety from pre- to post-test. For example, in Focht and Hausenblas' (2003) study with women who had high trait SPA, post-test measures at 60, 120, and 180 minutes after a bout of stationary cycling indicated that reductions in state anxiety were shorter in duration after mirrored exercise than non-mirrored exercise. Whereas reductions in anxiety persisted up to 120 minutes after exercise in the non-mirrored setting, anxiety returned to baseline levels within 60 minutes after mirrored exercise. It is important to note that Focht and Hausenblas' (2003) non-mirrored condition was in a laboratory with a female research assistant while the mirrored condition was in a public fitness facility that included both female and male

exercisers. Because the male gaze leads to increases in self-objectification and state SPA (Calogero, 2004; Martin Ginis et al., 2011), it is unclear whether the mirrors or the presence of males were responsible for Focht and Hausenblas' (2003) findings. In contrast, the current study design intentionally used female-only exercise environments for both conditions. This strengthens the ability to conclude that the mirrors were responsible for the diminished improvements in state SPA at post-test.

Contrary to the present findings regarding the adverse effect of mirrors on state SPA, Martin Ginis et al. (2003) found that sedentary women who were randomly assigned to complete a bout of stationary cycling in a mirrored or non-mirrored laboratory setting reported significant increases in state physical appearance state anxiety from pre- to post-test in both conditions. For sedentary women, exercise may have elicited physiological discomfort and increased their anxiety about appearing unfit. In contrast, participants in the present study tended to be highly active, and would therefore be more likely to have positive responses to exercise than sedentary women. In support of this suggestion, Lamarche et al. (2009) found that active women who were randomized to a group step aerobics class with mirrors or no mirrors reported significant decreases in state social anxiety from pre- to post-test. Unlike the present study, mirrors had no observable effect on state social anxiety. However, Lamarche et al. (2009) measured social anxiety regarding evaluations of physical coordination, condition, and physique; the present study was focused more specifically on SPA.

Although there were between-group differences in state SPA, it should be noted that participants reported significant decreases in state SPA from pre- to post-test, regardless of group assignment. In comparison to how they felt at pre-test, participants in

both conditions were less worried about others negatively evaluating their bodies after the yoga session. However, whereas the non-mirrored condition showed a large reduction in state SPA ( $d = -0.98$ ), the mirrored condition only demonstrated a small to moderate reduction ( $d = -0.41$ ). While Lamarche and Gammage (2010) observed decreases in state SPA from pre- to post-test among females in a group resistance training class, researchers had not previously investigated yoga's effects on SPA. This finding complements previous research that found a single session of yoga to reduce state anxiety (Berger & Owen, 1988), and provides empirical support for the suggestion that yoga cultivates internal body awareness (Daubenmier, 2005; Neumark-Sztainer, 2013).

**State self-objectification.** Although the non-mirrored condition displayed lower levels of state self-objectification (SO) than the mirrored condition, the interaction was non-significant. State SO scores were relatively low for both conditions at both pre- and post-test. This null finding was surprising, as previous psychology studies had found mirrors elicited objective self-awareness, SO, and negative affect among women (Fredrickson et al., 1998; Mor & Winquist, 2002; Windheim et al., 2011). The inability to detect the effect of mirrors on state SO may be due in part to the nature of the sample (i.e., highly active women with relatively positive state body image and low state SO at pre-test), and the use of a visual analogue scale that had only been used in one previous study (Prichard & Tiggemann, 2012b). Although Prichard and Tiggemann (2012b) found that this scale detected changes in state SO from pre- to post-test in response to exercise and exposure to sexually objectifying stimuli (i.e., music videos featuring thin and attractive women), it may not be able to detect subtler changes in state SO. An alternative strategy would be to administer the original version of the Self-Objectification

Questionnaire at post-test (Fredrickson et al., 1998). Because this measure asks participants to rank how important each of the competency and appearance items are to one's physical self-concept on a scale from zero to nine, with no duplicate rankings allowed, it may have been better suited for detecting subtle between-setting differences.

Additionally, there were no changes in state SO from pre- to post-test. This finding was contrary to the hypothesis that a yoga session would encourage participants to shift their focus from physical appearance to physical competence. Previously, Prichard and Tiggemann (2012b) found that a bout of treadmill exercise reduced state SO. Similarly, cross-sectional survey and quasi-experimental studies reported that yoga participants had lower levels of trait SO and appearance reasons for exercise than non-participants, and that more years of yoga experience were associated with lower trait SO (Daubenmier, 2005; Prichard & Tiggemann, 2008). However, it is possible that women who seek out and commit to yoga over the long term already possess healthier relationships with their bodies than women who choose different forms of exercise or who do not exercise regularly. Therefore, one interpretation of the present null finding is that one session of yoga is not sufficient to significantly alter beginner level students' state SO, particularly if they begin the class with a relatively low state SO.

**Task self-efficacy for yoga.** Contrary to the hypothesis, mirrors did not have an effect on SE. Both conditions reported significant increases in task self-efficacy (SE) from pre- to post-test. These increases were small to moderate in magnitude ( $d = 0.26$  for non-mirrored;  $d = 0.39$  for mirrored). In line with Bandura's (1977) self-efficacy theory and acute exercise research (e.g., Martin Ginis et al., 2003; Raedeke et al., 2007), these findings suggest that merely completing a yoga session provided beginner level students

with feelings of mastery and a sense of accomplishment, thereby increasing their SE.

Conversely, Katula and McAuley (2001) found that while highly active women reported significant increases in SE from baseline to post-test after a session of treadmill exercise in a mirrored setting, they did not report increases in SE within the non-mirrored setting. Between-setting differences in SE were not apparent immediately post-exercise.

However, SE was higher in the mirrored versus the non-mirrored setting after 20 minutes of rest. Katula and McAuley (2001) concluded that for active women who were already confident in their ability to complete vigorous exercise, completing a session of moderate treadmill exercise was not sufficient in and of itself to enhance SE. Mirrors further enhanced their feelings of mastery by providing visual feedback, similar to a self-modeling effect (Bandura, 1977). Because yoga is a more complex motor task than treadmill exercise and because the current participants were yoga beginners, the act of completing the class was challenging enough to enhance SE for participants in both conditions.

**Affect.** Based on the theory of objective self-awareness (Duval & Wicklund, 1972) and the Martin Ginis et al. (2003, 2007) findings, it was hypothesized that affect would be more positive in the non-mirrored condition than in the mirrored condition. However, this hypothesis was not supported; mirrors did not influence affect. Both conditions had significant increases in positive affective states and decreases in physical exhaustion from pre- to post-test. Notably, improvements in tranquility and revitalization were large in magnitude, ranging from  $d = 1.09$  to  $d = 1.57$ . These findings support previous research regarding positive affective responses to acute bouts of yoga (Berger & Owen, 1988, 1993; Kiecolt-Glaser et al., 2011; Szabo et al., 1998).

A synthesis of previous research regarding affective responses to mirrored exercise suggests that the inability to detect between-setting differences in affect may be due to the highly active nature of this sample. Whereas Martin Ginis and colleagues (2003, 2007) found that sedentary women reported less positive affect after exercise in a mirrored condition relative to exercise in a non-mirrored condition, subsequent research with more active samples of women have not replicated these findings (Chmelo et al., 2009; Raedeke et al., 2007). Although the present study intentionally recruited yoga beginners, the sample was highly active. Furthermore, unlike exercise on a treadmill or stationary bike, yoga is a complex motor task that requires focus and concentration in order to execute the poses. Therefore, as suggested by Raedeke et al. (2007) and Chmelo et al. (2009), participants may have used the mirrors mainly as an instructional tool to obtain proper alignment rather than to distract themselves from a repetitive task or to monitor their physical attractiveness. Using mirrors solely for checking form and alignment may have encouraged task-focused attention or subjective self-awareness (SSA; Duval & Wicklund, 1972), and therefore not elicited negative affect. Finally, because participants were unfamiliar with the class sequence and poses, their attention may have been too focused on following the verbal cues and executing the poses to engage in extensive self-evaluations.

### **Secondary Aim**

**Appearance comparisons.** In support of the secondary hypothesis, the mirrored condition engaged in more appearance-related social comparisons than the non-mirrored condition. It appears that while participants still compared themselves to one another in the non-mirrored condition, mirrors encouraged participants to directly compare their

self-reflections to co-exercisers and the instructor. This finding supports qualitative research with dancers (Reel et al., 2005). Although mirrors are intended as a tool for correcting technique and alignment, women have an innate tendency to engage in social comparisons with other women (Festinger, 1954; Franzoi et al., 2011), and thus participants may have felt compelled to use mirrors for appearance comparisons.

Conversely, Martin Ginis and colleagues (2007) found that participants in mirrored and non-mirrored group exercise conditions did not differ in their self-reported levels of appearance comparisons. However, the experimental conditions in their study lacked ecological validity. Specifically, group conditions consisted of two to four women on stationary bikes in a laboratory setting. In a repetitive task such as stationary cycling, there is little reason to look in the mirrors at other exercise participants. It is possible that mirrors are used more frequently for instructional and comparative purposes in group exercise classes than in settings where individuals are merely working out next to each other on exercise machines. Furthermore, Martin Ginis et al. (2007) used a single-item, non-validated measure of appearance comparison. The present study utilized the valid and reliable State Appearance Comparison Scale (Herbozo & Thompson, 2010; Tiggemann & McGill, 2004; Tiggemann & Slater, 2004).

Exploratory analyses revealed that appearance comparison had a strong, positive association with state SPA in both conditions. Furthermore, within the mirrored condition, participants who spent more time gazing at their self-reflections were more likely to compare their physical appearance to other participants and the instructor. In light of these findings, a post hoc analysis tested whether appearance comparisons mediated the effect of mirrors on SPA. As expected, the higher level of post-test state



SPA in the mirrored condition than in the non-mirrored condition was at least partially explained by the higher level of appearance-based social comparison in the mirrored vs. non-mirrored yoga class. This finding provides empirical support for previous researchers' hypotheses that social comparisons mediate women's psychological responses to mirrors within group exercise settings (Lamarche et al., 2009; Martin Ginis et al., 2007; Raedeke et al., 2007). Further research on the long-term effects of mirrored group exercise classes on appearance comparisons and social physique anxiety is warranted.

**Mindfulness.** Regarding the effect of mirrors on cognitive processes, it was hypothesized that mirrors would disrupt mindfulness (i.e., a non-judgmental focus on the present moment) through the elicitation of objective self-awareness and social comparison (Dijkstra & Barelds, 2011; Duval & Wicklund, 1972). Contrary to the hypothesis, participants reported similar levels of state mindfulness after yoga in both conditions. Mindfulness is a difficult concept to measure and this may have influenced the results. Although the state Mindful Attention Awareness Scale was previously utilized in an experience sampling methods study (Brown & Ryan, 2003), it had not been used to measure the effect of an experimental manipulation on state mindfulness. Therefore, it is possible that this was not the ideal measure for detecting the effect of mirrors on state mindfulness.

Because mindfulness was only measured at post-test, it is unknown whether the yoga session caused increases in state mindfulness over time. Mindfulness was surprisingly high in this sample, with an average score of 21.55 out of 30. Because research suggests that more advanced yoga participants report higher levels of trait

mindfulness than yoga beginners (Brisbon & Lowery, 2011), the present findings have questionable validity. However, it is interesting that higher levels of state mindfulness were positively associated with task SE and positive affective states, and negatively associated with state SPA, physical exhaustion, and appearance comparisons. These findings suggest that mindfulness merits investigation in longer-term studies examining yoga's effects on SPA, mood, and physical self-perceptions.

### **Tertiary Aim**

**Moderators of body image responses to yoga and mirrors.** It was hypothesized that personal characteristics (i.e., BMI, weekly minutes of MVPA) and trait body image variables (i.e., trait self-objectification, underlying motives for exercise) would moderate the relationship between mirror condition and state body image responses to yoga.

None of the hypothesized variables moderated the relationship between mirror condition and post-test state body image, SPA, or self-objectification (SO). Because the primary analyses found no between-group differences in state body image or SO, these findings were not surprising. Hypotheses were based mainly on the findings of experience sampling methods studies (Fuller-Tyszkiewicz et al., 2013; Lepage & Crowther, 2010) or cross-sectional survey studies with larger sample sizes (Cash, Novy, & Grant, 1994; Melbye, Tenenbaum, & Eklund, 2008; Prichard & Tiggemann, 2012a; Prichard & Tiggemann, 2005, 2008; Strelan et al., 2003). It is possible that there was not enough statistical power, variation in survey responses, or diversity in the sample to detect moderator effects within the current study. The effects of these potential moderators may become more salient with longer-term yoga participation and mirror exposure.

## **Exploratory Aims**

**Relationships between state body image and post-test measures.** In partial support of the first exploratory hypothesis, post-test state body image concerns were correlated with other psychosocial responses to yoga. More specifically, participants who reported higher levels of appearance comparisons tended to also report lower state body satisfaction and higher state SPA and self-objectification. This supports research regarding the “circle of objectification” and the relationships between self-objectification, appearance comparisons, appearance anxiety, and body dissatisfaction (Lindner et al., 2012; Myers & Crowther, 2009; Strelan & Hargreaves, 2005). Consistent with previous research that found an inverse relationship between trait SPA and physical self-efficacy (Katula et al., 1998), lower task self-efficacy for yoga was associated with higher state SPA, but was unrelated to the other state body image variables. A similar pattern of results was found for state mindfulness, which was inversely related to state SPA, but was not significantly correlated with other state body image concerns. This finding supports objectification theory’s (Fredrickson & Roberts, 1997) proposal that women are less anxious about their appearance when they are experiencing flow/mindfulness.

Contrary to the hypothesis, post-test state body image concerns were not significantly correlated with affective responses to yoga. Even at pre-test, state body satisfaction was only correlated with the Positive Engagement subscale of the Exercise-Induced Feeling Inventory (EFI). Previous research had found acute exercise to lead to concomitant increases in state body image and positive affect (e.g., Fuller-Tyszkiewicz et al., 2013; Lepage & Crowther, 2010; Vocks et al., 2009).

**Intentions.** Consistent with Raedeke et al. (2007), the current study found that mirrors had no observable effect on intentions to engage in future yoga-related behaviors. Regression analyses indicated that, regardless of whether mirrors were present or not, positive engagement and appearance comparison were both positively related to intentions to attend another yoga class, buy yoga equipment and apparel, talk to friends about yoga, and to practice yoga at least three times per week within the next three months. The motivational properties of positive affect are well documented; several researchers have observed that affective responses to a single bout of exercise predict future exercise intentions and long-term exercise adherence (Kwan & Bryan, 2010; Raedeke et al., 2007; Williams et al., 2008). The positive relationship between appearance comparisons and intentions to participate in yoga is intriguing. Seeing other participants and the instructor perform the yoga poses may have inspired individuals to want to participate in future yoga classes to improve their perceived competence, flexibility, strength, or physique.

Results did not support Raedeke and colleagues' (2009) finding that increases in task self-efficacy (SE) after a group step aerobics class predicted intentions to attend similar classes in the future. Whereas Raedeke et al. (2007, 2009) used a single-item measure of intentions to attend *any* future classes, the present study assessed intentions to engage in specific behaviors within a specific time frame. Although task SE did not emerge as a significant predictor of intentions within the regression model, it was positively correlated with yoga-related intentions and with the EFI subscales of Positive Engagement, Revitalization, and Tranquility. These findings align with previous research

that found task SE to indirectly predict exercise intentions through its relationship with positive affect (Kwan & Bryan, 2010; McAuley, Talbot, & Martinez, 1999).

**Frequency of mirror gazing.** As previously mentioned, participants who spent more time gazing at their self-reflection in the mirror engaged in more appearance comparisons during class than participants who spent less time looking at their self-reflections. Findings did not support Windheim and colleagues' (2011) observation that a longer duration of mirror gazing was associated with greater levels of distress. Whereas the participants in Windheim et al. (2011) were seated in front of a mirror in a laboratory setting, the participants in the present study were physically active during mirror exposure, had other stimuli to focus on, and potentially had a variety of motives for gazing in the mirrors (e.g., checking alignment in poses).

**Preferences for mirrors.** When asked about typical preferences for mirrors within group exercise classes, only a small minority of participants (8.2%) stated they preferred no mirrors. These participants reported significantly lower health and fitness-related motives for exercise than participants who preferred mirrors or had no mirror preference. However, participants who preferred no mirrors did not significantly differ from other participants in regards to BMI, weekly minutes of MVPA, trait SO, or appearance reasons for exercise. This is in contrast with Prichard and Tiggemann's (2010) cross-sectional survey study with 571 women, which found that participants who preferred aerobics classes without mirrors had a higher BMI and lower body esteem than participants who preferred or who had no mirror preference. The inability to replicate Prichard and Tiggemann's (2010) finding was potentially due to the smaller sample size.

## **Theoretical Implications**

The present findings provide partial support for the chosen theoretical frameworks, which include the theory of objective self-awareness (Duval & Wicklund, 1972), objectification theory (Fredrickson & Roberts, 1997) and social comparison theory (Festinger, 1954). According to the theory of objective self-awareness (OSA; Duval & Wicklund, 1972), a stimulus that encourages self-focused attention (i.e., a mirror) should initiate self-evaluations based on comparisons to internalized standards or ideals. If an individual perceives a high degree of discrepancy between the actual self and these ideals, he/she typically experiences negative affect and distress (e.g., body dissatisfaction).

It was therefore predicted that yoga beginners would respond negatively to seeing themselves in the mirrors. This prediction assumed that participants would be able to see the discrepancies between themselves and the instructor. However, the present findings suggest that beginner level participants—who had few prior yoga experiences with which to compare their current experiences to (i.e., no established personal standards)—may not have been able to detect discrepancies between how they looked in a pose and how they “should” have looked in a pose. It is also possible that yoga counteracted the potentially negative effects of OSA by encouraging subjective self-awareness (SSA). In other words, participants may have been focused on following the instructor’s verbal cues, feeling the physical sensations of each posture, and coordinating their movements with the breath. This explanation supports Duval and Wicklund’s (1972) proposal that exercise provides a positive distraction from the discomfort associated with OSA. Therefore, although the present findings did not align with previous research that found mirror-induced OSA to

lead to negative affect (Mor & Winquist, 2002), they may indicate that yoga mitigated the negative effects of OSA by encouraging SSA, flow, or mindfulness (Duval & Wicklund, 1972). This interpretation of the results merits investigation in future OSA research.

Within the present study, participants reported higher appearance comparisons and higher state social physique anxiety (SPA) after yoga in the mirrored condition than in the non-mirrored condition. These findings align with Lindner and colleague's (2012) proposed "circle of objectification," which combines tenets of objectification theory (Fredrickson & Roberts, 1997) and social comparison theory (Festinger, 1954) to contend that women experience negative affect or body image-related distress when they self-objectify and engage in comparisons with other women. When women make self-critical, upward social comparisons to female peers (i.e., comparing oneself to other women who are judged to be more physically attractive than oneself), these upward comparisons can lead to body dissatisfaction (Franzoi et al., 2011; Myers & Crowther, 2009; Strahan et al., 2006). Within the present study, female participants appeared to use the mirrors to engage in appearance comparisons with other women in a yoga class.

Although scores on the State Self-Objectification Questionnaire (Prichard & Tiggemann, 2012) indicated that neither mirrors nor yoga impacted state self-objectification, the higher levels of appearance comparisons and state SPA within the mirrored condition provide evidence to the contrary. When women compared their overall appearance and specific body parts to other participants and the instructor, they may have engaged in objectification of self and others, even if their primary (i.e., conscious) motive for using the mirror was for instructional feedback on form and

alignment. It is important to note that within the current study, appearance comparisons did not lead to *increases* in SPA from pre- to post-test, they only led to diminished reductions in SPA. However, reductions in SPA appeared to be more dramatic among participants in the non-mirrored condition. While these findings support Fredrickson and Roberts' (1997) suggestion that participation in physical activity counteracts the negative effects of self-objectification, further research is needed to determine whether mirrors (i.e., a potentially objectifying stimuli) undermine the positive effects of yoga on SPA by facilitating social comparison (i.e., objectification of self and others).

### **Strengths of Study Design**

The current study adds to the literature by addressing many of the methodological limitations of previous yoga and body image studies including: (1) Non-experimental and quasi-experimental designs; (2) samples comprised mainly of older, more experienced yoga participants; (3) no examination of state body image concerns; (4) no examination of how social-environmental variables affect psychological responses to yoga; (5) non-validated or single-item measures; and (6) small sample sizes. Based on an extensive search of the literature, this is the first study to use a randomized experimental design to examine state body image responses to yoga and mirrors. These qualities make the current study a novel contribution to the emerging body of literature on yoga and body image.

Furthermore, the present study assessed self-reported frequency of mirror gazing, which had not been assessed in previous mirror studies. Although previous researchers utilized the theory of objective self-awareness (Duval & Wicklund, 1972) and



objectification theory (Fredrickson & Roberts, 1997) as theoretical frameworks, this is the first known exercise study to directly measure the effect of mirrors on state self-objectification, body image, and social physique anxiety. Improving upon Focht and Hausenblas' research (2003), classes took place in a female-only group exercise setting to ensure that the presence of males would not confound the results. Another improvement upon previous research was that both the non-mirrored and mirrored settings were in naturalistic settings that were representative of a typical yoga class. Furthermore, the same female instructor taught all of the classes to ensure standardization of the sessions. Analyses of video recorded sessions confirmed class consistency across sessions and conditions.

### **Study Limitations**

Despite the strength of the present study design, there are limitations to the present study. The sample consisted of healthy, highly active young women ( $M = 4.5$  days of MVPA for 299 minutes per week). Only 14.4% of participants did not meet national PA guidelines (i.e., fewer than 150 weekly minutes of MVPA). A less active sample of women may have been more sensitive to the evaluative threat posed by a mirrored yoga class (Focht & Hausenblas, 2003; Martin Ginis et al., 2007, 2003). Although the racial/ethnic make-up of the sample was representative of the participating university's demographics, it was predominantly Caucasian (70.1%), precluding the ability to assess whether women of different ethnic backgrounds would respond differently to mirrors in yoga classes. Only 24.8% of participants reported a height and weight that would classify them as being in the overweight or obese categories of BMI, which is less than what is typically observed in college students (31.3% of female college

students in the U.S. are overweight or obese; American College Health Association, 2014). Therefore, findings cannot be generalized to older, sedentary, and/or obese individuals.

The lack of longer-term follow-up assessments is another limitation of the current study. Psychological responses were only measured within 10 minutes after yoga. Previous research indicates that responses to mirror exposure during exercise might emerge after a longer period of recovery. Focht and Hausenblas (2003) found no between-group differences in state anxiety immediately after mirrored versus non-mirrored exercise. However, differences were observed 60 minutes post-exercise. Furthermore, Katula and McAuley (2001) observed that between-group differences in SE were not apparent immediately after exercise, but emerged after 20 minutes of rest.

Another limitation was that affect and SPA were not measured *during* yoga. This is important given affect during exercise is a better predictor of exercise adherence than post-exercise affect (Williams et al., 2008). Furthermore, Focht and Hausenblas (2003) found that anxiety actually increased during mirror exercise, but was lower than baseline levels at five minutes post-exercise. It is possible that SPA actually increased during yoga in the mirrored condition, but then decreased afterward.

Finally, although the majority of psychosocial measures had previously undergone extensive psychometric testing, there were potential limitations with two of the measures. Specifically, the validity and reliability of the State Self-Objectification Questionnaire (S-SOQ; Prichard & Tiggemann, 2012b) and state Mindful Attention Awareness Scale (state MAAS; Brown & Ryan, 2003) have not been established. While pre-test S-SOQ scores were significantly correlated with other pre-test body image

measures in the expected direction, the original SOQ's format of rank ordering a list of appearance and competence attributes may have been better suited for detecting subtle between-setting differences at post-test (Fredrickson et al., 1998). In regard to mindfulness, future research should develop and examine measures of state mindfulness that are appropriate for experimental research within physical activity contexts.

### **Future Research Directions**

To address the previously mentioned limitations of the present study, future research should include longer-term follow-up assessments of psychological responses to mirrored and non-mirrored yoga sessions. In addition to completing surveys immediately after yoga, participants could also complete surveys at 60 and 120 minutes post-test. Researchers should also devise creative ways to unobtrusively measure psychological states during a yoga class. Furthermore, because it was found that participants in the mirrored condition with a higher BMI experienced the smallest improvements in SPA, future research should be conducted with samples representing more diverse body shapes and sizes.

Future yoga and body image studies should also compare yoga to other group exercise conditions (e.g., strength training, dance aerobics) and contact control conditions (e.g., meditation, stretching) to identify mechanisms underlying the unique psychological effects of yoga. Because there are many different types of yoga, it is also important to compare psychological responses to different intensities and styles of yoga to determine which styles have the largest effect on body image and mood for different populations.

In regard to mirror usage in yoga, research should examine the effect of mirrors on self-objectification, SPA, and social comparison among women in mixed-gender and

mixed-level yoga classes (i.e., including advanced students), as upward social comparisons and the presence of males may intensify these self-presentational concerns (e.g., Martin Ginis et al., 2011; Myers & Crowther, 2009). Similarly, researchers should measure the direction of appearance comparisons (i.e., downward versus upward) to better understand how these processes influence self-perceptions and affect in mirrored group exercise classes.

There is also a need for longer-term experimental studies that examine the effect of a consistent yoga practice and continual exposure to mirrors on trait body image concerns. These studies could address questions that could not be answered with the current study design. For example, do students become desensitized to mirrors over time? Do they use mirrors less as they become more familiar with poses? Do they become more self-critical? Qualitative research could further explore instructors' and students' relationships with mirrors in yoga studios. Focus group or interview questions could assess whether reasons for looking in mirrors during class (e.g., check alignment, evaluate one's physical appearance) differ as a function of yoga expertise, BMI, or trait self-objectification. Questions could also center on how yoga and mirrors impact participants' relationships with their bodies, thus identifying additional variables to be explored as mechanisms of change in yoga and body image research.

### **Practical Implications**

Although mirrors are intended to serve as an instructional tool for students to check their alignment in yoga postures (Choudhury, 2012), the current study suggests that beginner level female yoga students may also use mirrors to compare their physical appearance with other females in class. These appearance comparisons were related to

anxiety about how one's body appeared to others. Therefore, to encourage non-competition, non-judgment, and internal body awareness (i.e., focus on how a yoga pose feels rather than how it looks) in a mirrored classroom, yoga instructors might structure class so students face away from mirrors. Instructors could also verbally instruct students to redirect their attention inward toward bodily sensations and re-emphasize that the goal of yoga is to be non-judgmentally aware of the present moment. Also, instructors in mirrored studios may simply ask students upon their arrival to class whether they would prefer to face toward or away from the mirrors.

These recommendations are based on the responses of a highly active sample of college-aged women who were relatively new to yoga. Instructors should take into account their students' experience levels, potential body image concerns, and motives for yoga participation when structuring their classes. For example, the founder of Curvy Yoga encourages teachers to use mirrorless classrooms or to face students away from mirrors during class to promote body positivity among students of all shapes and sizes (A. Guest-Jelley, personal communication, 2015). These concerns may not be as salient in other yoga student populations. Additional research is needed before consensus statements can be made regarding the use of mirrors and how to structure yoga class environments to promote optimal psychological well-being among students.

## **Conclusion**

Although 11.2% of U.S. adults currently practice yoga (Clarke et al., 2015), little is known regarding how social environmental variables influence yoga's psychological benefits. Given the increased use of yoga in eating disorder prevention and treatment programs, research on yoga and body image is of paramount importance (Neumark-

Sztainer, 2013). The present study used a randomized experimental design to explore the effect of mirrors on women's psychological responses to a yoga session. Mirrors influenced the variables most relevant to the social-environmental context of a group exercise class. Participants who did yoga in front of a mirror reported higher state social physique anxiety (SPA) and appearance-related social comparisons than participants who did yoga without a mirror. However, similar to previous research on resistance and aerobic exercise, college-aged females reported meaningful improvements in state body image concerns, affect, and self-efficacy after 60 minutes of yoga. These improvements occurred regardless of whether participants completed the class in a mirrored or non-mirrored setting. This is the first known study to observe state body image and self-efficacy responses to a single session of yoga.

The present findings suggest that mirrors encouraged female yoga students to compare their bodies with other females in the yoga class. While participants' specific motives for mirror gazing and engaging in appearance comparisons were not examined, appearance comparisons mediated the relationship between mirrors and state social physique anxiety. It is recommended that when working with students who may have heightened body image concerns, instructors might consider covering mirrors, facing students away from mirrors, or encouraging students to view their reflections in the mirrors with non-judgment and compassion. Because yoga is a promising context for promoting positive body image and reducing self-objectification, it is imperative that researchers and yoga instructors collaborate with one another to create class environments that maximize participants' physical and psychological well-being.

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## Appendix A: IRB Approval Form

### UNIVERSITY OF MINNESOTA

*Twin Cities Campus*

*Human Research Protection Program  
Office of the Vice President for Research*

*D528 Mayo Memorial Building  
420 Delaware Street S.E.  
MMC 820  
Minneapolis, MN 55455*

*Office: 612-626-5654  
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E-mail: [irb@umn.edu](mailto:irb@umn.edu) or [ibc@umn.edu](mailto:ibc@umn.edu)  
Website: <http://research.umn.edu/subjects/>*

August 7, 2014

Amanda L Williams

RE: "The Effect of Mirrors on Women's Body Image and Affective Responses to Yoga"  
IRB Code Number: **1406P51365**

Dear Ms. Williams

The Institutional Review Board (IRB) received your response to its stipulations. Since this information satisfies the federal criteria for approval at 45CFR46.111 and the requirements set by the IRB, final approval for the project is noted in our files. Upon receipt of this letter, you may begin your research.

IRB approval of this study includes the consent form received August 7, 2014 and recruitment materials received June 11, 2014.

The IRB would like to stress that subjects who go through the consent process are considered enrolled participants and are counted toward the total number of subjects, even if they have no further participation in the study. Please keep this in mind when calculating the number of subjects you request. This study is currently approved for 90 subjects. If you desire an increase in the number of approved subjects, you will need to make a formal request to the IRB.

For your records and for grant certification purposes, the approval date for the referenced project is July 11, 2014 and the Assurance of Compliance number is FWA00000312 (Fairview Health Systems Research FWA00000325, Gillette Children's Specialty Healthcare FWA00004003). Research projects are subject to continuing review and renewal; approval will expire one year from that date. You will receive a report form two months before the expiration date. If you would like us to send certification of approval to a funding agency, please tell us the name and address of your contact person at the agency.

As Principal Investigator of this project, you are required by federal regulations to:

- \*Inform the IRB of any proposed changes in your research that will affect human subjects, changes should not be initiated until written IRB approval is received.
- \*Report to the IRB subject complaints and unanticipated problems involving risks to subjects or others as they occur.
- \*Inform the IRB immediately of results of inspections by any external regulatory agency (i.e. FDA).
- \*Respond to notices for continuing review prior to the study's expiration date.
- \*Cooperate with post-approval monitoring activities.

Information on the IRB process is available in the form of a guide for researchers entitled, What Every Researcher Needs to Know, found at <http://www.research.umn.edu/irb/WERNK/index.cfm>

The IRB wishes you success with this research. If you have questions, please call the IRB office at 612-626-5654.

Sincerely,

A handwritten signature in black ink that reads "Jeffery Perkey". The signature is written in a cursive style with a large, stylized initial "J".

Jeffery Perkey, MLS, CIP  
Research Compliance Supervisor  
JP/bw

CC: Beth Lewis

## Appendix B: Recruitment Flyer



UNIVERSITY OF MINNESOTA

### Participants Needed for Yoga Study

Volunteers are needed for a study at the University of Minnesota that is investigating how a session of yoga impacts women's thoughts and feelings. Participants will be asked to report to the Physical Activity and Sport Science Lab (Cooke 108) to complete surveys before and after a 60-minute beginner's level group yoga class. The class will take place in the University Recreation and Wellness Center, and will be taught by a certified instructor. The total time commitment for the study should be no more than 2 hours. Upon completion, participants will be given a \$10 gift card or extra credit.

To be eligible for participation, you must:

- **Be a woman between the ages of 18-25**
- **Be in good physical health**
- **Be able to safely perform yoga for 60 consecutive minutes**
- **Be a beginner's level yoga student or have limited yoga experience**

If you are interested in participating and/or have any questions, please contact the student researcher, Amanda Frayeh, via email at [will3956@umn.edu](mailto:will3956@umn.edu). The researcher is a PhD. student within the School of Kinesiology.

### Appendix C: On-Line Screening Questionnaire

Thank you for expressing interest in the Yoga Research Study. The following questions will collect information about you to determine if you are eligible for the study. All of the information you provide will remain confidential and will be kept without your name attached. Do we have your permission to keep this information? If yes, please continue to the next screen. If no, you may discontinue this survey and contact the primary investigator, Amanda Frayeh, with questions or concerns.

Please answer these general questions so we can learn more about the individuals who are interested in participating in our study. These questions will not impact your eligibility for the study.

1. How did you hear about the study? \_\_\_\_\_

2. Which of the following do you consider to be your racial group?

- White
- American Indian/Alaskan Native
- Asian
- Native Hawaiian or Other Pacific Islander
- Black or African American
- Other
- Don't know/refuse

3. Which of the following do you consider to be your ethnic group?

- Hispanic or Latino
- Not Hispanic or Latino

4. What is your academic major? \_\_\_\_\_

5. Year in school

- 1st year
- 2nd year
- 3rd year
- 4th year
- 5th year +
- Graduate student
- Not currently in school

6. What is your age? \_\_\_\_\_



7. Are you a female between the ages of 18 and 25?

- Yes
- No

Since this research study involves completing a 60 minute beginner's level yoga class, we need to ask you several questions about your health and yoga experience to find out if you are eligible. All of the information you give will be kept strictly confidential.

8. Are you currently pregnant?

- Yes
- No

Please read the questions carefully and answer each one honestly by checking YES or NO.

9. 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

10. Do you feel pain in your chest when you do physical activity?

- Yes
- No

11. In the past month, have you had chest pain when you were not doing physical activity?

- Yes
- No

12. Do you lose your balance because of dizziness or do you ever lose consciousness?

- Yes
- No

13. Do you have a bone or joint problem (for example, back, knee, or hip) that could be made worse by a change in your physical activity?

- Yes
- No

14. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?

- Yes
- No

15. Do you know of any other reason why you should not do physical activity?

- Yes
- No

16. How would you rate your level of proficiency in yoga?

- Beginner's Level
- Intermediate
- Advanced

Congratulations! You are eligible for the current study. The primary investigator, Amanda Frayeh, will be contacting you shortly to schedule your experimental session.

First Name \_\_\_\_\_

Last Name \_\_\_\_\_

How would you like us to contact you?

- Email
- Text
- Phone Call

Please provide the relevant information for your preferred method of contact (for example, your 10-digit phone number or email address).

\_\_\_\_\_

Are you participating in this study for extra credit or research credits?

- Yes
- No

If yes, who is your instructor? \_\_\_\_\_

Please press the arrow button to complete the survey.

## **Appendix D: Consent Form**

### **CONSENT FORM**

#### The Effect of Yoga on Thoughts and Feelings

You are invited to be in a research study on the effect of yoga on women's thoughts and feelings. You were selected as a possible participant because you are a healthy woman between the ages of 18 and 25 with limited yoga experience and who can safely engage in 60 minutes of beginner's level yoga. We ask that you read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted by Amanda Frayeh, a doctoral student within the School of Kinesiology at the University of Minnesota.

#### **Background Information:**

The purpose of this study is to examine the effect of a 60-minute beginner's level yoga class on women's thoughts and feelings. We are particularly interested in how participation in a single yoga class might influence participants' mood, body image, and confidence in their ability to do yoga.

#### **Procedures:**

If you agree to be in this study, we would ask you to report to the Physical Activity and Sport Science Laboratory (Cooke 108) to complete a background questionnaire and a series of surveys regarding your thoughts and feelings. After completing these surveys, you will be asked to walk to the University Recreation and Wellness Center to participate in a 60-minute beginner's level yoga class. The class will be in a group setting with other participants. A certified yoga instructor will be teaching the class, and she will offer modifications to poses to ensure that you can comfortably and safely participate in the class. The class will consist of a series of physical poses and stretches that are intended to build strength, flexibility, and balance. The aerobic intensity of the class will range from light to moderate, and the instructor will encourage you to go at your own pace and rest when needed. A video camera will be set up to record the instructor's words and actions so the researchers can assess her teaching quality and consistency; your image will not appear in the video. After the yoga class, you will be asked to walk back to the Cooke 108 laboratory to complete additional surveys regarding your thoughts, feelings, and typical exercise behaviors. The experimental session should last no more than two hours (30 minutes to complete baseline surveys and walk to the recreation center + 60 minute yoga class + 30 minutes to walk back to Cooke and complete the post-yoga surveys).

**Risks and Benefits of being in the Study:**

This study has several risks: First, participants are expected to experience very mild discomfort (such as sweating and accelerated heart rate) in response to yoga. Second, participation in yoga poses a potential risk for injury. Because you have been screened for any health conditions that would prevent you from safely exercising, it is not anticipated that you will have an adverse health reaction to the yoga class. However, there is still a very slight risk that you may experience muscle fatigue, dizziness, or abnormal changes in heart function. If you experience any pain during the class you should immediately notify the yoga instructor. In the unlikely event of an emergency, the yoga instructor, who is certified by the American Heart Association to provide Cardio-Pulmonary Resuscitation (CPR) and Automatic External Defibrillator (AED), will administer CPR and/or AED if appropriate and will call for emergency assistance. Third, because the questionnaires ask personal questions, you may feel uncomfortable answering some of the questions. However, your responses will be confidential and will not be linked to your name or contact information.

There are no direct benefits for participating in this research study, but study results can help researchers and practitioners understand ways to provide beginner's level yoga students with positive class experiences.

**Compensation:**

You will receive either a \$10 gift card or extra credit upon completion of the yoga class and surveys. Extra credit or class points may be awarded to you at the discretion of your course instructor.

**Confidentiality:**

The records of this study will be kept private. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely and only researchers will have access to the records. Study data will be encrypted according to current University policy for protection of confidentiality. Video recordings will be analyzed only in regard to consistency and quality of the instructor's teaching methods, and will be erased upon completion of the study (i.e., within three years). Only the principal investigator and her research team will have access to the video recordings.

**Voluntary Nature of the Study:**

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with the University of Minnesota. If you decide

to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.

**Contacts and Questions:**

The researchers conducting this study are: Amanda Frayeh and Dr. Beth Lewis. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact Amanda Frayeh at Cooke 210, 612-625-1043, [will3956@umn.edu](mailto:will3956@umn.edu), or Dr. Lewis at Cooke 209, 612-625-0756, [blewis@umn.edu](mailto:blewis@umn.edu).

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), **you are encouraged** to contact the Research Subjects' Advocate Line, D528 Mayo, 420 Delaware St. Southeast, Minneapolis, Minnesota 55455; (612) 625-1650.

*You will be given a copy of this information to keep for your records.*

**Statement of Consent:**

I have read the above information. I have asked questions and have received answers. I consent to participate in the study.

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Signature of Investigator: \_\_\_\_\_ Date: \_\_\_\_\_

Appendix E: Pre-Test Surveys



UNIVERSITY OF MINNESOTA



Yoga Research Study

Name: \_\_\_\_\_

**Objectified Body Consciousness Scale: Surveillance Subscale**  
(McKinley & Hyde, 1996)

How people feel about themselves and their bodies could influence their behaviors. Rate your personal level of agreement with each of the following statements by circling the corresponding number with: (1) indicating *strong disagreement* (strongly disagree), (2) *pretty much disagree*, (3) *sort of disagree*, (4) neutral (*neither agree nor disagree*), (5) *sort of agree*, (6) *pretty much agree*, or (7) indicating *strong agreement* (strongly agree).

*Please respond as accurately as possible and base your response on your personal feelings.*

	Strongly Disagree			Neutral			Strongly Agree
1. I rarely think about how I look.	1	2	3	4	5	6	7
2. I think it is more important that my clothes are comfortable than whether they look good on me.	1	2	3	4	5	6	7
3. I think more about how my body feels than how my body looks.	1	2	3	4	5	6	7
4. I rarely compare how I look with how other people look.	1	2	3	4	5	6	7
5. During the day, I think about how I look many times.	1	2	3	4	5	6	7
6. I often worry about whether the clothes I am wearing make me look good.	1	2	3	4	5	6	7
7. I rarely worry about how I look to other people.	1	2	3	4	5	6	7
8. I am more concerned with what my body can do than how it looks.	1	2	3	4	5	6	7

**Reasons for Exercise Inventory**  
(Silberstein et al., 1988)

People exercise for a variety of reasons. When people are asked why they exercise, their answers are sometimes based on the reasons they believe they *should* have for exercising. What we want to know are the reasons people *actually* have for exercising. Please respond to the items below as honestly as possible. **To what extent is each of the following an important reason that you have for exercising?** Indicate your response to each item by circling the appropriate number, ranging from 1 (*not at all important*) to 7 (*extremely important*).

	Not At All Important		Moderately Important			Extremely Important	
1. To be slim	1	2	3	4	5	6	7
2. To improve my muscle tone	1	2	3	4	5	6	7
3. To maintain my physical well-being	1	2	3	4	5	6	7
4. To improve my appearance	1	2	3	4	5	6	7
5. To improve my strength	1	2	3	4	5	6	7
6. To redistribute my weight	1	2	3	4	5	6	7
7. To improve my endurance, stamina	1	2	3	4	5	6	7
8. To be attractive to others	1	2	3	4	5	6	7
9. To improve my flexibility, coordination	1	2	3	4	5	6	7
10. To lose weight	1	2	3	4	5	6	7
11. To improve my cardiovascular fitness	1	2	3	4	5	6	7
12. To improve my overall body shape	1	2	3	4	5	6	7
13. To increase my resistance to illness and disease	1	2	3	4	5	6	7
14. To be sexually desirable	1	2	3	4	5	6	7
15. To improve my overall health	1	2	3	4	5	6	7
16. To alter a specific area of my body	1	2	3	4	5	6	7



**Body Image States Scale (Cash et al., 2002)**

For each of the items below, check the box beside the one statement that best describes how you feel RIGHT NOW, AT THIS VERY MOMENT. Read the items carefully to be sure the statement you choose accurately and honestly describes how you feel right now.

1. Right now I feel \_\_\_\_\_ with my physical appearance.

- |                          |                                    |
|--------------------------|------------------------------------|
| <input type="checkbox"/> | Extremely dissatisfied             |
| <input type="checkbox"/> | Mostly dissatisfied                |
| <input type="checkbox"/> | Moderately dissatisfied            |
| <input type="checkbox"/> | Slightly dissatisfied              |
| <input type="checkbox"/> | Neither dissatisfied nor satisfied |
| <input type="checkbox"/> | Slightly satisfied                 |
| <input type="checkbox"/> | Moderately satisfied               |
| <input type="checkbox"/> | Mostly satisfied                   |
| <input type="checkbox"/> | Extremely satisfied                |

2. Right now I feel...

- |                          |  |
|--------------------------|--|
| <input type="checkbox"/> | Extremely satisfied with my body size and shape                |
| <input type="checkbox"/> | Mostly satisfied with my body size and shape                   |
| <input type="checkbox"/> | Moderately satisfied with my body size and shape               |
| <input type="checkbox"/> | Slightly satisfied with my body size and shape                 |
| <input type="checkbox"/> | Neither dissatisfied nor satisfied with my body size and shape |
| <input type="checkbox"/> | Slightly dissatisfied with my body size and shape              |
| <input type="checkbox"/> | Moderately dissatisfied with my body size and shape            |
| <input type="checkbox"/> | Mostly dissatisfied with my body size and shape                |
| <input type="checkbox"/> | Extremely dissatisfied with my body size and shape             |

For each of the items below, check the box beside the one statement that best describes how you feel RIGHT NOW, AT THIS VERY MOMENT. Read the items carefully to be sure the statement you choose accurately and honestly describes how you feel right now.

3. Right now I feel...

- |                          |   |
|--------------------------|---|
| <input type="checkbox"/> | Extremely dissatisfied with my weight             |
| <input type="checkbox"/> | Mostly dissatisfied with my weight                |
| <input type="checkbox"/> | Moderately dissatisfied with my weight            |
| <input type="checkbox"/> | Slightly dissatisfied with my weight              |
| <input type="checkbox"/> | Neither dissatisfied nor satisfied with my weight |
| <input type="checkbox"/> | Slightly satisfied with my weight                 |
| <input type="checkbox"/> | Moderately satisfied with my weight               |
| <input type="checkbox"/> | Mostly satisfied with my weight                   |
| <input type="checkbox"/> | Extremely satisfied with my weight                |

4. Right now I feel...

- |                          |                                     |
|--------------------------|-------------------------------------|
| <input type="checkbox"/> | Extremely physically attractive     |
| <input type="checkbox"/> | Very physically attractive          |
| <input type="checkbox"/> | Moderately physically attractive    |
| <input type="checkbox"/> | Slightly physically attractive      |
| <input type="checkbox"/> | Neither attractive nor unattractive |
| <input type="checkbox"/> | Slightly physically unattractive    |
| <input type="checkbox"/> | Moderately physically unattractive  |
| <input type="checkbox"/> | Very physically unattractive        |
| <input type="checkbox"/> | Extremely physically unattractive   |

For each of the items below, check the box beside the one statement that best describes how you feel RIGHT NOW, AT THIS VERY MOMENT. Read the items carefully to be sure the statement you choose accurately and honestly describes how you feel right now.

5. Right now I feel...

- |                          |   |
|--------------------------|---|
| <input type="checkbox"/> | A great deal worse about my looks than I usually feel   |
| <input type="checkbox"/> | Much worse about my looks than I usually feel           |
| <input type="checkbox"/> | Somewhat worse about my looks than I usually feel       |
| <input type="checkbox"/> | Just slightly worse about my looks than I usually feel  |
| <input type="checkbox"/> | About the same about my looks as usual                  |
| <input type="checkbox"/> | Just slightly better about my looks than I usually feel |
| <input type="checkbox"/> | Somewhat better about my looks than I usually feel      |
| <input type="checkbox"/> | Much better about my looks than I usually feel          |
| <input type="checkbox"/> | A great deal better about my looks than I usually feel  |

6. Right now I feel that I look...

- |                          |  |
|--------------------------|--|
| <input type="checkbox"/> | A great deal better than the average person looks  |
| <input type="checkbox"/> | Much better than the average person looks          |
| <input type="checkbox"/> | Somewhat better than the average person looks      |
| <input type="checkbox"/> | Just slightly better than the average person looks |
| <input type="checkbox"/> | About the same as the average person looks         |
| <input type="checkbox"/> | Just slightly worse than the average person looks  |
| <input type="checkbox"/> | Somewhat worse than the average person looks       |
| <input type="checkbox"/> | Much worse than the average person looks           |
| <input type="checkbox"/> | A great deal worse than the average person looks   |

**State Social Physique Anxiety Scale**  
(Martin Ginis et al., 2011)

Circle the number that best represents the extent to which you are experiencing the feelings described by each item.

	Not At All			A Great Deal	
1. I feel uptight about my physique/figure.	1	2	3	4	5
2. I am concerned that other people in the room are evaluating my weight or muscular development negatively.	1	2	3	4	5
3. Unattractive features of my physique/figure make me nervous.	1	2	3	4	5
4. In this setting, I feel apprehensive about my physique/figure.	1	2	3	4	5
5. I feel comfortable with how fit my body appears to others.	1	2	3	4	5
6. It makes me uncomfortable to know that other people are evaluating my physique/figure.	1	2	3	4	5
7. When it comes to displaying my physique/figure in this setting, I feel shy.	1	2	3	4	5
8. I feel relaxed when it is obvious that other people in the room are looking at my physique/figure.	1	2	3	4	5
9. Wearing my workout clothes, I feel nervous about the shape of my body.	1	2	3	4	5

**State Self-Objectification Questionnaire** (Prichard & Tiggemann, 2012b)

Please indicate how *important* the following attributes are to you **right now** by placing a vertical line at the appropriate position on each horizontal line.

*Physical Coordination*

Not at all | \_\_\_\_\_ | Very much

*Health*

Not at all | \_\_\_\_\_ | Very much

*Weight*

Not at all | \_\_\_\_\_ | Very much

*Strength*

Not at all | \_\_\_\_\_ | Very much

*Sex Appeal*

Not at all | \_\_\_\_\_ | Very much

*Physical Attractiveness*

Not at all | \_\_\_\_\_ | Very much

*Energy Level (e.g., stamina)*

Not at all | \_\_\_\_\_ | Very much

*Firm/Sculpted Muscles*

Not at all | \_\_\_\_\_ | Very much

*Physical Fitness Level*

Not at all | \_\_\_\_\_ | Very much

*Measurements (e.g., chest, waist, hips)*

Not at all | \_\_\_\_\_ | Very much

### Task Self-Efficacy for Yoga

Please read each of the following statements **carefully** and indicate how confident you are that you can perform each of these activity-related tasks **during a 60-minute yoga class**.

Rate your degree of confidence by **circling a number** from 0% (*Not At All Confident*) to 100% (*Completely Confident*) on the scales provided **below each statement**.

#### How confident are you that you can...

1. Pace yourself to avoid over-exertion?

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%

Not At All Confident.....Completely Confident

2. Perform all the yoga poses?

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%

Not At All Confident.....Completely Confident

3. Follow directions from a yoga instructor?

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%

Not At All Confident.....Completely Confident

4. Complete the yoga poses using proper technique?

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%

Not At All Confident.....Completely Confident

5. Focus completely on coordinating your breath with body movements?

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%

Not At All Confident.....Completely Confident

Please read each of the following statements **carefully** and indicate how confident you are that you can perform each of these activity-related tasks **during a 60-minute yoga class**.

Rate your degree of confidence by **circling a number** from 0% (*Not At All Confident*) to 100% (*Completely Confident*) on the scales provided **below each statement**.

**How confident are you that you can...**

6. Smoothly transition from one pose to another?

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%

Not At All Confident.....Completely Confident

7. Sense how you are doing the poses by using an internal focus?

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%

Not At All Confident.....Completely Confident

**Exercise-Induced Feeling Inventory**  
(Gauvin & Rejeski, 1993)

**HOW ARE YOU FEELING?**

**Instructions:** Please use the following scale to indicate the extent to which each word below describes how you feel at this moment in time. Record your responses by circling the appropriate number next to each word.

<b>FEELING</b>	Do not feel	Feel slightly	Feel moderately	Feel strongly	Feel very strongly
1. Refreshed	0	1	2	3	4
2. Calm	0	1	2	3	4
3. Fatigued	0	1	2	3	4
4. Enthusiastic	0	1	2	3	4
5. Relaxed	0	1	2	3	4
6. Energetic	0	1	2	3	4
7. Happy	0	1	2	3	4
8. Tired	0	1	2	3	4
9. Revived	0	1	2	3	4
10. Peaceful	0	1	2	3	4
11. Worn-out	0	1	2	3	4
12. Upbeat	0	1	2	3	4



## Appendix F: Standardized Class Sequence

### Warm-Up: Mountain I

- Child's pose
- Side stretch starting from Table Top
- Cat/cow
- Downdog
- Ragdoll
- Samastithi (equal standing pose)

### Sun Salutation A #1 (slow): Valley I

- Mountain
- Forward fold
- Halfway lift
- Chaturanga (high to low plank)
- Updog
- Downdog

### Chaturanga Demo

- High/low plank variation on toes
- High/low plank variation on knees
- High plank variation on knees or toes, NO low plank

### Sun Salutation A #2 (flow: one breath to one movement)

- Mountain
- Forward fold
- Halfway lift
- Chaturanga
- Updog
- Downdog

### Sun Salutation A #3 (flow)

- Mountain
- Forward fold
- Halfway lift
- Chaturanga
- Updog
- Downdog

**Sun Salutation B #1 (slow): Mountain II**

- Chair pose
- Forward fold
- Halfway lift
- Chaturanga
- Warrior II
- Extended side angle
- Reverse warrior
- Chaturanga

**Sun Salutation B #2 (flow)**

- Chair pose
- Forward fold
- Halfway lift
- Chaturanga
- Warrior II
- Extended side angle
- Reverse warrior
- Chaturanga
  
- Childs pose (to rest)

**Sun Salutation B #3 (flow)**

- Chair pose
- Forward fold
- Halfway lift
- Chaturanga
- Warrior II
- Extended side angle
- Reverse warrior
- Chaturanga

**Crescent Lunge Series (Right side)**

- Crescent lunge
- Revolved crescent lunge
- Runners lunge
- High plank
- Modified side plank
- Chaturanga to downdog OR just downdog

**Crescent Lunge Series (Left side)**

- Crescent lunge
- Revolved crescent lunge
- Runners lunge
- High plank
- Modified Side plank
- Chaturanga to downdog OR just downdog
  
- Child's pose (to rest)

**Triangle Series (Right side)**

- Crescent lunge
- Warrior II
- Triangle
- Prasarita (wide-legged forward fold)
- Warrior II
- Reverse Warrior
- Chaturanga

**Triangle Series (Left side)**

- Crescent lunge
- Warrior II
- Triangle
- Prasarita
- Warrior II
- Reverse Warrior
- Chaturanga
- Samastithi

**Balancing Series: Valley II**

- Eagle (Right side)
- Eagle (Left side)
- Mountain pose
- Tree (Right side)
- Tree (Left side)

**Sun Salutation A**

- Mountain
- Forward fold
- Halfway lift
- Chaturanga
- Updog
- Downdog

**Hips and Seated: Mountain III**

- Half-pigeon (right side)
- Half-pigeon (left side)
- Cobra
- Floor bow (or 2<sup>nd</sup> set of cobra)
- Baddha konasana (butterfly)
- Seated forward fold
- Bridge
- Supta baddha konasana (reclined butterfly)
- Happy baby
- Supine spinal twist (right side)
- Supine spinal twist (left side)

**Final Relaxation**

- Savasana (corpse pose)

## Appendix G: Yoga Instructor Script

### Welcome/Introduction

Hello, my name is Hannah. I am currently a yoga instructor and undergraduate student here at the University of Minnesota, and I will be guiding you through a sixty minute all levels vinyasa style yoga class.

### Warm-Up: Mountain I

Let's all begin on our mat in extended child's pose. Bring your big toes to touch back of your mat, open your knees as wide as is comfortable and surrender your belly between your thighs. Rest your forehead down on your mat, reach your arms towards the top of your mat, and spread your fingers apart. Feel free to rock your head from side to side, massaging the space between your eyebrows. Let your hips sink closer to your heels.

We'll unite the breath and the energy in the room. Start by exhaling all of the air from your lungs, let everything go. Then inhale deeply through your nose, fill your lungs top to bottom and side to side, and open mouth exhale sigh out. Inhale, fill up. Open mouth exhale, let go. One more time. Inhale through the nose, and open mouth exhale, out.

Now seal your lips and start to engage ujjayi pranayama. Pranayama meaning breath, so this is your breath of victory or breath of heat. Inhale deeply through your nose, and as you do so constrict the muscles in the back of your throat, and then exhale deeply out your nose. Let your inhales melt right into your exhale. Make this breath textured like you are fogging up a mirror and audible like the sound of the ocean. Work to create steadiness and length in your breath even as you move through the various postures. If this steadiness is ever compromised or your breathing become labored and hard to maintain, simply come right back here to child's pose and join back into the practice whenever you are ready to do so.

Take one more deep inhale, and deep exhale. On your next inhale come forward to a tabletop pose, and exhale stack your shoulders over your wrists and hips over your knees. Find a flat back and long spine by reaching the crown of your head forward and your tailbone towards the back of the room. From here, walk your hands to the right side of your mat, make a c-shape with your spine and send your hips down and back towards your heels. Feel a stretch in your left side body. Allow your head to rest softly on the mat. Take one more inhale, and exhale release. Walk your hands back through center and then to the left side of your mat. Make that same c-shape with your spine and bring hips down and back. Walk your fingers a little bit further away from your body to feel a deeper stretch in right torso. Last inhale, and exhale release. Come back to table pose. Next we'll move through a few rounds of cow and cat.

Inhale, cow pose, drop your belly and lift your gaze skyward. Exhale cat pose, tuck chin to chest and round your spine.

Inhale cow pose, drop belly, tilt tailbone up, and look up. Exhale cat pose, chin to chest, and draw navel in towards your spine.

Inhale cow pose. Exhale cat pose.

Come back to tabletop, neutral spine, for spinal balancing. Reach your right arm forward, bicep close to your ear and extend your left leg behind you. Keep a flat back, and slightly tuck your chin to find a long neck. Level off your hips so that they are square to the mat. Inhale find length, reach from fingertips to toes, and exhale draw knee to elbow. Inhale lengthen, exhale knee to elbow, cat your back. Last time. Inhale length, exhale knee to elbow, curl and round. Inhale lengthen out, exhale tabletop. Other side. Reach your left arm forward, bicep close to your ear and extend your right leg behind you. Drop your right hip slightly so that it is inline with the left. Find a long spin, slightly tuck your chin. Inhale lengthen arm and leg, exhale draw knee to elbow. Inhale length, reach long, exhale knee to elbow, inhale, exhale, knee to elbow. Inhale reach and exhale tabletop pose.

Inhale prepare, exhale downward facing dog. Curl your toes under and lift your hips toward the ceiling. Take some movement in your downward dog. Pedal out your feet, bend your knees, look under right and left armpit. Then find some stillness and set up the alignment in your downdog. Look to your hands briefly and notice that they are shoulder width distance apart, press more weight into your thumbs and forefingers. Externally rotate your upper arm bones to spread your shoulder blades apart and away from your ears. Lift your sitting bones towards the ceiling and draw your navel into your spine to engage your core. This is also called uddiyana bandha or core lock. Feet are hip width distance and know that you can bend your knees any amount if that feel better in your hamstrings.

Inhale look to the top of your mat, exhale ragdoll pose. Step your feet behind your wrists, feet are frontal hipbone distance apart. Grab opposite hand and opposite bicep or elbow. Bring bend to your knees if that feels good. Sway side to side, let your head and neck be very heavy. Now switch your grip and bring the other forearm in front. Keep finding movement or stillness. Release your grip and we'll find a chest expansion. Interlace your hands behind your lower back or grab onto your elbows. Send your knuckles over head as your bring your torso closer to your thighs. Release your hands down to the mat. Bring your feet together to touch, bend your knees and then slowly rise until to standing, uncurling, take your time. Head and neck are the last thing to lift.

Once you reach the top, inhale shoulders up to ears, exhale drop them down your back. Bring your palms to touch and guide your thumbs to heart center. For Samastithi, standing at attention pose. Bring equal weight into both feet. Find active and strong legs by squeezing your thighs together and lifting up on your kneecaps to engage your quadriceps. Find a strong core by drawing your navel towards your spine, and lift your heart to your thumbs. Close your eyes for a moment, and lets set an intention or dedication for practice. Think of a person, place, or thing that you would like to dedicate your efforts, your breath, and movement today. It could be a loved one or a cause you

feel passionate about. Lets send that out together with breath. Exhale all of the air from your lungs. Inhale through your nose fill up with that intention. Open mouth exhale send it out. Reseal your lips. Continue strong ujjayi breathing and bring your arms by your sides. Next we'll move through Sun Salutation A.

### **Sun Salutation A #1: Valley I**

Inhale mountain pose. Reach your arms overhead and bring your biceps by your ears. Hold and breathe here. Root your feet down into the mat, squeeze your thighs together. Relax your shoulders away from your ears, and turn your pinkies inward to maintain active arms. Inhale here. Exhale forward fold. Hinge from your hips and bring your arms wide. Let your head and neck be heavy and stretch out through your hamstrings. Inhale halfway lift, bring your hands to your shins or thighs, and breathe here. Flatten out your back by reaching crown of head forward and tailbone back. But just keep your chin slightly tucked to keep upper spine long. Inhale, and exhale step back to a high plank pose. Plant your palms on the mat and step your feet back. Option here to come down to your knees. Hands are shoulder width distance, gaze down to your mat. Keep hips right in line with your shoulders and if knees are off the mat, straighten out your legs. Inhale shift forward slightly onto tipee toes, exhale low just half-way to low plank pose. Keep your elbows close to your body. Inhale upward facing dog. Un-tuck your toes, tops of the feet to the mat, straighten your arms and lift your chest. Exhale downward facing dog. Take one inhale here, and one exhale. Come down to your knees and I will give a demonstration of what we just did which is called chaturanga or high-to-low plank.

### **Chaturanga Demo**

**\*have students take a seat on their mat and watch demo with several modifications**

I will give a demonstration of chaturanga or high-to-low plank because we will be doing a lot throughout the practice. To start, inhale half-ways lift, bring hands to shins or thighs, just depending on your flexibility and find a flat back and long spine, rather than rounding. Do this by reaching crown of head forward and tailbone back. Inhale, and exhale plant palms, step back to a high plank pose. Here in high plank, work to find a long spine and strong core. Bring shoulder above your wrist joints and charge your heels towards the back of the room. Keep hips right in line with shoulders rather than hiking them up or sinking them low to the ground. From here, inhale shift forward onto tipee toes, exhale lower just half-way. So, very similar to a triceps pushup. Keep your elbows and upper arms pinned in towards your torso and ribs. Inhale upward facing dog. Lift your chest, bring the tops of your feet and toenails to the mat. Firm your thighs, straighten out your legs and lift your knees off the mat. This will keep you from dumping weight into your lower back. And then downward facing dog.

A second option is to modify by coming down to your knees if you are still working on building strength in your triceps or maybe have a shoulder injury. From high plank pose, come down to knees. And same as before, shift forward just slightly and lower half-way,

keeping elbows close to body. Upward facing dog, same as before. And then downward facing dog.

A third option is to simply come to high plank pose and hold and breathe either on your toes or knees and then push straight back to downward facing dog, rather than moving into the low plank or triceps pushup.

### **Sun Salutation A (Flow 2x)**

Next we will flow this sequence linking one breath to one movement. So lets all meet back in downward facing dog.

Inhale look forward, exhale step your feet top of your mat, toes and heels touch. Inhale halfway lift, flat back, exhale forward fold. Inhale mountain pose, reach your fingers overhead. Exhale forward fold. Inhale halfway lift, exhale chaturanga, high-to-low plank, option to come to knees to hold plank. Inhale upward facing dog, knees lift off your mat, exhale downward facing dog. Inhale send your hips to the ceiling, lengthen spine, exhale, press your heels more into the mat. Inhale, exhale. Inhale look forward, exhale step feet top of mat. Inhale halfway lift, exhale forward fold. Inhale mountain pose, exhale forward fold. Inhale halfway lift, exhale chaturanga, remember you can modify. Inhale upward facing dog, exhale downward facing dog. Inhale, exhale, inhale, exhale.

### **Sun Salutation B: Mountain II**

Inhale look forward, exhale step feet top of mat. Inhale chair pose, bend your knees, sink your hips low and reach your biceps by your ears. Breathe here. Bring more weight into your heels. Squeeze your ankle and shinbones together and bring inner thighs closer. Keep core tight by drawing navel to spine. Reach your fingertips closer to the front. Inhale here, exhale forward fold. Inhale halfway lift, exhale chaturanga. Inhale upward facing dog, exhale downward facing dog.

(\*Starting with the right side of the body)

Inhale right leg high, exhale low lunge. Step your foot between your hands. Inhale warrior II. Spin your back heel down to the mat, lift your chest, and bring your arms to a "T". Find front heel to back arch alignment in your feet. Bend your front knee so that it stacks directly above your ankle joint. Straighten out your left leg a lot. Stack your shoulders above your hips.

Inhale prepare, exhale extended side angle pose. Reach your right arm forward and bring your elbow to the inside or rest it on top of your front knee. Reach your left fingers directly to the ceiling. Keep your belly off your front thigh, and open your chest more towards the sidewall. Use your elbow to open your knee more towards the pinkie toe side of your foot. Gaze can be down, out, or up.



Inhale reverse warrior. Keep the bend in your front knee. Reach your left hand down onto your back thigh and stretch your right arm high. Breathe here. Lengthen through both sides of your torso and keep the back leg straight and strong. Keep hips sinking low as you lengthen through the sides of your waist.

Inhale, and exhale chaturanga. Circle your arms, plant your palms, high to low plank. Inhale upward facing dog. Exhale downward facing dog.

Other side. Inhale left leg high, exhale low lunge

\*\*\*Now repeat script from the right side of the body on the left side of the body.  
 \*\*\*Students will end in downward facing dog after I slowly cue the right and left side.  
 Next I will cue them through flowing 2 more sets of Sun B.

Next we will flow Sun B one breath to one movement.

(2<sup>nd</sup> set Sun B)

Inhale look forward, exhale step top of mat. Inhale halfway lift, exhale forward fold. Inhale chair pose, sink hips low, exhale forward fold. Inhale halfway lift, exhale chaturanga. Inhale right leg high, exhale low lunge. Inhale warrior II, spin the back heel down, lift your chest, exhale extended side angle. Inhale reverse warrior, stretch your side body, and exhale chaturanga. Inhale upward facing dog, exhale downward facing dog.

Inhale left leg high, exhale low lunge. Inhale warrior II, lift your chest, exhale extended side angle, reach forward and down. Inhale reverse warrior, exhale chaturanga. Inhale upward facing dog, exhale downward facing dog.

(child's pose rest)

Inhale come down to your knees, exhale child's pose. Keep big toes touching as you draw your knees apart. Bring your belly, chest, and forehead down to the mat and reach your arms long out in front of you. Take a few moments to rest here and reconnect to your breath. Take strong, slow, steady inhales through your nose, and strong, steady exhales out your nose.

Inhale come forward tabletop, exhale downward facing dog.

(3<sup>rd</sup> set Sun B)

Inhale look forward, exhale step top of mat. Inhale halfway lift, exhale forward fold. Inhale chair pose, exhale forward fold. Inhale halfway lift, exhale chaturanga. Inhale right leg high, exhale low lunge. Inhale warrior II, exhale extended side angle. Inhale reverse warrior, exhale chaturanga. Inhale upward facing dog, exhale downward facing dog.

Inhale look forward, exhale step top of mat. Inhale halfway lift, exhale forward fold. Inhale chair pose, exhale forward fold. Inhale halfway lift, exhale chaturanga. Inhale left

leg high, exhale low lunge. Inhale warrior II, exhale extended side angle. Inhale reverse warrior, exhale chaturanga. Inhale upward facing dog, exhale downward facing dog.

\*\*Students will end in downward facing dog at the end of flowing Sun B two times.

### **Crescent Lunge Series**

*\*(Crescent lunge, twist, runners lunge, high plank, and side plank right side of body)*  
 Inhale right leg high, exhale low lunge. Make sure that your feet have their own lane and are hip-width distance apart. Inhale crescent lunge, lift your chest, face the front, and reach your fingers high. Breathe here. Keep the back leg straight and strong and charge your heel to the back of the room. Option here is to bring your left knee to rest on the ground. Drop your tailbone down and lift your frontal hip points and keep your lower ribcage tucked into your torso. Relax your shoulders. Inhale here, exhale palms touch, hands at heart center. Inhale lift your chest and lengthen your torso forward, exhale revolved crescent lunge to the right. Hook your left elbow outside your right knee or thigh. Option to come down to your back knee at any point in time to help you with balance and focus more on your twist. Press your right palm really hard into your left palm, and work your thumbs towards heart center to deep your twist. Gaze down, out, or up. You are here for three, release to runners lunge in two, and one.

Runners lunge. Place your palms to the inside of your right foot move your foot more towards the top right corner of your mat. You can make this stretch dynamic by moving side to side, forward and back. You can also drop your left knee to the mat, and either stay on palms or come to forearms only if that is what feels good in your body. Allow your head and neck to be heavy, and breath into your hips in this deep stretch. If you are not there already, come back to your palms, curl your left toes under, and step back to a high plank pose.

From high plank we will find side plank pose. Place your left knee on the mat. Roll onto your left hand and knee, and reach your right fingers to the ceiling. Ground down through the sole of your entire right foot. Option is to come off of your bottom knee and stack your legs and feet. If you are in this variation ground down through the knife-edge of your left foot. Everyone zip your oblique muscles towards the center of your body to lift your hips even higher. Hold here for three, chaturanga, high to low plank or just downward facing dog in two, and one. Either flow through your chaturanga or go straight to downward facing dog.

*\*(Crescent lunge, twist, runners lunge, high plank, and side plank left side of body)*  
 Inhale left leg high, exhale low lunge. Make sure that your feet have their own lane and are hip-width distance apart. Inhale crescent lunge, lift your chest, face the front, and reach your fingers high. Breathe here. Keep the back leg straight and strong and charge your heel to the back of the room. Option here is to bring your left knee to rest on the

ground. Drop your tailbone down and lift your frontal hip points and keep your lower ribcage tucked into your torso. Relax your shoulders. Inhale here, exhale palms touch, hands at heart center. Inhale lift your chest and lengthen your torso forward, exhale revolved crescent lunge to the left. Hook your left elbow outside your right knee or thigh. Option to come down to your back knee at any point in time to help you with balance and focus more on your twist. Press your right palm really hard into your left palm, and work your thumbs towards heart center to deep your twist. Gaze down, out, or up. You are here for three, release to runners lunge in two, and one.

Runners lunge. Place your palms to the inside of your left foot move your foot more towards the top left corner of your mat. You can make this stretch dynamic by moving side to side, forward and back. You can also drop your left knee to the mat, and either stay on palms or come to forearms only if that is what feels good in your body. Allow your head and neck to be heavy, and breath into your hips in this deep stretch. If you are not there already, come back to your palms, curl your left toes under, and step back to a high plank pose.

From high plank we will find side plank pose. Place your right knee on the mat. Roll onto your right hand and knee, and reach your left fingers to the ceiling. Ground down through the sole of your entire left foot. Option is to come off of your bottom knee and stack your legs and feet. If you are in this variation ground down through the knife-edge of your right foot. Open your chest and hips to the sidewall. Lift hips just a little higher for three, chaturanga, high to low plank or just downward facing dog in two, and one. Either flow through your chaturanga or go straight to downward facing dog.

(child's pose rest)

Inhale come down to knees and exhale come to rest in child's pose. Again we will be here just for a few moments. Reconnect with your breath and let go of your practice thus far. Allow your mind and breath to settle into the present moment.

## **Triangle Series**

\*Right side

Inhale right leg high, exhale low lunge. Inhale crescent lunge, exhale warrior II, adjust your feet, heel to arch alignment. Inhale straighten front leg, exhale triangle pose. Reach your right fingers forward and down, engaging the right thigh as you go. Reach your left fingers straight up to the ceiling and stack your shoulders. Open your chest more and keep your left shoulder rooted in its socket. Squeeze your inner thighs towards each other to help with balance. Now inhale rise to stand, exhale pivot your right foot so that it is parallel to your left foot. Inhale lift your chest, little backbend, exhale fold forward. Hinge from your hips and let your hands rest on the floor beneath your shoulders. Option to reach your hands around your ankles or cup underneath your heels, pulling your body closer to your thighs. You can also bring a bend to your knees if this feels better in your back and legs. Bring more weight forward towards your toes. Open your arms to a "T". Inhale rise to stand, push through the ball mounds of your feet to lift you, and exhale

warrior II. Inhale reverse warrior, exhale chaturanga. Inhale upward facing dog, exhale downward facing dog.

**\*Left side**

Inhale left leg high, exhale low lunge. Inhale crescent lunge, exhale warrior II, adjust your feet, heel to arch alignment. Inhale straighten front leg, exhale triangle pose. Reach your right fingers forward and down, engaging the right thigh as you go. Reach your left fingers straight up to the ceiling and stack your shoulders. Open your chest more and draw your oblique muscles to the midline, using your core to support your torso in space. Squeeze your inner thighs towards each other to help with balance. Now inhale rise to stand, exhale pivot your right foot so that it is parallel to your left foot. You can keep your arms like this or option this time to find a chest expansion. Interlace your fingers behind your lower back or just grab for your elbows. Inhale lift your chest, little backbend, exhale fold forward. Hinge from your hips and reach your knuckles overhead. Allow neck and head to be heavy, reaching head closer to the mat. Again, option to bend your knees as much as you need. Use your knuckles to guide you up. Inhale rise to stand, push through the ball mounds of your feet to lift you, and exhale warrior II. Inhale reverse warrior, exhale chaturanga. Inhale upward facing dog, exhale downward facing dog.

**Balancing Series: Valley II**

Inhale look forward, exhale step feet top of mat. Inhale halfway lift, exhale forward fold. Inhale chair pose, exhale eagle pose on the right. Swing your right arm underneath your left and cross your arms like ropes, bringing your palms to touch. Otherwise you can just grab opposite hand opposite shoulder. Lift your left leg really high then cross your left thigh over your right. If it helps with your balance, set your toes on the ground beside your right foot. Draw your knees and elbows in towards the midline of your body, so about belly button center. Lift your elbows shoulder height, and press your palms away from your face. Last inhale here, and exhale release to chair pose. Inhale chair, exhale eagle on the left. Swing your left arm underneath your right and cross your arms like ropes, bringing your palms to touch. Otherwise you can just grab opposite hand opposite shoulder. Again, you can rest your toes on the mat if that helps you balance. Now line up your elbows and knees, and sink your hips a little bit lower. Lean your shoulders back so that they stack over your hips, and your spine is perpendicular to the ground. Last inhale, and exhale release to mountain pose, reach your arms over head.

Bring your palms to touch and draw your hands to heart center. Tree pose is next. Ground down through your right foot and bring the sole of your left foot to your ankle, calf, or inner thigh. Just be sure to avoid placing your foot at the knee joint, so either above or below your knee. Be strong through the standing leg. Lift up on the knee cap and engage the quadriceps and muscles around the knee. Now if you feel stable here, feel free to reach your arms overhead like branches of a tree. Keep your gaze focused on one unmoving point. (hold for a few breaths). Tree poses release. Draw your knee forward first, then set your foot down on the mat. Other side. Bring the sole of your right foot to

your ankle, calf, or pick it up to your inner thigh. Find a similar expression here as you did on the other side. Press your foot into your leg and leg back into foot in opposition. Draw your navel in towards your spine; remain strong and stable in your core. Again, option to reach your arms over head, and focus your gaze. (hold a few breaths). Release. Step your left foot down to meet your right.

Let's flow one Sun Salutation A. Inhale mountain pose, exhale forward fold, inhale half-way lift, exhale chaturanga.

### **Hips and Seated: Mountain III**

Inhale right leg high, exhale half-pigeon pose. Bring your right knee behind your right wrist and set your shin bone on the ground. Flex your right toes towards your shin to protect your knee joint. Move your hips around a little bit from side to side so that there is equal weight distribution on both hips. Now if this doesn't feel good in your knees, you can come onto your back right now and I can guide you through a supine variation. If you are staying in half-pigeon, walk your hands back to your hips to lengthen your spine and open your chest. Inhale here and exhale start to walk your hands out in front of you. You may choose to stay upright if you feel pretty tight in your hips. Otherwise bring your hands more out in front of you. You can surrender to belly and chest towards the floor to any amount that feels ok in your body. Send you breath to the areas in which you feel this stretch. Soften the muscles in your face, shoulders, and hips, and start to soften your thoughts, only focusing on your steady inhales and exhales.

(If a student comes onto their back for supine half-pigeon I will cue the following modification: If you are on your back, bend both knees and bring your right ankle on top of your left knee. Flex your right toes a lot. Grab behind your left thigh and pull your thigh in towards your chest. Continue to flex right toes and push the right knee away from you.)

(I would cue the same exact thing on the left side of the body)

Let's release from the posture. If you are on your back, just switch to the other side. Half-pigeons, walk your hands back to your hips, lift your chest and lengthen, then curl your toes under and find downward facing dog. Pedal out your hips a few tips, neutralize your hips and spine.

Other side. Inhale your left toes high, exhale half-pigeon pose. Set your left knee behind your left wrist and bring your shin down to the mat. Flex your left toes towards your shin. Move your hips around a little bit from side to side so that there is equal weight distribution on both hips. Now, this side might feel a little different than the right side. So if you need to come onto your back here, do so now. If you are staying in half-pigeon, walk your hands back to your hips to lengthen your spine and open your chest. Inhale here and exhale start to walk your hands out in front of you. Again, you might need to stay upright on this side or you can start to bring your belly and chest to the mat.

Half-pigeons, lets release. If you are on your back, rock and roll your way back to seated then step to downward facing dog. Half-pigeons walk hands back to your hips, lift and lengthen, then find downward facing dog. Pedal out your feet a few times then find stillness.

From here, inhale high plank pose, exhale lower all the way down to your mat. Next is spine strengthening. Cobra pose is first. Plant your palms directly beneath your shoulders, and bring your elbows closer together. Zip up your legs to touch like you only have one leg and press the tops of your feet hard into the mat. Inhale lift your chest, exhale squeeze your lower back. Draw your shoulder blades away from your ear and feel them drawing down your back. Now squeeze your thighs, your quadriceps more so that your knees lift off of the mat. You are here for 3, release all the way down in two, and one. Set your chin straight down to the mat first, then set your left cheek on the mat, and bring your arms by your sides and breath. So a little bit of recovery between spine strengthening sets. Breathe into the back line of your body.

Bring your chin back to center. Next is floor bow pose. If this posture doesn't feel ok once you get in, you can take a second set of cobra pose. Floor bows bend your knees, reach back with your hands and grab the outside edges of your feet. Bring your knees closer together Inhale lift your chest, exhale kick your feet into your hands. Allow the kick to drive this posture. Building strength in your legs and flexibility in your spine. Lift your chest more and kick just a little bit harder for three, last two, and one, release your entire body all the way down to the mat. This time bring your right ear to the mat, and gaze to your left.

Everyone bring your chin back to center. Plant your palms directly beneath your shoulders, and press up to a tabletop position then find downward facing dog.

### **Final Relaxation**

Inhale look forward, exhale step your feet all the way through your hands and come to a seat on your mat. Next we will find cobblers pose or butterfly pose. Bring the soles of your feet together and allow your knees to splay open towards the edges of your mat as wide as is comfortable in your body. Ground down through your sitting bones and let your spine feel long and tall. You can stay seat in an upright position just like this, or start to lean forward hinging from your hips to deepen the stretch. Continue drawing your knees closer to the floor and lengthen in your spine. Inhales lengthen you, exhales bring you deeper. Inhale, exhale.

And release. Slowly lift your torso back to a neutral position if its not already there. Seated forward fold is next. Bring your legs out in front of you and grab onto the bottoms of your feet. Bend your knees as much as you need in order to hold your feet. Bring your chest and belly to touch your thighs. Now your knees may need to stay really bent the entire time. Start to inch your heels a little closer to the top of your mat. Once you lose your belly to thigh connection, discontinue moving your heels, and hold your posture right there. Inhale lengthen your spine, exhale fold, go a little bit deeper. Inhale length,

exhale depth. Let yourself be content with exactly where you are at right now. And slowly come out of your fold, bring your shoulders over your hips, arms out in front of you and come down to your back, one vertebra at a time.

Once you are all the way down on your back, we'll take bridge pose. Place your feet parallel and hip width distance apart. Bring your heels in closer towards your set and place your arms by your sides. Press your heels into the mat, and using your quadriceps muscles lift your back one vertebra at a time off of the mat, starting the with base of the spine, working your way up to your neck. Now at the top lift your hips just a little bit higher and squeeze your inner thighs closer to each other. You are here just for three, last two, and one. Slowly release your entire spine on the mat coming out opposite the way you came in.

Reclined bound angle pose is next. Bring the soles of your feet to touch and open your knees wide, just like your open up a book. You can rest your arms by your sides or bring one hand to your heart and the other to your belly. With you hand on your chest, notice your heart rate slow down, and also feel your belly rise and fall with ease as breath enters and exits your body.

Bring your knees together and find happy baby pose. Grab the inside or outside edges of your feet or just grab your inner thighs and pulls your thighs closer to the ground. Rock side-to-side, massage the muscles of your back and around your spine. Keep your entire spine down to the mat and let your head relax down your mat.

Next we'll take a supine spinal twist. Draw your right knee in towards your armpit space and let your left leg be long and heavy on your mat. Give your right shin and knee some compression. Then guide your knee across your body towards the left side of the room and open your arms to a "T" and gaze over your right fingertips. It doesn't matter how close your knee is to the ground, simply allow gravity to deepen this twist, not trying to force anything in your body. Keep both shoulders anchored to the mat so that this twist permeates from lower back all the way to upper next. Now start to make your way back to center, and switch out your legs. So draw your left knee in and let your right leg be long on your mat. Give your knee a hug then draw it right and gaze left.

Make your back to center, and hug both knees into your chest. Hug your arms or wrists around your shin bones and take one final deep inhale, biggest breath all day, maybe all week, and open mouth exhale, savasana, corpse pose. Release your legs long on your mat and rest your arms by your sides. Work out any last movements or fidgets here, then allow your self to be completely still for a few minutes. Let your breath be natural, simply acknowledge any thoughts your might be having and let go of any attachment to those thoughts. And simply let yourself be still and soak in all of the benefits of the past 60 minutes of your practice.

(Let students rest in savasana for about 5 minutes in silence)

**Ending**

Let's start to make our way out of savasana. Start by deepening the breath into and out of your lungs. Then start to wiggle out your fingers and toes, and gently rock your chin from shoulder to shoulder, reawaking through your spine. Now send your arms overhead and stretch from fingertips to toes, just like you are waking up in the morning. Then bend your knees into your chest and come to a fetal position on your right side, using your right arm as a pillow. Let your body be soft here and still completely relaxed in your fetal position. With your eyes closed, slowly make your way to a comfortable seat, either cross your legs or sit on your knees. Bring your palms to touch and draw your thumbs to heart center. Root down through your sitting bones, and sit up just a little bit taller, lengthening your spine and reaching the crown of your head towards the sky. And lift your heart to your thumbs. It was truly an honor to guide each and every one of you through your yoga practice this afternoon. Now bring your thumbs to third eye center, the space between your eyebrows. The teacher, the light, and spirit in me honors and is so grateful for the teacher, the light, and the spirit in all of you. And we will end this practice with a word and gesture that in Sanskrit means "I see you" or "the spirit in me sees the spirit in you". So bowing forward we will seal in this practice with Namaste.

Thank you all so much for participating in this 60 minutes of yoga practice. Again my name is Hannah, if you have any questions or comments for me I would love talk. Otherwise please see Amanda if you have any further questions.



## Appendix H: Post-Test Only Surveys

### State Appearance Comparison Scale (Herbozo & Thompson, 2010)

During today's yoga class, to what extent did you...

1. Think about your own appearance?

No thought about my appearance.....						A lot of thought about my appearance
1	2	3	4	5	6	7

2. Compare your overall appearance to that of other research participants in the study?

No comparison.....						A lot of comparison
1	2	3	4	5	6	7

3. Compare your specific body parts to those of other research participants in the study?

No comparison.....						A lot of comparison
1	2	3	4	5	6	7

4. Compare your overall appearance to that of the yoga instructor?

No comparison.....						A lot of comparison
1	2	3	4	5	6	7

5. Compare your specific body parts to those of the yoga instructor?

No comparison.....						A lot of comparison
1	2	3	4	5	6	7

**State Mindful Attention Awareness Scale**  
(Brown & Ryan, 2003)

Using the 0-6 scale shown, please indicate the degree to which you were having each experience described below **during the yoga session**. Please answer according to what **really reflected** your experience rather than what you think your experience should have been.

	Not at All			Somewhat			Very Much
	0	1	2	3	4	5	6
1. I was finding it difficult to stay focused on what was happening.	0	1	2	3	4	5	6
2. I was doing the poses without paying attention.	0	1	2	3	4	5	6
3. I was preoccupied with the future or past.	0	1	2	3	4	5	6
4. I was doing the poses automatically, without being aware of what I was doing.	0	1	2	3	4	5	6
5. I was rushing through the poses without being really attentive to them.	0	1	2	3	4	5	6

**Intentions to Engage in Yoga**  
(adapted from Bryan & Rocheleau, 2002)

Please indicate how likely you are to engage in the following behaviors **within the next three months**, ranging from 1 (*Not At All Likely*) to 7 (*Very Likely*). Circle the appropriate number beside each statement.

How likely is it that you will...	Not At All Likely					Very Likely	
...talk to your friends about yoga in the next three months?	1	2	3	4	5	6	7
...get or buy equipment that can be used for yoga (workout clothes, yoga mat) in the next three months?	1	2	3	4	5	6	7
...go to a recreation center or a yoga studio to do yoga in the next three months?	1	2	3	4	5	6	7
...actually do yoga for at least three times a week in the next three months?	1	2	3	4	5	6	7


### Frequency of Mirror Gazing Visual Analogue Scale

Today's yoga class took place in a room with mirrors. We are interested in students' experiences with mirrors during yoga. Please think about your usage of mirrors during **today's** yoga class when answering the following questions.

For the following two questions, please put an **X** on the line at the point that indicates your rating. The **X** can be placed so that it directly corresponds to one of the numbers shown, or so that it lies anywhere in between the numbers shown.


**1. During today's yoga class, what percentage of the time did you use the mirror to look at your own reflection?**

Never      0%   5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95   100%   All of the Time



**2. During today's yoga class, what percentage of the time did you use the mirror to look at other people's reflections?**

Never      0%   5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95   100%   All of the Time



### Preferences for Mirrors in Group Exercise/Yoga

We are interested in students' preferred locations for mirrors in different types of group exercise classrooms. Please indicate your typical preference by placing a check mark in the appropriate box.

1. My preferred location for mirrors in a **group exercise class** (not yoga) is:

- Front of the room
- Side of the room
- Back of the room
- Anywhere/Don't Mind
- Nowhere/ Prefer no mirrors

2. My preferred location for mirrors in a **yoga class** is:

- Front of the room
- Side of the room
- Back of the room
- Anywhere/Don't Mind
- Nowhere/ Prefer no mirrors

**Background Information**

1. Do you currently practice yoga, or have you practiced yoga within the past 12 months?

*(circle)*

Yes

No

2. If you answered “yes”, how many months or years have you been practicing yoga?

- a. Less than 1 month
- b. 1 to 6 months
- c. 6 – 12 months
- d. 1 – 3 years
- e. More than 3 years

3. How many hours per week do you practice yoga on average?

- a) Less than 1 hour
- b) 1-2 hours per week
- c) 3-5 hours per week
- d) 5-7 hours per week
- e) More than 7 hours per week

4. To the best of your ability, please estimate your current...

Height: \_\_\_\_\_ ft. \_\_\_\_\_ in.

Weight: \_\_\_\_\_ lbs.

### Leisure Time Exercise Questionnaire (Godin & Shephard, 1985)

Considering a typical week (7 days) in the past month, **how many hours** did you do the following kinds of physical activity? Examples of activities appear in each category, but you may think of activities that are not listed. The key is to decide whether the activity makes your heart beat rapidly, requires effort but is not exhausting, or requires minimal effort

Use the grid on the left to tally the number of hours each day in each category. Then mark your total under the questions on the right.

	<b>Strenuous Activity (# hours)</b>	<b>Moderate Activity (# hours)</b>	<b>Mild Activity (# hours)</b>
<b>Mon</b>			
<b>Tues</b>			
<b>Wed</b>			
<b>Thurs</b>			
<b>Fri</b>			
<b>Sat</b>			
<b>Sun</b>			
<b>TOTAL</b>			

a) **STRENUOUS PHYSICAL ACTIVITY  
(HEART BEATS RAPIDLY)**

Examples: fast biking, aerobic dancing, running, jogging, swimming laps, rollerblading, skating, tennis, cross-country skiing, soccer, basketball

- None
- Less than ½ hour per week
- ½ to 2 hours per week
- 2¼ to 4 hours per week
- 4¼ to 6 hours per week
- More than 6 hours per week

b) **MODERATE PHYSICAL ACTIVITY  
(EFFORT, BUT NOT EXHAUSTING)**

Examples: fast walking, dancing, easy swimming, baseball/softball, easy bicycling, volleyball, badminton, strength training, skiing, snowboarding, skateboarding

- None
- Less than ½ hour per week
- ½ to 2 hours per week
- 2¼ to 4 hours per week
- 4¼ to 6 hours per week
- More than 6 hours per week

c) **MILD PHYSICAL ACTIVITY (LITTLE  
EFFORT)**

Examples: easy walking, bowling, horseshoes, golf, fishing, yoga, stretching muscles, household chores, snowmobiling

- None
- Less than ½ hour per week
- ½ to 2 hours per week
- 2¼ to 4 hours per week
- 4¼ to 6 hours per week
- More than 6 hours per week