DISSERTATION

THE INFLUENCE OF MIRROR EXPOSURE ON WEIGHT-RELATED HEALTH BEHAVIORS: PHYSICAL ACTIVITY AND FOOD SELECTION

Submitted by

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ABSTRACT

THE INFLUENCE OF MIRROR EXPOSURE ON WEIGHT-RELATED HEALTH BEHAVIORS: PHYSICAL ACTIVITY AND FOOD SELECTION

In terms of Objective Self-Awareness (OSA) theory, heightened focus on the self leads individuals to align their behavior with a personally- or socially-derived standard. Exposure to a mirror may increase self-awareness and has previously been found to induce behaviors that align with a known or implied standard, such as honesty and helping behavior. However, very little research has investigated the influence of mirror exposure on health behaviors, which are commonly valued. The present research describes two studies examining the effects of mirror exposure on the health behaviors of stair vs. elevator use and food selection, hypothesizing that individuals exposed to a mirror prior to one of these health choices would be more likely to take the stairs instead of the elevator and to select more healthful food products (i.e., lower in calories, saturated fat, sugar, and sodium), respectively. University students (n = 204 for stair use and n = 79 for food selection) were observed as they chose to take the stairs or elevator to the fourth floor of a campus parking garage or after they selected four food items from a laboratory-turned-grocery aisle, and then were surveyed on demographic information and their behaviors likely linked with physical activity and healthy eating. Results indicate that participants' odds of stair use were increased after exposure to a body-length mirror with a health sign describing caloric expenditure during stair use (OR = 2.99, $p = 0.06$, 95% CI: 0.96, 9.31) and after exposure to a social norm sign on its own (i.e., without a mirror) describing the high stair use of university students (OR = 3.63, $p = 0.02$, 95% CI: 1.21, 10.94). Neither body-length nor small mirrors

showing only the face were found to predict the mean caloric, saturated fat, sugar, or sodium content of participants' selected food items. Implications of these findings regarding weight-related health behaviors are discussed in the context of OSA theory and mirror exposure for health promotion.

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Introduction

Recent global excesses in weight gain are alarming and have motivated intervention efforts to focus on the promotion of healthy lifestyle behaviors. Body mass index, or BMI, is commonly used to provide a standardized weight-for-height assessment for adults and is calculated by dividing one's weight in kilograms by the square of their height in meters (kg/m^2; World Health Organization [WHO], 2016). The WHO reports that approximately 39% of the world's adult population is overweight (BMI $\geq$ 25) and 13% are obese (BMI $\geq$ 30; WHO, 2016). National research has concluded that 37.7% of adults in the United States are obese and rates are increasing, particularly among women (Flegal, Kruszon-Moran, Carroll, Fryar, & Ogden, 2016). Obesity may contribute to several leading causes of preventable death, including coronary heart disease, stroke, type 2 diabetes, and certain types of cancer (Centers for Disease Control and Prevention, 2016). Because a primary risk factor for several types of chronic disease is a high BMI, experts recommend increasing energy expenditure with physical activity (PA) and decreasing consumption of high-calorie foods containing a large amount of fat and sugar (WHO, 2016).

Individuals in the age range of 18-25, or "emerging adulthood" (Arnett, 2000), is of particular concern for poor health outcomes because of life changes common to this time period that make young adults especially vulnerable to unhealthy weight gain (Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008). Approximately 70% of American high school graduates attend college (United States Department of Labor, 2017) and first-year college students tend to gain weight at higher and faster rates than the general population (Vadeboncoeur, Townsend, & Foster, 2015), making universities important settings for promoting healthful behaviors among this population (Nelson et al., 2008). Young adults who are not in college may also be at risk for

weight gain and associated health issues, especially if they are employed in obesogenic work environments that support sedentary behavior and unhealthy food consumption. Because almost a third of the employed American adult's time is spent at work and those with mostly sedentary jobs are sitting for approximately 11 hours per day (Tudor-Locke, Leonardi, Johnson, & Katzmarzyk, 2011), improving physical activity and food choices on the job can not only benefit employee health, but could significantly aid in the reduction of costs to employers for employee health care, absenteeism, and lost productivity. Research has found that the total annual cost attributable to obesity-related problems among full-time employees is $73.1 billion (Finkelstein, daCosta DiBonaventura, Burgess, & Hale, 2010). Moreover, extremely obese employees, or those who have a BMI greater than 35, have been found to cost an extra $506 annually in lost productivity per worker than all other employees (Gates, Succop, Brehm, Gillespie, & Sommers, 2008) and to be responsible for 61% of excess costs to employers (Finkelstein et al., 2010). Therefore, interventions that successfully promote healthful behaviors such as PA hold important policy implications at the workplace. Common worksite interventions aimed at improving employees' PA levels via the built environment include use of treadmill workstations and stairwell enhancement.

Treadmill workstations, which replace traditional desk-and-chair workstations for employees, typically aim to decrease sitting time on the job. Employees who use treadmill workstations generally have elevated desks and computers so that they have to stand while working and have the choice of whether or not to walk on the treadmill while working and at what speed. Recent research has found that treadmill workstations improved daily PA, caloric expenditure, and work performance among employees compared to a control group who did not use them (Ben-Ner, Hamann, Koepp, Manohar, & Levine, 2014). Along with increasing

employee PA, other research has found that treadmill workstations reduced overweight and obese employees' sitting time, waist and hip circumference, low-density lipoproteins, and total cholesterol from baseline to follow-up (John et al., 2011). However, treadmill workstations can cost anywhere between $1000 and $4000 each (Ben-Ner et al., 2014), so employers may be more hesitant to implement them into their worksites for employee use.

Because the use of stairs over the more sedentary options of an elevator or escalator has been shown to have positive cardiovascular and other health benefits (Teh & Aziz, 2012), another strategy used to promote PA in multi-level buildings like worksites is that of stairwell enhancement. Stairwell enhancement involves improving the aesthetic feeling of stairwells through adornments like paint, carpet, music, and artwork. Longitudinal research has concluded that the addition of music to an office building stairwell increased stair use after three months of intervention (Kerr, Yore, Ham, & Dietz, 2004) and the addition of both music and art to worksite stairwells significantly increased stair use over the span of two years (Graham, Linde, Cousins, & Jeffery, 2013). Research on this strategy also supports combining prompts promoting stair use and stairwell enhancements to increase stair use among workers (Graham et al., 2013; Kerr et al., 2004). Like treadmill workstations, however, stairwell enhancement may be costly to implement and less supported by employers and building owners. Furthermore, evaluations of worksite-based PA interventions have indicated that using more strategies is just as effective as using fewer strategies and theory-based programs are more effective than non-theory-based programs (Taylor, Conner, & Lawton, 2012). Thus, inexpensive, theory-backed methods of encouraging regular PA among many individuals should be explored.

Several different methods have been considered and implemented in an effort to promote healthy choices among the public, including encouraging more daily leisure and utilitarian PA

and more nutritious food selection. Because research has indicated that most young adults may not be behaving in healthful ways that align with their values surrounding the importance of engaging in regular PA (Poobalan, Aucott, Clarke, & Smith, 2012) and nutritious food consumption (Graham & Laska, 2012), recent interventions have attempted to break down psychosocial barriers to such behaviors and bridge the gap between individuals' health attitudes and behaviors. Strategies that may help close the health attitude-behavior gap are using point-of-decision prompts and social norm messaging, because both aim to situationally remind people of the benefits of behaving a certain way (thereby changing or reminding individuals of their existing attitudes toward a behavior). Each of these strategies will be discussed in more detail in the following sections.

Point-of-decision prompts. Point-of-decision (POD) prompts are situational cues, such as signs, placed in areas where people are expected to make a choice between two or more behavioral options. Messages on POD signs may be health-oriented; for example, they may include statements to encourage stair over elevator or escalator use such as, "Improve your waistline, use the stairs" (Soler et al., 2010). POD prompts have been found to successfully increase stair use (Bellicha et al., 2015; Soler et al., 2010); studies conducted in public facilities and at worksites like health clinics and academic buildings determined that posting POD signage near elevators significantly increased stair use in those locations (Lee et al., 2012; Lewis & Eves, 2012). Such findings should be encouraging to public health professionals, as POD prompts provide easy and cost-effective opportunities for increasing utilitarian PA. It is likely that POD prompts are successful because they situationally remind individuals of the benefits of engaging in a specific behavior. Bargh (1994) has suggested that a key feature of automatic behavior is lack of awareness, so POD reminders encouraging positive behavior could remedy negative

habitual behavior by increasing individuals' awareness of a better alternative. For example, those who automatically choose to take the elevator because they have done so regularly in the past may respond especially well to POD prompts making them situationally aware of healthier alternatives like taking the stairs. In addition to reminding people of factors often personally-valued, such as health, social norm messaging can serve as an important mechanism for promoting behavior change by reminding individuals of behaviors commonly performed and accepted by others.

Social norms. A focus theory of normative conduct offered by Cialdini, Reno, and Kallgren (1990) conceptualizes different types of norms, or standards of regular behavior, that may influence one's actions to differing degrees. Descriptive norms indicate "typical" behavior by means of what most other people are doing in reference to a specific behavior; for example, a heavily-littered environment implies that others litter in the area (Cialdini et al., 1990). Injunctive norms, on the other hand, indicate what other people believe one should do in terms of a specific behavior, such as by suggesting that individuals "Please Do Not Litter" (Cialdini et al., 1990). Depending on the situation, both descriptive and injunctive norms can significantly affect behavior, with the more salient type of norm at the time tending to be the most influential (Cialdini et al., 1990). Turning attention toward health behaviors, Burger and Shelton (2011) found that only exposure to descriptive norm signage stating that most people use the stairs was associated with more stair and less elevator use on a university campus. Other research investigating the impact of social norms on eating behaviors has revealed that descriptive norm messaging can effectively influence both healthy and unhealthy snack selections (Burger et al., 2010) and may be more successful at increasing fruit and vegetable selection and consumption

than either injunctive norm messaging or health-focused messaging (Robinson, Fleming, & Higgs, 2014).

In addition to social norms, Schwartz (1973) argues that personal norms, or conceptions of what is self-appropriate behavior, can largely influence one's behavior because they impact the self-concept and are often derived from social standards. Like refraining from littering (Cialdini et al., 1990), engaging in PA and eating a healthy diet tend to be widely recognized as important behaviors (Steptoe et al., 2002), thus making appropriate foundations for normative messaging on POD prompts. However, the act of reminding individuals of their valued health-goals matters just as much, if not more, than the content of the messages, and will be discussed in the following section.

Self-monitoring. One of the most effective strategies for helping individuals lose or maintain weight has been employing self-monitoring, or the systematic tracking of one's behaviors known to be related to physical health (Kanfer, 1970). It is important to clarify that the term "self-monitoring" being used here refers to its conceptualization in dietary literature and not to what social psychologists define as "self-observation and self-control guided by situational cues to social appropriateness" (Snyder, 1974). Based on self-monitoring research in dietary contexts, for example, weight loss programs may recommend regular self-weighing to track individual dietary and PA progress. Longitudinal evidence has linked self-weighing with more successful weight loss and maintenance (Butryn, Phelan, Hill, & Wing, 2007; Thomas, Bond, Phelan, Hill, & Wing, 2014), however, it is less clear why such a strategy is effective. Baker and Kirschenbaum (1993) have argued that consistent self-weighing works well for weight loss because the regular monitoring of one's body weight heightens self-awareness. It is therefore logical to assume that more frequent attention directed toward the self would help individuals

better regulate their behavior in accordance with their weight loss goals. A recent study conducted by Hodgin and Graham (under review) examined this idea further by looking at the short-term effect of a single bout of self-weighing on food selection in a mock grocery task. They found that those who weighed themselves before vs. after the food choice was made selected foods significantly lower in calories and saturated fat. Because even one instance of heightened self-attention appears to be an important factor in inciting healthy behavior change, the next section will evaluate self-awareness more in-depth along with the associated psychosocial theories and strategies underlying the effectiveness of reminding people of their health-related values.

Theoretical Framework

Cognitive dissonance. Festinger's (1957) theory of cognitive dissonance postulates that mental discomfort arises when one's attitudes and behavior are discrepant. In an attempt to relieve the discomfort, individuals adjust their attitudes (Elliot & Devine, 1994) and/or their behavior (Draycott & Dabbs, 1998), making the introduction of cognitive dissonance an effective persuasion strategy. Inducing hypocrisy by reminding an individual who values a behavior of their current or past failures engaging in that same behavior, leads to dissonance and frequently, behavior change (Aronson, Fried, & Stone, 1991). Regarding positive health behavior change, utilization of the hypocrisy paradigm has increased condom use (Thompson, Kyle, Swan, Thomas, & Vrungos, 2002), reduced risk factors for eating disorders (Becker, Smith, & Ciao, 2006), and increased sunscreen use (Stone & Fernandez, 2011). Furthermore, Bator and Bryan (2009) were able to increase both exercise intentions and behavior among college students by asking them to give reasons why they do not exercise regularly and then having them sign a poster promoting regular exercise in the campus recreation center. Such findings make evident

the significance of reminding individuals of their own hypocrisy by drawing attention toward the gap between their behavior and their personal values. The next theory that will be discussed, objective self-awareness theory, sheds more light on the reasons why certain behaviors may be induced after drawing attention to the self.

Objective self-awareness. Objective Self-Awareness (OSA) theory (Duval & Wicklund, 1972), suggests that when attention is directed toward the self, individuals make a mental comparison of the self to a "standard" or what the individual considers to be the correct behavior of a person in that situation. A comparison that results in a discrepancy between the self and the standard will lead to cognitive dissonance and an attempt to close the perceived gap. Due to this drive for consistency between the self and the standard, self-awareness has been known to moderate the attitude-behavior relationship (Carver, 1975; Wicklund, 1975) such that attitudes are more predictive of behavior when the individual is aware of the self. In contrast to traits of self-focus typically seen as more stable, such as self-consciousness (Buss & Scheier, 1976; Carver & Glass, 1976), self-awareness depends on the situation and is considered highly changeable (Carver & Glass, 1976).

In addition to video cameras and viewing pictures of oneself, mirrors have commonly been used to heighten self-awareness by drawing attention toward the self (Govern & Marsch, 2001). For example, after setting a situational standard that suggested positive attitudes toward punishment (delivering electric shocks for mistakes in learning), Carver (1974; 1975) found that participants who were exposed to a mirror administered more electric shocks as punishment to a "learner" than those who were not exposed to a mirror. In addition, results from Carver's (1975) experiment assessing personal vs. situational attitudes toward aggression reveal that self-

awareness is key in aligning one's attitudes and behavior, as just making one's attitudes salient is not enough to bridge the gap.

Another study capitalizing on OSA theory and mirror exposure to investigate the typically-transgressive behavior of cheating found that significantly fewer participants cheated on an anagram test when a mirror was present in the testing room (Diener & Wallbom, 1976). The study authors speculated that both increased self-awareness via the mirror and decreased deindividuation, or a higher sense of responsibility for personal actions as a result of self-awareness (see Zimbardo, 1970), were responsible for the reduction in cheating behavior that was witnessed in that condition. Similar research by Beaman, Klentz, Diener, and Svanum (1979) supports Diener and Wallbom's (1976) conclusions by indicating that trick-or-treating children were less likely to break a standard put forth by experimenters asking that they each only take one piece of candy when a mirror was placed behind the candy bowl, and this effect was strengthened when children were individuated by saying their name and address aloud before taking the candy. More recent work by Abbate, Isgrò, Wicklund, and Boca (2006) also supports the moderating effect of self-awareness on the relationship between individuation and conformity to a personally or socially-valued behavior with the discovery that people who saw themselves in a handheld mirror were significantly more likely to help the researcher with a "favor" than those who saw a picture of someone else.

OSA and PA. Although previous research on OSA theory has studied the role of mirrors in producing aggression, honesty, and helping behaviors, very few studies have investigated the role of mirror-induced self-awareness in promoting healthy behaviors like PA and nutritious food selection. Considering the promotion of utilitarian PA, Hodgin and Graham (2016) manipulated full-length mirrors to reflect slightly thinner, slightly wider, or normal body sizes and examined

students' subsequent stair or elevator use to a higher floor in a university parking garage. Interestingly, they found no effects of mirror type on the more-active choice to use the stairs and found that participants were more likely to take the stairs in the no-mirror condition than any of the conditions where a mirror was present. The study authors postulated that their contrary-to-hypothesized results occurred because college students tend to be more extrinsically (e.g., appearance-focused) than intrinsically (e.g., health-focused) motivated to engage in physical activity (Kilpatrick, Hebert, & Bartholomew, 2005) and may not have seen taking the stairs over the elevator as an activity that would obviously change their appearance. Those in the mirror-condition, then, may have been more likely to choose the less physically-demanding method of floor-ascension and take the elevator, especially if they were reminded of being far from an ideal standard in terms of physical activity participation, which tends to be the case among college students (Heatherton & Baumeister, 1991; Hodgin & Graham, 2016). Future research should thus investigate the effects of mirror exposure on other populations and types of health behaviors that may be more strongly associated with extrinsic motivators, such as weight loss or social acceptance.

OSA and dietary behaviors. Somewhat more research has been conducted on the relationship between self-awareness and eating behaviors, but offers inconclusive results. For example, Pliner and Iuppa (1978) hypothesized that obese individuals are less self-aware when eating and thus tend to eat more than healthy-weight individuals, but experimentally-established that both those who were overweight and of a healthy-weight ate significantly less when in the presence of a mirror. However, inconsistent with OSA theory, the authors did not find a negative relationship between actual-ideal weight discrepancy and consumption quantity in the mirror condition for either weight class of participants (Pliner & Iuppa, 1978). On the other

hand, Heatherton and Baumeister (1991) conceptualize OSA in terms of an "escape theory," suggesting that individuals who are far from an ideal standard, such as those who tend to consume excessive amounts of food at one time (binge), may actually experience higher levels of uncomfortable self-awareness due to having inflated perceptions of social demands. These increased feelings of "aversive" self-awareness are typically associated with negative affect like low self-esteem and depression stemming from a perceived inability to meet high standards, so binge-eating may take place as a method of escaping from such awareness and diverting cognitive attention to the immediate situation involving eating (Heatherton & Baumeister, 1991). Although this explanation and the research by Pliner and Iuppa (1978) offer more psychological rationale for the effects of self-awareness on eating behaviors, they tend to focus on clinical populations while neglecting the realistic food-choice behaviors of average people. Consequently, future studies should assess how common food items chosen by average consumers vary as a function of the consumers' situationally-induced self-awareness.

A more recent study utilized a non-clinical sample to observe mirror-induced self-awareness and one factor frequently related to eating behavior: taste perceptions. Jami (2016) concluded that participants who were exposed to a mirror rated chosen unhealthy snack food (e.g., brownies) as less tasty than those not exposed to a mirror, because they were attributing the discomfort felt from their discrepant actual-ideal eating behavior to the food's taste. This study provides a key reason why consumers may eat less while self-aware, however, it does not reflect realistic food selection processes typically performed by the public. To address this gap and aid in the prevention of less healthful eating behaviors, research should examine how situational self-awareness impacts the type of food initially selected, before consumption even occurs.

Research Purpose and Main Hypotheses

The overall research presented next describes two studies that investigated the impact of mirror exposure on the weight-relevant health behaviors of physical activity and food selection. In light of OSA theory, both studies hypothesized that exposure to a mirror would improve the health choices made by undergraduate university students; specifically, it was predicted that mirror exposure would increase physical activity via stair over elevator use (Manuscript 1) and decrease the caloric, saturated fat, sugar, and sodium content of food items chosen from a mock grocery aisle (Manuscript 2).

Effects of mirrors and promotional signage on college student stair use

The health benefits of physical activity (PA) are vast and formidable. Regular PA may prevent or lower one's risk of excessive weight gain (Hill & Wyatt, 2005) and related chronic diseases like coronary heart disease and type II diabetes (Centers for Disease Control and Prevention [CDC], 2015b) and can improve cardiorespiratory fitness, blood pressure, and psychological functioning (Fletcher et al., 1996). Furthermore, reducing non-active time to less than three hours per day may prolong life expectancy (Katzmarzyk & Lee, 2012). Although the benefits of regular activity and decreased sedentary time are significant, only 20.3% of adults (CDC, 2014) and less than 35% of college students meet the recommended guidelines for PA (Deng, Castelli, Castro-Pinero, & Guan, 2011). College students may be at particularly high risk for negative health outcomes associated with a lack of PA as they tend to show greater and faster weight gain than the general population (Holm-Denoma, Joiner, Vohs, & Heatherton, 2008; Vadeboncoeur, Townsend, & Foster, 2015). While food choices and consumption habits may influence college students' higher weight gain, research has suggested that declining PA participation is more to blame because energy intake tends to decrease during the first semester of college (Butler, Black, Blue, & Gretebeck, 2004) and students are sedentary for nearly 30 hours per week (Buckworth & Nigg, 2004).

Like physical inactivity, sedentariness can substantially contribute to unhealthy weight gain and weight-related chronic diseases (Healy et al., 2008; Hu, Li, Colditz, Willett, & Manson, 2003). Furthermore, research has determined that the negative health effects of sedentariness occur independently of those associated with insufficient PA (Hamilton, Healy, Dunstan, Zderic, & Owen, 2008), making evident the need for interventions that both reduce sedentary behavior and encourage routine PA. Promoting stair over elevator or escalator use in multi-floored

environments is one potential strategy for increasing individuals' daily energy expenditure through utilitarian PA. In fact, experimental evidence has indicated that stair climbing utilizes 8.6 times more energy than being at rest (Bassett et al., 1997) and meets the minimum physical activity intensity requirements for cardiovascular health improvements put forth by the American College of Sports Medicine (Teh & Aziz, 2002). Some successful stair promotion efforts have incorporated tactics like point-of-decision (POD) prompts, or situational cues placed in areas where people are expected to make a choice between two or more behavioral options (Soler et al., 2010). Messages on POD signs may be health-oriented; for example, encouraging stair use by stating, "Improve your waistline, use the stairs" (Soler et al., 2010). Studies conducted in public facilities and at worksites such as health clinics and academic buildings determined that posting POD signage near stairwells and elevators significantly increased stair use in those locations (Lee et al., 2012; Lewis & Eves, 2012). Such findings should be encouraging to public health professionals, as POD prompts provide easy and cost-effective opportunities for increasing utilitarian PA. It is likely that POD prompts are successful because they situationally remind individuals of the benefits of engaging in a specific behavior and thus enhance awareness of a behavior that is personally or socially-valued. Social norm theories offer possible explanations for the impact of reminded values on behavior promotion and will be discussed in the next section.

Social norms. A focus theory of normative conduct offered by Cialdini, Reno, and Kallgren (1990) conceptualizes different types of norms, or standards of regular behavior, that may influence one's actions to differing degrees. Descriptive norms indicate "typical" behavior by means of what most other people are doing in reference to a specific behavior; for example, a heavily-littered environment implies that others litter in the area (Cialdini et al., 1990).

Injunctive norms, on the other hand, indicate what other people believe one should do in terms of a specific behavior, such as by suggesting that individuals "Please Do Not Litter" (Cialdini et al., 1990). Depending on the situation, both descriptive and injunctive norms can significantly affect behavior, with the more salient type of norm at the time tending to be the most influential (Cialdini et al., 1990). Turning attention toward health behaviors, Burger and Shelton (2011) found that only exposure to descriptive norm signage stating that most people use the stairs was associated with more stair and less elevator use on a university campus.

In addition to social norms, Schwartz (1973) argues that personal norms, or conceptions of what is self-appropriate behavior, can largely influence one's behavior because they impact the self-concept and are often derived from social standards. Like refraining from littering (Cialdini et al., 1990), engaging in PA and eating a healthy diet tend to be widely recognized as important behaviors and highly valued (Poobalan, Aucott, Clarke, & Smith, 2012; Steptoe et al., 2002), thus making appropriate foundations for normative messaging on POD prompts. However, the act of reminding individuals of their personally-valued health-goals likely matters just as much as the content of normative messages; Bator and Bryan (2009), for instance, increased college students' exercise intentions and behavior by having them state reasons why they do not exercise regularly and then sign a poster promoting regular exercise in the campus recreation center. Such findings elucidate the significance of reminding individuals of their own hypocrisy by drawing attention toward the gap between their behavior and their personal values. The next theory that will be discussed, objective self-awareness theory, sheds more light on the reasons why certain behaviors may be induced after drawing attention to the self.

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comparison of the self to a "standard" or what the individual considers to be the correct behavior of a person in that situation. A comparison that results in a discrepancy between the self and the standard will lead to cognitive dissonance and an attempt to close the perceived gap. Due to this drive for consistency between the self and the standard, self-awareness has been known to moderate the attitude-behavior relationship (Carver, 1975; Wicklund, 1975) such that attitudes are more predictive of behavior when the individual is self-aware. In contrast to traits of self-focus typically seen as more stable, such as self-consciousness (Buss & Scheier, 1976; Carver & Glass, 1976), self-awareness depends on the situation and is considered highly changeable (Carver & Glass, 1976).

Mirrors have commonly been used to heighten self-awareness by drawing attention toward the self (Govern & Marsch, 2001). For example, after setting a situational standard that suggested positive attitudes toward punishment (delivering electric shocks for mistakes in learning), Carver (1974; 1975) found that participants who were exposed to a mirror administered more electric shocks as punishment to a "learner" than those who were not exposed to a mirror. In addition, results from Carver's (1975) experiment assessing personal vs. situational attitudes toward aggression reveal that self-awareness is key in aligning one's attitudes and behavior, as just making one's attitudes salient is not enough to bridge the gap. While full-length mirrors showing more of a person are likely to induce public self-awareness, or heightened cognizance of the self in regard to what others perceive (e.g., our physical features), smaller mirrors that show only the face may enhance private self-awareness, or attention focused on internal aspects of the self, such as personal values (Buss, 1980; Govern & Marsch, 2001).

Although previous research has examined the role of self-awareness in producing aggression (Carver, 1974; 1975), honesty (Beaman, Klentz, Diener, & Svanum, 1979; Diener &

Wallbom, 1976), and helping behaviors (Abbate, Isgrò, Wicklund, & Boca, 2006), very few studies have investigated how heightened self-awareness may promote health-related behavior. Self-monitoring research has discovered a relationship between more frequent self-weighing and greater weight loss over time (Baker & Kirschenbaum, 1993; Butryn, Phelan, Hill, & Wing, 2007; Thomas, Bond, Phelan, Hill, & Wing, 2014) and has theorized this may be due to the fact that self-monitoring increases self-awareness (Baker & Kirschenbaum, 1993). Kanfer (1970) characterizes self-monitoring as the systematic tracking of one's behavior, so it is rational to conclude that consistent focus on one's behavior would bring about more frequent self-directed attention. However, exploration of the effect of a single bout of self-focused attention on a health choice has been limited.

Considering the promotion of utilitarian PA, Hodgin and Graham (2016) manipulated full-length mirrors to reflect slightly thinner, slightly wider, or normal body sizes and examined participants' subsequent stair or elevator use to a higher floor in a parking garage. Interestingly, they found no effects of mirror type on the more-active choice to use the stairs and found that participants were more likely to take the stairs in the no-mirror than any of the conditions where a mirror was present. The study authors postulated that their contrary-to-hypothesized results occurred because college students tend to be more extrinsically (e.g., appearance-focused) than intrinsically (e.g., health-focused) motivated to engage in PA (Kilpatrick, Hebert, & Bartholomew, 2005) and may not have seen taking the stairs over the elevator as an activity that would obviously change their appearance. Those in the mirror-condition, then, may have been more likely to choose the less physically-demanding method of floor-ascension and take the elevator, especially if they were reminded of being far from an ideal standard in terms of PA

participation, which tends to be the case among college students (Heatherton & Baumeister, 1991; Hodgin & Graham, 2016).

Another supposition for the reduced odds of stair use after mirror exposure observed by Hodgin and Graham (2016) is that the full-length mirrors utilized may have induced negative affect in the form of body dissatisfaction, which again would deter stair use among the typically non-active students reminded of their appearance right before their transportation decision. Past research supports such a conjecture with outcomes showing that enhanced public self-awareness specifically (e.g., induced via full-length mirror) can reduce intrinsic motivation for a behavior (Plant & Ryan, 1985) and inactive individuals report more negative feelings after exercising in a mirrored than a non-mirrored environment (Martin Ginis, Jung, & Gauvin, 2003). Because college students may only increase utilitarian activity like stair ascension after being provided with explicit reasons for why taking the stairs over an elevator is appropriate, or after being reminded of their own or similar others' values surrounding stair vs. elevator use, the present research sought to increase stair use among this population using large mirrors in conjunction with health and normative signage to enhance public self-awareness and small mirrors to enhance private self-awareness.

Due to a lack of empirical evidence illuminating the effect of enhanced situational self-awareness on utilitarian PA, the present research investigated the impact of self-awareness via one-time mirror exposure on a subsequent stair vs. elevator transportation choice. The overall goals of the studies were to determine whether a single bout of heightened self-awareness can elicit healthy behavior change and to compare the effectiveness of self-awareness enhancement between large mirror exposure with point-of-decision cues and small mirror exposure. The main hypothesis was that in comparison to those not exposed, individuals exposed to a full-length

mirror and promotional signage or to a small mirror would soon after be more likely to take the stairs over an equally-accessible elevator in an indoor public parking garage.

The present study tested the effect of self-awareness on subsequent stair use by exposing individuals to a sign promoting stair use, a promotional sign and a large, full-length mirror, or a small mirror. Specifically, participants were exposed to one of six conditions: a large mirror and a health-focused sign, a large mirror and a descriptive norm sign, the health or normative sign only, a small mirror, or nothing (control), and the following four hypotheses were assessed:

Hypothesis 1: Odds of stair use will be higher among those exposed to a promotional sign than among those not exposed to any mirror or signage (control group).

Hypothesis 2: A mirror will moderate the effect of promotional signage on stair use such that odds of stair use will be higher among those exposed to a large mirror plus a promotional sign than those exposed to signage only.

Hypothesis 3: Odds of stair use will be higher among participants exposed to a descriptive norm-based promotional sign than among those exposed to a health-based promotional sign.

Exploratory Hypothesis 4: Odds of stair use will be compared between those exposed to a small mirror and those in the control group.

Method

Participants

204 undergraduate students from a large, public university in the Western United States were recruited for this study. Participants voluntarily signed up for the study titled "psychological influences on transportation choices II" via a provided link to the psychology research website, and were awarded participation credit for the introductory psychology course

in which they were enrolled. Institutional Review Board (IRB) approval was obtained prior to commencement of the study (see Appendix B for IRB approval letter).

Research Design

This study implemented a quasi-experimental design within which participants were exposed to one of the six aforementioned conditions using block randomization. The primary independent variable was condition (categorical) and the primary dependent variable was the dichotomous behavior of stair or elevator use (categorical).

Materials and Measures

Mirror. In conditions with a large mirror present, participants were exposed to a full-length framed mirror that shows the entire body. The mirror's reflective surface faced outward, with the mirror positioned on an easel approximately one foot in height and placed on the floor near a check-in table on the ground level of an indoor parking garage lobby (see Appendix C, *Figure 1*). For conditions utilizing a small mirror, a short, "vanity" mirror showing only the face with a stand was placed directly behind a document on the check-table instructing participants to go to the fourth floor of the parking garage for a survey on transportation choices. The check-in area for the table, mirror, and signage was selected due to its central location between the stairs and the elevator in the parking garage lobby, so that one transportation method was not more viewable or accessible than the other.

Point-of-decision prompts. In conditions involving point-of-decision signage encouraging stair use, an 8" x 10" framed health-focused sign or social norm sign was placed on the participant check-in table on the ground floor of the parking garage lobby (see Appendix C, *Figures 1* and *2*). A sign size of 8" x 10" was chosen because it can be easily read and would not be too large so as to appear unnatural on the participant check-in table in the parking garage

lobby. The health sign had a small graphic of a person walking upstairs and read, "Walking up stairs burns almost 5 times more calories than riding an elevator. Take the stairs" based on signage used in the HealthWorks worksite stair use promotion campaign (Graham, Linde, Cousins, & Jeffery, 2013). The social sign had the same small graphic of a person walking upstairs but read, "Over 60% of CSU students take the stairs in here instead of the elevator. Take the stairs." The descriptive norm statement of 60% was based on campus stair use research conducted by Hodgin and Graham (2016) and both the health and normative messages were tested for appropriateness and receptiveness among the target demographic of non-participant students at the same university.

Stair and elevator use. Participants' stair or elevator use was assessed through investigator observation. While awaiting their arrival to the fourth floor of the parking garage, a member of the research team inconspicuously recorded each participant's condition and method of transportation used.

Demographics. A questionnaire given to participants on the fourth floor of the garage collected participants' demographic information including their self-reported age, sex, race, ethnicity, height, body weight, and physical injury/disability status (see Appendix A for questionnaire). Questions assessing participants' sex, race, ethnicity, and physical injury/disability status were modeled on the questions identified by Dorsey and Graham (2011). Self-reported height and body weight were used to calculate each participant's BMI by dividing their weight in kilograms by the square of their height in meters (CDC, 2015a).

Self-awareness. The valid and reliable Situational Self-Awareness Scale (SSAS; Govern and Marsch, 2001) was used to measure participants' self-awareness. The nine-item scale asked participants to rate the extent to which they agree (1 "strongly disagree" to 7 "strongly agree")

with statements about their public and private awareness, as well as their awareness of immediate surroundings based on how they were feeling right at that moment (Govern & Marsch, 2001). Sample items from each category of awareness included: "Right now, I am concerned about the way I present myself" (public), "Right now, I am conscious of my inner feelings" (private), and "Right now, I am keenly aware of everything in my environment" (surroundings).

Physical activity frequency and importance. Participants' frequency of strenuous, moderate, and mild PA was measured with three items from the Project Eat-III Survey for young adults (Neumark-Sztainer, Goeden, Story, & Wall, 2004). To gauge the extent to which participants value physical activity participation, the item, "How important is it to you to be physically active?" was also included in a later questionnaire and response choices ranged from "not at all important" to "extremely important" on a seven-point scale.

Motivation for physical activity. Participants' motivation (i.e., intrinsic vs. extrinsic) for engaging in PA was measured using items modified from the Exercise Motivation Inventory – 2 (EMI – 2), originally developed by Markland and Ingledew (1997). Participants indicated their agreement from 1 "Not true for me" to 5 "Very true for me" with reasons for personally engaging in PA such as, "To look more attractive" (extrinsic) and "To give me goals to work toward" (intrinsic; Kilpatrick, Hebert, & Bartholomew, 2005; Markland & Ingledew, 1997).

Items and reasons affecting stair choice. Some participants were questioned about the items with them or worn on their body during the time of their study participation so that items assumed to influence the stair vs. elevator transportation decision could be assessed. Participants were asked to check all of the items on a provided list that they had with or on them including "uncomfortable shoes," "a bag or backpack," and "a fitness tracker (e.g., Fitbit)." In addition,

some participants were asked to provide a reason why they believed they took the stairs or the elevator for the study as a means of obtaining further information on the transportation decision rationale.

Awareness of mirror and signage. To determine whether participants consciously registered the presence of the mirror and/or the promotional signage used in some conditions, two items were asked, "Did you see a mirror near the check-in table on the first floor?" and "Did you see a framed sign on the check-in table on the first floor? If yes, what did it say?" Response options for these items were "yes" and "no".

Procedures

Prior to participants' arrival to the campus parking garage study location, the appropriate materials were set up in the ground floor lobby. A small participant check-in table and any mirror or signage were placed in an easily-viewable corner of the lobby approximately equidistant from the stairs and the elevator (see Appendix C, *Figure 1*). The large mirror for the mirrored conditions was placed in an easel approximately one foot high on the ground next to the check-in table and the small mirror was placed directly behind the participant instructions taped on the check-in table. For conditions involving point-of-decision signage, either the health or social-focused sign was put in an 8" x 10" frame and placed on the check-in table near the large mirror. The control condition did not have a mirror or a framed sign on the table. Online instructions where students signed up for their research course credit told each participant to go to the indoor lobby near the Parking Services office on the first floor of the parking garage. Signs were posted on the doors of both entrances to the lobby area directing participants to the check-in table inside, on which a document was attached instructing participants to meet a researcher for a survey on the fourth floor. While awaiting the participant's arrival, a member of

the research team on the fourth floor overlooking the downstairs lobby area discretely recorded the participant's condition and transportation method (stairs or elevator) used. Participants provided written consent and were administered a questionnaire that assessed their demographic information, behaviors likely associated with stair use such as physical activity, and awareness of a mirror and/or framed sign on the first floor. All participants were thanked and debriefed as to the true nature of the study following completion of the questionnaire.

Analyses

Analyses were conducted in SPSS Statistics 17.0 (IBM Corporation, Armonk, NY). To test the primary study hypotheses, logistic regression was used as the main outcome variable is dichotomous and categorical (stair or elevator use). Covariates that likely correlate with stair use were controlled for in the regression models and included: sex, race, ethnicity, BMI, total PA, and motivation for PA. Hypothesis 1 was tested by comparing the predicted odds of stair use in each of the sign-only and mirror-plus-sign groups to the predicted odds of stair use in the control group (no signage or mirror), which served as the reference group. To test hypotheses 2 and 3, a series of separate regression models were run to compare each of the four experimental conditions (two mirror-plus-sign and two sign-only) to each other in order to determine whether the presence of a mirror and which type of sign (health or social) is more effective for increasing stair use. Hypothesis 4 was explored by comparing the predicted odds of stair use between the small mirror and control conditions.

Results

Data for 204 participants were analyzed after excluding two students who reported having participated in a version of the study before. The mean age of the sample was 20.3 years and most participants identified as male, white and not being of Hispanic, Latino/a, or Spanish

ethnic descent (see Table 1). Mean BMI for the sample was 23.8 kg/m^2; among males, average BMI was 24.2(*SD* = 4.6) kg/m^2 and among females was 23.3(*SD* = 4.1) kg/m^2. One-way analyses of variance (ANOVAs) and chi-square analyses indicated that participants' reported age ($p = 0.15$), sex ($p = 0.06$), race ($p = 0.40$), ethnicity ($p = 0.31$), and BMI ($p = 0.08$) did not significantly differ by experimental condition. Mean total self-awareness (SA) for the sample was 31.06 (out of 45); analyses revealed that neither total SA [$F(5,198) = 1.6$, $p = 0.15$], public SA [$F(5,198) = 1.1$, $p = 0.34$], or private SA [$F(5,198) = 0.9$, $p = 0.52$] significantly differed as a function of mirror exposure. Among those sampled with an item added later to the questionnaire (n = 69), the mean score indicating the importance of being physically active was high, at 5.7 out of 7, and 63.8% of these participants reported that PA is either "very important" or "extremely important" to them.

In regards to the dependent variable of interest, stair vs. elevator use, results indicate that overall, more participants took the stairs (59.8%) than the elevator (40.2%). Logistic regression was performed to determine the odds of stair (vs. elevator) use predicted by appropriate covariates identified from previous research in Block 1: sex, race, ethnicity, BMI, total PA, and intrinsic and extrinsic motivation for PA. In Block 2, the odds of stair use were compared between participants in the no-mirror control condition and participants in each of the five experimental conditions (see Table 1 for descriptive information) while controlling for the Block 1 covariates, and this omnibus model was significant, $X^2(12) = 51.85$, $p < 0.001$. Furthermore, the model predicted 31.9% of the variance in stair use (Nagelkerke R^2; up 5.6% from the variance explained by Block 1 alone) and correctly classified 71.5% of cases. Males, White individuals, those with lower BMI, and those who have more intrinsic motivation for PA had significantly greater odds of stair use than their counterparts (see Table 2). In addition, the

predicted odds of stair use compared to the control condition show an increasing trend among participants who were exposed to the large mirror-plus-health sign (OR = 2.99, $p = 0.06$, 95% CI: 0.96, 9.31) and the social norm sign only (OR = 3.63, $p = 0.02$, 95% CI: 1.21, 10.94), holding all other covariates constant.

Reasons for Stair and Elevator Use

A subset of 74 participants were sampled about the items with them after their stair vs. elevator use decision (e.g., if they were wearing uncomfortable shoes or clothing, if they were carrying a bag or backpack, etc.) and their self-reported reasons for their transportation choice in order to assess common themes. The number of items with participants that might have affected their stair or elevator decision did not significantly differ between experimental conditions ($p = 0.16$) or between transportation methods used ($p = 0.61$). Of the participants who responded to the question, "Why do you think you took the stairs or the elevator today (that is, what do you think influenced you to make the choice you did)?" (n = 66), 35 (53%) individuals took the elevator and 31 (47%) took the stairs to the fourth floor. The most common reasons reported for taking the stairs among stair users were because stairs are "healthier/more active" (n = 12), because participants typically took the stairs everywhere out of "habit" (n = 6), because participants were "running late" or because stairs are "faster" than the elevator (n = 3), and because participants were in close physical proximity to the stairs (n = 3). Among elevator users, the most common response reported for taking the elevator instead of the stairs was because the stairs were more "difficult" physically and/or the elevator was "easier" than the stairs (n = 17). Eight participants also reported taking the elevator because they were "running late" and interestingly, four participants reported choosing the elevator over the stairs because they were

"sore" from recent physical activity. Less common responses for elevator use included "habit" (n = 2) and "asthma" (n = 2).

Hypotheses Testing

To test hypothesis 1, that more participants exposed to a promotional sign would take the stairs than those not exposed to any mirror or signage, all four sign conditions were combined into one variable and a second logistic regression model was run to compare odds of stair use among the signage and control groups; this model was significant ($X^2(8) = 40.62$, $p < 0.001$) and predicted 29.5% of the variance in stair use (Nagelkerke R^2). Results indicate that while controlling for the covariates of sex, race, ethnicity, BMI, total PA, and intrinsic and extrinsic motivation for PA (see Table 3), the predicted odds of stair use are trending toward but not significantly higher among individuals exposed vs. not exposed to a sign (OR = 2.14, $p = 0.07$, 95% CI: 0.94, 4.88), thus failing to support hypothesis 1. Hypothesis 2 was examined by combining the two large mirror-plus-sign conditions and comparing odds of stair use among that group to the predicted odds of stair use among the combined signage-only groups; this model predicted 23.6% of stair use variance but revealed that odds of stair use are not significantly higher in the mirror-plus-signage group than in the signage-only group (OR = 1.18, $p = 0.70$, 95% CI: 0.50, 2.82) while controlling for the same seven covariates (see Table 4), failing to support hypothesis 2. Hypothesis 3 was assessed by comparing stair use odds between the combined norm-based signage groups and the combined health-based signage groups ($X^2(8) = 23.45$, $p = 0.003$; Nagelkerke $R^2 = 0.24$). Results from this model did not support hypothesis 3, as predicted odds of stair use were not significantly higher among those exposed to a social norm sign than those exposed to a health sign (OR = 1.45, $p = 0.41$, 95% CI: 0.60, 3.48) while controlling for all other covariates (see Table 5). Lastly, the exploratory hypothesis 4 regarding

small mirror exposure was tested and results suggest that while controlling for the covariates, odds of stair use were no higher among the small mirror group than among those in the control condition who were not exposed to a mirror (OR = 0.95, p = 0.93, 95% CI: 0.30, 2.97; see Table 1).

Table 1
Participant and Experimental Condition Characteristics of Stair Use Study

Covariates	n(%)	*M*(*SD*)
Age (range 17 – 45)		20.3(3.2)
Female	87(43.5%)	
Non-White	31(15.9%)	
Hispanic/Latino(a)	33(16.4%)	
BMI (range 15.6 – 43.3)		23.8(4.4)
Total PA (out of 24)		12.1(5.9)
Intrinsic Motivation for PA (out of 5)		3.9(0.8)
Extrinsic Motivation for PA (out of 5)		2.9(0.7)
Control Condition	45(22.1%)	
Large Mirror + Health Sign Condition	33(16.2%)	
Large Mirror + Social Sign Condition	24(11.8%)	
Health Sign Only Condition	32(15.7%)	
Social Sign Only Condition	41(20.1%)	
Small Mirror Only Condition	29(14.2%)	

Notes. For dichotomous categorical covariates (Female, Non-White, Hispanic/Latino(a)), label reflects group compared to reference group. Age, BMI, Total PA, and Intrinsic and Extrinsic Motivation for PA are continuous variables. BMI = body mass index. PA = physical activity.

Table 2
Logistic Regression for Stair Use Predictors in College Student Sample

Predictors	OR	*P*	95% CI
Female	0.27	<0.001	0.13 – 0.56**
Non-White	0.22	0.002	0.08 – 0.58*
Hispanic/Latino(a)	0.65	0.38	0.24 – 1.71
BMI	0.91	0.02	0.83 – 0.99*
Total PA	1.04	0.22	0.98 – 1.11
Intrinsic Motivation for PA	1.86	0.03	1.06 – 3.28*
Extrinsic Motivation for PA	0.63	0.11	0.36 – 1.12
Large Mirror + Health Sign	2.99	0.06	0.96 – 9.31
Large Mirror + Social Sign	1.94	0.27	0.59 – 6.38
Health Sign Only	1.18	0.76	0.41 – 3.41
Social Sign Only	3.63	0.02	1.21 – 10.94*
Small Mirror Only	0.95	0.93	0.30 – 2.97

Notes. For ease of interpreting categorical covariates (Female, Non-White, Hispanic/Latino(a), Conditions), the label reflects the group associated with the direction of the OR. An OR less than 1.0 indicates the covariate has an inverse relationship with stair use. BMI, Total PA, and Intrinsic and Extrinsic Motivation for PA are continuous variables. BMI = body mass index. PA = physical activity.
*$p < 0.05$. **$p \leq 0.001$.

Table 3
Logistic Regression for Hypothesis 1: Control vs. Sign Exposure

Predictors	OR	*P*	95% CI
Female	0.29	0.002	0.13 – 0.63*
Non-White	0.26	0.007	0.09 – 0.69*
Hispanic/Latino(a)	0.62	0.36	0.22 – 1.74
BMI	0.90	0.02	0.83 – 0.99*
Total PA	1.06	0.09	0.99 – 1.14
Intrinsic Motivation for PA	1.60	0.12	0.88 – 2.89
Extrinsic Motivation for PA	0.61	0.10	0.34 – 1.10
Sign Exposure	2.14	0.07	0.94 – 4.88

Notes. For ease of interpreting categorical covariates (Female, Non-White, Hispanic/Latino(a), Sign Exposure), the label reflects the group associated with the direction of the OR. An OR less than 1.0 indicates the covariate has an inverse relationship with stair use. BMI, Total PA, and Intrinsic and Extrinsic Motivation for PA are continuous variables. BMI = body mass index. PA = physical activity.
*$p < 0.05$. **$p \leq 0.001$.

Table 4
Logistic Regression for Hypothesis 2: Sign-only vs. Sign-plus-Mirror Exposure

Predictors	OR	*P*	95% CI
Female	0.30	0.01	0.12 – 0.75*
Non-White	0.20	0.01	0.06 – 0.69*
Hispanic/Latino(a)	1.17	0.80	0.35 – 3.88
BMI	0.88	0.03	0.79 – 0.99*
Total PA	1.07	0.09	0.99 – 1.16
Intrinsic Motivation for PA	1.32	0.43	0.66 – 2.66
Extrinsic Motivation for PA	0.94	0.87	0.48 – 1.87
Sign-Plus-Mirror Exposure	1.18	0.70	0.50 – 2.82

Notes. For ease of interpreting categorical covariates (Female, Non-White, Hispanic/Latino(a), Sign-Plus-Mirror Exposure), the label reflects the group associated with the direction of the OR. An OR less than 1.0 indicates the covariate has an inverse relationship with stair use. BMI, Total PA, and Intrinsic and Extrinsic Motivation for PA are continuous variables. BMI = body mass index. PA = physical activity.
*$p < 0.05$. **$p \leq 0.001$.

Table 5
Logistic Regression for Hypothesis 3: Health Sign vs. Social Sign Exposure

Predictors	OR	*P*	95% CI
Female	0.26	0.006	0.10 – 0.69*
Non-White	0.20	0.01	0.06 – 0.69*
Hispanic/Latino(a)	1.09	0.89	0.32 – 3.68
BMI	0.89	0.04	0.79 – 0.99*
Total PA	1.07	0.09	0.99 – 1.16
Intrinsic Motivation for PA	1.34	0.41	0.67 – 2.70
Extrinsic Motivation for PA	0.93	0.84	0.47 – 1.86
Social Sign Exposure	1.45	0.41	0.60 – 3.48

Notes. For ease of interpreting categorical covariates (Female, Non-White, Hispanic/Latino(a), Social Sign Exposure), the label reflects the group associated with the direction of the OR. An OR less than 1.0 indicates the covariate has an inverse relationship with stair use. BMI, Total PA, and Intrinsic and Extrinsic Motivation for PA are continuous variables. BMI = body mass index. PA = physical activity.
*$p < 0.05$. **$p \leq 0.001$.

Discussion

The present study aimed to determine whether odds of stair use could be increased on a university campus after exposing students to mirrors and POD signage promoting taking the stairs. Although Hodgin and Graham (2016) demonstrated a decrease in stair use among college students after large mirror-only exposure, the present study predicted that a mirror with a stair-promotional sign next to it would increase stair use because, based on OSA theory (Duval & Wicklund, 1972), the mirror would bring more self-attention to the potential gap between students' upcoming behavior and the behavioral standard to take the stairs put forth by the signs. Results suggest that students are no more likely to take the stairs after being exposed to a full-body mirror with a social norm-focused POD prompt, a health-focused POD sign by itself, or a small mirror, but are more likely to use stairs after exposure to a large mirror with a health POD prompt or only a social norm POD sign. Hypotheses in the present study were not supported, presumably because combining groups to directly test overall effects of large mirrors and POD message types resulted in a counteractive influence of certain manipulations; that is, large mirror exposure only increased odds of stair use when combined with a health POD message but not a social norm message and sign exposure alone was only successful when the sign contained a social norm but not a health message.

Further results indicate that a majority of participants reported PA as being important to them. Drawing from assumptions made by OSA theory, findings do not generally support the idea that the more physically-active (and common among the college student population) behavior of stair over elevator use may be promoted by exposing individuals to mirrors, a strategy that has previously been shown to increase both self-awareness (Govern & Marsch, 2001) and behaviors that support a personally- or socially-formed standard (Abbate et al., 2006;

Beaman et al., 1979). However, it is likely that in contrast to Hodgin and Graham's (2016) large mirror-only manipulations, the addition of POD promotional signage in the present study at least partially buffered the negative effects of large mirror exposure on college students' choice to use the stairs.

An especially interesting finding in the present study was the fact that exposure to a large mirror plus a POD sign with a health-focused message promoting stair use (i.e., a description of calories burned taking the stairs compared to riding in an elevator) showed similar odds regarding stair use as those observed from exposure to the normative sign only. That is, it appears that placing a body-length mirror with a health-based promotional sign at the POD for stair vs. elevator use could increase odds of stair use; this would imply that the addition of a large mirror may ameliorate the comparable-to-control odds of stair use after exposure to a health sign only, as was found presently and in past research (Burger & Shelton, 2011). The discovery that exposure to a descriptive norm sign by itself significantly increases odds of stair use compared to baseline supports work by Burger and Shelton (2011), who found that signs stating most people use the stairs were effective in reducing elevator use on a university campus, as well as research demonstrating that descriptive norm messaging increases a similar health behavior, nutritious food selection (Mollen, Rimal, Ruiter, & Kok, 2013; Robinson, Fleming, & Higgs, 2014).

In addition to the effects of mirror and POD signage exposure on stair use, the present study confirmed greater stair use among males than females and among those with lower vs. higher BMIs, which supports previous research (Eves, 2014; Hodgin & Graham, 2016). Furthermore, odds of stair use were higher among White individuals and participants reporting greater intrinsic motivation for PA (e.g., higher enjoyment- and health-related motivation for

PA). Although previous research has determined that college students tend to be more extrinsically-motivated to engage in PA (e.g., higher appearance-related motivation; Kilpatrick et al., 2005), in the present study students reported higher intrinsic than extrinsic motivation for PA. This discrepancy may be explained by social desirability, such that students preferred to agree more strongly with health than weight loss reasons for their own PA. It could have also been that because students were aware that the study was about health and transportation choices, there was some self-selection bias such that participants were more likely to sign up for this study based on interest and adhere to perceived expectations regarding reasons for their PA participation. Motivation may also explain why odds of stair use were higher after exposure to a health sign with a large mirror than a health sign alone, because the caloric expenditure message on the sign promoting stair use could be interpreted to help with either an intrinsic PA goal (improve physical health) or an extrinsic PA goal (lose weight) and the mirror could reinforce either such motive by showing the body. Conversely, the addition of the large mirror may have negatively impacted the effect of the social norm sign on stair use because seeing one's body does not obviously relate to and may distract from a message about stair use among peers.

It is important to consider the methodological limitations that may have affected study results. The current study did not employ true randomization of participants to control and experimental groups due to the logistical issues associated with setting up mirrors and signage between each individual participant. Due to the block randomization used, it is possible that characteristics of the participants that may have influenced their decision to use the stairs or the elevator may differ between experimental conditions and thus causality should be inferred with caution. However, this concern is curtailed by the conclusion that key demographic information such as sex and BMI did not significantly differ by condition. Similarly, the sample in the

present study was undergraduate university students, so results may not be generalizable to other groups in the general population. Future research can address this issue by assessing stair use in more at-risk populations, such as minority groups and sedentary adults. Although weather was not an issue in the indoor parking garage location, other environmental or social matters could have influenced participants' stair vs. elevator use; for example, one participant noted that they used the elevator because there were people doing construction work on the staircase when they arrived at the study location. A small number of participants also noted that they had to walk a long way across campus to get to the garage study location, which may have influenced their stair or elevator decision. Social influence on participant stair or elevator use from others is also possible although not likely a concern, as the study took place in a low-traffic area of the parking garage.

In addition to limitations to the present study's methodology, the author recommends interpreting the results with caution due to power limitations. After conducting post-hoc power analyses, it is evident that the study was underpowered; thus, issues with sample size may have influenced intervention effects. In order to more accurately capture what predicts college student stair use, replications of the current research should measure the same individual factors and experimental manipulations with adequate power.

Despite such limitations, the present research maintains unique strengths to its design and implementation. This study is one of the first to observe college students' stair vs. elevator use by requiring that they go to a certain floor in an on-campus building; requiring that participants go to the fourth floor of the garage allowed for more experimental control over other factors that may influence students' health choices and provides a more generalizable approach to promoting stair use in other buildings on campus where students most likely do not get to decide what floor

their classes or dormitories are on (i.e., in contrast to buildings where they may have more choice, such as which floor to park their car on). In addition, the present study provided key information about college students' stair vs. elevator rationale by asking some participants to explain why they believe they made the choice of one transportation method over another. Such information should inform future utilitarian PA promotional efforts in this distinctive and susceptible population. By improving the more physically-active choice to use the stairs among students before they leave the collegiate environment, healthy habits may be more sustainable later in life, such as when graduates enter the workforce.

There are several avenues through which findings from the current study may be applied in more diverse contexts and populations. For example, public health interventions could be implemented in office settings among employed adults who are mostly sedentary. Because American adult employees spend nearly a third of their time at the job (Tudor-Locke, Leonardi, Johnson, & Katzmarzyk, 2011), primarily sedentary worksites are optimal settings for occupational health efforts to get employees moving more. Employees who work in multilevel buildings and need to frequently ascend floors to do their job may easily be targeted for stair use as a form of utilitarian PA. Furthermore, sedentary employees may be receptive to increased activity via stair use if they are informed about a valued benefit of stair climbing, such as with a POD prompt. Since a majority of participants in the current study reported highly valuing PA and most stair users sampled indicated they took the stairs because they are "healthier/more active" than the elevator, inactive employees could be presented with a large mirror and a health message promoting stair use (such as the caloric expenditure message utilized in this study) before they make a floor climbing decision. Research by Crum and Langer (2007) supports such a notion with their finding that hotel maids experienced decreases in body weight, body fat,

blood pressure, and waist-to-hip ratio four weeks after being told that their job duties constitute "exercise" by meeting the Surgeon General's requirements. Thus, PA and related health benefits may be increased among adults if they are informed that their job duties or typical activities, such as ascending floors to get to their job, are actually a form of "exercise." It is also recommended that future research investigate the best message, size, and format for POD signage in order to increase the likelihood of prompts resonating with their target audience. In sum, it is worth exploring the impact of health-relevant POD messaging and mirrors on stair use in more inactive populations, such as sedentary office employees working in multilevel buildings.

Overall, the present study informs OSA theory and mirror exposure specifically with the discovery that odds of stair vs. elevator use may be increased only in certain mirrored contexts. Stair use was shown to increase after participants were exposed to a body-length mirror with a POD prompt containing a health message or to only a POD prompt containing a social norm message. These findings clarify that some environmental modifications, such as mirrors, may only increase a health behavior like stair use if they are used in conjunction with another item at the POD. It may also be that contrary to OSA theory, large mirror exposure with promotional signage induces health behaviors for reasons other than self-awareness enhancement, such as by showing individuals their body and a message related to physical health or appearance. Additionally, among populations that may be more sensitive to social norms, like college students, POD prompts with descriptive norm messaging alone may be the best way to increase PA or stair use. Nevertheless, the current study illuminates the different built environmental modifications that can be inexpensively implemented to increase utilitarian PA via stair use and provides an important stepping stone for future research on PA and health promotion.

Effects of mirror exposure on food selection in a mock grocery shopping task

Recent global excesses in weight gain are alarming and have motivated intervention efforts to focus on the promotion of healthy lifestyle behaviors. Body mass index, or BMI, is commonly used to provide a standardized weight-for-height assessment for adults and is calculated by dividing one's weight in kilograms by the square of their height in meters (kg/m^2; World Health Organization [WHO], 2016). The WHO reports that approximately 39% of the world's adult population is overweight (BMI $\geq$ 25) and 13% are obese (BMI $\geq$ 30; WHO, 2016). National research has concluded that 37.7% of adults in the United States are obese and rates are increasing, particularly among women (Flegal, Kruszon-Moran, Carroll, Fryar, & Ogden, 2016). Obesity may contribute to several leading causes of preventable death, including coronary heart disease, stroke, type 2 diabetes, and certain types of cancer (Centers for Disease Control and Prevention, 2016). Because a primary risk factor for several types of chronic disease is a high weight status, one strategy commonly recommended by public health experts is to decrease consumption of high-calorie foods containing a large amount of fat and sugar (WHO, 2016). In particular, research supports less consumption of saturated and *trans* fat as a means of reducing coronary heart disease (Jakobsen et al., 2009) and type 2 diabetes risk (Hu, van Dam, & Liu, 2001), as well as decreasing sodium intake to lower blood pressure and aid in the prevention of stroke and fatal coronary heart disease (Aburto et al., 2013).

Individuals in the age range of 18-25, or "emerging adulthood" (Arnett, 2000), is of particular concern for poor health outcomes because of life changes common to this time period that make young adults especially vulnerable to unhealthy weight gain (Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008). Approximately 70% of American high school graduates attend college (United States Department of Labor, 2017) and first-year college students tend to

gain weight at higher and faster rates than the general population (Vadeboncoeur, Townsend, & Foster, 2015), making universities important settings for promoting healthful behaviors among this population (Nelson et al., 2008). Young adults who are not in college may also be at risk for weight gain and associated health issues, especially if they are employed in obesogenic work environments that support sedentary behavior and unhealthy food consumption. Several different methods have been considered and implemented in an effort to promote healthy choices among the emerging adulthood population, including encouraging more daily leisure and utilitarian physical activity (PA) and more nutritious food selection. Because research has indicated that most young adults may not be behaving in healthful ways that align with their values surrounding the importance of engaging in regular PA (Poobalan, Aucott, Clarke, & Smith, 2012) and nutritious food consumption (Graham & Laska, 2012), recent interventions have attempted to break down psychosocial barriers to such behaviors and bridge the gap between individuals' health attitudes and behaviors.

Objective self-awareness. Objective Self-Awareness (OSA) theory (Duval & Wicklund, 1972) proposes that individuals who are reminded of themselves will try to more closely align their attitudes and behavior surrounding a personally- or socially-set standard. Because attitudes tend to be more predictive of behavior when a person is self-aware (Carver, 1975; Wicklund, 1975), behaviors that are considered "correct" in a situation may be promoted by enhancing self-attention as an individual attempts to reduce the discomfort of their cognitive dissonance, or a mismatch between what they value and their behaviors associated with those values (Festinger, 1957). Mirrors have been shown to situationally increase one's SA (Govern & Marsch, 2001); for instance, in children who were told to take one piece of candy while trick-or-treating on Halloween and subsequently were more likely to adhere to that standard when a mirror was

present near the candy bowl (Beaman, Klentz, Diener, & Svanum, 1979). Since such evidence indicates that mirrors can reduce divergent behavior, it is reasonable to assume that they may have an even stronger effect on behaviors that more closely relate to an image of one's body or appearance, such as physical health.

Regarding the health outcomes of weight gain and weight-related disease, it tends to be widely known that one's dietary choices are influential, including perceptions that fat, salt, and sugar should be avoided for a "healthy" diet (Paquette, 2005). The general knowledge concerning a relationship between food choices and body weight may explain why self-monitoring, or the systematic tracking of one's health behaviors (Kanfer, 1970), tends to be associated with more successful weight loss and maintenance (Butryn, Phelan, Hill, & Wing, 2007; Thomas, Bond, Phelan, Hill, & Wing, 2014). Regular self-weighing, for example, may be especially effective for long-term weight loss because monitoring one's body weight heightens self-awareness (Baker & Kirschenbaum, 1993). What is more, recent research has revealed that a single bout of self-weighing prior to food selection resulted in healthier products chosen in terms of caloric and saturated fat content (Hodgin & Graham, under review).

Some research has been conducted on the specific relationship between SA and eating behaviors, but offers inconclusive results. For example, Pliner and Iuppa (1978) hypothesized that obese individuals are less self-aware when eating and thus tend to eat more than healthy-weight individuals, but experimentally-established that both those who were overweight and of a healthy-weight ate significantly less when in the presence of a mirror. However, inconsistent with OSA theory, the authors did not find a negative relationship between actual-ideal weight discrepancy and consumption quantity in the mirror condition for either weight class of participants (Pliner & Iuppa, 1978). On the other hand, Heatherton and Baumeister (1991)

conceptualize OSA in terms of an "escape theory," suggesting that individuals who are far from an ideal standard, such as those who tend to consume excessive amounts of food at one time (binge), may actually experience higher levels of uncomfortable SA due to having inflated perceptions of social demands. These increased feelings of "aversive" SA are typically associated with negative affect like low self-esteem and depression stemming from a perceived inability to meet high standards, so binge-eating may take place as a method of escaping from such awareness and diverting cognitive attention to the immediate situation involving eating (Heatherton & Baumeister, 1991). Although this explanation and the research by Pliner and Iuppa (1978) offer more psychological rationale for the effects of SA on eating behaviors, they tend to focus on clinical populations while neglecting the realistic food-choice behaviors of average people. Consequently, future studies should assess how common food items chosen by average consumers vary as a function of the consumers' situationally-induced SA.

A more recent study utilized a non-clinical sample to observe mirror-induced SA and one factor frequently related to eating behavior: taste perceptions. Jami (2016) concluded that undergraduates who were exposed to a mirror rated chosen unhealthy snack food (e.g., brownies) as less tasty than those not exposed to a mirror, because they were attributing the discomfort felt from their discrepant actual-ideal eating behavior to the food's taste. This study provides a key reason why young adult consumers may eat less while self-aware, however, it does not reflect realistic food selection processes typically performed by the public. To address this gap, the research presented here sought to examine how a single bout of enhanced SA impacts the specific nutrient content of foods selected from a mock grocery aisle.

In light of conclusions from previous research on SA and a lack of studies considering mirrors as short-term enhancers of SA, the present study examined the effect of mirror exposure

on subsequent food selection in a mock grocery shopping task. The hypotheses for this study were: individuals who are exposed to a mirror (vs. no mirror) will choose food and beverage items with lower caloric (Hypothesis 1), saturated fat (Hypothesis 2), sugar (Hypothesis 3), or sodium content (Hypothesis 4).

Method

Participants

Participants were 79 undergraduate students enrolled in introductory psychology courses at a large public university in the Western United States. Students received course credit for completing this 30 minute study in an on-campus laboratory and were informed that they could win some groceries by participating in a lottery-style drawing during the study. Institutional Review Board (IRB) approval was acquired from the university before study commencement (see Appendix B).

Research Design

The present study was a between-subjects experimental design, with participants randomly assigned to be exposed to a large mirror, a small mirror, or no mirror before completing a food selection task. The primary independent variable was condition (categorical) and the primary dependent variables were the mean number of calories, grams of saturated fat (as a proxy for less healthful fat), grams of sugar, and milligrams of sodium in the food and beverage products chosen by participants in the selection task (continuous).

Procedures and Materials

Participants were randomly assigned to one of two mirror conditions or a no-mirror condition prior to selecting their preferred items from a mock grocery aisle. Those assigned to a mirror condition were exposed to either a full-length mirror (showing most of the body) or a

small, "vanity" mirror (showing the face and neck) with a stand set up adjacent to the grocery shelves so that the reflective surface faced the area in which the participant would have to stand to provide consent for their participation in the study and later to view the food and beverage options (see Appendix C, *Figure 3*). Each mirror rested on top of a filing cabinet approximately two feet off of the ground and was positioned using a standardized location and angle. For participants assigned to the no-mirror control condition, the mirrors were hidden in the laboratory so the reflective surfaces were completely out of sight.

After participants provided consent and signed in to the study at the filing cabinet where the mirrors for the mirrored conditions were positioned, they answered questions from the Situational Self-Awareness Scale (Govern and Marsch, 2001) on the computer so that accurate self-awareness measures could be obtained immediately following mirror exposure. The researcher then prompted the participants to choose four different food and/or beverage items that they wanted to take home with them at the end of the study, and explained that they could win some groceries at the conclusion of the study in order to facilitate realistic choices. The grocery aisle contained 96 non-perishable food and drink items (i.e., canned and boxed pre-packaged goods, not fresh produce), and represented a range of healthfulness within various product categories (e.g., among cereals, the amount of sugar ranged from 2 – 18 grams per serving).

All participants then had the opportunity to touch and examine the products in the aisle and were told they could take as much time as necessary to make their choices. When they had made their final choices, participants placed their four most-preferred items into a grocery basket and completed a brief questionnaire in the laboratory asking about the products selected, demographic characteristics, and behaviors typically related to dietary choices, such as frequency

of nutrition label use. An item at the end of the questionnaire also asked participants whether they saw a mirror in the laboratory before selecting their food items, and this information was used as a measure of conscious recall of the mirror. After completing the questionnaire, participants drew a ping pong ball from a bag containing 19 white balls and one orange ball to determine whether they would win some groceries. Participants who drew the orange ping pong ball were awarded a $10 grocery store gift card.

Analyses and Results

The primary study hypotheses were tested in SPSS Statistics 17.0 (IBM Corporation, Armonk, NY) by running linear regression models to compare differences in mean caloric, total saturated fat (in grams), sugar (in grams), and sodium (in milligrams) content of food and beverage items chosen by the mirrored and no-mirror groups. The following key covariates likely associated with food selection were also included in the model: sex, race, ethnicity, BMI, total PA, current weight loss behavior (dichotomized into yes/no), use of nutrition labels, and importance of healthy eating.

After removing the data for four individuals who reported having participated in a previous iteration of the present study, analyses were performed for 79 participants. Most participants identified as female, White, and not of Hispanic, Latino/a, or Spanish ethnic origin (see Table 6). Mean age for the sample was 20.0 years and mean BMI was 23.0 (Male M = 23.4; Female M = 22.7). Average importance for healthy eating reported was 5.2 out of 7 and approximately 42% of participants answered that consuming healthy foods is "very important" or "extremely important" to them. Chi-square analyses and analyses of variance (ANOVAs) indicated that participants' race (p = 0.34), ethnicity (p = 0.84), age (p = 0.51), and BMI (p = 0.27) did not significantly differ by experimental condition. Participant sex, on the other hand,

approached being significantly different by condition ($p = 0.05$). Further analyses also revealed that participants' assigned experimental condition did not have significant effects on their total SA ($M = 30.85$, $p = 0.12$), public SA ($M = 8.71$, $p = 0.69$), or private SA ($M = 10.77$, $p = 0.16$). Additionally, total SA did not significantly differ between participants who reported having seen the mirror in the room prior to their food selections and those who reported that they did not see the mirror, although it was present ($p = 0.84$). Of those who were exposed to a mirror, 27.1% reported consciously seeing the mirror prior to their food selections.

To test the four primary study hypotheses, individual linear regression models were run to assess mean calories, saturated fat, sugar, and sodium in the food and beverage products selected. Results from the models indicate that while controlling for sex, race, ethnicity, BMI, total PA, current weight loss behavior, nutrition label use, and importance of healthy eating, mean caloric ($R^2 = 0.17$), saturated fat ($R^2 = 0.13$), sugar ($R^2 = 0.04$) , and sodium ($R^2 = 0.11$) content did not significantly differ as a function of mirror exposure in the experimental conditions (see Table 7). These data fail to support hypotheses 1-4.

Table 6
College Student Participant and Experimental Condition Characteristics

Variables	n(%)	*M*(*SD*)
Age (range 18-45)		20.0(3.9)
Female	43(54.4%)	
Non-White	17(22.4%)	
Hispanic/Latino(a)	12(15.8%)	
Body Mass Index (range 18.1-37.2)		23.0(4.2)
Total Physical Activity (out of 24)		10.5(5.0)
No Weight Loss Behavior	48(62.3%)	
Nutrition Label Use (out of 4)		2.3(1.0)
Healthy Eating Importance (out of 7)		5.2(1.3)
Control Condition	19(24.1%)	
Large Mirror	33(41.8%)	
Small Mirror	27(34.2%)	

Notes. For dichotomous categorical covariates (Female, Non-White, Hispanic/Latino(a), No Weight Loss Behavior), label reflects group compared to reference group. Age, Body Mass Index, Total Physical Activity, Nutrition Label Use, and Healthy Eating Importance are continuous variables.

Table 7
Linear Regression for Food Selection Variables in College Student Sample

Covariates	Calories		Saturated Fat (g)		Sugar (g)		Sodium (mg)	
	β	*p*	β	*p*	β	*p*	β	*p*
Female	0.10	0.44	0.09	0.47	-0.06	0.67	0.02	0.91
Non-White	-0.18	0.15	0.01	0.96	-0.01	0.92	-0.08	0.53
Hispanic/Latino(a)	0.01	0.92	-0.03	0.78	-0.03	0.82	0.18	0.17
Body Mass Index	-0.07	0.64	0.08	0.58	-0.09	0.55	-0.04	0.78
Total Physical Activity	-0.18	0.15	-0.07	0.56	0.03	0.82	0.04	0.76
No Weight Loss Behavior	0.25	0.10	0.29	0.05	0.00	0.99	-0.19	0.21
Nutrition Label Use	-0.12	0.44	0.13	0.42	-0.10	0.53	0.22	0.16
Healthy Eating Importance	-0.04	0.77	0.00	0.99	-0.09	0.57	-0.20	0.19
Mirror Conditions	0.17	0.17	0.23	0.07	0.08	0.53	0.19	0.14

Notes. For ease of interpreting categorical covariates (Female, Non-White, Hispanic/Latino(a), No Weight Loss Behavior), label corresponds to direction of Beta value such that negative values indicate a decrease in selection of the outcome nutrient. Body Mass Index, Total Physical Activity, Weight Loss Behavior, Nutrition Label Use, and Healthy Eating Importance are continuous variables.

Discussion

The present study sought to compare the healthfulness of food and drink products selected by university students after exposure to two different types of mirrors. Findings did not support the hypotheses that participants would choose items lower in calories, saturated fat, sugar, and sodium after being exposed to a mirror than to no mirror. Furthermore, self-awareness did not differ between experimental conditions or between participants who did and did not report seeing a mirror that they were exposed to, failing to offer support for OSA theory (Duval & Wicklund, 1972). Contrary to the present study's results, previous research has found that both large and small mirror exposure increases self-awareness (Govern & Marsch, 2001) and behaviors that align with a known or implied standard, such as aggression (Carver, 1974; 1975) and helpful behavior (Abbate, Isgrò, Wicklund, & Boca, 2006). The fact that consuming healthy foods was reported as being important in the current study but participants exposed to a mirror were no more likely to select healthy foods also contradicts OSA theory, which postulates that self-awareness should strengthen the relationship between one's attitudes and their behavior (Carver, 1975; Wicklund, 1975). Such a finding is more in line with results from Pliner and Iuppa (1978), who did not see the theoretically-implicated inverse relationship between actual-ideal weight discrepancy and consumption quantity among participants exposed to a mirror (Pliner & Iuppa, 1978).

The inconclusive results demonstrated in this study also do not support previous research suggesting that individuals dislike unhealthy food items (Jami, 2016) and consume less (Sentyrz & Bushman, 1998) when in the presence of a mirror. However, there could be differences in food consumption and initial selection behavior among consumers, which further research should explore. Considering similar research on food selection, Hodgin and Graham (under review)

concluded that making participants aware of their body weight prior to food selection resulted in choices significantly lower in calories and saturated fat. Although some work has argued that monitoring of body weight works well for long-term weight loss because self-weighing likely enhances self-awareness of a goal-relevant factor (Baker and Kirschenbaum, 1993), it could be that self-weighing influences health choices differently than does seeing oneself in a mirror.

A discussion of limitations to the present study's methodology is warranted. Differences in ratio of males to females in each condition approached significance, however, sex did not independently predict the calories, saturated fat, sugar, or sodium in the food items selected, so this is not a meaningful concern. Although the large and small mirrors for experimental conditions were positioned in close physical proximity to a required sign-in area, some participants did not report seeing a mirror prior to their food selection task; in order to ensure that a lack of differences in self-awareness is not due to ignorance of a mirror, then, follow-up research could have participants select food items with a mirror directly behind the options. Likewise, because the grocery aisle was set-up in a university laboratory and contained non-perishable food and drink items, participants' choices may not be broadly applicable to real-world contexts. This concern was mitigated, however, by telling participants to choose products they most wanted to take home with them and offering them a chance to win items at the conclusion of the study. In addition, some food items may have been interpreted as health-ambiguous (e.g., cereals contain both "healthy" and "unhealthy" ingredients) by the college student sample and participants' food choices prior to the study were not measured, which could have influenced their selections. Future studies examining food choice among this population could therefore benefit by pilot testing college students' nutritional knowledge about specific

food and drink items and including more choices that are believed to be "healthy" or "unhealthy."

Another limitation concerns the size and homogeneity of the college student sample used. Post-hoc power analyses revealed that the current study was underpowered; as such, results should be interpreted with caution and future research should investigate food selection with a larger sample and in other contexts among more diverse populations, including those at-risk for diet-related health issues. Food choices could be examined in schools among younger students and in worksites among employees to both identify preferred items and explore ways to promote healthier options and selections. Utilizing other dietary measures, such as 24-hour dietary recall, would also provide additional insights into this research regarding what food and beverage items are typically consumed by certain populations.

Although this study did not find differences in the healthfulness of food and drink items chosen in a laboratory grocery aisle after mirror exposure, current findings add to the conceptualization of OSA theory and the use of mirrors to incite behavior change among college students. This study is one of the first to measure initial food choice, before consumption occurs, in a population that is likely acquiring more independent responsibilities including grocery shopping. Knowing that mirror exposure does not appear to influence initial food selection can focus preventive efforts aimed at motivating healthy behavior change before actual consumption occurs. For instance, making consumers aware of a more health-salient variable, such as body weight, prior to food selection may more successfully result in healthier choices. Mirror use may also be evaluated in conjunction with other environmental modifications to promote healthy food selection, such as POD signage emphasizing a health message related to diet. In summary, the

present study helps inform OSA theory as a framework through which dietary choices and overall health may be promoted and affords new ideas to test in behavioral medicine.

General Discussion

Two studies were conducted to evaluate the influence of mirror exposure on subsequent weight-related health decisions: physical activity and food selection. Physical activity (PA) was assessed in terms of stair vs. elevator use on a university campus and food selection was examined in a university laboratory-turned-grocery aisle. Based on Objective Self-Awareness (OSA) theory (Duval & Wicklund, 1972), the studies hypothesized that mirror exposure would increase the healthy behaviors of stair use and more nutritious food selection by enhancing participants' self-awareness and aligning typically positive attitudes toward health with health-promotive behavior. However, results from both studies do not generally support the OSA theory framework for inciting weight-relevant healthy behavior change. At the point-of-decision (POD), a body-length mirror with a social norm sign and a small mirror by itself did not increase odds of stair use and neither a body-length nor a small mirror resulted in more healthful food selection among university students. Successful environmental manipulations that did increase one health behavior, stair use, were a large (body-length) mirror with a sign containing a health message about caloric expenditure and a sign containing a descriptive norm message about stair use presented in the absence of (but not in the presence of) a mirror.

It is particularly interesting to note that in both studies on stair use and food selection, most participants sampled reported that the overall targeted health behavior, PA or healthy food consumption, was important to them. This suggests that most college students do hold positive attitudes toward physically active and healthy eating behaviors. The fact that mirror exposure in both of the present studies did not increase participants' self-awareness or behaviors that participants generally hold positive attitudes toward contradicts previous research that has successfully used mirrors to heighten self-awareness (Govern & Marsch, 2001) and indicated

that self-awareness helps align individuals' attitudes and behavior (Carver, 1975; Wicklund, 1975). Taken in sum, findings from the present studies suggest that mirror exposure prior to a PA or food selection decision is not conducive for promotion of these weight-relevant health behaviors in college students. Although previous research has found that desired non-health behaviors (Abbate et al., 2006; Diener & Wallbom, 1976) and more healthful consumption of food may be promoted among the college student population with mirror exposure (Pliner & Iuppa, 1978; Sentyrz & Bushman, 1998), it could be that the mirror manipulations in the current studies did not work in similar ways because they were presented to participants prior to instead of during the health behavior of interest. In the previous studies that successfully promoted desired behaviors, the mirror used to increase self-awareness was in front of the participants while they completed the targeted behavior; thus, future research could reexamine PA and food selection with participants exposed to a mirror for the entire duration of their task. Another explanation for the lack of mirror influence on stair use and healthy food selection found here could be that college students in general are relatively healthy in terms of BMI (averages in the samples used are considered to be in the "healthy" range) and may not be concerned about maintaining regular PA and/or considering the nutritional content of their foods; instead, they may abstractly value these health behaviors while simultaneously underestimating their long-term and preventive health benefits. Such presumptions may be further studied by assessing college students' specific beliefs surrounding their PA and dietary values.

A further explanation for the mirrors' general ineffectiveness could be that instead of being used alone, they need to be presented in conjunction with a related manipulation that promotes the targeted health behavior. For example, odds of stair use increased for participants exposed to both a large mirror showing the body and a health-oriented sign, which could be

because seeing one's body reminds an individual about their physical health or weight while they are also receiving a message on a similar topic that affects the body (i.e., caloric expenditure during stair use). The fact that odds of stair use did not increase in the large mirror-plus-social norm sign group supports the notion that the items being used to promote taking the stairs may need to display a common theme that the target population values (e.g., health/appearance). Behavior may not be influenced if the promotional modifications do not appear to corroborate one another, as could have been the case when participants saw their own body reflection and a stair use message not directly related to health or appearance. Indeed, recent research has concluded that large mirrors used alone do not increase stair over elevator use in college students (Hodgin & Graham, 2016) and making students aware of their own body weight (a very salient health-relevant characteristic) improves the healthfulness of subsequent food selections (Hodgin & Graham, under review). Future work building on these findings could investigate the impact of mirror exposure on health behaviors with other health- or appearance-relevant promotional cues.

Theoretical Implications

Although the current findings from stair use and food selection studies in college students do not appear to be supported by OSA theory (Duval & Wicklund, 1972), there are theoretical alternatives that may help explain what was observed. For one, the college student participants in this research may not have experienced cognitive dissonance between their attitudes and their behavior, but their behavior may have instead been reflective of their embodied cognition. A theory of an "economy of action" put forth by Proffitt (2006) argues that the way in which individuals perceive a spatial environment directly relates to their behavior of traversing such an environment. More specifically, one's perception of a terrain, for example a staircase, will be

affected by their physical status and the associated costs of movement through that terrain that are brought to mind. Evidence corroborating this theory has been found in individuals who perceive hills as steeper when they are wearing a heavy backpack (Proffitt, 2006). Therefore, it could be that PA is valued, but one-time stair climbing is not readily perceived as PA so the associated energy costs of ascending a staircase do not endorse stair over elevator use. This assumption is backed up by findings from the present research suggesting that messages promoting stair over elevator use for a specific reason (e.g., for health or social reasons) tend to increase odds of stair use among college students.

Another potential theoretical rationale for the current discoveries involves social facilitation. The college student sample used in this research could have been socially facilitated in the presence of a mirror before they made their food choices in the grocery aisle study. Recent research by Nakata and Kawai (2017), for example, found that university students ate more food in the presence of a mirror and argued this was because seeing their own reflection created a facilitation effect of eating. That is, the students felt like they were eating with others when in the presence of a mirror, and previous research has shown that people tend to consume more with others than when alone (DeCastro & Brewer, 1991). Therefore, results from the food selection study may be at least partially explained by social facilitation, as students tended to choose food and beverage items slightly (though not significantly) higher in calories, saturated fat, and sodium when exposed to a mirror.

The findings from the studies described presently also help inform research on self-monitoring in the non-psychological health literature, defined as the systematic tracking of one's behaviors known to be related to physical health (Kanfer, 1970). For instance, although consistent self-weighing is a form of self-monitoring and may increase individuals' self-

awareness by focusing their attention on their own body weight (Baker and Kirschenbaum, 1993), the current results suggest that mirror exposure does not improve healthy food choices among the college student population comparable to what one-time self-weighing has been found to do (Hodgin & Graham, under review). Therefore, it seems that self-weighing and mirror exposure immediately prior to food selection do not influence college student consumers in the same way; this may be because self-awareness is not similarly enhanced or because seeing one's own body reflection is not as strong a motivator to encourage healthy choices as self-weighing is. Supporting evidence for the latter postulation has been obtained by Sugovic, Turk, and Witt (2016), who found that it is not one's beliefs about their body weight but their actual body weight that affects judgments of distance. Consequently, physically active and other healthy choices may be promoted by making people more self-aware of an objective measure of health.

Turning attention toward other theoretical constructions, results from one study also augment existing knowledge about the focus theory of normative conduct (Cialdini et al., 1990) and POD prompts. After exposure to a sign containing a descriptive norm message about stair use, participants' odds of stair over elevator use increased significantly, supporting previous research (Burger & Shelton, 2011) and suggesting that certain behaviors may be best promoted in college students by reminding them of those behaviors' popularity among similar others. A related health behavior, food selection, may also be most effectively impacted in this population by exposing students to social norm signage, for example, depicting more healthful food or beverage options commonly chosen by peers in campus cafeterias. Other empirical support has been found for the effectiveness of descriptive norm over health-based messaging observed here, specifically in regards to promoting stair use (Burger & Shelton, 2011) and healthy food selection (Robinson, Fleming, & Higgs, 2014). Perhaps the most noteworthy contribution of the

present research to what is known about POD messaging, then, is the discovery that a health behavior (stair use) can be promoted after exposure to a health-focused POD sign as long as a body-length mirror accompanies the health prompt. As such, future health promotion efforts may benefit by measuring the effect of large mirrors and health-based POD prompts on PA and healthy food selection, especially in populations that may be less influenced by others' behaviors like non-student adult employees.

Applications and Future Directions

In the United States, employed adults spend approximately one-third of their time at work and sit for about 11 hours per day in more sedentary jobs (Tudor-Locke, Leonardi, Johnson, & Katzmarzyk, 2011). Furthermore, obesity-related problems among full-time employees are estimated to cost companies $73.1 billion a year (Finkelstein, daCosta DiBonaventura, Burgess, & Hale, 2010), making worksites key locations for interventions that promote PA and healthy eating behaviors. Employee health may be promoted if appropriate mirror and promotional signage combinations are presented at the POD for stair use and food selection. Findings from the current research suggest that in areas where employees are expected to choose between taking the stairs or an elevator to a higher floor and/or should make food and beverage choices (e.g., cafeterias, vending machines), health prompts with body-length mirrors or solo descriptive norm prompts may be most effective. However, such recommendations should be heeded with caution in non-college student populations, as employed adults may not be as receptive to certain messages regarding healthy behavior change. Nonetheless, POD cues may successfully promote employee PA and healthy dietary choices, and are likely to be inexpensively implemented compared to other environmental modifications, like treadmill workstations, which can cost upwards of $1000 each (Ben-Ner, Hamann, Koepp, Manohar, & Levine, 2014).

Both studies on stair use and food selection discussed here were not without limitations, such as having small and homogenous samples, but their outcomes are noteworthy nonetheless. The mixed effects of mirror exposure observed on the health behaviors of stair use and food selection help elucidate the psychological underpinnings of OSA theory and the use of mirrors to heighten self-awareness. Furthermore, these studies help narrow the focus of potential public health and behavioral medicine interventions seeking to inexpensively promote more physically active and healthful dietary behaviors in specific populations. Knowing what is and is not effective for promoting these healthy behaviors is a crucial step toward preventing and ameliorating the negative consequences of obesity and weight-related disease.

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Appendix A – Questionnaire Items

Psychological Influences on Transportation Choices Survey

Please circle your response to each statement below based on how you feel RIGHT NOW, AT THIS INSTANT – not how you feel in general, or at this point in your life:

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
1. Right now, I am keenly aware of everything in my environment.	1	2	3	4	5
2. Right now, I am conscious of my inner feelings.	1	2	3	4	5
3. Right now, I am concerned about the way I present myself.	1	2	3	4	5
4. Right now, I am self-conscious about the way I look.	1	2	3	4	5
5. Right now, I am conscious of what is going on around me.	1	2	3	4	5
6. Right now, I am reflective about my life.	1	2	3	4	5
7. Right now, I am concerned about what other people think of me.	1	2	3	4	5

8. Right now, I am aware of my innermost thoughts.	1	2	3	4	5
9. Right now, I am conscious of all objects around me.	1	2	3	4	5

We would now like to know how you feel. Please circle the number indicating how you are FEELING RIGHT NOW on the following scales:

	Not feeling this at all						Feeling this very much
10. Happy	1	2	3	4	5	6	7
11. Excited	1	2	3	4	5	6	7
12. Frustrated	1	2	3	4	5	6	7
13. Enthusiastic	1	2	3	4	5	6	7
14. Stressed	1	2	3	4	5	6	7
15. Angry	1	2	3	4	5	6	7
16. Sad	1	2	3	4	5	6	7
17. Guilty	1	2	3	4	5	6	7
18. Regretful	1	2	3	4	5	6	7
19. Satisfied	1	2	3	4	5	6	7
20. Hungry	1	2	3	4	5	6	7

21. Have you participated in this study, Psychological Influences on Transportation Choices (I, II, or III), before?
    1. No
    2. Yes

22. Have you participated in either of the studies titled Grocery Shopping or Food Selection before?
    1. No
    2. Yes

Please circle the number indicating how true the following statements are to you regarding why you engage in physical activity.

I engage in physical activity:	Not true for me				Very true for me
23. To spend time with friends	1	2	3	4	5
24. To look more attractive	1	2	3	4	5
25. To give me goals to work toward	1	2	3	4	5
26. Because I like trying to win in physical activities	1	2	3	4	5
27. Because I enjoy the feeling of exerting myself	1	2	3	4	5
28. Because my doctor advised me to	1	2	3	4	5
29. To prevent health problems	1	2	3	4	5
30. To stay/become more agile	1	2	3	4	5
31. To have a healthy body	1	2	3	4	5
32. Because it makes me feel good	1	2	3	4	5
33. To show my worth to others	1	2	3	4	5
34. To increase my endurance	1	2	3	4	5
35. Because it helps reduce tension	1	2	3	4	5
36. To stay slim	1	2	3	4	5
37. Other reason: _____	1	2	3	4	5
38. Other reason: _____	1	2	3	4	5

We would now like to know some general information about you.

39. What language do you speak at home?

_____

40. What is your sex?
    1. Male
    2. Female
    3. Other

41. What is your age?
    _____ years

42. Are you Hispanic, Latino/a, or of Spanish origin? (1 or more categories may be selected)
    1. No, not of Hispanic, Latino/a, or Spanish origin
    2. Yes, Mexican, Mexican American, Chicano/a
    3. Yes, Puerto Rican
    4. Yes, Cuban
    5. Yes, another Hispanic, Latino/a, or Spanish origin

43. What is your race? (1 or more categories may be selected)
    a. White
    b. Black or African American
    c. American Indian or Alaska Native
    d. Asian Indian
    e. Chinese
    f. Filipino
    g. Japanese
    h. Korean
    i. Vietnamese
    j. Other Asian
    k. Native Hawaiian
    l. Guamanian or Chamorro
    m. Samoan
    n. Other Pacific Islander

44. How tall are you?

_____ feet and _____ inches

45. How much do you weigh?

_____ pounds

46. Do you have serious difficulty walking or climbing stairs due to physical injury (e.g., use crutches)?

1. Yes
2. No

Please answer the following two questions regarding **the Lake Street Parking Garage** (where you currently are).

	Not safe/Not usable	Somewhat safe/Somewhat usable	Very safe/Very usable
47. How would you rate the safety of this parking garage?	1	2	3
48. How would you rate the usability of this parking garage?	1	2	3

49. What is your PRIMARY method of transportation <u>to your</u> college campus?

1. Motor vehicle (car)
2. Bus
3. Motorcycle/motorized scooter
4. Skateboard/non-motorized scooter
5. Walking
6. Bicycle
7. Other: _____

50. How satisfied are you with your body?

1. Extremely dissatisfied
2. Somewhat dissatisfied
3. Neither satisfied nor dissatisfied
4. Somewhat satisfied
5. Extremely satisfied

51. During the past 12 months, have you tried to lose weight?
    1. Yes
    2. No

52. Are you currently trying to lose weight?
    1. Yes
    2. No

53. Please circle any of the following things you have done in order to lose weight or keep from gaining weight during the past year.
    1. Fasted
    2. Ate very little food
    3. Took diet pills
    4. Made myself throw up
    5. Used laxatives
    6. Used water pills
    7. Used food substitute like powder or special drink
    8. Skipped meals
    9. Smoked more cigarettes
    10. Followed a high protein/low carbohydrate diet like Atkins or another

In a **usual week**, how many hours do you spend doing the following activities? (**Circle the number** for each type of activity).

	None	Less than ½ hour a week	1/2 – 2 hours a week	2 ½ - 4 hours a week	4 ½ - 6 hours a week	More than 6 hours a week
54. Strenuous exercise (heart beats rapidly). Examples: biking fast, aerobics, jogging, basketball, swimming laps, soccer, rollerblading.	1	2	3	4	5	6
55. Moderate exercise (not exhausting). Examples: walking quickly, easy bicycling, volleyball, skiing, dancing, skateboarding, snowboarding.	1	2	3	4	5	6

56. Mild exercise (little effort). Examples: walking slowly, bowling, golf, fishing, snowmobiling.	1	2	3	4	5	6

How often have you done each of the following things in order to lose weight or keep from gaining weight during the past year? Please circle the number for each line.

	Never	Rarely	Sometimes	On a regular basis
57. Exercise	1	2	3	4
58. Ate more fruits and vegetables	1	2	3	4
59. Ate less high-fat foods	1	2	3	4
60. Ate less sweets	1	2	3	4
61. Drank less soda pop (not including diet pop)	1	2	3	4
62. Watched my serving sizes	1	2	3	4

63. How often do you read the nutrition information on food labels before purchasing foods or beverages?
    1. Never/rarely
    2. Sometimes
    3. Often
    4. Always/almost always

64. How important is it to you to be physically active?
    1. Not at all Important
    2. Very Unimportant
    3. Somewhat Unimportant
    4. Neither Important nor Unimportant
    5. Somewhat Important
    6. Very Important
    7. Extremely Important

Please indicate how much you agree with the following statements:

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
65. Other people my age would approve if I used active transportation methods to get around.	1	2	3	4	5
66. Other people my age think I should use active transportation methods to get around.	1	2	3	4	5
67. Most other people my age use active transportation methods to get around.	1	2	3	4	5

68. Please describe the purpose of the study you just completed:

_____

69. Please circle all of the following that apply to you right now:
    1. I am currently wearing uncomfortable shoes
    2. I am currently wearing uncomfortable clothing
    3. I have a bag or backpack with me right now
    4. I have a child or animal with me right now
    5. I have a fitness tracker with or on me right now (e.g., Fitbit)
    6. I have a medical brace, boot, or other device on or with me right now (e.g., crutches)
    7. I was running late to this study today

70. Did you see a sign on the first floor check-in table other than the participant instructions?
    1. No
    2. Yes
        i. If you answered Yes, what did the sign say? _____

71. Did you see a mirror near the check-in table on the first floor?
    1. No
    2. Yes

72. The study you completed was designed to determine whether viewing a promotional sign is related to the choice to use the stairs or the elevator. One group of participants took the stairs or the elevator to the fourth floor while a promotional sign was positioned nearby and for another group the sign was removed. We were interested in understanding whether having recently seen a sign about stair use related to the stair vs. elevator transportation choice. Do you think the presence or absence of a sign on the first floor was related to your stair or elevator choice today?
    1. No
    2. Yes

73. Some participants took the stairs or the elevator to the fourth floor while also having a mirror positioned nearby (and others did not have a mirror up). We were interested in seeing whether having recently viewed oneself in a mirror related to the stair vs. elevator transportation choice. Do you think seeing yourself was related to your stair or elevator choice today?
    1. No
    2. Yes

Why do you think you took the stairs or the elevator today (that is, what do you think influenced you to make the choice you did)?

_____

Food Selection Survey

Please circle your response to each statement below based on how you feel RIGHT NOW, AT THIS INSTANT – not how you feel in general, or at this point in your life:

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
1. Right now, I am keenly aware of everything in my environment.	1	2	3	4	5
2. Right now, I am conscious of my inner feelings.	1	2	3	4	5
3. Right now, I am concerned about the way I present myself.	1	2	3	4	5
4. Right now, I am self-conscious about the way I look.	1	2	3	4	5
5. Right now, I am conscious of what is going on around me.	1	2	3	4	5
6. Right now, I am reflective about my life.	1	2	3	4	5
7. Right now, I am concerned about what other people think of me.	1	2	3	4	5
8. Right now, I am aware of my innermost thoughts.	1	2	3	4	5

9. Right now, I am conscious of all objects around me.	1	2	3	4	5

We would now like to know how you feel. Please circle the number indicating how you are FEELING RIGHT NOW on the following scale:

	Not feeling this at all						Feeling this very much
10. Happy	1	2	3	4	5	6	7
11. Excited	1	2	3	4	5	6	7
12. Frustrated	1	2	3	4	5	6	7
13. Enthusiastic	1	2	3	4	5	6	7
14. Stressed	1	2	3	4	5	6	7
15. Angry	1	2	3	4	5	6	7
16. Sad	1	2	3	4	5	6	7
17. Guilty	1	2	3	4	5	6	7
18. Regretful	1	2	3	4	5	6	7
19. Satisfied	1	2	3	4	5	6	7
20. Hungry	1	2	3	4	5	6	7

21. Have you participated in this study titled Food Selection or Grocery Shopping before?
    1. No
    2. Yes

22. Have you participated in any of the Psychological Influences on Transportation Choices (I, II, or III) studies before?
    1. No
    2. Yes

At this point, we ask that you please **choose the four food items that you would most like to take home with you today** and put them into the shopping basket.

23. Please enter the number written on the bottom of one of your chosen products: _____

24. Please enter the NAME of this same product (e.g., Corn Flakes cereal):

_____

The next few questions refer to the product you entered just now:

25. How would you rate the overall HEALTHFULNESS of this product? (Circle a number).

1	2	3	4	5	6	7	8	9
Very Low Healthfulness								Very High Healthfulness

26. How would you rate the overall DELICIOUSNESS of this product? (Circle a number).

1	2	3	4	5	6	7	8	9
Not at all Delicious								Very Delicious

27. How frequently do you EAT/DRINK this product? (Circle a number).

1	2	3	4	5	6	7	8	9
Never								Every Day

28. How frequently do you PURCHASE this product? (Circle a number).

1	2	3	4	5	6	7	8	9
Never								Every Day

29. How much would you like to eat/drink this product RIGHT NOW? (Circle a number).

1	2	3	4	5	6	7	8	9
Not at All								Very Much

30. Please enter the number written on the bottom of one of your chosen products that was NOT already entered before (2 of 4 products chosen): _____

31. Please enter the NAME of this same product (e.g., Diet Coke 2-liter bottle):

_____

The next few questions refer to the product you entered just now:

32. How would you rate the overall HEALTHFULNESS of this product? (Circle a number).

1	2	3	4	5	6	7	8	9
Very Low Healthfulness								Very High Healthfulness

33. How would you rate the overall DELICIOUSNESS of this product? (Circle a number).

1	2	3	4	5	6	7	8	9
Not at all Delicious								Very Delicious

34. How frequently do you EAT/DRINK this product? (Circle a number).

1	2	3	4	5	6	7	8	9
Never								Every Day

35. How frequently do you PURCHASE this product? (Circle a number).

1	2	3	4	5	6	7	8	9
Never								Every Day

36. How much would you like to eat/drink this product RIGHT NOW? (Circle a number).

1	2	3	4	5	6	7	8	9
Not at All								Very Much

37. Please enter the number written on the bottom of one of your chosen products that was NOT already entered before (3 of 4 products chosen): _____

38. Please enter the NAME of this same product (e.g., Sun Chips Harvest Cheddar):

_____

The next few questions refer to the product you entered just now:

39. How would you rate the overall HEALTHFULNESS of this product? (Circle a number).

1	2	3	4	5	6	7	8	9
Very Low Healthfulness								Very High Healthfulness

40. How would you rate the overall DELICIOUSNESS of this product? (Circle a number).

1	2	3	4	5	6	7	8	9
Not at all Delicious								Very Delicious

41. How frequently do you EAT/DRINK this product? (Circle a number).

1	2	3	4	5	6	7	8	9
Never								Every Day

42. How frequently do you PURCHASE this product? (Circle a number).

1	2	3	4	5	6	7	8	9
Never								Every Day

43. How much would you like to eat/drink this product RIGHT NOW? (Circle a number).

1	2	3	4	5	6	7	8	9
Not at All								Very Much

44. Please enter the number written on the bottom of the LAST of your chosen products that was NOT already entered before (4 of 4 products chosen): _____

45. Please enter the NAME of this same product (e.g., Hawaiian Punch Fruit Juicy Red):

_____

The next few questions refer to the product you entered just now:

46. How would you rate the overall HEALTHFULNESS of this product? (Circle a number).

1	2	3	4	5	6	7	8	9
Very Low Healthfulness								Very High Healthfulness

47. How would you rate the overall DELICIOUSNESS of this product? (Circle a number).

1	2	3	4	5	6	7	8	9
Not at all Delicious								Very Delicious

48. How frequently do you EAT/DRINK this product? (Circle a number).

1	2	3	4	5	6	7	8	9
Never								Every Day

49. How frequently do you PURCHASE this product? (Circle a number).

1	2	3	4	5	6	7	8	9
Never								Every Day

50. How much would you like to eat/drink this product RIGHT NOW? (Circle a number).

1	2	3	4	5	6	7	8	9
Not at All								Very Much

Please circle the number indicating how true the following statements are to you regarding why you engage in healthy eating.

I engage in healthy eating:	Not true for me				Very true for me
51. Because my friends do	1	2	3	4	5
52. To look more attractive	1	2	3	4	5
53. To give me goals to work toward	1	2	3	4	5
54. Because I like to be healthier than other people	1	2	3	4	5
55. Because I enjoy the feeling of eating healthy	1	2	3	4	5
56. Because my doctor advised me to	1	2	3	4	5
57. To prevent health problems	1	2	3	4	5
58. To have a healthy body	1	2	3	4	5
59. Because it makes me feel good	1	2	3	4	5
60. To show my worth to others	1	2	3	4	5
61. Because it helps reduce stress	1	2	3	4	5
62. To stay slim	1	2	3	4	5
63. Other reason: _____	1	2	3	4	5
64. Other reason: _____	1	2	3	4	5

We would now like to know some general information about you.

65. What language do you speak at home?

_____

66. I am a:
    1. CSU PSY100 student
    2. CSU faculty or staff member
    3. Other: _____

67. What is your sex?

4. Male
5. Female
6. Other

68. What is your age?

_____ years

69. Are you Hispanic, Latino/a, or of Spanish origin? (1 or more categories may be selected)

6. No, not of Hispanic, Latino/a, or Spanish origin
7. Yes, Mexican, Mexican American, Chicano/a
8. Yes, Puerto Rican
9. Yes, Cuban
10. Yes, another Hispanic, Latino/a, or Spanish origin

70. What is your race? (1 or more categories may be selected)

11. White
12. Black or African American
13. American Indian or Alaska Native
14. Asian Indian
15. Chinese
16. Filipino
17. Japanese
18. Korean
19. Vietnamese
20. Other Asian
21. Native Hawaiian
22. Guamanian or Chamorro
23. Samoan
24. Other Pacific Islander

71. How tall are you?

_____ feet and _____ inches

72. How much do you weigh?

_____ pounds

73. How satisfied are you with your body?

1 Extremely dissatisfied
2 Somewhat dissatisfied
3 Neither satisfied nor dissatisfied
4 Somewhat satisfied
5 Extremely satisfied

74. During the past 12 months, have you tried to lose weight?

3. Yes
4. No

75. Are you currently trying to lose weight?

3. Yes
4. No

76. Please circle any of the following things you have done in order to lose weight or keep from gaining weight during the past year.

11. Fasted
12. Ate very little food
13. Took diet pills
14. Made myself throw up
15. Used laxatives
16. Used water pills
17. Used food substitute like powder or special drink
18. Skipped meals
19. Smoked more cigarettes
20. Followed a high protein/low carbohydrate diet like Atkins or another

In a **usual week**, how many hours do you spend doing the following activities? (**Circle the number** for each type of activity).

	None	Less than ½ hour a week	1/2 – 2 hours a week	2 ½ - 4 hours a week	4 ½ - 6 hours a week	More than 6 hours a week
77. Strenuous exercise (heart beats rapidly). Examples: biking fast, aerobics, jogging, basketball, swimming laps, soccer, rollerblading.	1	2	3	4	5	6
78. Moderate exercise (not exhausting). Examples: walking quickly, easy bicycling, volleyball, skiing, dancing, skateboarding, snowboarding.	1	2	3	4	5	6
79. Mild exercise (little effort). Examples: walking slowly, bowling, golf, fishing, snowmobiling.	1	2	3	4	5	6

How often have you done each of the following things in order to lose weight or keep from gaining weight during the past year? Please circle the number for each line.

	Never	Rarely	Sometimes	On a regular basis
80. Exercise	1	2	3	4
81. Ate more fruits and vegetables	1	2	3	4
82. Ate less high-fat foods	1	2	3	4
83. Ate less sweets	1	2	3	4
84. Drank less soda pop (not including diet pop)	1	2	3	4
85. Watched my serving sizes	1	2	3	4

When you are shopping for food, how important are the following factors in whether or not you BUY a product?

	Not at all important	Very Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Somewhat Important	Very Important	Extremely Important
86. Price	1	2	3	4	5	6	7
87. Brand	1	2	3	4	5	6	7
88. Taste	1	2	3	4	5	6	7
89. Calories	1	2	3	4	5	6	7
90. Fat	1	2	3	4	5	6	7
91. Serving Size	1	2	3	4	5	6	7
92. Saturated Fat	1	2	3	4	5	6	7
93. Trans Fat	1	2	3	4	5	6	7
94. Sodium	1	2	3	4	5	6	7
95. Sugar	1	2	3	4	5	6	7
96. Fiber	1	2	3	4	5	6	7
97. Protein	1	2	3	4	5	6	7
98. Vitamins	1	2	3	4	5	6	7
99. Minerals	1	2	3	4	5	6	7
100. Artificial Colors	1	2	3	4	5	6	7
101. Artificial Flavors	1	2	3	4	5	6	7
102. GMOs	1	2	3	4	5	6	7

How important do you think each of the following food/drink factors are to your HEALTH?

		Not at all important	Somewhat unimportant	Neither important nor unimportant	Somewhat important	Very important
103.	Calories	1	2	3	4	5
104.	Fat	1	2	3	4	5
105.	Saturated Fat	1	2	3	4	5
106.	Trans Fat	1	2	3	4	5
107.	Sodium	1	2	3	4	5
108.	Sugar	1	2	3	4	5
109.	Fiber	1	2	3	4	5
110.	Protein	1	2	3	4	5
111.	Vitamins	1	2	3	4	5
112.	Minerals	1	2	3	4	5
113.	Artificial Colors	1	2	3	4	5
114.	Artificial Flavors	1	2	3	4	5
115.	GMOs	1	2	3	4	5

How important do you think each of the following food/drink factors are to your APPEARANCE?

		Not at all important	Somewhat unimportant	Neither important nor unimportant	Somewhat important	Very important
116.	Calories	1	2	3	4	5
117.	Fat	1	2	3	4	5
118.	Saturated Fat	1	2	3	4	5
119.	Trans Fat	1	2	3	4	5
120.	Sodium	1	2	3	4	5
121.	Sugar	1	2	3	4	5
122.	Fiber	1	2	3	4	5
123.	Protein	1	2	3	4	5
124.	Vitamins	1	2	3	4	5
125.	Minerals	1	2	3	4	5
126.	Artificial Colors	1	2	3	4	5
127.	Artificial Flavors	1	2	3	4	5
128.	GMOs	1	2	3	4	5

129. Do you have any dietary restrictions (select all that apply)?
    1. None
    2. Lactose intolerance
    3. Nut allergy
    4. Seed allergy
    5. Gluten restriction
    6. Vegetarian
    7. Vegan
    8. Other: _____

130. How often do you read the nutrition information on food labels before purchasing foods or beverages?
    1. Never/rarely
    2. Sometimes
    3. Often
    4. Always/almost always

131. How important is it to you to consume healthy foods?
    1. Not at all Important
    2. Very Unimportant
    3. Somewhat Unimportant
    4. Neither Important nor Unimportant
    5. Somewhat Important
    6. Very Important
    7. Extremely Important

Please indicate how much you agree with the following statements:

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
132. Other people my age would approve if I ate healthfully.	1	2	3	4	5
133. Other people my age think I should eat healthfully.	1	2	3	4	5
134. Most other people my age are healthy eaters.	1	2	3	4	5

135. Please describe the purpose of the study you just completed:

_____

136. Did you see a mirror in the lab before you selected your four food products?
    1. No
    2. Yes

137. The study you completed was designed to determine whether viewing oneself in a mirror is related to food choices. One group of participants selected their foods while a mirror was positioned nearby, for another group this mirror was removed. We were interested in seeing whether having recently viewed oneself in a mirror related to food selections. Do you think seeing yourself was related to your food choices today?
    1. No
    2. Yes

Please do not tell anyone else about what we were investigating in this study, as it may influence their answers if they participate later. Thank you! If you have any feedback you would like to provide about the study, please do so below, or ask the experimenter any questions you might have. Thanks again!

Appendix B – IRB Approval Forms

Colorado State University

Research Integrity & Compliance Review Office
Office of Vice President for Research
Fort Collins, CO 80523-2011
(970) 491-1553
FAX (970) 491-2293

DATE: April 5, 2017

TO: Dan Graham, Ph.D., Assistant Professor, Psychology
Katie Hodgin, Doctoral Candidate, Psychology

FROM: IRB Coordinator, Research Integrity & Compliance Review Office (RICRO_IRB@mail.colostate.edu)

TITLE: Psychological Influences on Transportation II

Grant Title: None

IRB ID: 088-16H **Review Date: April 5, 2017**
This project is valid for three years from the review date.

The Institutional Review Board (IRB) Coordinator has reviewed the following modifications of this project:

1. Updated recruitment to include Front Range and CSU students not currently part of the Psychology Department research pool; to update the participant numbers approved to recruit to include no more than 50 CSU students and 50 Front Range students; and to use the updated recruitment file for this new population. Please provide the supporting document from Front Range Community College upon receipt and prior to recruitment at this site.

and has declared the study remains exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b). The IRB determination of exemption means that:

- You do not need to submit an application for annual continuing review.
- You must carry out the research as proposed in the IRB application, including obtaining and documenting (signed) informed consent if stated in your application or if required by the IRB.
- Any modification of this research should be submitted to the IRB through an email to the RICRO IRB Coordinator (RICRO_IRB@mail.colostate.edu), prior to making any changes, to determine if the project still meets the Federal criteria for exemption. If it is determined that exemption is no longer warranted, then an IRB proposal will need to be submitted and approved before proceeding with data collection.
- Please notify the IRB (RICRO_IRB@mail.colostate.edu) if any problems or complaints of the research occur.

Please note that you must submit all research involving human participants for review by the IRB. **Only the IRB may make the determination of exemption**, even if you conduct a similar study in the future.

Colorado State University

Research Integrity & Compliance Review Office
Office of Vice President for Research
Fort Collins, CO 80523-2011
(970) 491-1553
FAX (970) 491-2293

Date: September 11, 2015

To: Dan Graham, Psychology and Colorado School of Public Health

From: IRB Coordinator, Research Integrity & Compliance Review Office (RICRO_IRB@mail.colostate.edu)

Re: Grocery Shopping

IRB ID: 077 -16H **Review Date:** September 11, 2015
This project is valid from three years from the review date.

The Institutional Review Board (IRB) Coordinator has reviewed this project and has declared the study exempt from the requirements of the human subject protections regulations with conditions as described above and as described in 45 CFR 46.101(b):

Category 2 - Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

The IRB determination of exemption means that:

- **This project is valid for three years from the initial review.** After the three years, the file will be closed and no further research should be conducted. If the research needs to continue, please let the IRB Coordinator know before the end of the three years. You do not need to submit an application for annual continuing review.
- You must carry out the research as proposed in the Exempt application, including obtaining and documenting (signed) informed consent if stated in your application or if required by the IRB.
- Any modification of this research should be submitted to the IRB through an email to the IRB Coordinator, prior to implementing any changes, to determine if the project still meets the Federal criteria for exemption.
- Please notify the IRB Coordinator (RICRO_IRB@mail.colostate.edu) if any problems or complaints of the research occur.

Please note that you must submit all research involving human participants for review by the IRB. **Only the IRB or designee may make the determination of exemption**, even if you conduct a similar study in the future.

Appendix C – Study Locations and Materials

Figure 1. Study 1 check-in area on first floor of university parking garage.

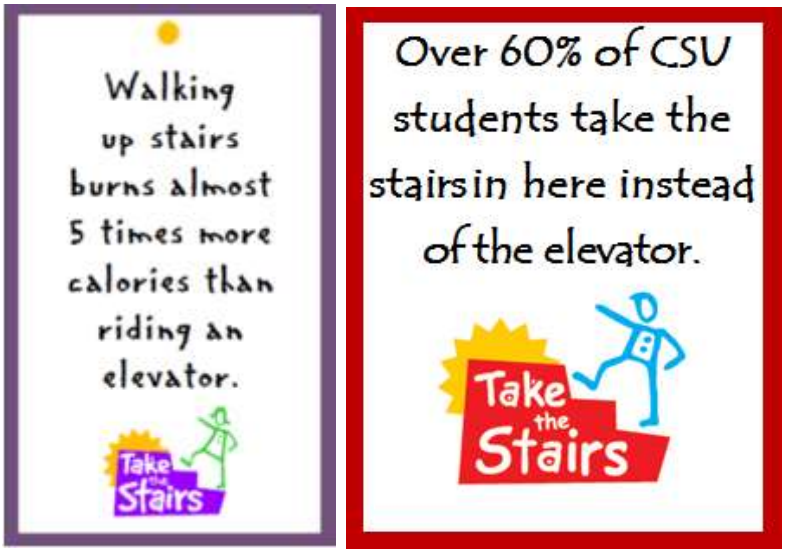

Figure 2. Study 1 point-of-decision signage.

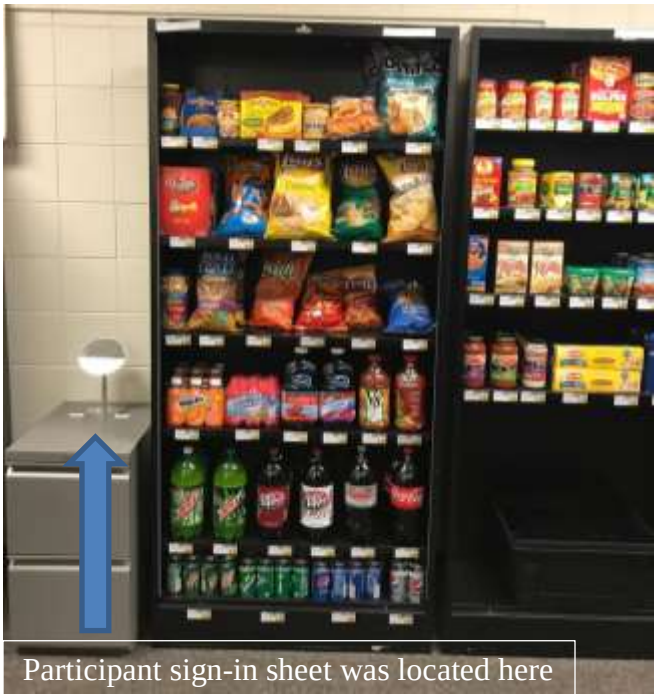

Figure 3. Study 2 mirror and grocery aisle set-up in campus laboratory.