

2011

## Effects of environmental variables on food consumption

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EFFECTS OF ENVIRONMENTAL VARIABLES ON FOOD CONSUMPTION

An Abstract of a Thesis  
Submitted  
in Partial Fulfillment  
of the Requirements for the Degree  
Specialist in Education

Denise Eslinger  
University of Northern Iowa  
May 2011

## ABSTRACT

Overweight and obesity is a growing epidemic among adults, adolescents, and children in the United States. Since 1980, rates of obesity have doubled among adults and tripled among children, and college students are not immune to this trend. This may be due, in part, to portion sizes that exceed individuals' caloric needs. Although many studies have demonstrated that people's food consumption is highly influenced by environmental factors (e.g., the size of a portion that is given), there has been very little theoretical work exploring the reasons for this influence. To determine if portion size would affect consumption when a facilitating social cue was given, in the following study, cue and portion size were manipulated in a college classroom setting. Contrary to previous studies and our hypothesis, findings suggest that portion size did not have an effect on consumption in any condition. Nevertheless, as supported by previous research, the results maintain the idea that a facilitative social cue can have a significant effect on the amount of food college students consume and/or self-serve no matter the size of the portion of food presented or other social variables that may have been present. However, it is still not clear whether portion size affects consumption in a natural social setting. More research examining the effects of social norms on portion size in a social setting versus a more restricted setting is suggested. A greater understanding of the reasons that underlie food consumption, specifically with respect to factors related to portions sizes, social influences, and social norms will help in designing modifications of food presentations intended to help people moderate their food consumption.

# EFFECTS OF ENVIRONMENTAL VARIABLES ON FOOD CONSUMPTION

A Thesis

Submitted

in Partial Fulfillment

of the Requirements for the Degree

Specialist in Education

Denise Eslinger

University of Northern Iowa

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This Study by: Denise Eslinger

Entitled: Effects of Environmental Variables on Food Consumption

has been approved as meeting the thesis requirement for the

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## CHAPTER 1

### INTRODUCTION

Overweight and obesity is a growing epidemic among adults, adolescents, and children in the United States and college students are part of this trend. Rates of overweight and obesity have increased dramatically in past few decades. In light of the obesity epidemic, several research approaches have been advanced, including the study of environmental and social factors related to eating behavior. Below, the literature on overweight and obesity and methods to ameliorate this problem are reviewed.

#### Overweight and Obesity Epidemic

In the United States, overweight and obesity have increased dramatically among children, adolescents, and adults in the past few decades. Since 1980, rates of obesity have doubled among adults and tripled among children (National Center for Chronic Disease Prevention and Health Promotion, 2009). Obesity and overweight are commonly defined according to a person's body mass index (BMI). BMI is calculated by using one's weight and height and is an indicator of body fat as well as certain health risks related to overweight and obesity. According to the *National Health and Nutrition Examination Survey* (NHNES) from 2001-2004, approximately two-thirds of adults over the age of 20 in the United States were overweight or obese. In addition, according to the NHNES, 12.4% of children ages 2 to 5, 17.5% of children ages 6 to 11, and 17% of adolescents ages 12 to 19 were recorded as overweight (National Institute of Diabetes and Digestive and Kidney Diseases, 2007). It is evident that overweight and obesity is an

increasing problem among children, adolescents, and adults in the United States and there has yet to be significant progress toward decreasing this epidemic.

Overweight and obesity group differences. Not only does the obesity epidemic affect people of all ages, overweight and obesity has also been found to be disproportionately present in minority groups. For example, among adult women in the United States, the prevalence of overweight and obesity of non-Hispanic Black and Mexican-American women is 79.6% and 73%, respectively (National Institute of Diabetes and Digestive and Kidney Diseases, 2007). Moreover, in 2008, obesity rates among preschool aged children in the United States were highest among American Indian or Alaska Native (21.2%) and Hispanic children (18.5%), and lowest among White (12.6%), Asian or Pacific Islander (12.3%), and African-American children (11.8%). Additionally, rates of overweight and obesity in low-income, preschool aged children was 14.6% (U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2010). The prevalence of overweight and obesity is continuing to rise and needs to be given special consideration across diverse groups.

Prevention of overweight and obesity. As a result of the rising epidemic of childhood and adult overweight and obesity, the U.S. Department of Health and Human Services has given recommendations to guide prevention efforts. The *Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity* (U.S. Department of Health and Human Services, Office of the Surgeon General, 2007) requests more research on the behavioral and biological causes of overweight and obesity, more intervention research toward prevention and treatment, and more effort toward decreasing

ethnic and racial health disparities with respect to overweight and obesity. Also, in the *Surgeon General's Vision for a Healthy and Fit Nation* (U.S. Department of Health and Human Services, Office of the Surgeon General, 2010), it has been suggested that schools take action by requiring physical education and recess at all grade levels, developing programs to promote exercise outside of school, providing more healthy food options on school campuses, prohibiting serving foods of minimal nutritional value during mealtimes in school food service areas, establishing a health curriculum that teaches students to make healthy eating choices and engage in physical activity, using presentation and education techniques to encourage students to make healthier eating choices (U.S. Department of Health and Human Services, Office of the Surgeon General, 2010). It can be concluded, from these efforts, that the obesity epidemic has become a concern across the country and that the U.S. government has taken note of the need to decrease and prevent overweight and obesity across multiple age groups and diverse ethnic populations.

Obesity in Iowa. As in the rest of the United States, overweight and obesity have become an increasing concern among Iowans. In 2008, according to the *Behavioral Risk Factor Surveillance System*, the percentage of adults in the state of Iowa who were overweight or obese was 64.3%, and according to the 2007 *Youth Behavior Risk Survey*, 28.8% of high school students in Iowa were overweight or obese (Iowa Department of Public Health, 2009b). In addition, according to the 2009 *Iowa Fit for Life Survey*, 37.5% of children in 3<sup>rd</sup> through 5<sup>th</sup> grade were overweight or obese and rates of obesity among 3<sup>rd</sup> through 5<sup>th</sup> graders increased dramatically between 2005 and 2007 (Iowa Department

of Public Health, 2009a). Since the fall of 2005, the Iowa Department of Public Health has recorded the height and weight of 3<sup>rd</sup> through 5<sup>th</sup> grade students in 12 schools across the state, biannually, and dramatic increases were found in the rates of overweight and obesity. From the fall of 2005 to the spring of 2007, the percentage of boys who were overweight or obese increased from 12.6% to 36.3%, and the percentage of girls increased from 18.3% to 37.3%.

As in the rest of the country, children who were members of low-income families (children receiving free and reduced-price lunches) in Iowa were found more likely to be overweight or obese (Iowa Department of Public Health, 2009a). These trends indicate that more research-based interventions are needed that target diverse populations and provide children, adolescents, and young adults in these groups equal opportunities to learn more healthful eating behaviors. Programs and interventions that promote healthy eating behaviors and active lifestyles by intervening in public institutions, such as schools, would be valuable in generating widespread change (U.S. Department of Health and Human Services, Office of the Surgeon General, 2010).

Health risks related to overweight and obesity. The health risks associated with overweight and obesity highlight the need for widespread change. Obesity and overweight can lead to a number of damaging health concerns and, therefore, have contributed, and will continue to add, to tremendous healthcare costs in the United States (National Center for Chronic Disease Prevention and Health Promotion, 2009). Those who are overweight or obese have increased risks of developing numerous health problems, many of which are severe. Health problems associated with obesity include the

following: high cholesterol, hypertension, coronary heart disease, Type 2 diabetes, respiratory ailments, sleep apnea, osteoarthritis, gynecological problems, stroke, liver and gallbladder disease, and cancer (endometrial, breast, and colon; National Center for Chronic Disease Prevention and Health Promotion, 2009).

In addition, because it is likely that overweight children, adolescents, and young adults will become or remain obese when they are older (National Institute of Diabetes and Digestive and Kidney Diseases, 2007), eating behaviors in these young populations are becoming an increased concern. Young populations that practice unhealthy eating may continue these behaviors into adulthood, leading to several health issues later in life, as well as a lower mean age of mortality rates. Children today may have a lower mean age of mortality rate than that of their parents (National Center for Chronic Disease Prevention and Health Promotion, 2009). Moreover, obese children, adolescents, and young adults are more likely to have risk factors for heart disease, including high cholesterol levels, high blood pressure, and abnormal glucose tolerance (National Center for Chronic Disease Prevention and Health Promotion, 2009). Obesity in young populations has been found to be associated with social and psychological problems, such as discrimination and poor self-esteem (Dietz, 1998). Any of these health problems, whether physical or psychological, can be harmful to an individual, as well as require costly medical intervention.

The multitude of health problems associated with being overweight or obese contribute to extreme healthcare expenditures in the United States. In 2000, obesity-related health care costs totaled approximately \$117 billion (National Center for Chronic

Disease Prevention and Health Promotion, 2009). Also, from 1979-1999, annual hospital costs related to obesity in children and adolescents rose from \$35 million to \$127 million. These healthcare costs contribute to 27% of the increase in medical costs in the United States in those years (National Center for Chronic Disease Prevention and Health Promotion, 2009). Considering the health risks and costs associated with overweight and obesity, it is evident that such problems can be damaging throughout one's lifespan as well as costly to society as a whole.

### Environmental Factors Related to Obesity

There are many contributing factors to the problem of overweight and obesity in the United States. Generally, the cause of overweight or obesity in any given individual is the result of an excess of calorie intake compared with his or her calorie expenditure. In other words, people in the United States are making unhealthy eating choices with respect to amount of food consumed compared to the level of physical activity in which they engage. Although this seems to be a simple concept, the contributing environmental and psychological factors related to obesity are quite complex (AbuSabha & Achterburg, 1997; Birch & Fisher, 1998; Geier, Rozin & Doros, 2006; Rolls, Roe, Meengs, & Wall, 2004; Wansink, 2004).

A great deal of research supports the importance of environmental and psychological factors in food consumption and the role these factors may play in overweight and obesity (due to over-eating). Most of this research has focused on external factors, as compared to individual attributes or internal characteristics. This, in part, may be due to the fact that external factors can be altered more feasibly and have the

potential to lead to widespread change in diverse populations, or that much variability was found in early research examining internal trait theories of nutrition behavior (AbuSabha & Achterburg, 1997). Studies have been conducted looking at individual internal factors such as self-efficacy and locus of control (AbuSabha & Achterburg, 1997; Holt, Clark, & Krueter, 2001), memory (Higgs, 2005), motivation (Furia, Lee, Strother & Huang, 2009), self-awareness and disinhibition (Heatherton, Polivy, Herman, & Baumeister, 1993), and literacy skills (Huizinga et al., 2009). The research on internal factors related to obesity has produced mixed results and does not demonstrate causal relationships. Although information pertaining to internal attributes related to over-eating and/or obesity provides valuable insights into the complexity of the causes of obesity and can lead to more informed research in this area, it would be difficult to translate these findings into effective large-scale interventions for diverse populations. This is because, by their very nature, such internal attributes are stable and thus resistant to change. On the other hand, many studies on environmental or external factors that are related to over-eating have shown significant results and are likely to contribute to large-scale interventions as these factors can be feasibly altered and applied to large populations.

Studies focusing on certain environmental factors related to over-eating have examined numerous environmental variables such as package size, variety, plate size, distractions, presence of others (Wansink, 2004), TV viewing (Blass et al., 2006), accessibility and exposure to particular foods (Birch & Fisher, 1998), and portion sizes or units of food (Geier et al., 2006; Siegel, 1957; Stroebele, Ogden, & Hill, 2009; Young & Nestle, 2002). Researchers have also investigated the influence of social factors, such as



eating more in the presence of others (De Castro, 1994), modeling others' eating behaviors (Birch, 1980; Roth, Herman, Polivy, & Pliner, 2001), eating a certain amount because one believes he or she is being evaluated by others (Herman, Polivy, & Roth, 2003) and socialization of children by their parents (Birch & Fisher, 1998; Orelle-Valente et al., 2007). Although there are many studies on the specific variables related to over-eating, more research is needed in determining the conditions under which such environmental and social factors operate and how certain factors interact to influence how much individuals decide to eat. By exploring the theoretical basis for the environmental and social influences that affect caloric consumption, it should be possible to develop more effective interventions to change eating behaviors in children, adolescents, and adults.

Consumption norms. As stated above, much of the current research regarding obesity has focused on various environmental factors that affect food consumption. Wansink (2006) conducted many studies in this area; in several studies, he and his colleagues examined numerous external factors that affect energy intake by manipulating environmental and social factors such as package size, plate shape, lighting, socialization, availability, distractions, portion size, and variety (for a review of environmental factors see Wansink, 2004). He found that many of these factors influence peoples' decision about how much to eat and he hypothesized these effects to be due to *consumption norms* (what people consider an appropriate or normal amount), *consumption monitoring* (using external cues for "stopping points"), *social influences* (eating more or less in the presence of others) and *effort* (Wansink, 2004).

For example, in one study, Wansink, Painter, and North (2005) provided evidence that people use visual cues to monitor consumption. In this study, 60 college students were invited to a soup lunch. Four people sat at a table together and two of them had refillable soup bowls (a tube hidden under the table kept the bowls of soup full as they ate). After 20 minutes of eating, the students were asked how much they thought they had eaten and how full they were. Wansink et al. (2005) found that those who ate out of the normal soup bowls ate about 9 ounces of soup, while those who ate out of the refillable soup bowls ate about 15 ounces (73% more). Students in both groups estimated they had eaten the same number of calories. Further, although participants did not seem to focus on internal cues to stop eating, such as satiety, participants claimed to use such internal cues when asked how full they were (Wansink et al., 2005). This study provides evidence that people use visual cues in order to gauge the appropriate amount of food to consume, yet they seem to be unaware of using such cues. Wansink (2006) has also argued that consumption norms seem to govern eating behavior. In other words, people eat as much as they think is the appropriate amount based on visual cues, such as the amount given to them and their own internal learned norms, or appropriate amounts of food to eat in specific situations (Wansink, 2006).

In another study examining the effects of visual cues and portion size on consumption, Wansink and Kim (2005) manipulated the size of popcorn containers in a movie theater. Each participant received either a large or medium-sized bucket of stale popcorn to eat during a movie. After the movie, they were asked to bring their remaining popcorn with them and fill out a survey. The popcorn was then weighed and participants

were asked questions about their eating behavior. In this study, participants with large popcorn buckets, as compared to those with medium popcorn buckets, ate an average of 173 calories of popcorn more (that is 53% more) even though they had rated the popcorn as not tasting very good (Wansink & Kim, 2005). This study provides a good example of how environmental cues, such as portion and container size contribute to determining how much a person chooses to eat, even more so than the taste of the food itself. In this study, it appeared, people focused on how much popcorn was in the container and determined an appropriate amount based on how much they were given (Wansink & Kim, 2005).

### Social Influences

Consumption norms seem to be highly influenced by social standards and social facilitation (Herman et al., 2003; Wansink, 2006). In the study involving popcorn at the movies, Wansink (2006) also found that dating couples had certain eating “scripts” (Wansink, 2006). For instance, there seemed to be a perceived appropriate amount to eat related to one’s gender and context. Women felt they were supposed to eat less during a date as to seem “feminine” (as self-reported by females in the study), whereas men felt they were supposed to eat more because it was “studly” and “powerful” (as self-reported by males in the study). In this study, females who were on a date and reported they attended to what they were eating, ate less than females who were not on a date, and males who were on a date ate more than males who were not on a date (Wansink, 2006). This study provides evidence that social standards and consumption norms affect eating behaviors differently depending on the individual and the context. Further, other social

influences, such as eating more in the presence of others (De Castro, 1994), modeling others' eating behaviors to eat more or less (Roth et al., 2001), and eating a certain amount because one believes he or she is being evaluated by others (Herman et al., 2003) have also been shown to significantly affect peoples' food consumption. Therefore, consumption norms seem to be, in large part, influenced by multiple social factors.

Social norms. Two major explanations for social influences on eating behavior proposed by Herman et al. (2003) include: (a) *the matching norm* which involves eating the maximum amount possible while matching what others are eating, or not eating any more than whomever eats the most; and (b) *the norm for minimal eating* which involves eating as little as one can while still trying to match the eating of others, or trying to eat less than whomever eats the least (Herman et al., 2003). In a review of studies on the effects of social norms on eating behavior, Herman et al. (2003) examined several studies involving eating more in the presence of others (social facilitation); modeling others' eating behaviors to eat more or less; and eating less because one believes he or she is being evaluated. He proposed the matching norm and the norm for minimal eating as explanations for many of the findings in these studies.

Social norm models. Researchers have also found that descriptive social norm models (i.e. verbal or written reports of others' behaviors in the same context, situation, and circumstance) have been shown to have a more marked effect on behavior than other types of persuasion, and other social models, and these influences can be present with or without another person observing the behavior (Goldstein, Cialdini, & Griskevicius, 2008). In a study by Goldstein, et al. (2008) examining the influence of descriptive social

norms on behavior, researchers found that hotel guests were more likely to reuse their towels if a message stated, “75% of people who stayed in room #xxx participated in our new resource savings program by using their towels more than once” (Goldstein et al., 2008, p. 5). This descriptive, social norm was more influential than if *fellow citizens* or *men and women* replaced *people who stayed in room #xxx* in the message. This study provides evidence that people make decisions based on others’ behaviors, and presenting this type of message in the same context, situation, and circumstance seems to have more influence on people’s behavior than presenting the message with other identifying characteristics. In addition, people seem to be unaware of the effects of descriptive social norm messages as they rate the behaviors of others as having the least effect on their own behavior (Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008).

Roth et al. (2001) used a descriptive social norm cue such as this with regard to eating behavior. In this study, Roth et al. (2001) found results consistent with the matching norm and the norm for minimal eating (proposed by Herman et al., 2003) by studying the effects of social norms and social models on eating behavior in female college students. In this study, half of the participants were alone while eating, while the other half were accompanied by an experimenter who did not eat, but instead sat with a magazine across the table. Upon completing a survey, participants were presented with three plates of different flavored cookies (25 of each flavor) along with a strategically placed sheet of paper displaying the number of cookies that previous participants had eaten (social norm model). Then, researchers gave one of two instructions that corresponded to the number on the strategically placed sheet of paper: (a) “People have

been eating lots;” and (b) “People haven't been eating that many” (Roth et al., 2001, p. 168). There was also a control group that did not receive a social model or any instruction regarding the amount previously eaten. Roth et al. (2001) found that when participants were left alone, they ate more in the presence of social norm models that indicated others had eaten a lot of cookies than those with models who indicated others had eaten minimal cookies, or those who were in the control condition (Roth, et al., 2001). Moreover, those who were in the presence of a non-eating observer ate minimal cookies no matter the condition (Roth et al., 2001). It seems if a female thinks she is being evaluated by someone who is not eating, she will eat considerably less. It should also be noted that not a single participant identified the social norm model (piece of paper or instruction) as having influenced the amount of food that she ate (Roth et al., 2001).

Overall, it seems people decide the appropriate amount to eat based on how much others are eating and/or how much they perceive others to be eating, and this effect depends on individual characteristics, such as gender, as well as the context and situation in which the person is to exhibit the behavior. Social norms for eating behaviors, like other variables that have been shown to affect eating, are largely determined by external cues and provide a basis for a consumption norm. It is possible that many of the other external cues studied also provide a way for people to gauge what is socially acceptable. Therefore, it is likely social models or social norms underlie some of the other external variables that have been considered thus far (Herman et al., 2003).

Social influence can unknowingly have a significant effect on eating behavior, even through a simple instruction or a seemingly irrelevant piece of information. For

example, in the study by Roth et al. (2001), participants seemed to gauge their consumption in terms of the number of cookies they thought another person had eaten. In this study, the researchers provide evidence that people look for cues, such as a socially appropriate number, to determine the appropriate amount to consume. However, because participants were only presented with a number, it is not clear how the size of the food item affected their decision in this situation. For example, it is not apparent whether the participants in this study (Roth et al., 2001) would have eaten a smaller number of cookies if the cookies were significantly larger than the conventional size given, or if they would have still based the appropriate amount on the number derived from the social model, causing them to eat significantly more.

#### Cognitive Processes Related to Eating Behavior

It is evident that eating behavior is a complex process that involves the dynamics of numerous variables that are difficult to control on a daily basis. It is also evident that people are not aware of the consumption norms and social influences that affect eating behavior because they usually attribute their consumption to degree of satiety (Roth et al., 2001; Wansink, 2004). Therefore, it is probable that people do not recognize specific cognitive processes they use to determine the appropriate amount to consume. Research needs to be carried out looking at feasible ways to provide awareness of the cognitive processes, or cognitive monitoring (Wansink, 2006) related to food consumption, along with looking at controllable external variables that can contribute to large-scale change across diverse groups.

With consumption norms and social influences in mind, it is still not clear how individuals determine the appropriate amount to eat. For example, one could count the number of food items and try to eat an appropriate or socially acceptable amount according to number; one could just eat what is given to him or her; one could try to determine the appropriate amount of food to eat according to what he or she considers acceptable in that particular context; one could focus on the appropriate serving of a food item based on knowledge of nutrition; or one could attend to internal satiety cues.

Portion size. In view of these environmental factors as well as the possible cognitive processes that govern their influence, portion size seems to be a large contributing external factor in any case. In the past few decades there has been a dramatic increase in portion sizes from manufacturers and restaurants in the U.S. (U.S. Department of Health and Human Services, National Heart Lung and Blood Institute, 2010; Young & Nestle, 2002). Current portion sizes from Americans' main food sources have increased significantly since the 1970s and they exceed FDA and USDA standard portion guidelines (U.S. Department of Health and Human Services, National Heart, Lung, and Blood Institute, 2010; Young & Nestle, 2002). The consequences of such increases are considerable and several studies have shown significant effects on peoples' eating behavior when portion sizes are increased. According to several studies, increasing the portion size of a unit of food, or the meal size given to a person, significantly increases energy intake in adults, adolescents, and children regardless of BMI, race, gender, and certain individual attributes, such as disinhibition and dieting (Fisher, Liu,



Birch, & Rolls, 2007; Geier et al., 2006; Rolls et al., 2004; Rozin, Kabnick, Pete, Fischler, & Shields, 2003; Wansink, 2004; Wansink, 2006).

For example, in a study examining how varying the portion size of a food item affects intake, Rolls et al. (2004), provided 6oz, 8oz, 10oz and 12oz cold meat sandwiches, on separate occasions, to participants ranging from 20-45 years old. Each participant came to the lab once a week for 4 weeks and received a different weight and length of sandwich each time. To measure consumption, the food was weighed before and after the meal. Participants' BMI, age, weight, height, hunger tendency, dietary restraint, and a rating of disinhibition were also recorded. It was found that when the sandwich size was increased from 6 to 12 inches, females consumed 31% more and males consumed 56% more; also, when the portion size was increased from 8 to 12 inches, females consumed 12% more and males consumed 23% more (Rolls et al., 2004). This study provides sufficient evidence that increasing the portion size of an identifiable food item (a sandwich) significantly increases consumption. However, since participants were exposed to sandwiches that were a different weight and length on each occasion, and neither weight nor length was held constant in this experiment, this study does not provide any evidence whether the amount of food in weight or the length of the sandwich affected consumption. Therefore, the basis for consumption norms in this experiment is not particularly evident. It is not clear whether the weight of the food item, or its size in length or width was related to participants' consumption.

The unit bias. It has been hypothesized that the unit bias influences the consumption of a portion size given (Geier et al., 2006). The idea that people consume a

certain amount based on units of food was first studied by Seigel (1957), when he found that people tend to eat food items in whole no matter the size of the item or the number offered. The unit bias (Geier et al., 2006) assumes that the number of pieces of food, rather than the size or weight of the food, is the basis determining how much people eat. In other words, people seem to concentrate on the number of items (or what appears to be one unit) rather than the size or weight of the food.

In a number of studies involving the perception of portions of food as units, Geier et al. (2006) looked at ways people can perceive a food item and examined whether the number of units, versus the amount of food according to weight or size, determined consumption. For example, in one study by Geier et al. (2006), he and his colleagues placed bowls of large Tootsie Rolls and bowls of small Tootsie Rolls in an office building on alternating days. In one condition, the bowl contained 80 small Tootsie Rolls and in another condition, the bowl contained 20 large Tootsie Rolls. Researchers weighed the food at the end of the day to measure consumption, measurements were taken for 10 days and it was found that participants ate significantly more candy in weight when the Tootsie Rolls were larger.

In addition, Geier et al. (2006) found that a serving utensil of any size can be considered one unit. For example, as in the study with Tootsie Rolls, researchers placed bowls of M&Ms in an office building, but this time with different sized serving scoops in each of the bowls, and found the same effect. People ate more when the scoop was larger. It seems they looked at one scoop as one unit. In each of the experiments, Geier et al. (2006) found that more food by weight was consumed when the unit was larger.

Therefore, participants did not seem to be gauging their consumption based on the weight or size of food presented, but rather on the number of individual units presented.

Participants in this study seemed to be attuned to the number of units they were consuming rather than the weight of food they were consuming because, if participants would have been attuned to the weight of food they were consuming, they would have been expected to take approximately four small Tootsie Rolls for every one large Tootsie Roll, or two small scoops for every one large scoop of M&Ms; instead, they took approximately the same number of each size of Tootsie Roll, as well as the same number of scoops of M&Ms. Nevertheless, the studies by Geier et al. (2006) were somewhat variable and lacked adequate control. In addition, the researchers did not look at other environmental factors that may have been influencing consumption, such as possible social cues that could affect or override the results, including people's beliefs about the appropriate amount of food to eat in the situation.

Overall, it seems the number of units of a food item, rather than the amount in weight or size, creates a consumption norm or interacts with an existing consumption norm which provides a basis for eating the perceived appropriate amount or socially acceptable amount. However, in these studies, it is not clear what causes people to see a particular entity as a unit and how they decide how many units, or how much of a unit, is the appropriate amount to eat. In order to better understand the factors that influence food consumption, more research needs to be carried out looking at the conditions under which the unit bias exists, including other environmental factors that may mediate the unit bias, such as social influence or consumption norms.

Specific factors that may underlie the unit bias. By finding out more about the specific cognitive factors under which consumption norms and the unit bias operate, people may be able to become more aware of external cues that lead to overeating; therefore, theoretically based, large-scale interventions will be more plausible. It is possible the cognitive processes that lead one to think of a unit as the appropriate amount (social acceptability or consumption norms) could significantly impact the unit bias. In turn, this could influence one's estimation of the appropriate or acceptable amount of food to eat.

Little is known about the conditions under which consumption norms and the unit bias operate, and why they are influential. For example, as much research has demonstrated that social norms are highly influential in determining eating behavior, it would be important to consider whether certain social cues could cause the unit bias to diminish. In other words, if students are made to believe that it is socially acceptable to eat a large amount of a particular snack, they may not feel as if they have to eat a number of units they would otherwise consider acceptable. Under these conditions, it is not clear whether they would count the number of items they eat to try to determine how much to eat or if they would base their decision on something else, such as the amount of food by weight, how much is left on the plate, satiety, etc.

## Intervention Studies

Very few intervention studies have focused on the environmental factors that have been proven to significantly influence caloric consumption, and of the few, a majority have focused on training individuals to estimate portion sizes while ignoring other contributing external factors. A small number of intervention studies have used teaching and training techniques related to portion size to conduct intervention research (e.g., Steenhuis & Veermeer, 2009); however, these studies were not based on a theoretical framework, and the interventions did not significantly decrease consumption (Steenhuis & Veermeer, 2009).

In a review examining the effects of intervention studies that were meant to reduce consumers' consumption through techniques such as teaching awareness of inappropriate portion sizes, looking at labels to determine the appropriate amount to consume, substituting low-fat ingredients for full-fat ingredients, and using references and measurement aids to determine correct portion sizes, mixed results were found and many of the studies did not generate a significant effect (Steenhuis & Veermeer, 2009). More research in this area needs to be conducted, specifically with respect to factors that govern the size of portions, such as social influences and consumption norms. More research on the factors that influence the unit bias as well as the cognitive processes that cause the increase of consumption due to increased portion sizes is needed (Geier et al., 2006). Additional research in this area could help in designing modifications of food presentation that are intended to help people reduce their portion sizes.

## Purpose of Research

The purpose of this research was to examine some of the environmental factors in the presentation of food that influence the amount of food that college students consume and/or take when offered the food. An extensive body of research has accumulated demonstrating that environmental factors, such as portion sizes that are offered to people, have a large influence on how much they consume (Wansink, 2006). Much less is known, however, about the conditions under which these factors operate, and why they are influential. One possibility is that people have consumption norms which are learned, that is, informal rules for what they consider an acceptable amount or an appropriate number of food items to eat (Wansink, 2006). Several researchers suggest that a pre-determined portion of food creates a consumption norm and provides a basis for eating what appears to be the appropriate amount (Geier et al., 2006; Rolls et al., 2004; Wansink, 2006). However, we have not located any studies to date examining whether consumption norms, specifically social norms, underlie and therefore, mediate the unit bias. The results of the study will help to better explain the cognitive and environmental influences on portion sizes of food that are selected by college students, and whether social norms influence such decisions. Research needs to be carried out to identify feasible ways to provide awareness of the cognitive processes related to food consumption, along with looking at controllable external variables that can contribute to large-scale change across diverse groups.

Research questions. This research was conducted to answer the following question: Will the unit bias be reduced if college students are given a *facilitating social*

*cue* (an instruction that includes a descriptive social cue indicating other students have eaten a large amount of Snickers and that students should eat as much as they want, adapted from Goldstein et al. [2008] and Roth et al. [2001]) as compared to using a default consumption norm, such as the unit bias? More specifically, this study examined the amount of Snickers candy in grams, served in small units, college students consumed and/or took relative to candy served in large units, if they were given an instruction with a facilitating social cue such as, “In some of my other classes, each group ate almost a whole big bowl and I still have a ton of these,” designed to override their default consumption norm for portion size, in contrast to students who were not given such an instruction.

Hypotheses. It was hypothesized that the unit bias would be reduced, and college students would eat less than or equal to the amount, in grams, of large Snickers compared to small Snickers if they were given a facilitating social cue indicating they could eat as much as they want. It was also hypothesized that when students were given a control instruction, they would adhere to the unit bias and eat significantly more large Snickers in grams than small Snickers. In this study, the unit size of Snickers candy and the social norm for eating behavior was manipulated in a college classroom setting in order to determine if the unit bias would still operate when participants were made to believe others had eaten a large amount of a food item, and that they could eat as much as they wanted.

## CHAPTER 2

### METHODS

#### Participants

Participants were 15 male and 44 female college juniors, and 23 male and 43 female college sophomores (125 total) in a mid-sized, Midwestern university. A priori power analysis was conducted in order to determine that a sample of 84 participants would allow sufficient power if a moderate effect was achieved. Most participants ranged in age from 18-22 years old and a few non-traditional students were in their late 20s. All participants were enrolled in one of two teacher education courses offered at the university.

Participants were selected based on their enrollment in one of the two courses scheduled around lunch time. Permission from the professor was received prior to collecting data in each of the classrooms. All students attending any of the chosen courses during the time of data collection were given the following instruction from the professor of their course: "I brought some snacks. Please help yourself." Participants were then given Snickers candy and could choose whether or not to eat and/or take any of the candy. Therefore, participants comprised all of the students sitting in the classroom during class time on the day of the study.

#### Design

A two by two factorial design was used. Independent variables were *size* (large versus small Snickers candy bars) by *instruction* (facilitating social norm cue, "I still have a lot of these," adapted from studies by Goldstein et al. [2008] and Roth et al.



[2001] versus a control instruction, “Please help yourself”) and the dependent variable was the weight of food consumed and/or taken in grams. The unit size of a Snickers candy bar was manipulated within each classroom and the instruction was manipulated across classrooms with two of the classes receiving the control instruction and the other two classes receiving the facilitating social cue instruction. Each class received two of the four conditions, as shown in Table 1.

Table 1

*Classes Corresponding With the Four Conditions*

Class	Condition (Unit x Instruction)	<i>n</i>
Class A	Small x “Help yourself”	17
	Large x “Help yourself”	13
Class B	Small x “I still have a ton of these”	12
	Large x “I still have a ton of these”	17
Class C	Small x “I still have a ton of these”	11
	Large x “I still have a ton of these”	18
Class D	Small x “Help yourself”	13
	Large x “Help yourself”	14

## Materials

Each of the four classes received Snickers *Miniatures* which were considered small units and were approximately 9g per unit, as well as Snickers *Fun Size*, which were considered large units and were approximately 17g per unit. The Snickers were placed in large clear bowls, 4.5 inches deep and 10 inches in diameter, on tables in the classrooms. Additionally, the candy was weighed multiple times by two different researchers before and after each class with a digital kitchen scale and the average weight was used in case of disagreements.

## Procedure

The study took place in two different classrooms in the same building at the university. Two different professors taught the courses. One professor (Professor 1) taught two sections of one course at 11:00am (class A) and 12:30pm (class B) with 30 and 29 students, respectively, participating in the study, and another professor (Professor 2) taught two sections of a different course at 11:00am (class C) and 2:00pm (class D), with 29 and 37 students, respectively, participating. Professor 1's classes contained mostly college juniors, and Professor 2's classes contained mostly college sophomores. All of the classes were an hour and fifteen minutes in length. In each of the two classrooms, the students sat in groups of 3-6 around hexagon-shaped tables. There were seven tables in Professor 1's classroom, and 8 tables in Professor 2's classroom.

During their class time, participants were offered the Snickers candy and could choose whether or not to eat and/or self-serve the candy. They were not told about the

purpose of the study prior to being offered the food. As in order to determine how much participants would eat without introducing bias, they could not know that they were being offered food to find out how much they would consume and/or take.

Size manipulation. The researchers presented the two unit size conditions within each classroom by placing one bowl filled with either large units of candy (Snickers Fun Size) or small units of candy (Snickers Miniatures) in the center of each table. The size of the unit of food that was presented was manipulated as in the study by Geier et al. (2006), by randomly assigning tables in the classroom to a bowl filled with either large or small units of candy. To randomly assign the unit size to each table, as well ensure there were an evenly distributed number of large and small Snickers across conditions, the researchers used a random number generator (retrieved from [www.randomizer.org](http://www.randomizer.org)). For example, in class A, a graph of the layout of the room was created and each of the 7 tables were assigned numbers (1-7). Then, each of the seven bowls were also assigned numbers (1-7) and a coin was flipped to determine which size of candy would be in bowls numbered 1-3 and which size would be in bowls numbered 4-7. From this, large units would go in bowls numbered 1-3 and small units would go in bowls numbered 4-7 in class A. Then, the random number generator was used to assign each bowl to a particular table. This was repeated for class B, except this time, bowls numbered 1-4 were assigned large units and bowls numbered 5-7 were assigned small units as to have the sizes represented equally. The process was also repeated for classes C and D, except bowls were numbered 1-8 as there were eight tables in each of these classrooms.

In order to fill each of the bowls as to appear to have an ample amount of candy as well as to appear to have the same amount of candy in each bowl, the researchers put an average of 1180g of Snickers Miniatures in the appropriate bowls and an average of 1250g of Snickers Fun Size in the appropriate bowls. Because each of the bowls looked equally full, it was decided the bowls did not need to weigh exactly the same as there could have been differences in the weight of each piece of candy. Additionally, there was more wrapper material in the bowls filled with small units of Snickers because there were more pieces of candy; therefore, the bowls filled with small units were lighter, but still appeared to have the same amount of candy as the bowls filled with large units.

Instruction manipulation. The researchers varied two social instructions across classrooms. Therefore, each class received one of two instructions. One instruction indicated other classes had eaten an unusually large amount of candy and that the professor had a lot of the candy (facilitating social cue); this instruction included the following parts: (a) The professor let the students know they could eat the snack by saying, “I brought some snacks. Please help yourself.” (b) The professor provided a facilitating social cue, by saying, “In some of my other classes, each group ate almost a whole big bowl and I still have a ton of these.” (The facilitating social cue was adapted from Goldstein et al., 2008 and Roth et al., 2001.) (c) The professor also let the students know although the packaging was different colors, the candy was the same, by saying, “All this candy is the same—it’s just in different packaging.” The three parts of the instruction were given consecutively by the professor before the class began. In the other class, the professor gave an instruction indicating the students could eat the candy, but

did not include a facilitating social cue. The control instruction included the following:

(a) The professor let the students know they could eat the snack by saying, “I brought some snacks. Please help yourself.” (b) The professor let the students know that although the packaging was different colors, the candy was the same, by saying, “All this candy is the same—it’s just in different packaging.”

Instruction conditions were randomly assigned to class A and class B by flipping a coin to find out which section would receive each instruction. From this, class A received a control instruction, and class B received an instruction including the facilitating social cue. The instruction condition was then counterbalanced in classes C and D as to control for time of day. For example, class A and class C took place at 11:00am, therefore, these classes would likely occur before the students ate lunch. Conversely, class B took place at 12:30pm and class D at 2:00pm, therefore, these classes would likely occur after lunch time. By counterbalancing the instructions, the effects of time of day and hunger levels of the students would be better controlled. Preceding the presentation of the Snickers in each classroom, the professor of the course was informed of the study and given a sheet of paper with one of the two specific instructions to place on the podium and say verbatim at the beginning of class.

Data collection procedure. Prior to entering each classroom, IRB approval was sought and received. Before each class began, the researchers weighed the candy that would be presented and placed one of the seven large bowls of candy in the center of each table in the classroom. The bowls were numbered on the bottom in order to randomize the presentation of unit size as well as to determine the average amount

students at a particular table consumed and/or took out of each bowl, and the gender of the students sitting at that table. The researchers also gave the professor a set of instructions that included the facilitating social cue instruction or the control instruction before the class began. After all of the students arrived in the classroom, the professor read the instructions and went on with the normal class. After the class was over, the researchers collected each of the bowls, weighed the uneaten candy and recorded how much each group had consumed and/or took. The researchers also recorded the number of students at each table and the gender of the students. Participants were debriefed upon completion of the study.

## CHAPTER 3

### RESULTS

A two by two factorial design was used to find out how much Snickers candy college students consumed and/or took in large versus small units if they were given a social facilitating cue to imply that other students had eaten a large amount and that they could eat as much as they wanted. It was hypothesized that the unit bias would be reduced if college students were given a facilitating social cue indicating others had eaten a large amount of a Snickers candy, as compared to college students who were not given such a cue, but may have been using a default consumption norm. Specifically, it was hypothesized, when given the control cue, the mean grams of Snickers consumed and/or taken would be greater in the large unit condition than in the small unit condition as found in the unit bias study by Geier et al. (2006), but when given a facilitating social cue instruction, the mean grams of Snickers consumed and/or taken of large units would be lesser than or equal to the amount eaten and/or taken of small units (indicating the unit bias was not operating in this condition).

#### Analyses

Initially, to test this hypothesis, two separate analyses were conducted in order to compare the pattern of results across different professors' classes and examine whether the level (sophomore versus junior) of the students, and/or professors' attitudes had an effect on the results. Therefore, using SPSS version 16.0, two separate, 2 (size) x 2 (instruction) between subjects factorial ANOVAs were conducted comparing the average weight each student at a particular table consumed depending on the unit size presented,

and whether one of two instructions was given, in each professor's classes; one analysis was conducted for classes A and B and another analysis for classes C and D. Then, another analysis was conducted combining the data from all four classes and one, 2 (size) x 2 (instruction) between subjects factorial ANOVA was conducted comparing the weight that each student at a particular table consumed depending on the unit size presented, and whether one of two instructions was given, in all classes.

Results for classes A and B. With data from classes A and B only, a 2 (size) x 2 (instruction) between subjects factorial ANOVA was conducted comparing the weight that each student at a particular table consumed depending on the unit size presented, and whether one of two instructions was given. The hypothesized interaction was not significant  $F(1, 55) = 1.66, p > .05$ . However, a significant main effect for instruction was found  $F(1, 55) = 29.34, p < .01$ . Participants who received the facilitating social cue instruction in class A consumed significantly more ( $M = 122.93, SD = 64.78$ ) in grams than participants who received the control instruction in class B ( $M = 54.33, SD = 25.39$ ), and in contrast to previous studies, the main effect for unit size was not significant  $F(1, 55) = 0.23, p > .05$ . The means for grams and number of Snickers candy consumed and/or taken for each condition in classes A and B are displayed in Table 2 and Figure 1.

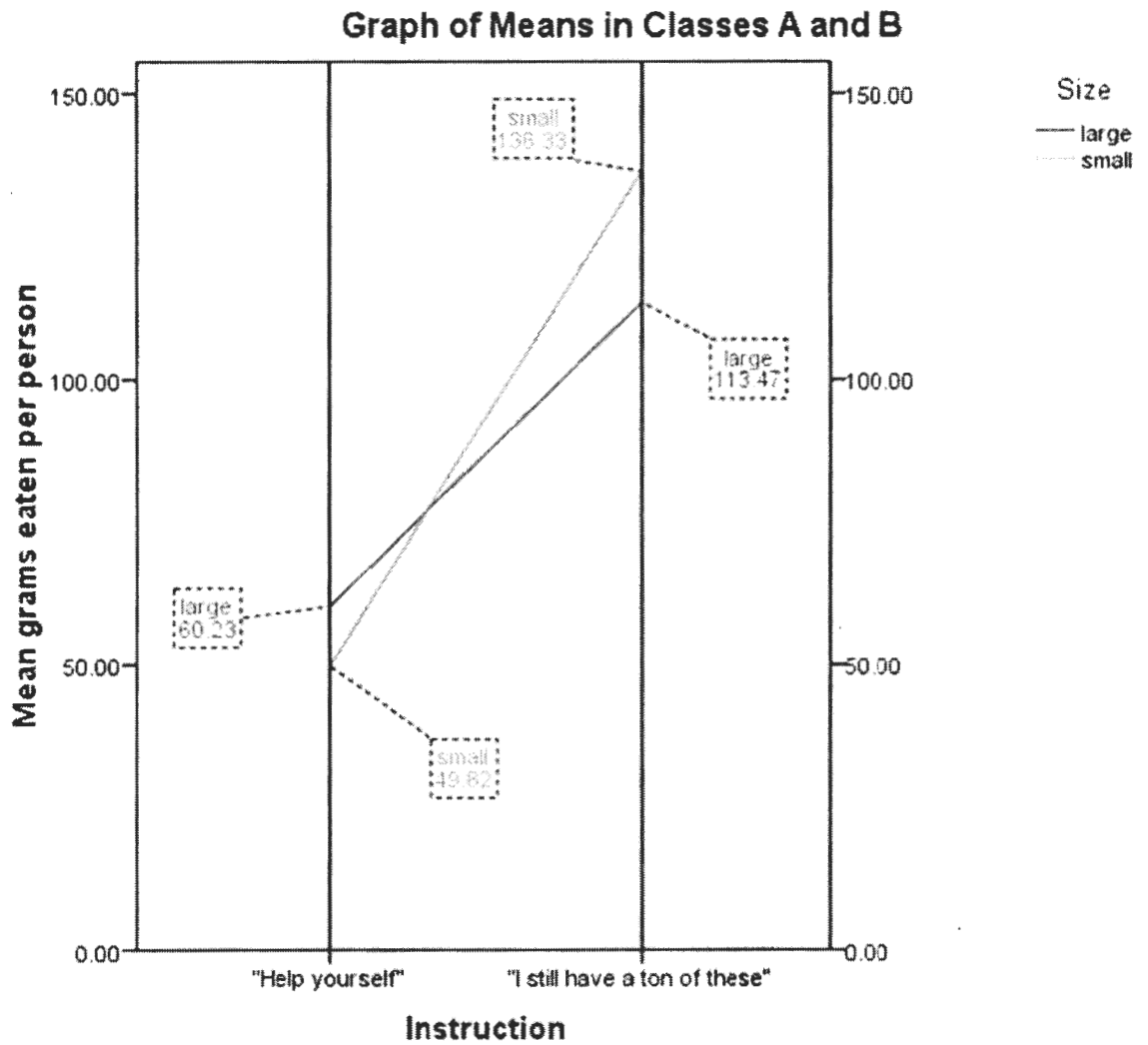


Table 2

*Means for Grams and Number of Snickers Candy Consumed and/or Self-served for Each Condition in Classes A and B*

Variable	<i>n</i>	<i>M (SD)</i> grams	<i>M</i> number	<i>F(1,55)</i>
Unit				0.23
Small				
“I still have a ton of these”	12	136.33 (78.68)	15.15	
“Help yourself”	17	49.82 (22.67)	5.54	
Total	29	85.62 (67.87)	9.51	
Large				
“I still have a ton of these”	17	113.47 (53.47)	6.67	
“Help yourself”	13	60.23 (28.40)	3.54	
Total	30	90.4 (51.29)	5.32	
Instruction				29.34**
“I still have a ton of these”	29	122.93 (78.35)		
“Help yourself”	30	54.33 (49.64)		
Instruction*Unit	59			1.66

\* $p < .05$ . \*\* $p < .001$



*Figure 1.* Graph of Means for Grams of Snickers Candy Consumed and/or Self-served in Classes A and B

Results in classes C and D. With data from classes C and D only, 2 (size) x 2 (instruction) between subjects factorial ANOVA was conducted comparing the weight that each student at a particular table consumed depending on the unit size presented, and whether one of two instructions was given, in classes C and D. The hypothesized

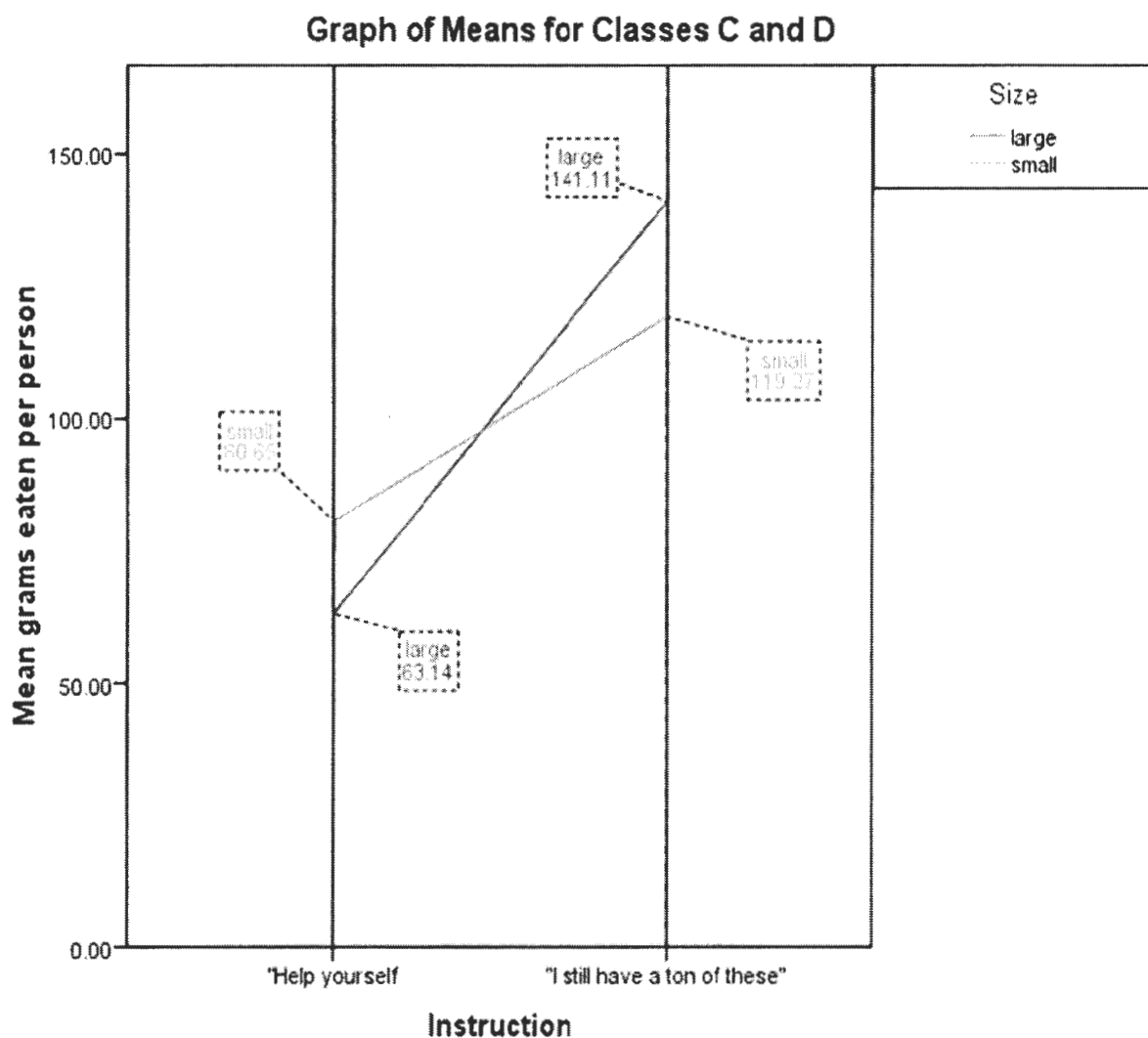
interaction was not significant  $F(1,62) = 1.01, p > .05$ . However, a significant main effect for instruction was found  $F(1,62) = 8.89, p < .01$ . Participants who received the facilitating social cue instruction in class C consumed significantly more ( $M = 132.83, SD = 90.82$ ) in grams than participants who received the control instruction in class D ( $M = 74.03, SD = 61.82$ ), and in contrast to previous studies, the main effect for unit size was not significant  $F(1,62) = 0.01, p > .05$ . The means for grams and number of Snickers candy consumed and/or taken for each condition in classes C and D are displayed in Table 3 and Figure 2.

Table 3

*Means for Grams and Number of Snickers Candy Consumed and/or Self-served for Each Condition in Classes C and D*

Variable	<i>n</i>	<i>M (SD)</i> grams	<i>M</i> number	<i>F(1,62)</i>
Unit				0.01
Small				
“I still have a ton of these”	11	119.27 (46.64)	13.25	
“Help yourself”	23	80.65 (65.07)	8.96	
Total	34	99.86 (80.84)	11.10	
Large				
“I still have a ton of these”	18	141.11(110.07)	8.30	
“Help yourself”	14	63.14 (56.66)	3.77	
Total	32	107.0 (97.64)	6.29	
Instruction				8.89**
“I still have a ton of these”	29	132.83 (74.02)		
“Help yourself”	37	65.21 (49.64)		
Instruction*Unit	66			1.01

\* $p < .05$  \*\* $p < .001$



*Figure 2.* Graph of Means for Grams of Snickers Candy Consumed and/or Self-served in Classes C and D

Results for all classes. Because the results of the above analyses showed a similar pattern as classes A and B (a significant main effect for instruction and no significant main effect for size or interaction was found) the data were collapsed, combining the data from classes A, B, C, and D and a 2 (unit size) x 2 (social instruction) between subjects

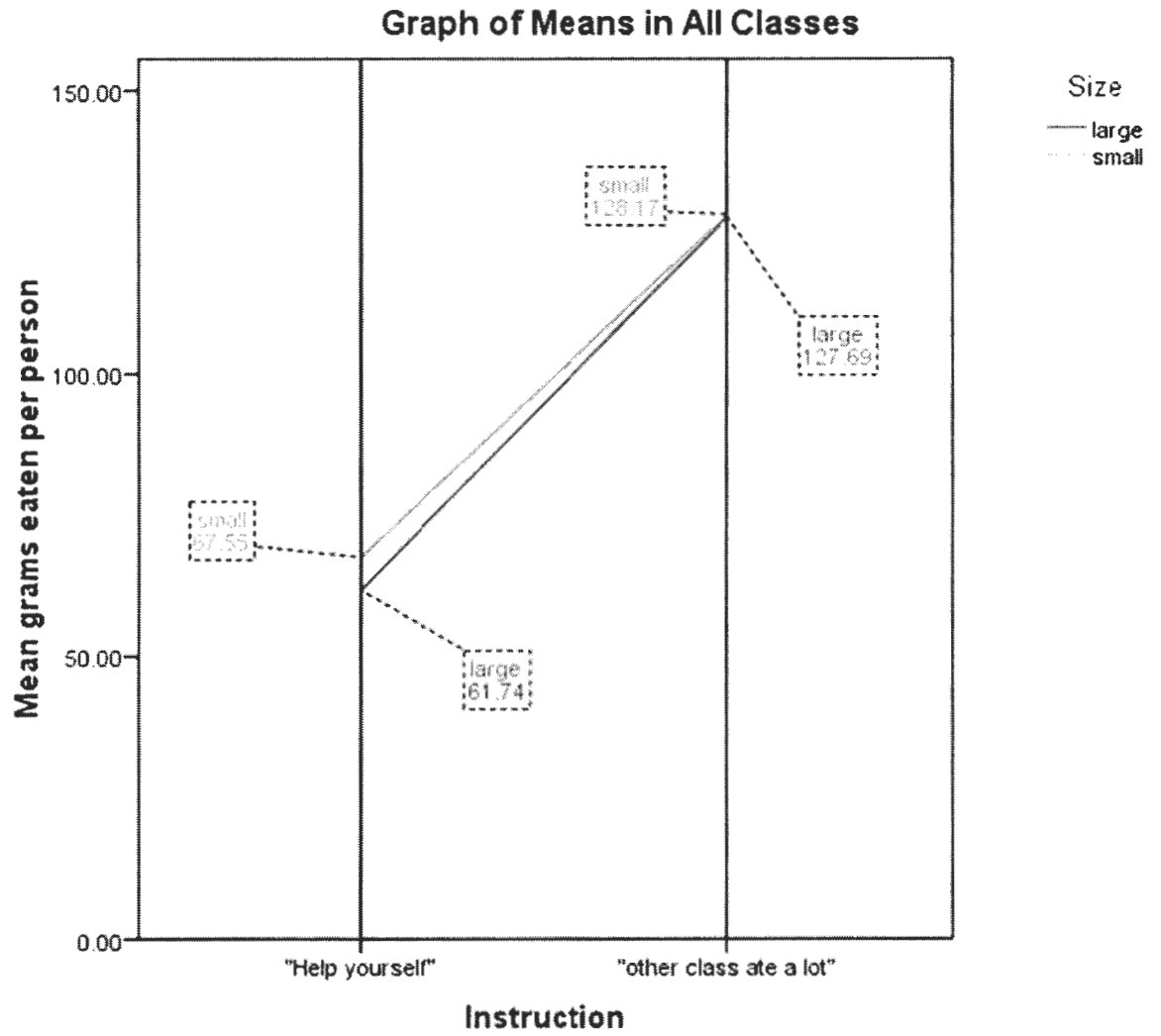
factorial ANOVA was calculated comparing the average weight each student at a particular table consumed depending on the unit size presented, and whether one of two social instructions was given, in all four classes. A significant main effect for instruction was found  $F(1,121) = 28.23, p < .000$ , mirroring the significant analyses obtained for different professors' classes. Participants who received the facilitating social cue instruction consumed significantly more ( $M=127.88, SD= 78.35$ ) in grams than participants who received the control instruction ( $M=65.21, SD=49.64$ ). Additionally, as in the separate analyses, the main effect for unit size was not significant  $F(1,121) = .070, p > .05$  and the interaction was not significant  $F(1, 121) = .050, p > .05$ . The means for grams of Snickers candy consumed and/or taken for each condition in all four classes are displayed in Table 4 and Figure 3.

Table 4

*Means for Grams and Number of Snickers Candy Consumed and/or Self-served in All Classes*

Variable	<i>n</i>	<i>M (SD)</i> grams	<i>F(1,121)</i>
Instruction			28.23**
“I still have a ton of these”	58	127.88 (78.35)	
“Help yourself”	67	65.21 (49.64)	
Unit			0.07
Small	63	89.68 (64.24)	
Large	62	98.97 (78.52)	
Instruction*Unit	125		0.50

\* $p < .05$ . \*\* $p < .001$



*Figure 3.* Graph of Means for Grams of Snickers Candy Consumed and/or Self-served in All Classes



### Informal Observations

There were some significant student behaviors exhibited across the four classes that were reported by the professors of each of the classes. In each of the classes, there were specific tables that seemed to *hoard*, or take the candy for later consumption, significantly more than others. In classes A and B students hoarded candy by taking handfuls at a time, but never completed an entire bowl, and in classes C and D there were was one table in each class that ate and/or took *all* of the candy contained in one bowl. Nevertheless, all of these groups were included in the results of the study because hoarding was not prohibited by the professors, and therefore, it was considered within the expected range of classroom behaviors by the participants. Additionally, as in the study by (Geier et al., 2006), the researchers' measurement of the unit bias included how much one took and/or consumed of a particular snack food rather than solely measuring how much they actually consumed.

There were also some notable behaviors within the classes. In class B, students seemed to be suspicious of the numbers on the bowls as a few different students inquired about the bowls and even asked if the professor was conducting some kind of study with the candy. Students were given an unusually large amount of candy in all four classes and it is likely that the appearance of the candy looked suspicious across classrooms. It should also be noted that there was one table in class C at which only one female student was sitting alone; her data was not included in the results of the study as, unlike the rest of the participants, she did not have any direct observers or peer models at her table during the study.

## CHAPTER 4

### DISCUSSION

There is a large body of research demonstrating that environmental factors, such as portion sizes that are offered to people and social influences have a significant effect on how much they consume (Geier et al., 2006; Roth et al., 2001; and Wansink, 2006). One possible explanation for this effect is that people have consumption norms which are learned, that is, informal rules for what they consider an acceptable amount or an appropriate number of food items to eat (Wansink, 2006) depending on the environmental factors present. Several researchers suggest that a pre-determined portion of food creates a consumption norm and provides a basis for eating what appears to be the appropriate or socially acceptable amount (Geier et al., 2006; Rolls et al., 2004; Wansink, 2006). The unit bias (Geier et al., 2006), suggests the number of units of a food item, rather than the amount in weight or size, creates or interacts with an existing consumption norm which provides a basis for eating the perceived appropriate amount. However, in these studies, it was not clear what caused people to decide how many units, or how much of a unit, is the appropriate amount to eat, and how social factors influence this decision. In order to better understand the factors that influence food consumption, specifically with regard to consumption norms, we examined social factors that may underlie the unit bias.

In this study, it was hypothesized that when college students are given a control instruction, the mean grams of Snickers consumed and/or taken would be greater in the large unit conditions than in the small unit conditions, but when given a facilitating social

cue, the mean grams of Snickers consumed and/or taken in the small unit conditions would be greater than or equal to the amount eaten and/or taken in the large unit conditions (indicating the unit bias was not operating in this condition). Results indicate that the facilitating social cue manipulation was effective at reducing participants' inhibitions regarding taking and/or eating candy. However, the results do not support the original hypothesis that the unit bias is reduced when college students are given a facilitating social cue indicating others have eaten an unusually large amount of Snickers candy, rather than using a default consumption norm.

It should be noted, however, classes A and B did show a pattern in the hypothesized direction. As shown in the table of means, when the control cue was given, the mean grams of Snickers consumed and/or taken was greater in the large unit condition than in the small unit condition in these two classes; therefore, it seems the unit bias could have been operating. Moreover, the means in the social cue condition show a pattern opposite from the unit bias. When students were given a facilitating social cue, the mean grams of Snickers consumed and/or taken of small units was greater than was eaten and/or taken of large units indicating the unit bias may not have been operating in this condition. Because the means for classes A and B show a pattern in the hypothesized direction, but are not significant, it is possible that a larger sample size, and a more controlled study, could yield significant results.

On the other hand, classes C and D did not indicate a pattern in the hypothesized direction and the unit bias did not seem to be operating in any of the conditions in these classes. When a control instruction was given, the mean grams consumed and/or taken in

the small unit condition was greater than in the large unit condition indicating the unit bias was not operating in classes C and D; therefore, conclusions about variables underlying the unit bias in these particular classes could not be made. The variation between classes could have been due to several factors, including the differences in the level (sophomore versus junior) of the students across classes, professors' possible differential delivery of the scripted message, and social influences of differing classmates.

It seems the classroom setting made the social facilitating cue instruction effective; however, when a control instruction was given, the unit bias did not operate as expected. It may be that all four classes actually contained social influences that intervened with the unit bias in all four conditions and for that reason there was not a significant difference in the number of large versus small Snickers eaten and/or taken in any of the four conditions.

### Limitations

There are several possible explanations for the differences across classes, the absence of the unit bias, and the lack of significant results. Notably, we decided that data should be collected in a natural social setting, where participants could see one another, as opposed to a setting in which participants did not have direct observers as in Geier et al. (2006). We chose the classroom setting as we believed stronger social pressure would exist in this setting. However, in a classroom setting, it is difficult to control for extraneous social variables and participant variables as the setting was intended to remain as natural and unobtrusive as possible and the presence of the researchers in the

classroom was not appropriate. Due to this lack of information regarding extraneous variables and other participant variables, other variables could have unknowingly affected the results of the study.

It seems this setting and the social factors that existed made the social facilitating cue instruction effective, however, it may have had a dampening effect on the unit bias. It is possible that classmates and/or the professor could have acted as perceived social models or evaluative observers, or exhibited other social influences during the study and therefore, interacted with the instruction given by the professor. According to Herman et al. (2003) participants could have been determining the appropriate amount to eat by watching others and not eating any more than whoever eats the most, eating as little as one can while still trying to match the eating of others, or trying to eat less than whoever eats the least (Herman et al., 2003). All of these social factors could have been operating differently depending on one's attitude and the table in which he or she was sitting.

Nevertheless, as supported by our study and studies by Roth et al. (2001) and Goldstein et al. (2008), social factors such as this can act as facilitating social cues and therefore, could have mediated the instruction given by the professor. For example, if one or two students at a particular table ate and/or took an unusually large amount of food, it is possible one could interpret this to mean it is socially acceptable to take the same amount. Ideally, external variables such as this would be controlled with a large sample in anticipation that other students would take less than the "normal" amount; however, it was not clear whether this was true as researchers were not present in the classrooms during the study. It should also be noted the professors indicated that a few tables

hoarded the candy much more than other tables; however, these outliers were included in the results of the study because, as in the study by (Geier et al., 2006), the researchers' measurement of the unit bias included how much one took and/or consumed of a particular snack food rather than only measuring how much they actually consumed. Extraneous social norm cues, such as hoarding, could have been operating and, therefore, may have interfered with the effects of the unit bias in the absence of the facilitating social cue.

In addition to gauging the appropriate amount to consume based on the observed actions of others, it seems people also determine how much to eat based on other contextual variables. As proposed by Roth et al. (2001) and Wansink (2006), males and females gauge the appropriate amount to eat differently depending on the presence of others and their gender. Therefore, it is possible the presence of the opposite sex at certain tables had an effect on the amount male versus female individuals chose to eat and/or take. The number of males and females sitting at each table was not controlled as the researchers did not want the setting to distract from students' normal routine. Additionally, it would be difficult to control for the effects of the opposite sex by merely taking into account the number of males and females at each table, as there was not an equal distribution of opposite sex tables.

It would also be important to note that participants were all college students studying education in a mid-sized, Midwestern university. Due to participants' similar backgrounds and possible knowledge of educational interventions, the results of the study may be based on a nonrepresentative sample of eating behavior, with respect to the

population of U.S. college aged people. Moreover, the level of the students differed across professors' classes; therefore, their age and level discrepancy may have been responsible for differences across classes. Also, as the classes were taught by two different professors who were also responsible for giving the appropriate instruction, the attitude of each of the professors, as well as the particular lesson each professor was giving on that particular day, could have had an effect on the students' interpretation of the instruction.

There are several social factors and participant variables that were impossible to control in a classroom setting and it is possible that this led to the lack of significant results, including to lack of influence of the unit bias in the control condition. Due to the social variables that existed in the natural classroom setting, it is also possible that there was actually a social intervention occurring in the control condition as well as the facilitating social cue condition. For this reason, a control condition was not utilized and the effect of the instruction on the unit bias could not be determined.

Potentially, some of the limitations of this study could have been resolved in a more restrictive setting as the unit bias has been shown to operate in such a setting (Geier et al., 2006); however, as previously stated, a more controlled setting may not have comprised the social pressure that was likely operating in the classroom setting. If one were to complete the study in a more controlled lab, testing subjects individually, a more statistically sound study could be completed and the original hypothesis may be supported; however, it is not clear whether the facilitating social cue would have the same effect as it may be stronger when people feel they are being evaluated by others in a

natural social setting. Additionally, as our results did not indicate the unit bias was operating in either condition, it is still not clear whether the unit bias would operate in a social setting, such as a classroom, at all. The results of the unit bias may be limited to a more restrictive setting. More research in this area is needed and, if possible, a more controlled setting should be warranted as to compare the effects of the unit bias in a group setting, such as a classroom, to a laboratory setting where participants would be eating alone.

Despite the limitations of the study, a main effect was found for instruction. This provides support that the facilitative social cue used can have a significant effect on the amount of food college students consume and/or take in a social setting, such as a classroom, no matter the size of the unit or other extraneous social variables that may have been present. This finding is consistent with studies by Goldstein et al. (2008), Nolan et al., (2008), and Roth et al. (2001), It seems a descriptive, facilitating social cue affects the eating behavior of college students, and this is true in a college classroom setting with several other social variables present.

### Implications

More research needs to be completed in regard to the cognitive and social factors that underlie the unit bias. A greater understanding of the factors that underlie food consumption, specifically those factors that govern the size of portions, will help researchers design modifications of food presentation that are intended to help people reduce their portion sizes. Little theoretical work has been done with respect to the environmental and social factors related to eating behavior (Geier et al., 2006; Wansink,



2004). Therefore, studies such as this one, looking at the factors that underlie the unit bias, can provide valuable insights to guide future research on eating behavior. Rather than generating a collection of studies on different environmental factors, this study may contribute to developing a better articulated theoretical framework that will allow predictions about eating behaviors to be made.

It is recommended that a more controlled study be carried out examining the effects of the unit bias in the presence of a facilitating social cue as to compare the results with that of a group study such as this one. For example, research could be conducted comparing the effect on the unit bias in the presence of a facilitating social cue that is given to participants who will be eating in groups versus participants who will be left alone to eat. When participants are left alone to eat, we hypothesize that the unit bias will be mediated by the facilitating social cue instruction. We believe this to be true because there will not be social models, evaluative observers, or other extraneous contextual variables interfering with the unit bias in the control condition when a participant is left alone to eat; therefore, the effect of the social cue on the unit bias will be more evident. It is possible that the unit bias still operates in a social setting; however, it seems its effects are not as strong when other social variables are present.

*The Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity* (2007) requests more research on the behavioral and biological causes of overweight and obesity, more intervention research toward prevention and treatment, and more effort toward decreasing ethnic and racial health disparities with respect to overweight and obesity. In finding out more about the conditions under which

environmental factors, such as the unit bias, operate, as well as the cognitive processes, such as facilitating social cues, that underlie factors affecting eating behaviors, theoretically-based, wide scale interventions may be developed. Interventions that focus on decreasing and preventing the obesity epidemic among all populations in the United States could include manipulating food presentations as well as teaching and training people to be aware of cognitive processes, social cues, and the effects of perceived consumption norms. Interventions should be carried out in large public institutions such as schools, employee health trainings, hospitals and clinics, etc. as to target all populations and allow people equal opportunities to be exposed to such information.

Implications for schools and school psychologists. Schools are ideal places to implement large-scale, research-based interventions that target diverse populations. As illustrated by the U.S. Department of Health and Human Services, Office of the Surgeon General (2010), programs that promote healthy eating behaviors and active lifestyles by intervening in public institutions, such as schools, would be valuable in generating widespread change. Although this particular study was completed with college students, it would be beneficial to use information from studies such as this to guide nutrition education and interventions for students of all ages.

Schools can play an integral role in the process of reducing the overweight and obesity epidemic in the United States and the U.S. Department of Health and Human Services has given recommendations to guide prevention efforts. In the *Surgeon General's Vision for a Healthy and Fit Nation* (2010), it was suggested that schools take action by providing more healthy food options on school campuses, establishing a health

curriculum that teaches students to make healthy eating choices and engage in physical activity, using presentation and education techniques to encourage students to make healthier eating choices, and developing after-school programs to promote exercise and healthy eating (U.S. Department of Health and Human Services, Office of the Surgeon General, 2010).

It is evident that implementing system-wide programs that have the potential to change eating behaviors would be very valuable in schools. Nevertheless, large-scale changes are difficult to achieve; therefore, experts in systems consultation and data-based decision-making would be essential in the development, implementation, and evaluation of a system-wide health program. As school psychologists are knowledgeable of the problem-solving process, are trained to perform systems needs assessment and program implementation and evaluation, are experts in the collection and interpretation of data, as well as the use psychological principles in the process of change, it seems the school psychologist could be a key player in developing, implementing, and evaluating an effective nutrition program, school-wide. The obesity epidemic affects people in the United States from all demographics and disproportionately affects minority groups, therefore, it would be advantageous for public schools to develop system-wide, theoretically-based nutrition programs. According to the reviewed research regarding environmental factors that affect eating behavior, it seems these programs should focus on educating children about the contextual and social factors that affect eating behavior and developing ways to present food in school cafeterias in a way that will allow students to make healthy, thoughtful consumption decisions. It can be concluded, that the obesity

epidemic should be addressed in the schools and educators, such as school psychologists need to take action in making research-based changes.

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