Eating Regulation Within the Context of Self-Determination Theory

A Plan B Research Project
SUBMITTED TO THE FACULTY OF
UNIVERSITY OF MINNESOTA
BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
MASTER OF ARTS

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May 2020

Acknowledgements

I am most grateful to Drs. Lara and Rick LaCaille for always being there for me and supporting me throughout this Plan B journey. I cannot thank them enough for everything that they have taught me along the way and for always being so involved and patient with this study. They also made every step of this project so enjoyable, that it became easy for me to find the motivation to complete this research. I could not have asked for better advisors. I would also like to thank my fellow H2L lab members for their valuable inputs at different stages of the study and their help with data collection. Lastly, I would like to thank my parents, who despite being 8,000 miles away, provided constant emotional support and encouraged me to do my best.

Abstract

About 40% of young adult females engage in dysregulated eating behaviors (Goldschmidt et al., 2018) which is concerning because this can serve as an antecedent to clinical eating disorders (Bryla, 2003). Research suggests that dysregulated eating may result from the blocking or frustration of three fundamental psychological needs of autonomy, competence, and relatedness (Deci & Ryan, 2000). Conversely, satisfaction of these three needs may contribute to more regulated and healthier eating patterns. More specifically, the supporting and/or thwarting of the need for relatedness seems to have the most robust association with individuals' eating behaviors. The purpose of this study was to experimentally test the impact of relatedness support and thwarting on eating regulation. Female undergraduate students ($N = 82$; $M_{age} = 19.21$) first played a "Boggle" game during which they experienced connecting, rejecting or neutral interactions with the researchers, as part of the need manipulation. They then participated in a bogus chocolate taste test. Dependent variables included the amount of chocolate eaten, positive/negative affect, state anxiety, intrinsic motivation, and game performance. One-way ANOVAs and ANCOVAs suggest that when individuals experienced relatedness thwarting, they consumed more food ($d = .45$), experienced more negative mood ($d = .66$), less positive mood ($d = .73$), and less intrinsic motivation (willingness to recommend experience, $d = .76$) than those who experienced relatedness support. Tendencies toward emotional eating and eating more or less in response to stress did not influence the amount of chocolate consumed. Overall, the findings were supportive of self-determination theory's propositions about basic psychological needs and indicated that when individuals feel socially rejected or undermined, they are more likely to engage in dysregulated eating and experience ill-being.

Contents

List of Tables

List of Figures

Introduction

A convergence of societal pressures about physical appearance and people's own desire to appear "attractive" have likely contributed to a rise in rates of dysregulated eating patterns that may paradoxically contribute to obesity and disordered eating. Notably, more than 60% of 13 year old girls and over 60% of women older than 50 years report a fear of gaining weight (Micali et al., 2014). It is not surprising, then, for people driven by such fears to engage in unhealthy weight loss behaviors such as compulsive exercising, self-induced vomiting, and restrictive dieting. A larger proportion of the adult women in the U.S. engage in less severe dieting behaviors including consuming fewer calories (63%), consuming less fat (58%), and skipping meals (9%; Kruger et al., 2004).

Contrary to what many people believe, evidence suggests that such restrictive eating practices may actually contribute to the development of obesity (Stice et al., 1999) and eating disorders such as anorexia nervosa, bulimia nervosa, and binge eating disorder (Wadden et al., 2004). It is estimated that about 7% of the total population has a diagnosable eating disorder (Smink et al., 2012), with many more people engaging in problematic eating behaviors consistent with subclinical levels of eating disorders (i.e., disordered eating; Bryla, 2003). This paradoxical phenomena of increasing societal pressures for thinness and restrictive eating practices and corresponding increases in obesity rates are notable. Thus, there is an increasing focus on better understanding the psychological factors and motivational processes that underlie eating (dys)regulation.

Self-Determination Theory

Recent efforts to explain dysregulated eating have stimulated research linking eating behaviors and self-determination theory (SDT). SDT is an empirically-based theory of human

behavior and development that examines how social-environmental conditions either facilitate or thwart the inherent human capacities toward psychological growth, engagement, and wellness (Ryan & Deci, 2017). The basic psychological needs theory, which is a sub-theory of SDT, holds that for an individual to experience optimal functioning, well-being, and vitality, the satisfaction of three basic psychological needs -- autonomy, competence and relatedness -- are required. Need satisfaction refers to a state wherein an individual is able to meet the three basic psychological needs in a way that fosters optimal motivational functioning and well-being (Ryan & Deci, 2007). Autonomy involves the ability to carry out tasks in accordance with one's own will as opposed to being coerced into doing something. Competence refers to experiencing a sense of efficacy or feeling adept at a task rather than ineptness and incapability. Relatedness denotes feeling connected to and cared for by others in comparison to feeling lonely and alienated (Deci & Ryan, 2000).

Not only can low satisfaction of any of these needs hamper psychological growth and well-being, but the active thwarting of needs can be especially harmful and even pathogenic (e.g., Bartholomew et al., 2011). Thus, need thwarting may be defined as the process of undermining any of the three basic needs wherein the individual experiences frustration and subsequent compromised functioning and ill-being (Bartholomew, 2011). Notably, low need satisfaction and need frustration are experienced as two separate and orthogonal processes with psychological needs. One reason for this is that literature has consistently found that the two constructs are associated with distinct outcomes. For example, need satisfaction is associated with increased wellbeing, intrinsic motivation and productivity (Bartholomew, 2011; Longo et al., 2016), whereas need-frustration has been implicated in the development of ill-being or pathology (Bateman, 2011). Similarly, this dichotomous conceptualization of need frustration

and need satisfaction has found support by a number of studies testing statistical models for this distinction. For example, Cordeiro et al. (2016) and Longo et al. (2018) compared a model with three factors for each need (autonomy, competence, satisfaction) versus a model with six factors (autonomy satisfaction, autonomy frustration, competence satisfaction, competence frustration, relatedness satisfaction, relatedness frustration). They found a poor fit for the three factor model or a unidimensional perspective of need satisfaction and frustration being on the same continuum. A good fit (with intercorrelations among the six factors) was found for the other model which provides support for satisfaction and frustration being separate constructs.

According to SDT theory, frustration of needs gives rise to two maladaptive coping responses: need substitutes and compensatory behaviors (See Figure 1; Ryan et al., 2006). Need substitutes are goals that people engage in to make up for a lack of need satisfaction. For example, prioritizing physical attractiveness may be pursued in lieu of satisfying one's need for genuine interpersonal connections and relatedness. On the other hand, compensatory behaviors may involve an excessive upheaval against self-control, for example binge eating (Verstuyf et al., 2012), or the development of rigid behavior patterns that provide a sense of structure, predictability, and security (Vansteenkiste & Ryan, 2013), such as extreme restriction of food consumption or choices (Verstuyf et al., 2012).

Need Satisfaction and Regulated Eating

Need satisfaction has been found to be associated with a healthier diet and eating behaviors (e.g., higher intake of fruits and vegetables; Ryan et al., 2008). In a diary study, daily fluctuations in psychological need satisfaction were associated positively with daily fluctuations in healthy eating behaviors (Verstuyf et al., 2013). Additionally, when an individual's needs are relatively satisfied, the level of need satisfaction works to preclude the development of

dysregulated eating. Bégin et al. (2018) found that for women, the higher their satisfaction of their basic psychological needs, the more autonomously they regulated their eating behaviors, the less they adopted disordered eating behaviors and attitudes and the higher their reported satisfaction with life.

Need Frustration and Eating Dysregulation

Need frustration appears to contribute to the development of need substitutes (e.g., endorsement of thin ideal) or compensatory behaviors (e.g., rigid restrictive eating, excessive or uncontrolled eating). Initial evidence suggests that need frustration may be implicated in the etiology of disordered and dysregulated eating (Kopp & Zimmer-Gembeck, 2011). For instance, using diary study methodology, frustration of the basic psychological needs of autonomy, competence, and relatedness were found to be associated with disordered eating attitudes (Bateman, 2011).

As a consequence of need frustration, binge eating (a compensatory behavior) has been explained using two models. The first, the *escape-from-awareness model* (Heatherton et al., 1991), holds that individuals will binge eat to divert their attention away from emotional distress produced by high standards and self-criticism. In contrast, the *affect regulation model* (Hawkins & Clement, 1984) suggests that binge eating is a mechanism to cope with negative emotions by deriving comfort from food. As one would expect, emotional eaters (those with a tendency to eat when emotionally aroused; O'Conner & O'Conner, 2004), appear especially likely to report more binge-eating symptoms on days that basic psychological needs are thwarted (Verstuyf et al., 2013).

In the case of another compensatory behavior -- extreme restriction of food -- success in living up to this stringent behavioral pattern may result in short term satisfaction. However,

failure to succeed with rigid restriction can result in overeating or binge eating as it is perceived that the diet is already "blown" (Shafran et al., 2000). It may also be that the failure to maintain restrictive eating leads to negative emotions, which then contributes to binge eating (Macht, 2008; Spoor et al., 2007).

Proximal Effects of Need Thwarting on Eating Regulation

Previous research on SDT and eating regulation suggests that psychological need thwarting may have a long term and enduring positive relationship with dysregulated eating behaviors (Bateman, 2011). However, the more immediate impact on eating regulation, for example on the same day or immediately following the need thwarting event, is yet to be studied sufficiently and warrants further investigation. To our knowledge only two studies have investigated this question, both of which used daily diary methodology. One daily diary study (Verstuyf et al., 2013) that tested the impact of day-to-day variation in need frustration and satisfaction on binge eating symptoms, found that young adult women experienced more binge eating symptoms on days their needs had been thwarted. The researchers concluded that this association between need thwarting and binge eating symptoms was dynamic and only took place within the day. This study also found that relatedness frustration was strongly associated with binge eating symptoms (Verstuyf et al., 2013). The second daily diary study (Bateman, 2011) found that need thwarting had a strong positive association with eating dysregulation attitudes, but the time course of that relationship was likely delayed. They also found a relationship between need thwarting and negative affect as well as stress on the same day (Bateman, 2011). Therefore, more research related to the proximal influences of need thwarting on eating behaviors may add to the understanding and body of literature that has established more distal and general need thwarting associations with dysregulated eating.

Importantly, the use of an experimental design and testing of the effects of need thwarting versus need satisfaction would fill a methodological gap and offer clearer causal inferences about dysregulated eating. Although there are some experimental manipulations testing SDT in contexts such as sports (Fransen et al., 2018), health behaviors (Halvari et al., 2017), and exergaming (Weathers-Mayer, 2015), we did not identify any published studies using an experimental paradigm to examine the effect of thwarting or supporting needs on eating behavior.

Importance of Need for Relatedness

As mentioned previously, the need for relatedness involves having a deep and meaningful sense of connection with others as opposed to feeling alienated. It appears that the satisfaction as well as the frustration of relatedness can have important implications in several different areas, e.g., relatedness satisfaction results in an increase in prosocial motivation and the intention to volunteer (Pavey et al., 2011), enhanced performance on cognitive tasks, intrinsic motivation and positive affect (Sheldon & Filak, 2008), increased engagement in pro-environment behavior (Cooke et al., 2015), and increased motivation to learn (Niemiec & Ryan, 2009). Importantly, Sheldon and colleagues (2010) found that progressing towards goals that enhanced the participants' sense of relatedness yielded the strongest benefits in terms of experienced well-being in comparison to competence and autonomy enhancing goals. Conversely, thwarting of relatedness may result in higher negative affect (Sheldon & Filak, 2008).

With respect to examining eating behaviors, Sproesser et al. (2014) tested the effect of social inclusion and exclusion on food intake to ultimately study complementary adjustment of food consumption. Complementary adjustment of food consumption can be understood as a compensatory eating pattern wherein people who show a certain eating response to stressful

situations for instance, might show a complementary eating response in other situations. The inclusion/exclusion manipulation included receiving rejecting (social exclusion group), accepting (social inclusion group) or neutral (control group) feedback from the participants' partner after the partner supposedly reviewed the participant's videotaped message. The participants' partners (who were confederates in the study) decided to decline meeting with the participants (exclusion group), evaluated the participants favorably and looked forward to meeting them (inclusion group) or communicated that they had to cancel their participation (control group). Although an SDT framework was not explicitly studied, there is notable similarity to the need for relatedness in that the researchers manipulated "social inclusion" by giving participants either accepting or rejecting feedback from another individual. Thus, it appears that relatedness needs were either satisfied or thwarted in the process. Results indicated that in the social exclusion condition, stress hyperphagics (individuals who habitually eat more in response to stress) consumed much more ice-cream as compared to stress hypophagics (individuals who habitually eat less in response to stress). The opposite pattern was found in the social inclusion condition. That is, hyperphagics consumed less ice-cream than hypophagics. A particular merit of this study was the use of a "bogus taste test" because this method measures the actual consumption of food intake while eliminating the bias of self-report and retrospective memories of eating behavior (Evers et al., 2009).

Thus, it appears that in the two studies that hold the greatest relevance to the present study (i.e., Sheldon & Filak, 2008; Sproesser et al., 2014), more consistent effects have been found with respect to the need for relatedness. For instance, Sheldon and Filak (2008; which forms the basis of a conceptual replication for "part 1" of the present study) found that relatedness satisfaction resulted in enhanced performance on cognitive tasks, intrinsic motivation

and positive affect. Similarly, Sproesser et al. (2014; which forms the basis of a conceptual replication of "part 2" of the present study) found significant differences in eating as a result of manipulation of relatedness.

Laboratory Studies of Eating Behavior

Self-report methods for measuring food intake such as food frequency questionnaires and dietary recalls have been used frequently in research studying eating behaviors. In spite of their popularity, their validity has been questioned on account of issues such as misreporting by the participants which may include omission of information, incorrect estimation of food intake, and memory lapses (Gibson et al., 2017). On the other hand, laboratory measurements of food consumption present a much more methodologically sound approach for studying eating behaviors by potentially eliminating some extraneous variables (Buckland & Dalton, 2018). An important consideration, however, is that if deception about the true nature of the study is not ensured, the food intake may be influenced by demand characteristics as opposed to the effect of the independent variable.

The bogus taste test is a type of laboratory method that provides an opportunity for the unobtrusive measurement of food intake. Typically, the amount of food consumed is estimated under the guise of a taste test wherein participants are led to believe that the true purpose of the study is to ascertain their taste perceptions of the food with which they are presented. Participants are then given food rating forms where they evaluate the foods on attributes such as taste, texture, appearance, and color. In order to reduce the potential confounding effects of the presence of others (Cruwys et al., 2015) and awareness that eating behavior is being monitored (Robinson et al., 2016), researchers usually leave the room for several minutes and let the participant rate and eat the food by themselves. The weight of the remaining food is then

compared with the original weight of the food. Robinson and colleagues (2017) reviewed 31 bogus taste test studies and found that the test was a valid method given its sensitivity to experimental manipulations, and all variables in their review that had previously been identified as being reliably associated with food intake in other paradigms (e.g., hunger, sex, liking of food) were also associated with taste test food intake. It appears that bogus taste tests typically make use of sweet foods such as milkshakes (Bongers et al., 2013), ice-cream (Lee et al., 2007), licorice (Jansen et al., 2009), marshmallows (Guerrieri et al., 2009), raisins (Evers et al., 2009), donuts (Adams & Leary, 2007), and chocolates (Adams & Leary, 2007; Evers et al., 2009; Guerrieri et al., 2007; Guerrieri et al., 2009; Houben & Jansen, 2011; Houben & Jansen, 2015). Chocolate appears to be the most frequently used food in bogus taste tests and the food of choice in the current study.

Individual Differences in Eating Behavior

Individuals differ in their eating behavior in response to various internal and external cues. More specifically, individuals' food consumption may vary as a product of the degree to which they are an "emotional eater." Emotional eating is defined as eating in response to feeling states, especially those that are perceived as stressful and negative (Timmerman & Acton, 2001) such as perceived stress, worry, boredom, and depressed mood (Goossens et al., 2009). The tendency to overeat in more stressful situations and undereat in less stressful situations is called *hyperphagia* and the tendency to undereat in more stressful situations and overeat in less stressful situations is called *hypophagia*.

Emotional eating is problematic because it is associated with reduced awareness of internal hunger and satiety cues (Tan & Chow, 2014), which may ultimately lead to consuming unhealthy foods (those higher in fat and calories) whether or not one is hungry, eating quickly,

and/or eating larger quantities (Wildermuth et al., 2013). Emotional eating tendencies serve to function as a maladaptive coping strategy (Frayn et al., 2018). In fact, Zellner and colleagues (2006) found that people (particularly women) who were stressed consumed more chocolate than individuals who were unstressed.

Research on the impact of an emotional eating style on food consumption has yielded mixed findings (e.g., van Strien et al., 2009) with a slight majority of studies concluding that emotional eating results in overeating (Geliebter & Aversa, 2003). In a review of studies focused on emotional eating, Macht (2008) found that in about 40% of the studies on non-restrained, normal individuals, participants ate more after experiencing negative affect, whereas in 40% of the studies a diminished rate of consumption was observed. In the remaining proportion, no significant change in food consumption as a result of negative affect was observed.

Specific Aims and Hypotheses

The aim of the present study was to examine the impact of the supporting and thwarting of the need for relatedness on eating regulation using an experimental design. Participants were randomly assigned to a condition in which we attempted to support (need supporting condition) or thwart (need thwarting condition) their relatedness needs, or withhold support and avoid thwarting of needs (control condition). A bogus taste test was used to measure the primary outcome of food consumption following the manipulation. Performance on a task (a word game), positive/negative affect, state anxiety/stress, and intrinsic motivation were also assessed as outcomes. It was hypothesized that individuals in the need thwarting condition would: (a) eat more chocolate, (b) perform worse on the Boggle game, (c) report less positive affect, (d) report greater negative affect, (e) report higher state anxiety, and (f) report less intrinsic motivation for the task compared to participants in the need supporting condition. Participants in the control

condition were expected to score between the other two conditions on each of these variables. In addition, we hypothesized that individual differences regarding how people eat in response to negative emotions would moderate the effect of the amount of chocolate eaten. Specifically, it was hypothesized that individuals high in emotional eating tendencies and/or hyperphagia (tendency to eat more in response to stress) would consume more food as compared to individuals high in hypophagia (tendency to eat less when stressed) in the need thwarting condition. Neither emotional eating tendencies nor hyper/hypophagia status would moderate eating in the need supporting or control conditions.

Research Design and Method

Study Design

The proposed study used a between subjects experimental design with three conditions. Participants were randomly assigned to: (a) need thwarting, (b) need supporting, or (c) control condition (where the need was neither actively supported or thwarted). Dependent variables included: self-reported positive and negative affect, performance on a cognitive task, intrinsic motivation, state anxiety and actual food consumption. Potential moderators of food consumption included emotional eating and hyper/hypophagic eating style. The present study was approved by the university's institutional review board (IRB).

Participants

Participants ($N = 82$) were female undergraduates, who were randomly assigned to one of the three conditions: relatedness supporting ($n = 28$), relatedness thwarting ($n = 28$) or control condition ($n = 26$). They were at least 18 years old, and were recruited from a subject pool of students in psychology courses at a mid-sized Midwestern university. Only female students participated in the study because they are more likely to increase consumption of unhealthy,

sweet foods when stressed as compared to men (Zellner et al., 2006). The mean age of participants was 19.21. In terms of race/ethnicity, the majority of participants were White (85.5%), followed by Asian or pacific islander (7.3%), Black, Non-Hispanic (3.7%), and other (3.7%). The average BMI of the sample was 23.98. Participant characteristics by group can be found in Table 1.

The sample size needed for adequate power was estimated using G*Power 3.1 (Erdfelder et al., 1996) with an aim to detect a small effect size. Robinson et al. (2017) conducted a participant-level analysis of 31 experimental studies using the bogus taste test, and found small (η_{p^2} = 0.02), but consistent effects of manipulations on amount of food consumed. The average effect size for experimental conditions hypothesized to result in eating more food than the control group was d = .11, the average effect size for conditions hypothesized to result in eating less food than the control group was d = .27, and the average effect size of the difference between the two non-control groups was d = .38. Given this small expected effect, we calculated that we would need a total sample size of 441 participants to find a statistically significant result (80% power, $p < 0.05$) for the amount of food consumed. Given such a large sample size would not be feasible and the typical effect size is known (d = .11-.38), a reasonable approach would be to emphasize interpretation of effect sizes rather than inferential statistical tests, both in terms of interpreting the results as well as determining when to conduct post-hoc tests for the amount of food consumed. For other variables tested in the present study, the interpretation will focus primarily on statistical significance and effect sizes will be provided to supplement those results. In their review of 140 laboratory studies of human eating behavior, Robinson et al. (2018) reported that the median number of participants per condition for between-subject designs was 26 and small effects were typically found.

Procedures

The participants were sent an email a day prior to their scheduled session, asking them to refrain from eating or drinking anything (except water) for two hours before coming to the psychology laboratory. Sessions were scheduled between 12:00 p.m. and 8:00 p.m. when food is typically consumed by most college students. Upon arrival, the participants were instructed that there were two independent studies (being conducted by two different student researchers), and were given a (supposedly) common consent form. "Study 1" was described as *researching the relationship between student characterics and enjoyment and performance on a game*, whereas "Study 2" was described as studying *how preferences for different types of tastes influence eating patterns*.

Participants were randomly assigned to one of the three conditions and sessions were run one at a time by two research assistants (one for each of the two parts of the study). Participants in the need thwarting and supporting conditions were administered demographic questions verbally as part of the manipulation of relatedness, whereas the control condition participants completed a written version. Next, depending on condition, participants heard different instructions in order to manipulate relatedness (see Appendix A). Participants were then introduced to the word game "Boggle," (described below) using a general set of instructions and explanation of rules, followed by an opportunity to practice. The main game phase involved three Boggle grids each lasting for 3 minutes. Every participant was given the same grids in order to standardize the difficulty level.

The need for relatedness was manipulated using methods similar to Sheldon and Filak (2008), though the manipulation was extended through most of the experimental session, and included more verbal and nonverbal attempts to manipulate relatedness (described below). The

participants then filled out the, Positive and Negative Affect Schedule, State-Trait Anxiety Inventory, questions assessing intrinsic motivation and the satisfaction and frustration of the three psychological needs in the current context. The participants were thanked for their participation in "Study 1" after which, the second research assistant introduced "Study 2." The actual intake of food was assessed using a bogus taste test. Participants were first provided with five bowls, each full of 550g (±1g) of different types of chocolate chips (i.e., milk, dark, white, peanut butter, and semi-sweet) and were asked to evaluate each one in terms of taste, sweetness, cocoa flavor, creaminess, milkiness, smooth texture, and provide an overall rating. The order of the bowls, which were brought in a tray and then laid out on a table, varied between participants, to reduce order effects. Each bowl had a spoon in it and the participants were provided with a plate to be used for putting the desired amount of chocolate chips on it to taste and provide the taste ratings. Participants were encouraged to taste as much chocolate as they wanted. Due to the large amount of chocolate provided and style of bowl, the participant could reasonably have several spoonfuls of each type of chocolate without much notice (i.e., little signs of depletion in overall amount). Then, during the taste test, the experimenter left the room for 7 minutes on the pretext of preparing additional questionnaires. The experimenter indicated they would be gone for several minutes, and then closed the door so that participants could feel more comfortable eating as much as they wanted without being observed. Following this, participants were asked to complete a measure of emotional eating and additional items asking about height, weight, and diet quality. The questionnaire was administered after the taste test so as to not prime the participants about the true purpose of the study or influence their eating behavior. After this, the second research assistant measured how much chocolate had been consumed using a food scale

in a separate room, while the first research assistant carried out the debriefing process with the participant.

Finally, a funneled debriefing was used during the debriefing process to obtain relatedness ratings for how the researchers treated the participants, obtain an estimation of condition assignment and to determine awareness of study purposes (see Appendix A; Bargh & Chartrand, 2000). The true purpose of the study was eventually revealed, participant questions were addressed, and participants were then thanked for their participation. Participants were also given the opportunity to withdraw their data due to the deception used in the study; none chose to do so.

Need Manipulation. The research assistants who carried out the experimental manipulation underwent training sessions in order to accurately and convincingly portray the required verbal and nonverbal behaviors. As the first step, three videos, each representing one of the three experimental conditions, were created by two of the primary investigators to create a model for how to implement the manipulation. Next, every research assistant met with one primary investigator who gave a demonstration (as the researcher) of how to speak and behave in the experimental condition chosen for practice. This was followed by the research assistant practicing the manipulation, with the primary investigator as the participant and was given tips and feedback. Every research assistant had at least two practice sessions (but more if needed) before conducting the study with actual participants.

In the supporting condition, acknowledgement, care, and interest was expressed by the researcher both verbally (e.g., "*One thing I want you to know is that everybody is unique, and so it is important to learn about each person as an individual. Because of this, I am trying to understand your approach to learning. So, I hope you'll share your experiences with me after*

you're done") and non-verbally (e.g., using a friendly tone, smiling frequently, maintaining good eye contact). Conversely, in the thwarting condition, the researcher displayed disinterest and lack of care or concern both verbally (e.g., "*One thing you need to know is that to me, everybody is the same. We aren't really concerned about you as an individual, we only care about your performance in our experiment, that is, the data. So we can be as efficient as possible, please keep your observations to yourself during the process")* and non-verbally (e.g., using an aggressive tone, frowning frequently and maintaining poor eye contact). Researchers adopted a more neutral style of interaction in the control condition. The complete script is provided in Appendix A.

Materials

Boggle. Boggle is a timed cognitive task that requires a player to create as many words as possible from a 4 x 4 letter grid. The game was chosen because most people find it interesting and engaging, which may help reduce demand characteristics as well as lend itself well to the manipulation of relatedness using verbal instructions. For the present study, the game was played using Boggle puzzles taken from a book (Lamford & Cansfield, 1999) and the same hints were provided to all three conditions to help the players get familiar with the game.

Taste Test. All participants were asked to rate the five types of chocolate chips on six dimensions, including taste, sweetness, cocoa flavor, creaminess, milkiness, and texture, as well as an overall ranking. Such rating forms have been used in other bogus taste test studies as a means of adding to the believability of the task (e.g., Adams & Leary, 2007; Sproesser et al., 2014).

Food items. For the present study, different types of chocolate chips were used (e.g., milk, dark, white, mint, semi-sweet) because they were popular, could be stored easily, were

relatively less costly, and have been used quite frequently in bogus taste tests (e.g., Adams & Learly, 2007; Guerrieri et al., 2009; Houben & Jansen, 2015; Werthmann et al., 2011).

Measures

A number of measures were used in the study; some were used as outcome measures, some as manipulation checks, and others as covariates or moderators (See Appendix B). Additionally, some just added support to the cover story.

Primary Outcome Measures

Amount of Chocolate Consumed. The amount of chocolate chips eaten was determined by subtracting the weight (in grams) of the food bowls after the taste test from the pre-taste test weight.

Performance. Although eating behavior was the key dependent variable, performance on the Boggle game was also assessed, as there is little experimental research on the effects of manipulation of relatedness on cognitive performance (Sheldon & Filak, 2008). Each of the three Boggle games was scored based on the length of the word (three to four letter words = 1, five letter words = 2, six letter words = 3, seven letter words =5, and words containing eight or more letters = 11 points. Each participant received a final Boggle score which was an average of the scores on the two puzzles presented after the hints were provided. This provided specific information about the extent to which objective performance was affected by the manipulation.

Intrinsic Motivation. This was measured using "enjoyment/interest" in the game and "willingness to recommend the Boggle experience." Two items based on the Interest/Enjoyment scale of the Intrinsic Motivation Inventory (Deci et al., 1994) were used, including, "I enjoyed the challenges this game provided" and "I would be interested in playing this game again." Responses were captured on a 7 point scale ranging from 1 = *not true at all* to 7 = *very true*. The

internal consistency reliability for these two items was high (α = .90). These two items provided information about the level of participants' satisfaction with and desire to engage in the game because they found it naturally satisfying.

The participants completed a brief measure containing three questions (as used by Sheldon & Filak, 2008) which assessed their willingness to recommend the study to another person. The participants were asked the following three questions in order to determine their overall experience: "I would recommend this experiment to a friend," "I would recommend this experimenter to a friend" and "I would recommend the Boggle game to a friend." Responses were captured on a 5 point scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. These items had acceptable internal consistency reliability (α = .79).

Positive and Negative Affect Schedule-General (PANAS). The PANAS (Watson et al., 1988) is a self-report measure designed to measure positive and negative affect. It consists of 20 items, 10 measuring positive affect (e.g., interested, enthusiastic) and 10 measuring negative affect (e.g., upset, guilty). The general instructions were modified to assess affect at the time of the study (i.e., "to what extent do you feel this way right now?"). All items were rated on a 5-point scale with responses ranging from 1 = *very slightly or not at all* to 5 = *extremely*. A total score was calculated for each subscale, with a possible range from 10-50; higher scores indicate more positive or more negative affect according to the scale. The PANAS has been demonstrated to have high internal consistency for both positive affect (α = 0.86 to 0.90) and negative affect (α = 0.84 to 0.87; Watson et al., 1988). In the present study, the PANAS demonstrated strong internal consistency reliability for positive affect (α = .90) and acceptable reliability for negative affect (α = .79).

State-Trait Anxiety Inventory (STAI) -- State Anxiety scale. The STAI (Spielberger et al., 1983) is a 40 item self-report measure that assesses both state anxiety (i.e., temporary or momentary emotional states as a function of stressful conditions) and trait anxiety (i.e., a long standing pattern or tendency to respond to stressful conditions with anxiety). For the present study, only the state anxiety items (20 items) were administered to assess the more proximal impact of need thwarting or supporting on the experience of stress/anxiety (e.g., "I feel calm," "I feel upset"). Individuals respond to the items based on how they feel at the moment and responses range from 1 = *not at all* to 4 = *very much so*. A total score is calculated and can range from 20 to 80, with higher scores indicative of greater state anxiety. Spielberger et al. (1983) reported that the internal consistency reliability of the STAI ranged from .86 to .95. In the present study, STAI demonstrated strong internal consistency reliability (α = .93)

Moderator Measures

Dutch Eating Behavior Questionnaire (DEBQ) -- Emotional Eating Scale. The DEBQ (Van Strien et al., 1986) is a 33 item self-report measure designed to assess three different eating behaviors in adults (i.e., emotional eating, external eating, and restrained eating), however in this study, only the 13 item emotional eating (overeating in response to negative emotions; e.g., "Do you have a desire to eat when you are feeling lonely?") subscale was used. Responses range from 1 = *never* to 5 = v*ery often*, with higher scores indicative of greater endorsement of emotional eating. The DEBQ emotional eating subscale has been found to have high internal consistency reliability in a non-clinical sample of normal, overweight and obese participants (α = 0.96 to 0.97; Bohrer et al., 2015). In the present study, the DEBQ emotional eating subscale demonstrated good internal consistency reliability (α = .89).

Hyper/Hypophagia. The tendency to overeat or undereat when stressed was assessed using a single item (Sproesser et al., 2014) to which the participants responded by selecting one of the three options: "When other people cause me stress (e.g., partner, friends, relatives, colleagues), I eat . . . 1 = *much less than usual*, 2 = *the same as usual*, 3 = *much more than usual*, 4 = *more than usual*, or 5 = *much more than usual*." Responses 1 and 2 were categorized as "hypophagia," response 3 was "neither" and responses 4 and 5 were categorized as "hyperphagia."

Manipulation Check Measures

Psychological Need Satisfaction and Frustration. The satisfaction and frustration of each of the three needs, as experienced in the current study, was assessed with 12 items. Two items assessed the satisfaction and two items assessed the frustration of each of the three needs. The items were modified from the Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS; Chen et al., 2015) which has 24 items and is designed to measure both satisfaction as well as the frustration of the need for autonomy, competence and relatedness more globally (i.e., not specific to a particular context). For the present study, the items were slightly modified to make them relevant to the nature of the cognitive task. For example, for relatedness satisfaction, the original item was "I feel that the people I care about also care about me*"* and was reworded to *"*I felt that the researcher cared about me*."* All items were rated on a 5-point scale (1 = *not true at all* to 5 = *completely true*). In the present study, the subscales demonstrated good internal consistency reliability for relatedness satisfaction (α = .87), relatedness frustration (α = .82), and competence frustration (α = .81). The internal consistency reliability for autonomy satisfaction (α = .35), autonomy frustration (α = .54) and competence satisfaction (α = .22) make them unreliable measures for analyses and warrant interpretation with caution. There was also wide

variability in internal consistencies when examined by condition. For example, the reliability for the autonomy satisfaction items increased to α = .52 for the control group but reduced to α = -.16 for the supporting group. This suggests that items within these scales were measuring something other than intended and may have been tapping into some other variables manipulated in the study. This measure was intended to serve as a manipulation check to assess the extent to which relatedness needs were manipulated, and other needs were mostly not affected.

Relatedness Rating. Participants' perceived experience of relatedness with the experimenter was assessed using 1 item (i.e., "To what extent did you feel a sense of relatedness with the experimenter?") which was rated on a scale of 1 to 7, with 1 = *a very strong sense of feeling alienation* and 7 = *a very strong sense of connection*. This item was asked during the debriefing phase after explaining the rationale for the need to use deception and subsequently explaining the concept of relatedness. This provided additional information about the effectiveness of the need manipulation strategies, as some participants may have been reluctant to rate their experience with the researcher assistant in a negative way prior to understanding that there was intentional manipulation.

Other Measures

Demographics, Background and Eating/Weight Patterns. The participants received a survey (verbally administered in the supporting and thwarting conditions or a handout in the control condition) containing questions about their demographics (e.g., age, ethnicity), education (high school GPA, ACT score) and background (e.g., "How would you describe your vocabulary?"). GPA and ACT scores would possibly serve as covariates for the task performance outcome and contributed to the cover story about the variables being studied. Items assessing diet quality, current and ideal weight, height, and whether participants were (at the time of the

experiment) trying to lose weight, were presented after the bogus taste test, so as to not prime the participants about the main outcome of the study (i.e., food measurement) or influence how much they ate. Weight and height information was used to calculate BMI. The participants were asked to indicate their liking for chocolate using 1 item with a 7-point response scale ranging from 1 = *not at all* to 7 = *extremely* (e.g., Adams & Leary, 2007). Information about "level of hunger" was obtained by embedding this construct with other PANAS constructs, as later food consumption in the taste test may have been impacted by the level of hunger (Best et al., 2018). Preference for chocolate and level of hunger were used as covariates to measure the amount of chocolate consumed.

Statistical Analyses Approach

The data were analyzed using SPSS (v.26). There were only a few missing values, which were either treated using grand mean substitution (for missing BMI and ACT score values), or imputing an item value with the individual participant's mean of the other items in the scale (for the STAI and relatedness satisfaction scales). The data were also checked for outliers, which were either treated by replacing outlier scores with a value equivalent to ± 3 *SD* of the participant's group mean for that variable, or if still an outlier, by replacing the score with the next closest non-outlier value in that condition (chocolate consumption, PANAS negative affect subscale, enjoyment of Boggle). The data were then tested for skewness. If the distribution was skewed for a variable in any condition, square root transformation was used for all values across conditions. This was successful in treating the skewness for all such variables including chocolate consumption, Boggle performance, PANAS negative affect subscale, and willingness to recommend Boggle experience.

To check for effectiveness of random assignment, group equivalence was tested on demographic variables, as well as other possible covariates and moderators, using one-way ANOVA (for continuous measures) and Chi-Square (for categorical measures).

T-tests were used for preliminary analyses to determine whether there were group differences between those who ate within two hours of the experiment versus those who did not, as well as between those individuals who may have guessed there was a connection between the two studies versus those who did not.

Correlation analyses were run to test the association among outcome variables, moderators, covariates and some background/demographic characteristics. Pearson's correlation was used for continuous variables and Spearman's correlation was used for categorical variables.

One-way ANOVAs were conducted to examine differences between groups on most of the dependent variables. For variables that had unequal variances, the Welch's *F* statistic was interpreted (Field, 2018). To examine differences between pairs of groups, Tukey's post-hoc comparisons were conducted when the assumption of homogeneity of variances was met and Games-Howell post-hoc comparisons in case of unequal variances (Field, 2018). One-way ANCOVAs were conducted to examine the group differences in food consumption and performance on Boggle, followed by Šidák-corrected post hoc tests (Field, 2018). Effect size estimates (Cohen's *d* and partial eta squared, η_p^2) were also used to determine the actual magnitude of differences. Generally, the respective effect sizes are interpreted as being small (*d* = 0.2, η_p^2 = 0.01), moderate (*d* = 0.5, η_p^2 = 0.06), or large (*d* = 0.8, η_p^2 = 0.13). For the amount of chocolate consumed, the interpretation will focus primarily on the effect size (small effect sizes of η_p^2 = 0.02 and *ds* = 0.1 to 0.4 are anticipated; Robinson et al., 2017), whereas for other variables in the present study, the interpretation will consider both statistical significance

and effect sizes given the small sample size and use of a between-subjects design. In terms of moderator analyses, factorial ANOVAs based upon a 3 (need condition) x 3 (hyperphagia, hypophagia, neither) matrix were conducted. In case of a significant interaction, the results were to be followed up using simple effects analysis. Because emotional eating is a continuous variable, regression-based moderation analysis was performed using PROCESS v3.4.1 (Hayes, 2018), an SPSS macro, in order to test how the relationship between need manipulation and chocolate consumption was impacted by emotional eating. Given there are three groups, the model compares the interaction effect for each group compared to the other two groups. The PROCESS simple moderation model (Model 1) was used. Bootstrap was fixed to 5,000 iterations and produced a 95% confidence interval.

Results

Two participants were excluded from the analyses because in the first case (supporting condition), the same researcher ran both parts of the experiment. In the second case (control condition), the participant's first language was not English, which resulted in substantial deviation from the standard administration of questionnaire and task instructions.

Preliminary Analysis

An important element of the study was the utilization of a bogus taste test so as to not prime the participants about the actual aim of the study. To ensure this, the debriefing phase included questions ascertaining whether the participants guessed the true purpose or not. A review of the participants' responses indicate that even though some individuals guessed that there was a connection between the two "studies" (e.g., "One is about learning and one is about how stress affects learning and eating*"*), almost all of their responses were generally vague and did not reflect an understanding that the amount of chocolate consumed would be measured.

That said, participants were categorized into two groups, i.e., those who possibly guessed the connection between the two study parts and true purpose of the study (n = 9) and those who did not (n = 73), in order to assess potential group differences among outcome variables. T-tests indicated that the two groups did not differ significantly (ps = 0.13 to 0.99, ds = .00 to 0.68) along any of the outcome variables (i.e., positive affect, negative affect, state anxiety, emotional eating, intrinsic motivation, Boggle score, and chocolate consumption), except for willingness to recommend Boggle experience, $t(17.57) = 2.59$, $p = 0.02$, $d = .68$, where those who possibly guessed the purpose were less likely to recommend the experience (M = 3.85, SD = 0.41) than those who did not (M = 4.20, SD = 0.77). Because the groups were largely similar on the outcomes, especially on chocolate consumption, the participants who had some vague guess that the studies were connected were not excluded from the analyses.

Similarly, to see whether food consumption right before the experiment impacted the amount of chocolate eaten, a t-tests was run to compare those who did not have any food or water (including caffeine) for two hours before the study (n = 49) and those who did (n = 33). Results indicate that the two groups did not differ significantly (p = 0.71, d = 0.08). Also, food consumption before the experiment was not significantly correlated with the amount of chocolate consumed (r_s = -.02) and thus, was not included as a covariate in the analysis. Level of hunger was not significantly correlated with chocolate consumption (r = .12) but because it has been shown to affect food intake in these types of laboratory eating studies (Robinson et al., 2018) it was included as a covariate for chocolate consumption.

A comparison of the three conditions revealed no statistically significant group differences in participant characteristics such as age (p = .23, η_{p^2} = .06), GPA (p = .81, η_{p^2} = .01), ACT score (p = .57, η_{p^2} = .01), ethnicity (p = .81), previous experience with Boggle (p = .43),

consumption of food within two hours before experiment (p = .31, η_{p^2} = .03), level of hunger (p = .13, η_{p^2} = .05), emotional eating (p = .62, η_{p^2} = .01), time of day the experiment occurred (p = .33, η_{p^2} = .03), and stress eating (p = .83). The groups did differ significantly in terms of BMI (p = .05, η_{p^2} = .06). Thus, with the exception of BMI, groups were equivalent and random assignment of participants appeared effective.

Correlational analyses indicated that certain measures were significantly correlated with one another (See Table 2). Notably, chocolate consumption was positively correlated with emotional eating (r = .44), but not with the tendency to eat more when stressed (r = .05). This suggests that although both measures are designed to assess the tendency to overeat in response to emotional states (and are indeed moderately correlated with one another, r = .50), they are not measuring the same construct. It also provides support for examining each of these constructs separately as moderators. As expected, positive affect was negatively correlated with negative affect (r = -.33) and state anxiety (r = -.54), as well as positively correlated with enjoyment of the experience (r = .55) and willingness to recommend Boggle (r = .61). State anxiety was also highly correlated with negative affect (r = .77).

In order to assess the effectiveness of the experimental manipulation, groups were compared on their scores on the relatedness satisfaction scores, relatedness frustration scores, and relatedness rating scores using one-way ANOVAs (See Table 3). Results indicated large and statistically significant group differences in terms of experienced relatedness frustration, *Welch's* $F(2, 46.81) = 9.08$, $p < .001$, η_{p^2} = .29, and relatedness satisfaction, *Welch's* $F(2, 48.46) = 30.57$, $p < 0.001$, η_{p^2} = .38, with the need supporting condition reporting the highest satisfaction and lowest frustration, and the need thwarting group reporting the opposite pattern. Post-hoc analyses indicated that the need supporting condition reported considerably more relatedness need

satisfaction than both the thwarted group ($p < .001$, $d = 1.79$) and the control group ($p < .001$, $d = 1.55$), whereas the difference between the control group and frustration group was much smaller ($p = .32$, $d = .39$). In terms of scores for relatedness frustration, the need supporting group scored significantly lower than the need thwarted group ($p < .001$, $d = 1.15$) but not the control group ($p = .87$, $d = .15$). Indeed, the thwarted group reported considerably more need frustration than the control group ($p < .001$, $d = 1.12$). Finally, on the relatedness rating, the groups were also significantly different, *Welch's* $F(2, 49.13) = 20.20$, $p < .001$, $\eta_{p^2} = .30$. Post-hoc group-wise comparisons indicated that the need supported group reported significantly higher relatedness ratings than the need thwarting condition ($p < .001$, $d = 1.50$) and the control condition ($p < .001$, $d = 1.23$). There was a much smaller difference between the control and thwarted groups ($p = .19$, $d = .48$).

Overall, these data indicate that the manipulation of relatedness thwarting and support was successful. Specifically, the supporting manipulation resulted in more relatedness satisfaction in the need supporting group but less in the thwarting and control groups. Similarly, the thwarting manipulation resulted in more frustration in the thwarting group but less in the supporting and control groups. Further, in terms of the other two needs -- competence and autonomy, even though the items were less reliable (except for competence frustration), there were no statistically significant differences for competence satisfaction and frustration and autonomy frustration with effect sizes ranging from small to medium (ds = .09 to .61). For autonomy satisfaction, however, there was a significant group difference ($p = .05$). Thus, these findings generally suggest that the manipulation of relatedness did not result in substantial manipulation of a different need.

Primary Outcomes

As anticipated, notable variability occurred with chocolate consumption (M = 22.02 g SD = 15.92 g; range 2 to 79 g) and the group differences for the amount consumed were not statistically significant, $F(2, 79) = 1.64$, $p = 0.20$, $\eta_p^2 = .04$, even after controlling for the possible effects of BMI, level of hunger, and preference for chocolate. Based on a meta-analyses of laboratory eating tests (Robinson et al., 2017) effect sizes represent a more clear indicator of the magnitude of group differences. We hypothesized an overall effect of $\eta_p^2 = .02$ and ds ranging from .1 to .4). Condition-wise post hoc comparison of effect sizes showed that the need supporting group ate small-to-moderately less amounts of chocolate (M = 18.5 g) compared to the thwarting condition (M = 23.90 g; d = .45) and the control group (M = 23.78 g; d = .39). Counter to our hypothesis, no discernable differences were seen between the thwarting and control groups (d = .06).

One-way ANOVAs revealed significant differences among the three conditions for positive affect, $F(2, 79) = 3.90$, $p = 0.02$, $\eta_p^2 = .09$. Post hoc comparisons indicated that the need supporting group experienced moderately more positive affect (M = 3.25) than both the thwarting condition (M = 2.70; p = .04, d = .73) and the control group (M = 2.74; p = .06, d = .61). The control group was more similar to the thwarting group (d = .05). For negative affect, the group differences were also significant, *Welch's* $F(2, 47.70) = 3.95$, $p = 0.03$, $\eta_p^2 = .07$. Condition wise comparisons revealed that the need supporting group experienced moderately less negative affect (M = 1.35) than the frustration group (M = 1.64; p = .06, d = .66) and the control group (M = 1.63, p = .12, d = .59), though these differences did not meet the statistical significance threshold of $p < .05$ with the Tukey correction. There was no difference in the level of negative affect experienced by the control and frustration groups (p = .99, d = .02). Thus the

hypotheses about the need supporting group experiencing more positive affect and less negative affect were generally supported.

Similar analyses were performed to compare the groups on state anxiety, with the overall test revealing statistically significant and moderately sized differences, $F(2, 79) = 3.39$, $p = 0.04$, $\eta_{p^2} = .08$. Post hoc comparisons indicated that the supporting group ($M = 1.74$) had moderately less anxiety than both the thwarting condition ($M = 2.07$; $p = .08$, $d = .63$) and control condition ($M = 2.09$; $p = .06$, $d = .66$), though again, these were marginally statistically significant. No differences were found between the control and thwarting conditions ($p = .99$, $d = .03$). The hypothesis that the need supporting group would experience less anxiety was supported.

For performance on Boggle games, no statistically significant group differences were obtained, $F(2, 77) = 0.66$, $p = .34$, $\eta_{p^2} = .02$, even after controlling for the effects of ACT scores and previous experience with Boggle puzzles. ACT and previous experience with Boggle games were chosen as covariates because they were significantly correlated with performance on Boggle games ($r = .36$ and $r = .41$, respectively). The transformed covariate adjusted estimated marginal means (need supporting $M = 3.62$, need thwarting $M = 3.78$, control $M = 3.57$; not tabled) indicated that the control group performed the least well but none of the group wise comparisons were statistically significant and effect sizes were small (ds = .13 to .35). The hypothesis that the supporting group would perform better on Boggle was not supported.

Intrinsic motivation included enjoyment/interest in Boggle and willingness to recommend the Boggle experience. In terms of enjoyment or interest in Boggle, the differences between groups was marginally statistically significant, *Welch's* $F(2, 47.96) = 2.54$, $p = 0.09$, $\eta_{p^2} = .05$. Condition wise comparisons showed non-statistically significant differences among all the groups, though the effect sizes were small to medium. Specifically, the supporting group ($M =$

4.25) enjoyed the game more than the thwarting condition (M = 3.88; p = .30, d = .40) as well as the control condition (M = 3.71; p = .12, d = .56). The thwarting and control group did not differ (p = .87, d = .15). The hypothesis that the supporting group would enjoy Boggle more was generally supported.

The groups also differed significantly in terms of willingness to recommend the Boggle experience, $F(2, 79) = 4.25$, $p = 0.02$, $\eta_{p^2} = .10$. Condition-wise comparisons indicated that the supporting group (M = 4.46) was considerably more likely to recommend the experience than the thwarting condition (M = 3.92; p = .02, d = .76). Although a similar pattern was evident between the supporting group and the control group (M = 4.09; p = .13, d = .56), the difference was not statistically significant. The difference between the thwarting and control condition was non-significant (p = .70, d = .22), suggesting that both the groups were fairly similar in their willingness to recommend the Boggle experience. The hypothesis that the supporting group would be more likely to recommend the Boggle experience was supported.

In terms of the moderation analysis, both eating tendency when stressed as well as emotional eating did not moderate the relationship between relatedness manipulation and chocolate consumption. For the stress eating pattern, it was found that there was no significant Group x Stress eating tendency (hyperphagia, hypophagia, neither) interaction, $F(4, 73) = 0.97$, p = .43, on amount of chocolate consumed. Similarly, there was no significant interaction between the manipulation condition and emotional eating on amount of food consumed (control condition versus the other two conditions, $t = 1.11$, p = .27, need supporting condition versus the other two conditions, $t = 0.24$, p = .81, and thwarting condition versus the other two, $t = 0.01$, p = .99.

Discussion

The primary aim of the present study was to understand the impact of manipulating the need for relatedness on subsequent eating behavior. Other outcomes included performance on a cognitive task, intrinsic motivation, and affect. We also examined how individual characteristics, including the tendency to eat for emotional reasons and to eat more or less when stressed. It was hypothesized that individuals in the need thwarting condition would: (a) consume more food than the supporting condition and have (b) lower scores on the Boggle game, (c) lower positive affect, (d) higher negative affect, (e) higher state anxiety, and (f) lower intrinsic motivation. In terms of the control condition, it was predicted that people who neither have the relatedness needs supported or thwarted, would lie in between the supporting and thwarting groups across the different outcomes.

Many of the primary hypotheses of this study appeared supported. That is, the need thwarting and need supporting groups performed as hypothesized on all the outcomes, except Boggle game performance. The need supporting group experienced more positive affect (e.g., interested, enthusiastic, proud) and less negative affect (e.g., upset, irritable, hostile) than the other groups, particularly the thwarting group. These findings are consistent with previous studies. For instance, Gunnell et al. (2013) found that changes in relatedness satisfaction significantly predicted both positive affect and vitality, and Sheldon and Filak (2008) found that negative affect was higher in the relatedness non-supportive as opposed to the supportive condition. Similarly, Bateman (2011) found that individuals who experienced higher levels of perceived relatedness thwarting also experienced higher levels of negative affect on the same day.

In terms of food consumption, the need thwarting group ate more than the need supporting group. As expected, the difference was small to moderate (d = .45), though this was

not statistically significant and the control group ate about the same amount (average of 49 chocolate chips) as the thwarting group (50 chocolate chips). The largest difference was seen between the thwarting and need supporting conditions, wherein individuals in the supporting condition ate an average of 38 chocolate chips (24% less). This is in line with the findings of Verstuyf et al. (2013) who found that thwarted need for relatedness was associated with more problematic eating (i.e., binge eating like symptoms), whereas satisfaction of psychological needs appear to preclude dysregulated eating (Bégin et al., 2018). Thus, social environments that leave individuals feeling alienated and undermined are likely to result in greater food consumption for many people, especially food that has higher caloric content. On the contrary, social environments that evoke a sense of social connection and feeling cared for are likely to result in relatively less consumption of high calorie food. Overall, consistent with a number of studies measuring food consumption in a laboratory following manipulation (Robinson et al., 2017), a small effect (η_{p^2} = .04) size was obtained. Given the study was underpowered to detect the typically small effects found in studies measuring food consumption in a laboratory following a manipulation (Robinson et al., 2017), the lack of statistical significance for this outcome is unsurprising. It should be noted that in spite of lack of anticipated statistical significance, the bogus taste test has been deemed as a method that is quite sensitive to identifying the causal effects of manipulations on amount of food consumed (Robinson et al., 2017). Additionally, research has found that increasing the variety of food presented is related to increased food consumption by participants (Wansink, 2004) and given that we used only one type of food, our food consumption findings may have been hindered by this constraint. It is important to note that even though a small effect was both expected and obtained, a seemingly inconsequential amount of food consumption when stressed or upset becomes pathological when

these small effects are accumulated over time, contributing to a longstanding dysregulated eating behavioral pattern.

There was no group difference on performance of Boggle puzzles, which runs contrary to the findings of most previous studies. For example, studies that include relatedness thwarting (Sheldon & Filak, 2008) or social exclusion (Themanson et al., 2014; Baumeister et al., 2002) found that individuals assigned to these conditions exhibit compromised functioning on cognitive tasks (e.g., Boggle, GRE exam, Eriksen flanker task). One possible explanation for the comparable performance of the three groups, specifically the need supporting and thwarting groups, is that when individuals were led to believe that they are not valued or accepted, they felt more motivated to engage in certain activities in an attempt to achieve high relational evaluation (Leary, 1999). Thus, after individuals in the thwarting condition experienced a sense of relatedness frustration, they may have put in extra effort in order to make the researcher 'like' them or at least 'dislike' them less.

An interesting general trend that emerged in the study was that, for virtually all outcomes, the control group responded more similarly to the thwarting group rather than the supporting group, or even at a midpoint between the other two groups. This suggests that the withholding of relatedness need support appears to also be detrimental to a person. The reason that the control group also experienced negative experiences as the thwarting group is in line with the suggestion made by Bartholomew (2011) that an absence of need satisfaction can be experienced as a deprivation and also be related to negative outcomes (e.g., depression). However, the striking similarity between the two groups runs counter to preliminary evidence that the active thwarting of needs is more likely to lead to psychopathology than the lack of satisfaction (Longo et al., 2018). The similarity was surprising and contrary to Sheldon and Filak (2008) who found that

their neutral or control group was more like the supporting group. For the present study, a more promising alternative explanation for this similarity is that in an attempt to keep the control condition script neutral, we reduced the number of verbal instruction or opportunities to verbally engage with the participant (e.g., ascertaining demographic information using a handout as opposed to verbally asking). This reduction or 'lack of' verbal engagement might have been perceived by the control condition participants as cold or somewhat alienating, aligning with how the thwarting group felt. It is also possible that the instruction for verbal and non-verbal manipulation were more similar for the thwarting and control conditions. For example, "be matter of fact" and occasionally making eye contact in the control condition may not have been significantly different from looking away while you give instructions in the thwarting condition. Relatedly, we noted that it was challenging for many of the research assistants to fully implement the need thwarting behaviors as such behaviors run counter to social norms. Perhaps the verbal and nonverbal thwarting behaviors were not as distinct in the need thwarting condition as intended.

Scores on relatedness satisfaction and frustration as well as relatedness ratings suggest that the need manipulation was overall effective. For relatedness satisfaction, as expected, the need supporting condition experienced a sense of warmth and connection with the researcher (M = 4.30 on a 5 point scale) whereas the ratings for the need thwarting and control groups were below the midpoint on the scale (i.e., < 3). For relatedness frustration, the need supporting and control groups reported almost no feelings of distance or dislike from the researcher (M = 1.07 and 1.12 on a 5 point scale). Importantly, even though the thwarting group experienced the most alienation out of the three conditions (M = 2.29 where 2 = "*slightly true*"), its lower mean suggests that this group did not feel particularly rejected by the researchers, or at least did not

appear to endorse personalizing it. Similarly, participants' subjective rating of their interpersonal relationship with the researcher (where 1 = *very strong sense of being alienated* and 7 = *very strong sense of being connected*) indicated that although the participants in the need supportive condition felt highly connected, and substantially more so than the other two groups, the need thwarting participants were still above the midpoint on the scale (i.e., > 3.5). It seems that although the need thwarting manipulation produced differences with need satisfaction, it did not produce a particularly elevated level of active rejection in those participants. Alternatively, this pattern could also be due to the discomfort in directly acknowledging to the researcher that they felt the researcher was being dismissive or undermining of their relatedness need. Thus, social desirability to appear polite may have influenced the ratings.

The finding that the experimental manipulation likely did not result in a high magnitude of frustration for the thwarting group is also supported by the thwarting group's ratings of negative affect and anxiety/stress. The thwarting group's negative affect average score (M = 1.64) on a scale from 1-5 with 5 reflecting high degrees of negative affect, suggests that the thwarting verbal and non-verbal manipulations could not evoke the intensity of negative emotions (e.g., afraid, irritable, nervous) that might be expected when someone is being actively rejected by another person. This was also true of the anxiety/stress average score (M = 2.07 on a 4 point scale). A possible explanation for this trend is that, because the manipulation happened in an artificial laboratory setting (which does not mimic participants' daily life situations) and with an individual (the researcher) that the participants did not know before the experiment, it might be the case that individuals experience substantial need frustration, stress, and negative affect when relatedness is thwarted by someone they care about or are very close with, or that happens with greater consistency. Alternatively, even though relatedness satisfaction results in relational

wellbeing, the satisfaction of autonomy and competence are also needed to ensure a high quality close relationship (Deci & Ryan, 2014). So, it is possible that the opposite might also be true only in the presence of autonomy and competence frustration. Indeed, many of the participants seemed uninterested in the study to begin with, and were there to receive extra course credit, and may not have been overly concerned about the researcher's behavior.

In the current study, neither tendency toward emotional eating or eating more or less in response to stress influenced how much chocolate people consumed as a function of the manipulation they received. Even though (as mentioned in the introduction) there are mixed findings about the moderating role of emotional eating on food consumption, some studies provided support for this effect (Geliebter & Aversa, 2003; Wallis & Hetherington, 2004). One possible explanation for the lack of impact of emotional eating tendency on chocolate consumption is provided by Evers et al. (2009). They suggest that it is difficult for people to accurately assess and identify their tendency towards emotion-related food consumption. Given that we used self-report measures to assess tendencies to overeat in response to negative emotions, it may be that our measure did not accurately capture actual behavioral tendencies. Another possible reason for the lack of a moderation effect may be that our manipulation did not induce the level of negative affect and stress needed for the stress/emotional eaters in our study to respond to the need thwarting condition through eating. For example, in a recent study Michels et al. (2020) found that the relationship between stress and food consumption was moderated by a number of factors such as emotional eating, external eating etc. in the context of an exam period for university students. However, individuals in their sample reported an average stress score of 8 on a scale from 1-10 (10 being higher stress), which indicates that the participants were indeed notably stressed. In the present study, however, (in

spite of successful need thwarting), individuals did not appear to be very stressed or upset as evidenced by the lower negative affect average (M = 1.64) on a scale from 1-5 (5 being higher negative affect) and lower state anxiety average (M = 2.07) averages on a scale from 1-4 (4 being higher anxiety). Thus, the lower magnitude of stress experienced might explain the differences in findings. Notably, in the current study, we were not directly attempting to increase stress or negative affect (there are well-validated methods for inducing these specific states that were not implemented in the current study), but we thought the need thwarting manipulation would result in greater negative affect than it did. Also, they used the natural stress produced by examinations as their stress induction method which is more persistent and spread over a longer time (one to two months) as compared to the thwarting manipulation in the present study which was more short term and lasted only about 30-40 minutes.

The current study has a few important limitations worthy of mentioning. The manipulation of relatedness thwarting was difficult because (as mentioned earlier), the researchers generally found it difficult to be dismissive and rejecting towards the participants. This sense of discomfort in thwarting relatedness might have compromised fidelity to the condition and prevented the accurate implementation of thwarting behaviors, even though weekly meetings with the researchers focused on emphasizing and modeling these behaviors. In terms of the other two needs, our items for autonomy and competence yielded low internal consistency making them unreliable measures. This prevents us from accurately assessing how autonomy and competence influence the study outcomes and how they are related to the supporting or thwarting of relatedness. Also, the fact that only one type of food was used might have influenced the effect of chocolate consumption. Instead presenting a variety of foods might result in greater overall food consumption and better differentiation of groups. Next, there may

not be generalizability beyond an undergraduate students sample that was predominately of normal weight. Additionally, the total number of participants in the study is relatively small, which made it difficult to find statistically significant effects, particularly in terms of finding moderation effects if they exist. Lastly, it was noted that during the debriefing phase, while (verbally) obtaining the relatedness rating, a number of participants endorsed responses that were more favorable to the researcher, even though they were in the thwarting condition. This could be due to a few reasons. First, as previously mentioned, the participants may have felt hesitant in acknowledging that the researcher was undermining or thwarting towards them and chose socially desirable responses. Second, a clearer and standard explanation of the conditions and expectation for the participant to reflect on their relationship with the researcher and then to guess their condition assignment might have been helpful. Finally, it may have been that the thwarting manipulation was not that powerful.

In light of the uncertainty about the distinction between need frustration and absence of need satisfaction as being two separate constructs, future studies might use designs which allow the comparison on need manipulation between the two conceptualization of need frustration and lack of need satisfaction. Additionally, studies could experimentally manipulate all three needs in the same design to study their individual contributions to dysregulated eating. Testing other moderators such as emotion regulation strategies used, for example expressive suppression (reduced or non expression of emotions during an emotional state; Evers et al., 2010), might contribute important insights to the existing literature. Similarly, assessing the contribution of other types of eating styles such as external eating or restrained eating (van Strien et al., 1986) in the context of the present study might add to the understanding of problematic eating among college females. Lastly, a replication with males may also find different results.

References

Adams, C. E., & Leary, M. R. (2007). Promoting self–compassionate attitudes toward eating among restrictive and guilty eaters. *Journal of Social and Clinical Psychology, 26*(10), 1120-1144.

Bargh, J. A., & Chartrand, T. L. (2000). The mind in the middle: A practical guide to priming and automaticity research. In H. T. Reis & C. M. Judd (Eds.), *Handbook of research methods in social and personality psychology* (pp. 253–285). New York, NY: Cambridge University Press.

Bartholomew, K., Ntoumanis, N., Ryan, R., & Thøgersen-Ntoumani, C. (2011). Psychological need thwarting in the sport context: Assessing the darker side of athletic experience. *Journal of Sport & Exercise Psychology, 33*(1), 75-102.

Bateman, R. (2011). The role of psychological need-thwarting in the experience of disordered eating symptoms: A diary study. University of Rochester, Rochester, NY (unpublished doctoral dissertation).

Baumeister, R. F., Twenge, J. M., & Nuss, C. K. (2002). Effects of social exclusion on cognitive processes: Anticipated aloneness reduces intelligent thought. *Journal of Personality and Social Psychology, 83*(4), 817–827

Bégin, C., Fecteau, A., Côté, M., Bédard, A., Senécal, C., & Ratté, C. (2018). Disordered eating behaviors through the lens of self-determination theory. *Europe's Journal of Psychology, 14*(3), 571-580.

Bekker, M., Van de Meerendonk, C., & Mollerus, J. (2004). Effects of negative mood induction and impulsivity on self-perceived emotional eating. *International Journal of Eating Disorders, 36*(4), 461-469.

Best, M., Barsalou, L., & Papies, E. K. (2018). Studying human eating behaviour in the laboratory: Theoretical considerations and practical suggestions. *Appetite, 130*, 339-343.

Blackhart, G., Brown, C., Clark, K., Pierce, E., & Shell, T. (2012). Assessing the adequacy of postexperimental inquiries in deception research and the factors that promote participant honesty. *Behavior Research Methods, 44*(1), 24-40.

Bohrer, B. K., Forbush, K. T., & Hunt, T. K. (2015). Are common measures of dietary restraint and disinhibited eating reliable and valid in obese persons? *Appetite*, *87*, 344–351.

Bongers, P., Jansen, A., Houben, K., & Roefs, A. (2013). Happy eating: The Single Target Implicit Association Test predicts overeating after positive emotions. *Eating Behaviors, 14*(3), 348-355.

Bryla, K.Y. (2003). Disordered eating among female adolescents: Prevalence, risk factors, and consequences. *The Health Education, 35*(2), 25-29.

Buckland, N. J., & Dalton, M. (2018). Commentary: Methodological and reporting practices for laboratory studies assessing food intake using fixed and ad libitum test meals. *Appetite, 130*, 336-338.

Castro J., Toro J., & Cruz, M. (2000). Quality of rearing practices as predictor of short-term outcome in adolescent anorexia nervosa. *Psychological Medicine 30*(1), 61–67.

Chen, B., Vansteenkiste, M., Beyers, W., Boone, L., Deci, E. L., Van der Kaap-Deeder, J., . . . Verstuyf, J. (2015). Basic psychological need satisfaction, need frustration, and need strength across four cultures. *Motivation and Emotion, 39*(2), 216-236.

Chin, S. N. M., Laverty, A. A., & Filippidis, F. T. (2018).Trends and correlates of unhealthy dieting behaviours among adolescents in the United States, 1999–2013. *BMC Public Health,18*(1), 1-8.

Cooke, A., Fielding, K. S., & Louis, W. R. (2015). Environmentally active people: The role of autonomy, relatedness, competence and self-determined motivation. *Environmental Education Research, 22*(5), 1-27.

Cordeiro, P., Paixão, P., Lens, W., Lacante, M., & Sheldon, K. (2016). Factor structure and dimensionality of the balanced measure of psychological needs among Portuguese high school students. Relations to well-being and ill-being. *Learning and Individual Differences,47*(C), 51-60.

Cruwys, T., Bevelander, K. E., & Hermans, R. C. J. (2015). Social modeling of eating: A review of when and why social influence affects food intake and choice. *Appetite, 86*, 3-18.

Deci, E. L., Eghrari, H., Patrick, B. C., & Leone, D. R. (1994). Facilitating internalization: The self-determination theory perspective. *Journal of Personality, 62*(1), 119-142.

Deci, E., & Ryan, R. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*(4), 227-268.

Deci, E. L., & Ryan, R. M. (2014). Autonomy and need satisfaction in close relationships: Relationships Motivation Theory. In N. Weinstein (Ed.), *Human motivation and interpersonal relationships* (pp. 53–73). New York: Springer.

Erdfelder, E., Faul, F., & Buchner, A. (1996). GPOWER: A general power analysis program. *Behavior Research Methods, Instruments & Computers, 28*(1), 1–11.

Evers, C., de Ridder, D. T. D., & Adriaanse, M. A. (2009). Assessing yourself as an emotional eater: Mission impossible? *Health Psychology, 28*(6), 717-725.

Evers, C., Marijn Stok, F., & de Ridder, D. (2010). Feeding your feelings: Emotion regulation strategies and emotional eating. *Personality and Social Psychology Bulletin, 36*(6), 792-804.

Field, A. (2018). *Discovering statistics using IBM SPSS Statistics* (5th ed.). Thousand Oaks, CA: Sage.

Fransen, K., Vansteenkiste, M., Vande Broek, G., & Boen, F. (2018). The competence-supportive and competence-thwarting role of athlete leaders: An experimental test in a soccer context. *PLoS ONE, 13*(7), E0200480.

Frayn, M., Livshits, S., & Knauper, B. (2018). Emotional eating and weight regulation: A qualitative study of compensatory behaviors and concerns. *Journal of Eating Disorders, 6*(1), 1-10.

Froreich, F. V., Vartanian, L. R., Zawadzki, M. J., Grisham, J. R, & Touyz, S. W. (2017). Psychological need satisfaction, control, and disordered eating. *British Journal of Clinical Psychology, 56*(1), 53-68.

Geliebter, A., & Aversa, A. (2003). Emotional eating in overweight, normal weight, and underweight individuals. *Eating Behaviors, 3*(4), 341-347.

Gibson, R., Charrondiere, U., & Bell, W. (2017). Measurement errors in dietary assessment using self-reported 24-hour recalls in low-income countries and strategies for their prevention. *Advances in Nutrition, 8*(6), 980-991.

Goldschmidt, A. B., Wall, M. M., Choo, T. J., Evans, E. W., Jelalian, E., Larson, N., & Neumark-Sztainer, D. (2018). Fifteen-year weight and disordered eating patterns among community-based adolescents. *American Journal of Preventive Medicine*, *54*(1), e21–e29.

Goossens, L., Braet, C., Van Vlierberghe, L., & Mels, S. (2009). Loss of control over eating in overweight youngsters: The role of anxiety, depression and emotional eating. *European Eating Disorders Review,17*(1), 68-78.

Gross, J. J. (Ed.). (2007). Handbook of emotion regulation. New York, NY, US: The Guilford Press.

Guerrieri, R., Nederkoorn, C., & Jansen, A. (2007). How impulsiveness and variety influence food intake in a sample of healthy women. *Appetite, 48*(1), 119-122.

Guerrieri, R., Nederkoorn, C., Schrooten, M., Martijn, C., & Jansen, A. (2009). Inducing impulsivity leads high and low restrained eaters into overeating, whereas current dieters stick to their diet. *Appetite, 53*(1), 93-100.

Gunnell, K., Crocker, P., Wilson, P., Mack, D., & Zumbo, B. (2013). Psychological need satisfaction and thwarting: A test of Basic Psychological Needs Theory in physical activity contexts. *Psychology of Sport & Exercise, 14*(5), 599-607.

Hales, C., Carroll, M., Fryar, C., & Ogden, C. (2017). Prevalence of obesity among adults and youth: United States, 2015-2016. *NCHS Data Brief,* (288), 1-8.

Halvari, A. E. M. & Halvari, H., (2006). Motivational predictors of change in oral health: An experimental test of self-determination theory. *Motivation and Emotion, 30*(4), 294-305.

Halvari, A.E. M, Halvari, H., Williams, G.C., & Deci, E.L. (2017). Predicting dental attendance from dental hygienists' autonomy support and patients' autonomous motivation: A randomised clinical trial. *Psychology & Health, 32*(2), 127-144.

Hawkins, R. C., & Clement, P. F. (1984). Binge eating: Measurement problems and a conceptual model. In R. C. Hawkins, W. J. Fremouw, & P. F. Clement (Eds.), *The binge purge syndrome: Diagnosis, treatment, and research* (pp. 229–251). New York, NY: Springer.

Hayes, A. F. (2018). *Introduction to mediation, moderation, and conditional process analysis: A regression-based perspective* (2nd ed.). New York, NY: The Guilford Press.

Heatherton, T. F., & Baumeister, R. F., & Steinberg, R. J. (1991). Binge eating as escape from self-awareness. *Psychological Bulletin, 110*(1), 86-108.

Houben, K., & Jansen, A. (2015). Chocolate equals stop. Chocolate-specific inhibition training reduces chocolate intake and go associations with chocolate. *Appetite, 87*, 318-323.

Houben, K., & Jansen, A. (2011). Training inhibitory control. A recipe for resisting sweet temptations. *Appetite, 56*(2), 345-349.

Jansen, A., Nederkoorn, C., Van Baak, L., Keirse, C., Guerrieri, R., & Havermans, R. (2009). High-restrained eaters only overeat when they are also impulsive. *Behaviour Research and Therapy, 47*(2), 105-110.

Knee, C. R., & Neighbors, C. (2002). Self-determination, perception of peer pressure, and drinking among college students. *Journal of Applied Social Psychology, 32*(3), 522-543.

Kopp, L. L., & Zimmer-Gembeck, M. J. (2011). Women's global self-determination, eating regulation, and body dissatisfaction: Exploring the role of autonomy support. *Eating Behaviors, 12*(3), 222-224.

Kruger, J., Galuska, D. A., Serdula, M. K., & Jones, D. A. (2004). Attempting to lose weight: Specific practices among U.S. adults. *American Journal of Preventive Medicine, 26*(5), 402-406.

Lamford, P., & Cansfield, J. (1999). *Improve your game: 100 Boggle puzzles.* London: Chameleon books.

Leary, M. R. (1999). Making sense of self-esteem. *Current Directions in Psychological Science, 8*(1), 32–35.

Lee, S., Chan, Y. Y. L., Kwok, K., & Hsu, L. K. G. (2005). Relationship between control and the intermediate term outcome of anorexia nervosa in Hong Kong. *Australian and New Zealand Journal of Psychiatry, 39*(3), 141-145.

Longo, Y., Alcaraz-Ibanez, M., & Sicilia, A. (2018). Evidence supporting need satisfaction and frustration as two distinguishable constructs. *Psicothema, 30*(1), 74-81.

Longo, Y., Gunz, A., Curtis, G., & Farsides, J. (2016). Measuring Need Satisfaction and Frustration in Educational and Work Contexts: The Need Satisfaction and Frustration Scale (NSFS). *Journal of Happiness Studies, 17*(1), 295-317.

Macht, M. (2008). How emotions affect eating: A five-way model. *Appetite, 50*(1), 1-11.

Micali, N., Ploubidis, G., De Stavola, B., Simonoff, E., & Treasure, J. (2014). Frequency and patterns of eating disorder symptoms in early adolescence. *Journal of Adolescent Health, 54*(5), 574-581.

Michels, N., Man, T., Vinck, B., & Verbeyst, L. (2020). Dietary changes and its psychosocial moderators during the university examination period. *European Journal of Nutrition, 59*(1), 273-286.

Niemiec, C. P., & Ryan, R. M. (2009). Autonomy, competence, and relatedness in the classroom: Applying self-determination theory to educational practice. *Theory and Research in Education, 7*(2), 133–144.

O' Connor, D. B., & O' Connor, R. C. (2004). Perceived changes in food intake in response to stress: The role of conscientiousness. *Stress and Health, 20*(5), 279-291.

Ogden, C., Kit, B., Carroll, M., & Flegal, K. (2014). Prevalence of childhood and adult obesity in the United States, 2011-2012. *The Journal of the American Medical Association, 311*(8), 806-814.

Pavey, L., Greitemeyer, T., & Sparks, P. (2011). Highlighting relatedness promotes prosocial motives and behavior. *Personality and Social Psychology Bulletin, 37*(7), 905-917.

Perera, M., Brintz, C., Birnbaum-Weitzman, O., Penedo, F., Gallo, L., Gonzalez, P., . . . Llabre, M. (2017). Factor structure of the Perceived Stress Scale-10 (PSS) across English and Spanish language responders in the HCHS/SOL sociocultural ancillary study. *Psychological Assessment*, *29*(3), 320-328.

Robinson, E., Bevelander, K. E., Field, M., & Jones, A. (2018). Methodological and reporting quality in laboratory studies of human eating behavior. *Appetite, 1*(125), 486-491.

Robinson, E., Haynes, A., Hardman, C. A., Kemps, E., Higgs, S., & Jones, A. (2017). The bogus taste test: Validity as a measure of laboratory food intake. *Appetite, 116*, 223-231.

Robinson, E., Proctor, M., Oldham, M., & Masic, U. (2016). The effect of heightened awareness of observation on consumption of a multi-item laboratory test meal in females. *Physiology & Behavior, 163*, 129-135.

Ryan, R. M. & Deci, E. L. (2007). Active human nature: Self-determination theory and the promotion and maintenance of sport, exercise, and health. In M. S. Hagger & N. L. D. Chatzisarantis (Eds.), *Intrinsic motivation and self-determination in exercise and sport* (pp. 1-19). Champaign, IL: Human Kinetics.

Ryan, R. M., & Deci, E. L. (2017). Self-determination theory: Basic psychological needs in motivation, development, and wellness. New York, NY, US: Guilford Press.

Ryan, R. M., Patrick, H., Deci, E. L., & Williams, G. C. (2008). Facilitating health behaviour change and its maintenance: Interventions based on self-determination theory. *European Health Psychologist, 10*(1), 2–5.

Ryan, R. M., Deci, E. L., Grolnick, W. S., & La Guardia, J. G. (2006). The significance of autonomy and autonomy support in psychological development and psychopathology. In D. Cicchetti & C. D. (Eds.), *Developmental psychopathology: Theory and methods* (2 ed., Vol. 1, pp. 795-849). New York: Wiley.

Schüler, J., & Kuster, M. (2011). Binge eating as a consequence of unfulfilled basic needs: The moderating role of implicit achievement motivation. *Motivation and Emotion, 35*(1), 89-97.

Shafran, R., Cooper, Z., & Fairburn, C. G. (2002). Clinical perfectionism: A cognitive–behavioural analysis. *Behaviour Research and Therapy, 40*(7), 773-791.

Sheldon, K. M., Abad, N., Ferguson, Y., Gunz, A., Houser-Marko, L., Nichols, C. P., & Lyubomirsky, S. (2010). Persistent pursuit of need-satisfying goals leads to increased happiness: A 6-month experimental longitudinal study. *Motivation and Emotion, 34*(1), 39-48.

Sheldon, K., & Filak, V. (2008). Manipulating autonomy, competence, and relatedness support in a game-learning context: New evidence that all three needs matter. *British Journal of Social Psychology, 47*(2), 267-283.

Shoebridge, P., & Gowers, S. (2000). Parental high concern and adolescent-onset anorexia nervosa. A case-control study to investigate direction of causality. *The British Journal of Psychiatry: The Journal of Mental Science, 176*(2), 132-137.

Smink, F., Hoeken, R., & Hoek, E. (2012). Epidemiology of eating disorders: Incidence, prevalence and mortality rates. *Current Psychiatry Reports, 14*(4), 406-414.

Soenens, B., Vansteenkiste, M., Vandereycken, W., Luyten, P., Sierens, E., & Goossens, L. (2008). Perceived parental psychological control and eating-disordered symptoms:

Maladaptive perfectionism as a possible intervening variable. *Journal of Nervous and Mental Disease, 196*(2), 144-152.

Spielberger, C. D., Gorsuch, R. L., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). *Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press.

Spoor, S. T. P., Bekker, M. H. J., Van Strien, T., & Van Heck, G. L. (2007). Relations between negative affect, coping, and emotional eating. *Appetite, 48*(3), 368-376.

Sproesser, G., Schupp, H. T., & Renner, B. (2014). The bright side of stress-induced eating: Eating more when stressed but less when pleased. *Psychological Science, 25*(1), 58-65.

Stephen, E. M., Rose, J. S., Kenney, L., Rosselli-Navarra, F., & Weissman, R. S. (2014). Prevalence and correlates of unhealthy weight control behaviors: Findings from the national longitudinal study of adolescent health. *Journal of Eating Disorders, 2*(1), 16.

Stice, E., Cameron, R. P., Killen, J. D., Hayward, C., & Taylor, C. B. (1999). Naturalistic weight-reduction efforts prospectively predict growth in relative weight and onset of obesity among female adolescents. *Journal of Consulting and Clinical Psychology, 67*(6), 967-974.

Tan, C. C., & Chow, C. M. (2014). Stress and emotional eating: The mediating role of eating dysregulation. *Personality and Individual Differences, 66*, 1-4.

Themanson, J., Ball, A., Khatcherian, S., & Rosen, P. (2014). The effects of social exclusion on the ERN and the cognitive control of action monitoring. *Psychophysiology, 51*(3), 215-225.

Thompson, J., & Stice, E. (2001). Thin-ideal internalization: Mounting evidence for a new risk factor for body-image disturbance and eating pathology. *Current Directions in Psychological Science, 10*(5), 181-183.

Timmerman, G. M., & Acton, G. J. (2001). The relationship between basic need satisfaction and emotional eating. *Issues in Mental Health Nursing, 22*(7), 691-701.

Vansteenkiste, M., & Ryan, R. M. (2013). On psychological growth and vulnerability: Basic psychological need satisfaction and need frustration as a unifying principle. *Journal of Psychotherapy Integration, 23*(3), 263-280.

Vansteenkiste, M., Soenens, B., Van Petegem, S., & Duriez, B. (2014). Longitudinal associations between adolescent perceived degree and style of parental prohibition and internalization and defiance. *Developmental Psychology, 50*(1), 229-236.

Van Strien, T., Frijters, J. E., Bergers, G., & Defares, P. B. (1986). The Dutch Eating Behavior Questionnaire (DEBQ) for assessment of restrained, emotional, and external eating behavior. *International Journal of Eating Disorders, 5*(2), 295–315.

Van Strien, T., Herman, C. P., & Verheijden, M. W. (2009). Eating style, overeating, and overweight in a representative Dutch sample. Does external eating play a role? *Appetite, 52*(2), 380-387.

Verstuyf, J., Heather, P.,Vansteenkiste, M., & Teixeira, P. J. (2012). Motivational dynamics of eating regulation: A self-determination theory perspective. *International Journal of Behavioral Nutrition and Physical Activity, 9*(1), 21.

Verstuyf, J., Vansteenkiste, M., & Soenens, B. (2012). Eating regulation and bulimic symptoms: The differential correlates of health-focused and appearance-focused eating regulation. *Body Image, 9*(1), 108-117.

Verstuyf, J., Vansteenkiste, M., Soenens, B., Boone, L., & Mouratidis, A. (2013). Daily ups and downs in women's binge eating symptoms: The role of basic psychological needs, general

self-control, and emotional eating. *Journal of Social and Clinical Psychology, 32*(3), 335-361.

Wade, T. D., Wilksch, S. M., Paxton, S. J., Byrne, S. M., & Austin, S. B. (2015). How perfectionism and ineffectiveness influence growth of eating disorder risk in young adolescent girls. *Behaviour Research and Therapy, 66*, 56-63.

Wadden, T. A., Foster, G. D., Sarwer, D. B., Anderson, D. A., Gladis, M., Sanderson, R. S.,...Phelan, S. (2004). Dieting and the development of eating disorders in obese women: Results of a randomized controlled trial.(Author Abstract). *American Journal of Clinical Nutrition, 80*(3), 560.

Wallis, D., & Hetherington, M. (2004). Stress and eating: The effects of ego-threat and cognitive demand on food intake in restrained and emotional eaters. *Appetite, 43*(1), 39-46.

Wansink, B. (2004). Environmental factors that increase the food intake and consumption volume of unknowing consumers. *Annual Reviews, 24*(1), 455-479.

Watson, D., Clark, L. A., Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54*(6), 1063-1070.

Weathers-Meyer, A. J. (2015). *An Experimental Investigation of Autonomy Support Versus Thwart in an Exergaming Context* (Publication No. etd-07122015-112034) [Master's thesis, Louisiana State University]. LSU Digital Commons.

Werthmann, J., Roefs, A., Nederkoorn, C., Mogg, K., Bradley, B., Jansen, A., & Kazak, A. E. (2011). Can(not) take my eyes off it: Attention bias for food in overweight participants. *Health Psychology, 30*(5), 561-569.

Wildermuth, S., Mesman, G., & Ward, W. (2013). Maladaptive Eating Patterns in Children. *Journal of Pediatric Health Care, 27*(2), 109-119.

Williams, G., Niemiec, C., Patrick, C., Ryan, P., & Deci, H. (2009). The importance of supporting autonomy and perceived competence in facilitating long-term tobacco abstinence. *Annals of Behavioral Medicine, 37*(3), 315-324.

Zellner, D. A., Loaiza, S., Gonzalez, Z., Pita, J., Morales, J., Pecora, D., & Wolf, A. (2006). Food selection changes under stress. *Physiology & Behavior, 87*(4), 789-79

Table 1

Participant Characteristics

Characteristics	Supporting condition		Control condition		Thwarting condition		*p*
	M	*SD*	*M*	*SD*	*M*	*SD*	
Age	19.71	2.23	18.92	.94	18.96	.74	.23
GPA	3.60	.38	3.54	.35	3.60	.35	.81
ACT score	24.04	3.32	23.12	2.92	23.25	3.99	.57
BMI	24.60	4.15	24.62	3.57	22.76	2.67	.05
Hunger rating	2.82	1.25	2.27	1.22	2.93	1.33	.13
DEBQ emotional eating	2.49	.75	2.60	.84	2.69	.66	.62
Chocolate liking	6.00	1.33	5.92	1.38	5.79	1.42	.84
	n	*%*	*n*	*%*	*n*	*%*	*p*
Previous Boggle experience	14	50	9	34.6	10	35.7	.43
Ethnicity [a]							.81
Asian/Pacific Islander	3	10.7	1	3.8	2	7.1	
Black, Non-Hispanic	2	7.1	0	0	1	3.6	
Hispanic	0	0	0	0	0	0	
Native American	0	0	0	0	0	0	
White, Non-Hispanic	23	32.9	23	32.9	24	34.3	
Other	0	0	2	66.7	1	33.3	
Stress eating category							.83
Hyperphagics	9	30	10	33.3	11	36.7	
Hypophagics	11	32.4	12	35.3	11	32.4	
Neither	8	44.4	4	22.2	6	33.3	
Currently trying to lose weight	11	35.5	11	35.5	9	29	.67

Note. DEBQ = Dutch Eating Behavior Questionnaire scores range from 1-5, higher scores indicate greater emotional eating; Hunger ratings could range from 1-5 with higher scores indicating more hunger; chocolate liking ranged from 1-7 with higher scores indicate greater liking; Hypophagia = eat less, Hyperphagia = eat more.
[a] Chi Squared was calculated based on categorization of White, Non-Hispanic vs. all other groups.

Table 2

Descriptive Statistics and Correlations for Study Variables

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9
1. BMI	23.98	3.58									
2. DEBQ Emotional eating	2.59	.75	.09								
3. Stress eating	-.05	.89	.09	.50**							
4. Chocolate consumption (g)	22.02	15.92	.11	.44**	.05						
5. Positive affect	2.90	.84	.00	.01	-.01	.01					
6. Negative affect	1.54	.51	.08	.26*	.18	.10	-.33**				
7. State anxiety/stress	1.96	.57	.21	.25*	.16	.15	-.54**	.77**			
8. Enjoyment	3.95	1.04	.19	-.03	.07	-.11	.55**	-.43**	-.41**		
9. Recommendation	4.16	.75	-.07	-.04	-.05	-.05	.61**	-.52**	-.51**	.70**	
10. Boggle score	17.99	5.48	-.05	.25*	.18	.03	.16	-.22*	-.13	.14	.16

Note. BMI = Body mass index; DEBQ = Dutch Eating Behavior Questionnaire; Stress eating 1= hypophagia (eating less when stressed), 2 = no change, 3 = hyperphagia (eating more when stressed). All rating scales use 1-5 scale except state anxiety/stress used 1-4 scale; higher scores reflect endorsement of more of that variable.
*$p < .05$, **$p < .01$

Table 3

Unadjusted Means, Standard Deviations and Between Group Comparisons for Study Outcomes

Outcome	Supporting condition (S)		Control condition (C)		Thwarting condition (T)		*F*	*p*	η_p^2	S vs. T		S vs. C		T vs. C	
	M	*SD*	*M*	*SD*	*M*	*SD*				*p*	*d*	*p*	*d*	*p*	*d*
Chocolate consumption (g)	18.50	14.87	23.78	16.77	23.90	16.11	1.64	.20	.04	.28	.45	.42	.39	.99	.06
Boggle performance	18.50	6.90	18.44	4.81	17.07	4.45	.66	.34	.02	.80	.22	.99	.08	.62	.30
Positive affect	3.25	.73	2.74	.93	2.70	.78	3.90	.02	.09	.04	.73	.06	.61	.98	.05
Negative affect [a]	1.35	.29	1.63	.61	1.64	.55	3.95	.03	.07	.06	.66	.12	.59	.99	.02
Recommend Boggle	4.46	.59	4.09	.73	3.92	.82	4.25	.02	.10	.02	.76	.13	.56	.70	.22
Enjoyment [a]	4.25	.67	3.71	1.19	3.88	1.14	2.54	.09	.05	.30	.40	.12	.56	.87	.15
State anxiety	1.74	.45	2.09	.60	2.07	.59	3.39	.04	.08	.08	.63	.06	.66	.99	.03
Relatedness satisfaction [a]	4.30	.66	2.98	1.01	2.54	1.22	30.57	<.001	.38	<.001	1.79	<.001	1.55	.32	.39
Relatedness frustration [a]	1.07	.38	1.12	.26	2.20	1.34	9.08	<.001	.29	<.001	1.15	.87	.15	<.01	1.12
Relatedness rating [a]	5.93	.94	4.54	1.30	3.79	1.79	20.20	<.001	.30	<.001	1.50	<.001	1.23	.19	.48

Note. Cohen's *d* calculated using unadjusted *M*s and *SD*s. Tukey's post-hoc comparisons were used unless otherwise noted.
[a] Reflects comparisons in which Welch's *F* statistic was used and post-hoc comparisons made using Games-Howell test

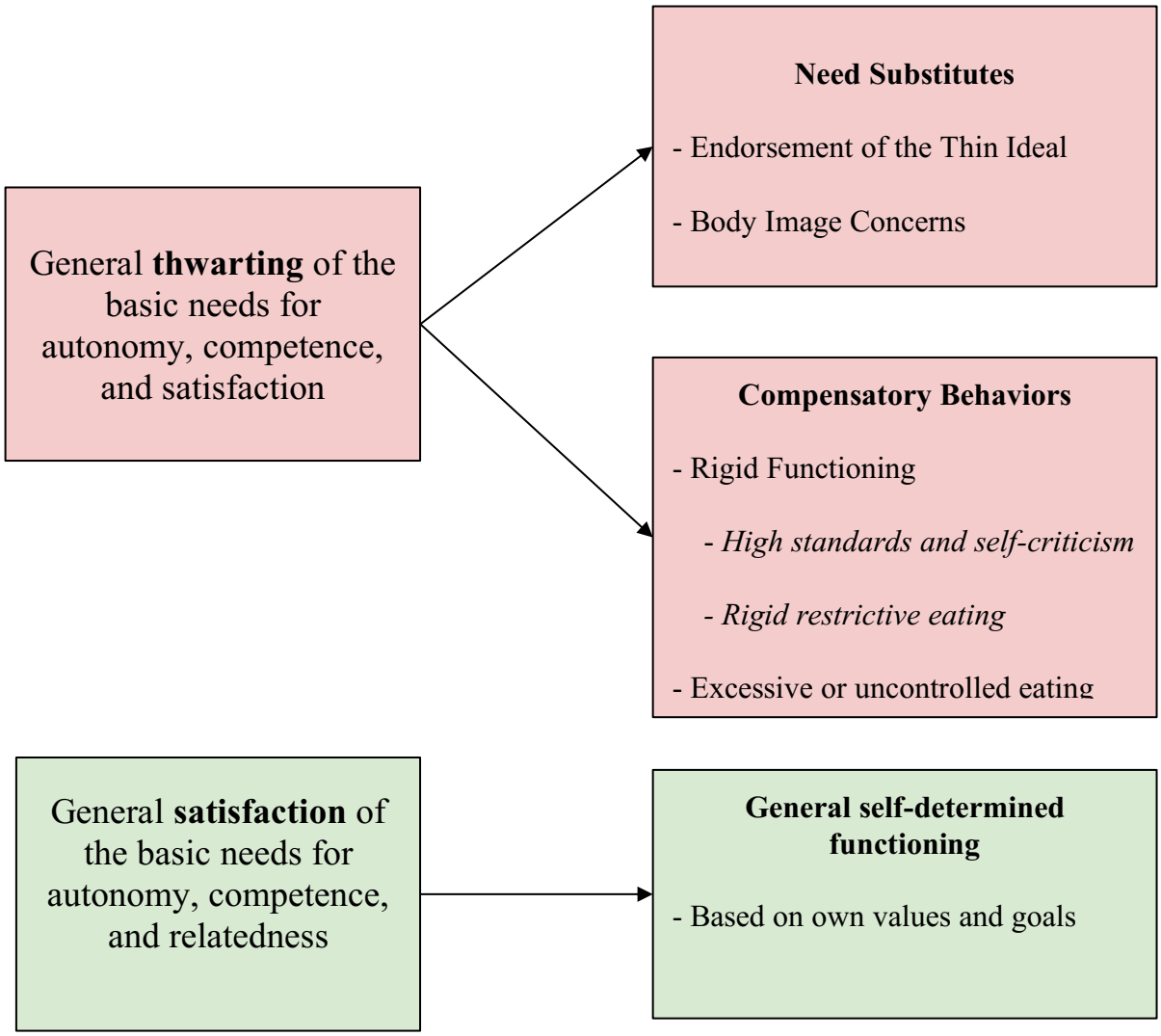

Figure 1. The role of basic psychological need satisfaction versus thwarting in the etiology of disordered eating. Adapted from "Motivational dynamics of eating regulation: a self-determination theory perspective" by J. Verstuyf, H. Patrick, M. Vansteenkiste and P.J. Teixeira, 2012, *International Journal of Behavioral Nutrition and Physical Activity, 9*, p. 3.

Appendix A: Manipulation Script

(Relatedness Satisfaction Condition)
Part 1
Instructions

Instructions for Non-verbals

- Eye contact: Look at the participant while (1) you speak and (2) listen to them respond.
- Facial expressions: Smile frequently while giving out instructions/asking questions. Nod regularly in agreement.
- Tone: Use a soft, friendly tone.
- Touch: Offer a handshake upon greeting.

Greeting

"Hi, are you (Participant's name)? Okay. Thanks for coming in. It's so nice to meet you.

Introduction

"Let me tell you a bit about what we are going to be doing today. As you might recall when you signed up, this study examines peoples' characteristics, such as interests and background, and its relationship with enjoyment and performance on a game. The study is actually quite short, so we have added a second study to this time slot. There is another student working with the same professor, so we will have you participate in both -- first in mine and then in the other student's study. The second study is about understanding how preferences for different types of tastes influences eating patterns. The other student is using chocolate in her study and so…

are you able to eat chocolate today ?" YES _____ NO _____
*If participant says NO, do not administer part 2

Informed Consent

*"Here's the Informed Consent form that I'd like you to take a look at and sign. One main point that I want to highlight is that all of the information we collect is confidential. We only use a study ID number on all of the information we collect about you, and so you can be assured that your data is private. As you look this over**, please feel free to ask me anything that you have concerns or questions about."***

After Informed consent process

*"So again, the aim of this study is to assess the relationship between peoples' background and characteristics, experiences with a game and performance on the game. **I have several questions that I want to ask you so that I can get to know you better as a person."***

Administer Demographics and Preferences Questionnaire <u>Verbally</u>

Time of Day: _____

Before we begin, could you please tell me what you have had to eat or drink in the past 2 hours? _____

_____

---

1. How old are you? _____
2. What is your current major? _____
   "Wow, that's pretty cool! I have some other friends who are also majoring in ____"

   OR (For students without a major)

   "I think that it's a great idea to take your time and make an informed choice. I have some other friends who took their time to decide their major and they were glad they took the time to figure it out."

3. What do you consider your race or ethnicity?
   - Asian or Pacific Islander
   - Black, Non-Hispanic
   - Hispanic
   - Native American (American Indian)
   - White, Non-Hispanic
   - Other

4. What was your high school GPA? _____
5. What was your favorite subject in high school? _____
   That was mine, too!
6. What was your ACT score? _____
7. Have you ever played a game called Boggle before? Yes No

   If yes, how often have you played it? _____
8. How would you describe your concentration level right now? (*nod your head in understanding, but otherwise remain neutral)*

   On a scale from 1-7, with 1 being low and 7 being high, how would you rate your concentration level?

   1 2 3 4 5 6 7

9. How would you describe your vocabulary? (*nod your head in understanding, but otherwise remain neutral)*

On a scale from 1-7, with 1 being low and 7 being high, how would you rate your vocabulary?

1 2 3 4 5 6 7

10. How often do you play video games? Which ones are your favorite?

"*I like that one too!" or some other affirmation and agreement.*

Introduce Boggle

- *"Now, you will be taught how to play the Boggle game. I will give you some instructions.* ***As we go along, you can ask me any questions you have.***
- Hand out example game
- *You are to make words that can be constructed from the letters that are next to each other. The letters can be horizontal (like this CAPE), vertical (like PAD), or diagonally (like COD). The words you find don't have to go right-to-left. They can go up, down, backwards, forwards, and diagonally as long as all of the letters are connected in a chain and each letter is used only once (like JAUNT).*
- *Words need to be at least three letters long, and you can count both a singular and plural version of the same word.*
- *You will want to write down every word that you discover on the paper provided. It's common for simple words to appear on the Boggle board several times. However, you only write each word once on your piece of paper.*
- *Words that are allowed include common nouns, verbs, adjectives and adverbs. Words which are not allowed include proper nouns (like Justin or Rome), abbreviations (like UMD), contractions, which are words that use apostrophes to take the place of letters (like don't), and words borrowed from languages other than English (such as mazeltov).*
- *After three minutes, I will say "stop" and you will need to stop writing immediately and put the pencil down.*
- *Points are awarded based on the length of the word. So, for a three or four letter word, you will receive one point, for a five letter word, you will receive two points, for a six letter word, you will receive three points, for a seven letter word, you will receive five points, and for words containing eight letters or more, you will receive eleven points.*
- *Do you have questions?*
- ***One thing I want you to know is that everybody is unique, and so it is important to learn about each person as an individual. Because of this, I am trying to understand your approach to learning. So, I hope you'll share your experiences with me after you're done."***

Hand out the first Boggle grid and answer sheet.

- *"Here is your first game. On this piece of paper, write down as many words as you can."*
- *"Your time starts now."* Set timer for 3 minutes – Say, *"Time to stop."*

After the first Boggle game

- *How are you doing right now?*

Hand out second Boggle grid

- *Here is your second game.*

Give hints for the grid

- *"I've got three hints or strategies to help boost your score on the game. First, look out for plurals, and words that end in '-er', '-ed', or '-ing.' Second, if you find a long word, make sure that you also break it into its smaller components. Third, sometimes words make other words when they are spelled backwards. For example, the word 'REED' can be turned into 'DEER.'*
- ***The first time I did these puzzles I found the hints really helpful, and I bet you will too.***
- ***Remember, your individual approach to learning is important and I want to really understand it. So, please be sure to remember what you were thinking and feeling, so we can discuss your reactions later."***
- "*Your time starts now."* *Set timer for 3 minutes – Say, *"Time to stop."*

After the second Boggle game

- ***"OK, it's time for the final timed test. I can understand that you might not be sure you like games like this, or feel worried about your performance. Just remember that I know you are a unique individual, with your own approach to learning, and so I am focused on trying to understand you personally, not just your score on the game itself.***
- *Your time starts now."* *Set timer for 3 minutes – Say, *"Time to stop."*

After final Boggle game

"What was this experience like for you?" (Take time to listen, nod, make eye contact, maintain an open body posture. Make some pretend notes here)

Hand out Questionnaires

"I've now got a few more questions for you that ask about your experience with the game today. When you are done, just put them in this envelope. Only your study ID number is on this, not your name. You may not feel comfortable having me see your responses. I want you to know that this information is important and another member of the research team will enter your responses into a database without your name on it."

Step out of the room, but leave the door open. When it is clear that the participant is done:

Collect Envelope

Looks like you're all done. Thank you so much for participating (shake hands). *It was so nice to meet you. I'll go get the researcher for the second study."*

Part 2

While participant is completing Part 1:

- Measure 550g (+-1 g) of Chocolate Chips into each of the 5 bowls
- Place appropriate label under each bowl (M, D, S, PB, W) in the order on the participant's taste test rating form. (Order starts in back, left to right 1-3, 4-5 are in front, left to right)
- On recording page, write down the starting weight of each bowl, to the nearest .01g.
- Make sure the scale and chocolate chip containers are stored out of view of the participant.

Introduction

"Hi. My name is _____. You must be (name)? Its nice to meet you. ***How did the first study go?***

Offer some type of affirmation (e.g., I know, those word games can be so hard/fun/etc….)

Let's move on to my study. The purpose of this study is to assess the relationship between your perceptions of different sweet tastes and your typical eating patterns and attitudes about food. We think that what you grew up eating and the types of foods you eat day-to-day, may be related to how you perceive different tastes."

Administer Chocolate preference item <u>verbally</u>

"I'm going to be asking you to taste and rate several types of chocolate. Before we begin, ***I'd be really interested in knowing how much you like chocolate****. On a scale of 1 to 7, where 1 means you do not like at all and 7 means you like it a great deal, how much do you like chocolate?"*

---

1 = Do not like at all **7 = Like it a great deal**

	Rating
Like chocolate	**1 2 3 4 5 6 7**

Get Chocolate

"*I'm going to get the chocolate from the other room. I'll be right back."* (return with chocolate and place tray on table.

Explain taste test

"Here are 5 bowls of chocolate chips. Please complete this taste test form as you taste each chocolate. As you taste each type, you are asked to rate them on different taste qualities, as well as an overall rating of how much you like each one.
Show the form, point to the columns, explain that each bowl is label with the same letter as on the taste test form. Ask participants to use the spoon, to spoon chocolate into their hand or the plate.
You are also encouraged to eat as many as you want so that you can give the most accurate rating. You can go back and resample any of them and change your ratings along the way."

Hand out Taste Test Rating Form

"While you do this, I'll be in the other room getting some questionnaires ready for you. I'll be back in about 5-10 minutes. In the meantime, please feel free to taste and eat as much chocolate as you like. *When I return, you will fill out some questionnaires about your general food preferences and eating habits. Do you have any questions?"*

Leave room for 7 minutes, close the door to the room.

Hand out Survey

(After returning) *"I have a questionnaire that I'd like you to fill out."* **(Hand out DEBQ)**

End of Taste Test

"This brings us to the end of this study. I'm going to get the first research assistant and she will talk with you a bit more about the study" (Be sure to thank the participant. Leave the room and weigh the chocolate while the first RA debriefs).

Debriefing

*Act warm and friendly towards the participant throughout this debriefing process
"I would like to thank you for your participation in our study. I have a few questions to help reassess your understanding of these studies.

1) *Now that you are done, what do you think the purposes of these experiments were?*
2) *What did you think about being asked to do two different studies during this time slot? (*looking for any awareness here of the two studies being connected)
3) *Did you think there was any connection between the two studies?*

Now that the experiment has come to an end, I would like to provide you with important details of the study. As you may be aware, some studies require that their true purpose be withheld from the participants until the very end. This is because sometimes when participants know what the study is assessing, they may change their behavior and act in ways that they believe the experimenter wants them to. In other words, they may not display their original behavior. This is why you were not told the actual aim of the study.

As you may recall, the two studies you completed were introduced as being unrelated to each other. The two parts, however, are related. The overall purpose of the study is to understand how the degree to which people feel related to others can affect their food intake. The true purpose of Part 1 was to affect the degree to which you felt relatedness or connection to the

experimenter by fostering it, hampering it, or neither depending on the condition that you were randomly assigned to.

I'd like to know from you, the extent to which you felt a sense of relatedness with me or the lack thereof on a scale of 1 to 7 with 7 being "A very strong sense of relatedness" and 1 being "A very strong sense of feeling alienated."

Alienated Strong sense of relatedness

Rating: 1 2 3 4 5 6 7

Which condition do you think you were in? **NS ____ NF ____ CG ____**

(Correct Identification of condition): *"Yes, that's right. You were assigned to the Relatedness Condition."*

(Incorrect Identification of condition): *"Well, you were actually assigned to the Relatedness Condition."*

The true purpose of the second study was to see how much chocolate you ate and how this might be related to the way the experimenter treated you. The chocolate tasting was just a part of the cover story.

*What are your thoughts or feelings about this element of deception in our study? (*Probe here as needed. May want to ask specifically if the participant felt irritated, angry, or it affected how the responded to the taste test).
(At this point, you will provide reassurance that many people eat more when they are not being watched and it is normal for people to eat lots of the chocolate.)

As a reminder, the amount you ate and all of your other responses are confidential and are not in any way connected to your name or any other identifying information.

That said, because you were not told the real purpose of the study, you have the right to withdraw the use of any of your data in this study. Will you allow us to use your data?

YES NO

Now that you know the true purpose of the study and the importance of concealing its actual aim until after the experiment is over, I would request that you refrain from sharing the information I just discussed with others.

If others are made aware of what our research is actually studying, participants who come in with that knowledge may knowingly or unknowingly try to portray inauthentic behaviors, give fake responses, and display inaccurate performances.

As a result of all these possible situations, our research will run the risk of producing inaccurate data which would render the study useless. So, again it is so important that you not share the true purpose of this study with your friends and classmates.

Are you willing to keep your experiences to yourself, by not telling any of your classmates about this? Or anyone who might be taking one of these psychology classes?
Do you have any questions at this point?
If you have any questions that arise later on, please feel free to contact me. I would like to thank you for your time and participation and hope you enjoyed this experience.

(Relatedness Frustration Condition)
Part 1
Instructions

Instructions for Non-Verbals

- Eye contact: Look away while you give instructions and when the participant responds.
- Facial expressions: Frown frequently while giving out instructions/asking questions as though you didn't really want to be stuck collecting data from people and that you'd really rather not be a part of the study.
- Gesture & movement: Make use of finger pointing while giving out instructions for the Boggle game.
- Tone: Use an abrupt and disinterested tone, or 'sign-song rhythm with dialogue to communicate boredom; sigh slightly at times to seem bored.

Greeting

"Are you (Participant's name)? Okay. Follow me." (Don't offer to shake hands)

Introduction

"I going to tell you a bit about what you are going to be doing today. As you might recall when you signed up, this study examines peoples' characteristics, such as interests and background, and its relationship with enjoyment and performance on a game. The study is actually quite short, so we have added a second study to this time slot. There is another student working with the same professor, so we will have you participate in both -- first in this one and then in the other study. The second study is about understanding how preferences for different types of tastes influences eating patterns. The other study involves eating chocolate and so…

are you able to eat chocolate today?" YES _____ NO _____

*If participant says NO, do not administer part 2

Informed Consent

"Here's the Informed Consent form. You can look it over and then sign it. ***One thing you should know is that your responses are confidential. We are not interested in your individual responses, but instead will combine your with everyone else and look at group data only. Your name will not be included on any of the forms."***

"So again, the aim of this study is to assess the relationship between peoples' background and characteristics, experiences with a game and performance on the game. ***I have several questions that I have to ask you. Just so you know, I am not specifically interested in getting to know you better as an individual and am just asking everyone to provide me with some basic information."***

Administer Demographics and Preferences Questionnaire <u>Verbally</u>

Time of Day: _____
Before we begin, could you please tell me what you have had to eat or drink in the past 2 hours? _____

_____

_____

1. How old are you? _____
2. What is your current major? _____
   "Really? I would never want that major" (furrow brow)

   OR (if Psychology)

   "Wish I would have chosen a different major."
3. What do you consider your race or ethnicity?
   - Asian or Pacific Islander
   - Black, Non-Hispanic
   - Hispanic
   - Native American (American Indian)
   - White, Non-Hispanic
   - Other
4. What was your high school GPA _____ (seem uninterested either way)
5. What was your favorite subject in high school _____
6. What was your ACT score _____
7. Have you ever played a game called Boggle before? Yes No
   If yes, how often have you played it? _____

(Answers to the items below are unimportant – just jot quickly and seem disinterested)

8. How would you describe your concentration level? (*remain neutral here)*
   On a scale from 1-7, with 1 being low and 7 being high, how would you rate your concentration level?
   1 2 3 4 5 6 7
9. How would you describe your vocabulary? *(remain neutral here)*
   On a scale from 1-7, with 1 being low and 7 being high, how would you rate your vocabulary?
   1 2 3 4 5 6 7
10. How often do you play video games?
    Which ones are your favorite games?
    "Not me!" I can't stand video games. They are such a waste of time" or some other statement that is disaffirming and in disagreement."

Introduce Boggle

- ***"Now, you will be taught how to play the Boggle game. I will give you certain instructions and I would like for you to listen closely because once I'm done giving you the instructions, you don't want to be asking me everything again.***
- Hand out example game
- *You are to make words that can be constructed from the letters that are next to each other. The letters can be horizontal (like this CAPE), vertical (like PAD), or diagonally (like COD). The words you find don't have to go right-to-left. They can go up, down, backwards, forwards, and diagonally as long as all of the letters are connected in a chain and each letter is used only once (like JAUNT).*
- *Words need to be at least three letters long, and you can count both a singular and plural version of the same word. .*
- *You will want to write down every word that you discover on the paper provided. It's common for simple words to appear on the Boggle board several times. However, you may only write each word once on your piece of paper.*
- *Words that are allowed include common nouns, verbs, adjectives and adverbs. Words which are not allowed include proper nouns (like Justin or Rome), abbreviations (like UMD), contractions which words that use apostrophes to take the place of letters (like don't), and words borrowed from languages other than English (such as mazeltov).*
- *After three minutes have elapsed, you will need to stop writing immediately and put the pencil down.*
- *Points are awarded based on the length of the word. So, for a three or four letter word, you will receive one point, for a five letter word, you will receive two points, for a six letter word, you will receive three points, for a seven letter word, you will receive five points, and for words containing eight letters or more, you will receive eleven points.*
- *Do you have questions?*
- ***One thing you need to know is that to me, everybody is the same. I'm not really concerned about you as an individual, I only care about your performance in our experiment, that is, the data. So we can be as efficient as possible, please keep your observations to yourself during the process."***

Hand out the first Boggle grid and answer sheet.

"Here is your first game. On this piece of paper, write down as many words as you can. ***Remember, your individual style of learning isn't important here, so keep your observations to yourself as you work on this."***

"Your time starts now." *Set timer for 3 minutes – Say, *"Time to stop."*

After the first Boggle game

"Irrespective of however you're feeling right now, we need to move on. Here is your second game. (Hand out grid #2)

Give hints for the grid

I am suppose to tell you the following hints*. First, look for plurals, and words that end in '-er', '-ed', or '-ing.' Second, if you find a long word, make sure that you also break it into its smaller components. Third, sometimes words make other words when they are spelled backwards. For example, the word 'REED' can be turned into 'DEER.'*

"Your time starts now." *Set timer for 3 minutes – Say, *"Time to stop."*

After the second Boggle game

"OK, it's time for the final timed game. You may be thinking that you don't like games like this, but that doesn't matter. Remember, you're just one anonymous participant, the same as everybody else. I am focused on trying to understand data from the game, not you personally."

Hand out grid #3

"Your time starts now." *Set timer for 3 minutes – Say, *"Time to stop."*

After final Boggle game

"Again, irrespective of how you may be feeling right now, we need to get you started on some questionnaires and keep this moving along."

Hand out Questionnaires

"There are a few more questions that ask about your experience with the game today. When you are done, just put them in this envelope. Only your study ID number is on this, not your name. I will not see your responses as another assistant will enter this data into a spreadsheet without your name.

Step out of the room, leave door open. When it is clear the participant is done:

Collect envelope.

"I'm done. I'll go get the researcher for the second study."

Part 2

While participant is completing Part 1:

- Measure 550g (+-1 g) of Chocolate Chips into each of the 5 bowls
- Place appropriate label under each bowl (M, D, S, P, W) in the order on the participant's taste test rating form.
- On recording page, write down the starting weight of each bowl, to the nearest .01g.
- Make sure the scale and chocolate chip containers are stored out of view of the participant.

Introduction

"I'm here to do the second study with you. *The purpose of this study is to assess the relationship between your sensitivity to different sweet tastes and your typical eating patterns and attitudes about food. We think that what you grew up eating and the types of foods you eat day-to-day, may be related to how you perceived different tastes."*

Administer Chocolate preference item <u>verbally</u>

"*Next you are going to be tasting and rating several types of chocolate. Not that it is crucial, but how much do you like chocolate on a scale of 1 to 7 where 1 = do not like at all and 7 = you like it a great deal?"*

---

1 = Do not like at all **7 = Like it a great deal**

	Rating
Like chocolate	**1 2 3 4 5 6 7**

Get Chocolate

"I'm going to get the chocolate from the other room. I'll be right back." (return with chocolate and place tray in table.)

Explain taste test & hand out Taste Test Rating Form

"Here are 5 bowls of chocolate chips. You will complete this rating form as you taste each chocolate. As you taste each type, you are asked to rate them along different criteria. ***You are also encouraged to eat as many as you want so that you can give the most accurate rating. You can go back and resample any of them and change your ratings along the way."***

Show the form, point to the columns, explain that each bowl is label with the same letter as on the taste test form. Ask participants to use the spoon, to spoon chocolate into their hand or the plate.

"While you do this, I'll be in the other room getting some questionnaires ready for you. I'll be back in about 5-10 minutes. In the meantime, please feel free to taste and eat as much chocolate as you like. *When I return, you will fill out some questionnaires about your general food preferences and eating habits. Do you have any questions?"*

Leave room for 7 minutes, close the door to the room.

Hand out survey

"I have a questionnaire that I'd like you to fill out." **(Hand out DEBQ)**

End of Taste Test

"This brings us to the end of this study."

Debriefing

***Act warm and friendly towards the participant throughout this debriefing process**

"I would like to thank you for your participation in our study. I have a few questions to help reassess your understanding of these studies.

1) *Now that you are done, what do you think the purposes of these experiments were, in your own words?*
2) *What did you think about being asked to do two different studies during this time slot? (*looking for any awareness here of the two studies being connected)
3) *Did you think there was any connection between the two studies?*

Now that the experiment has come to an end, I would like to provide you with important details of the study. As you may be aware, some studies require that the true purpose be withheld from the participants until the very end. This is because sometimes when participants know what the study is assessing, they may change their behavior and act in ways that they believe the experimenter wants them to. In other words, they may not display their original behavior. This is why you were not told the actual aim of the study.

As you may recall, the two studies you completed were introduced as being unrelated to each other. The two parts, however, are related. The overall purpose of the study is to understand how the degree to which people feel related to others can affect their food intake. The true purpose of Part 1 was to affect the degree to which you felt relatedness or connection to the experimenter by fostering it, hampering it, or neither depending on the condition that you were randomly assigned to.

I'd like to know from you, the extent to which you felt a sense of relatedness with the experimenter or the lack thereof on a scale of 1 to 7 with 7 being "A very strong sense of relatedness" and 1 being "A very strong sense of feeling alienated."

	Alienated						Strong sense of relatedness
Rating:	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Which condition do you think you were in? **NS ____ NF ____ CG ____**

(Correct Identification of condition): *"Yes, that's right. You were assigned to the Relatedness Frustration Condition."*

(Incorrect Identification of condition): *"Well, you were actually assigned to the Relatedness Frustration Condition."*

How I was treating you was actually an act. I was trying to be disinterested in you, etc… (take time to explain this and restore the relationship here)

The true purpose of the second study was to see how much chocolate you ate and how this might be related to the way the experimenter treated you. The chocolate tasting was just a part of the cover story.

What are your thoughts or feelings about this element of deception in our study? (Probe here as needed. May want to ask specifically if the participant felt irritated, angry, or whether they think it influenced the amount they ate.)

(At this point, you will provide reassurance that many people eat more when they are not being watched and it is normal for people to eat lots of the chocolate.)

As a reminder, the amount you ate and all of your other responses are confidential and are not in any way connected to your name or any other identifying information.

That said, because you were not told the real purpose of the study, you have the right to withdraw the use of any of your data in this study. Will you allow us to use your data?

YES NO

Now that you know the true purpose of the study and the importance of concealing its actual aim until after the experiment is over, I would request that you refrain from sharing the information I just discussed with others.

If others are made aware of what our research is actually studying, participants who come in with that knowledge may knowingly or unknowingly try to portray inauthentic behaviors, give fake responses, and display inaccurate performances.

As a result of all these possible situations, our research will run the risk of producing inaccurate data which would render the study useless. So, again it is so important that you not share the true purpose of this study with your friends and classmates.

Are you willing to keep your experiences to yourself, by not telling any of your classmates about this? Or anyone who might be taking one of these psychology classes.
Do you have any questions at this point?

If you have any questions that arise later on, please feel free to contact me. I would like to thank you for your time and participation and hope you enjoyed this experience.

(Control Condition)
Part 1
Instructions

Instructions for Non-verbals

- Put in no extra effort to come across as either friendly or rude
- Be matter of fact. Polite, but not overly friendly

Greeting
"Hi, are you (Participant's name)? Why don't we get started"

Introduction

"Let me tell you a bit about what we are going to be doing today. As you might recall when you signed up, this study examines peoples' characteristics, such as interests and background, and its relationship with enjoyment and performance on a game. The study is actually quite short, so we have added a second study to this time slot. There is another student working with the same professor, so we will have you participate in both -- first in this one and then in the other student's study. The second study is about understanding how preferences for different types of tastes influences eating patterns. The other study involved eating chocolate and so…

are you able to eat chocolate today?" YES _____ NO _____

*If participant says NO, do not administer part 2

Informed Consent

"Here's the Informed Consent form. Let me know if you have concerns or questions about it."

After Informed consent process

"So again, the aim of this study is to assess the relationship between peoples' background and characteristics, experiences with a game and performance on the game. ***There are several questions in this handout for you."***

<u>Hand out</u> Demographics and Preferences Questionnaire

Introduce Boggle

- ***"Now, you will be taught how to play a game. I will give you certain instructions and I would like for you to listen closely."***
- Hand out example game
- *You are to make words that can be constructed from the letters that are next to each other. The letters can be horizontal (like this CAPE), vertical (like PAD), or diagonally (like COD). The words you find don't have to go right-to-left. They can go up, down, backwards, forwards, and diagonally as long as all of the letters are connected in a chain and each letter is used only once (like JAUNT).*
- *Words need to be at least three letters long, and you can count both a singular and plural version of the same word.*
- *Write down every word that you discover on the paper provided. It's common for simple words to appear on the Boggle board several times. However, you only write each word once.*
- *Words that are allowed include common nouns, verbs, adjectives and adverbs. Words which are not allowed include proper nouns (like Justin or Rome), abbreviations (like UMD), contractions which words that use apostrophes to take the place of letters (like don't), and words borrowed from languages other than English (such as mazeltov).*
- *After three minutes have elapsed, you must stop writing immediately and put the pencil down.*
- *Points are awarded based on the length of the word. So, for a three or four letter word, you will receive one point, for a five letter word, you will receive two points, for a six letter word, you will receive three points, for a seven letter word, you will receive five points, and for words containing eight letters or more, you will receive eleven points.*
- ***Do you have questions?"***

Hand out the first Boggle grid and answer sheet.

"Here is your first game. On this piece of paper, write down as many words as you can."
Your time starts now."
*Set timer for 3 minutes – Say, *"Time to stop."*

After the first Boggle game

"Here is the second game.

Give hints for the grid

- *Here are some hints or strategies that can help you perform better. First, look out for plurals, and words that end in '-er', '-ed', or '-ing.' Second, if you find a long word, make sure that you also break it into its smaller components. Third, sometimes words make other words when they are spelled backwards. For example, the word 'REED' can be turned into 'DEER.'*

"Your time starts now." *Set timer for 3 minutes – Say, *"Time to stop."*

After the second Boggle game

"OK, it's time for the final timed game.
"Your time starts now." *Set timer for 3 minutes – Say, *"Time to stop."*

After final Boggle game

"Alright. The game part is now done."

Hand out Questionnaires

"I've now got a few more questions for you that ask about your experience with the game today. When you are done, just put them in this envelope. Only your study ID number is on this, not your name. Another member of the research team will enter your responses into a database without your name on it."

Step out of the room while participant completes forms, leaving door open. When completed, say

"Looks like you've filled out all the questionnaires. I'll go get the researcher for the second study."

Part 2

While participant is completing Part 1:

- Measure 550g (+- 1 g) of Chocolate Chips into each of the 5 bowls.
- Place appropriate label under each bowl (M, D, S, P, W) in the order on the participant's taste test rating form.
- On recording page, write down the starting weight of each bowl, to the nearest .01g.
- Make sure the scale and chocolate chip containers are stored out of view of the participant.

Introduction

"The purpose of this study is to assess the relationship between your sensitivity to different sweet tastes and your typical eating patterns and attitudes about food."

Administer Chocolate preference item <u>verbally</u>

"Next I will ask you to taste and rate several types of chocolate. How much do you like chocolate on a scale of 1 to 7 where 1 = do not like at all and 7 = you like it a great deal?"

---

1 = Do not like at all **7 = Like it a great deal**

	Rating
Like chocolate	**1 2 3 4 5 6 7**

Get Chocolate

"I'm going to get the chocolate from the other room. I'll be right back." (return with chocolate and place tray on table."

Explain taste test & hand out Taste Test Rating Form

"Here are 5 bowls of chocolate chips. Please complete a taste test form as you taste each chocolate. As you taste each type, you are asked to rate them along different taste qualities, as well as an overall rating of how much you like each one.

Show the form, point to the columns, explain that each bowl is label with the same letter as on the taste test form. Ask participants to use the spoon, to spoon chocolate into their hand or the plate.

"You are also encouraged to eat as many as you want so that you can give the most accurate rating. You can go back and resample any of them and change your ratings along the way."

"While you do this, I'll be in the other room getting some questionnaires ready for you. I'll be back in about 5-10 minutes. In the meantime, please feel free to taste and eat as much chocolate as you like*. When I return, you will fill out some questionnaires about your general food preferences and eating habits. Do you have any questions?"*

Leave room for 7 minutes, close the door to the room.

Hand out Survey

(After returning) *"I have a questionnaire that I'd like you to fill out."* **(Hand out DEBQ)**

End of Taste Test

"This brings us to the end of this study." (Be sure to thank the participant, Leave the room, and weigh the chocolate while the first RA debriefs).

Debriefing

*Act warm and friendly towards the participant throughout this debriefing process
"I would like to thank you for your participation in our study. I have a few questions to help reassess your understanding of these studies.

1) *Now that you are done, what do you think the purposes of these experiments were?*
2) *What did you think about being asked to do two different studies during this time slot? (*looking for any awareness here of the two studies being connected)
3) *Did you think there was any connection between the two studies?*

Now that the experiment has come to an end, I would like to provide you with important details of the study. As you may be aware, some studies require that their true purpose be withheld from the participants until the very end. This is because sometimes when participants know what the study is assessing, they may change their behavior and act in ways that they believe the experimenter wants them to. In other words, they may not display their original behavior. This is why you were not told the actual aim of the study.

As you may recall, the two studies you completed were introduced as being unrelated to each other. The two parts, however, are related. The overall purpose of the study is to understand how the degree to which people feel related to others can influence their food intake. The true purpose of Part 1 was to influence the degree to which you felt relatedness or connection to the experimenter by fostering it, hampering it, or neither depending on the condition that you were randomly assigned to.

I'd like to know from you, the extent to which you felt a sense of relatedness with the experimenter or the lack thereof on a scale of 1 to 7 with 7 being "A very strong sense of relatedness" and 1 being "A very strong sense of feeling alienated."

Alienated Strong sense of relatedness

Rating: 1 2 3 4 5 6 7

Which condition do you think you were in? **NS ____ NF ____ CG ____**

(Correct Identification of condition): *"Yes, that's right. You were assigned to the Control Condition."*

(Incorrect Identification of condition): *"Well, you were actually assigned to the Control Condition."*

The true purpose of the second study was to see how much chocolate you ate and how this might be related to the way the experimenter treated you. The chocolate tasting was just a part of the cover story.

What are your thoughts or feelings about this element of deception in our study? (Probe here as needed. May want to ask specifically if the participant felt irritated, angry, or it affected how the responded to the taste test).

(At this point, you will provide reassurance that many people eat more when they are not being watched and it is normal for people to eat lots of the chocolate.)

As a reminder, the amount you ate and all of your other responses are confidential and are not in any way connected to your name or any other identifying information.

That said, because you were not told the real purpose of the study, you have the right to withdraw the use of any of your data in this study. Will you allow us to use your data?

YES NO

Now that you know the true purpose of the study and the importance of concealing its actual aim until after the experiment is over, I would request that you refrain from sharing the information I just discussed with others.

If others are made aware of what our research is actually studying, participants who come in with that knowledge may knowingly or unknowingly try to portray inauthentic behaviors, give fake responses, and display inaccurate performances.

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Are you willing to keep your experiences to yourself, by not telling any of your classmates about this? Or anyone who might be taking one of these psychology classes?

Do you have any questions at this point?

If you have any questions that arise later on, please feel free to contact me. I would like to thank you for your time and participation and hope you enjoyed this experience.

Appendix B: Measures

Demographics and Background

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1. Approximate Time: _____
2. What you have had to eat or drink in the past 2 hours*?* _____

   _____
3. How old are you? _____
4. What is your current major? _____
5. What do you consider your race or ethnicity (check all that apply)?
   - Asian or Pacific Islander
   - Black, Non-Hispanic
   - Hispanic
   - Native American (American Indian)
   - White, Non-Hispanic
   - Other
6. What was your high school GPA? _____
7. What was your favorite subject in high school? _____
8. What was your ACT score? _____
9. Have you ever played a game called Boggle before? Yes No

   If yes, how often have you played it? _____
10. How would you describe your current concentration level?

    On a scale from 1-7, with 1 being *low* and 7 being *high*, how would you rate your ability to concentration?

1 2 3 4 5 6 7

11. How would you describe your vocabulary?

On a scale from 1-7, with 1 being *low* and 7 being *high*, how would you rate the extent of your vocabulary?

1 2 3 4 5 6 7

12. How often to you play video games? Which ones are your favorite?

Psychological Need Satisfaction and Frustration

Below we are going to ask about your actual experiences of certain feelings while completing the study and Boggle task. Please read each of the following items carefully. You can choose from 1 to 5 to indicate the degree to which the statement is true for you at this point in the experiment.

	Not at all true	Slightly true	Moderately true	Mostly true	Very true
1. I felt capable at what I did in the study.	1	2	3	4	5
2. I felt a sense of choice and freedom during the study.	1	2	3	4	5
3. I felt connected with the researcher.	1	2	3	4	5
4. I felt pressured to do too many things in the study.	1	2	3	4	5
5. I felt disappointed with my performance.	1	2	3	4	5
6. I have the impression that the researcher disliked me.	1	2	3	4	5
7. I felt forced to do many things I wouldn't choose to do in the study.	1	2	3	4	5
8. I felt competent to achieve a good score on the game.	1	2	3	4	5
9. I experienced a sense of warmth from the researcher.	1	2	3	4	5
10. I felt like I did what really interested me in the study.	1	2	3	4	5
11. I felt that the researcher was cold and distant towards me.	1	2	3	4	5
12. I felt insecure about my ability to perform well.	1	2	3	4	5

Intrinsic Motivation

(Enjoyment/Interest in the game)

Please indicate how true each statement is for you, using the following scale.

	Not true at all		Some-what true		Very true
1. I enjoyed the challenges this game provided**.**	1	2	3	4	5
2. I would be interested in playing this game again.	1	2	3	4	5

(Willingness to recommend Boggle)

Please evaluate the given statements based on the following rating scale*:*

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1. I would recommend this study to a friend.	1	2	3	4	5
2. I would recommend this researcher to a friend.	1	2	3	4	5
3. I would recommend the Boggle game to a friend.	1	2	3	4	5

Positive and Negative Affect Schedule-General (PANAS)

This scale consists of a number of words that describe different feelings and emotions. Read each item and then check the response that best indicates the extent to which you feel this way <u>right now</u>.

	Very slightly or not at all	A Little	Moderately	Quite a bit	Extremely
1. **Interested**	1	2	3	4	5
2. **Disinterested**	1	2	3	4	5
3. **Excited**	1	2	3	4	5
4. **Upset**	1	2	3	4	5
5. **Strong**	1	2	3	4	5
6. **Guilty**	1	2	3	4	5
7. **Scared**	1	2	3	4	5
8. **Hostile**	1	2	3	4	5
9. **Enthusiastic**	1	2	3	4	5
10. **Proud**	1	2	3	4	5
11. **Irritable**	1	2	3	4	5
12. **Hungry**	1	2	3	4	5
13. **Ashamed**	1	2	3	4	5
14. **Inspired**	1	2	3	4	5
15. **Nervous**	1	2	3	4	5
16. **Determined**	1	2	3	4	5
17. **Attentive**	1	2	3	4	5
18. **Jittery**	1	2	3	4	5
19. **Active**	1	2	3	4	5
20. **Afraid**	1	2	3	4	5
21. **Alert**	1	2	3	4	5

State-Trait Anxiety Inventory (State Anxiety)

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate HOW YOU FEEL RIGHT NOW, that is, AT THIS MOMENT. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer that seems to describe your resent feelings best.

	Not at all	Somewhat	Moderately so	Very much so
1. **I feel calm**	1	2	3	4
2. **I feel secure**	1	2	3	4
3. **I am tense**	1	2	3	4
4. **I feel strained**	1	2	3	4
5. **I feel at ease**	1	2	3	4
6. **I feel upset**	1	2	3	4
7. **I am presently worrying over possible misfortunes**	1	2	3	4
8. **I feel satisfied**	1	2	3	4
9. **I feel frightened**	1	2	3	4
10. **I feel comfortable**	1	2	3	4
11. **I feel self-confident**	1	2	3	4
12. **I feel nervous**	1	2	3	4
13. **I am jittery**	1	2	3	4
14. **I feel indecisive**	1	2	3	4
15. **I am relaxed**	1	2	3	4
16. **I feel content**	1	2	3	4
17. **I am worried**	1	2	3	4
18. **I feel confused**	1	2	3	4
19. **I feel steady**	1	2	3	4
20. **I feel pleasant**	1	2	3	4

Taste Test

Please rate the extent to which each type of chocolate chip has the quality listed, using a 1-10 rating scale, where *1 = does not have the quality at all* and *10 = has a lot of this quality*.

Also rate your overall liking of each type of chocolate chip, where *1 = do not like it at all* and *10 = like it very much*.

Aspect of food to be rated	Type of Chocolate Chips				
	PB	W	M	D	S
1. Sweetness					
2. Cocoa Flavor					
3. Creaminess					
4. Milkiness					
5. Smooth texture					
6. Overall liking					

Dutch Eating Behavior Questionnaire (DEBQ) -- Emotional Eating Scale

Please respond to the given questions based on the following rating scale:

	Never	Seldom	Some-times	Often	Very often
1. Do you have the desire to eat when you are irritated?	1	2	3	4	5
2. Do you have a desire to eat when you have nothing to do?	1	2	3	4	5
3. Do you have a desire to eat when you are depressed or discouraged?	1	2	3	4	5
4. Do you have a desire to eat when you are feeling lonely?	1	2	3	4	5
5. Do you have a desire to eat when somebody lets you down?	1	2	3	4	5
6. Do you have a desire to eat when you are cross?	1	2	3	4	5
7. Do you have a desire to eat when you are approaching something unpleasant to happen?	1	2	3	4	5
8. Do you get the desire to eat when you are anxious, worried or tense?	1	2	3	4	5
9. Do you have a desire to eat when things are going against you or when things have gone wrong?	1	2	3	4	5
10. Do you have a desire to eat when you are frightened?	1	2	3	4	5
11. Do you have a desire to eat when you are disappointed?	1	2	3	4	5
12. Do you have a desire to eat when you are emotionally upset?	1	2	3	4	5
13. Do you have a desire to eat when you are bored or restless?	1	2	3	4	5

Hyper/Hypophagia

14. When other people cause me stress (e.g., partner, friends, relatives, colleagues), I eat:

- ○ Much less than usual
- ○ Less than usual
- ○ The same as usual
- ○ More than usual
- ○ Much more than usual

Eating and Weight patterns

15. What is your height ? _____ ft _____ in (or cm)

16. What is your weight ? _____ lbs (or kg)

17. What is your ideal weight? _____ lbs (or kg)

18. Are you currently trying to lose weight?

- ○ Yes
- ○ No

19. To what extent do you agree with this statement: **My eating habits are healthy.**

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

Preference for Chocolate

---

1 = *Do not like at all* **7 = *Like it a great deal***

	Rating						
Like chocolate	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Amount of chocolate consumption

RA for Part 1 _____

RA for Part 2 _____

Weight measurements (to nearest .01 g):

	Before	After
M		
D		
S		
RB		
W		
Plate	**If chips left on plate, zero out scale with an empty plate on it and record weight of chocolate →**	

Other notes: