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Valenced and arousal-based affective evaluations of foods

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VALENCED AND AROUSAL-BASED AFFECTIVE EVALUATIONS OF FOODS

by

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A thesis submitted in partial fulfillment
of the requirements for the Doctor of Philosophy
degree in Psychology (Clinical Psychology) in the
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CERTIFICATE OF APPROVAL

PH.D. THESIS

This is to certify that the Ph.D. thesis of

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has been approved by the Examining Committee for
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ABSTRACT

Objective: To examine nutrient-specific and individual-specific correlates of valenced and arousal-based affective evaluations of foods across the spectrum of disordered eating, as well as to examine the validity of automatic and controlled processes of affective evaluation.

Methods: 283 undergraduate women provided implicit and explicit valence and arousal-based evaluations of 120 food photos with known nutritional information (i.e., high or low added fat, high or low added sugar). Participants completed structurally similar indirect and direct affect misattribution procedures (AMP; Payne et al., 2005; 2008). These AMPs were paired with novel arousal-based AMPs to investigate both fundamental dimensions of affective evaluations of foods: valence and arousal. Participants completed questionnaires assessing body mass index, hunger, eating restriction, and binge eating.

Results: Nomothetically, added fat and added sugar enhance the pleasantness and arousal of affective evaluations of foods. Idiographically, hunger and binge eating are associated with higher arousal, whereas BMI and restriction enhance pleasantness ratings. Added fat enhances the pleasantness ratings of women who are hungrier, or who endorse greater restriction, and enhances both the pleasantness and the arousal ratings of heavier women. In contrast, added sugar is especially influential on the pleasantness and arousal ratings of less hungry women. Restriction was related only to valenced affective evaluations, whereas binge eating related only to arousal affective evaluations. Finally, patterns of findings are largely similar across implicit and explicit affective evaluations, albeit stronger for explicit.

Conclusions: Findings support the utility of distinguishing nutrients in future work, underscore the importance of examining both the valence and the arousal dimensions of affective evaluations, and provide modest support for the validity of dual-process models of affective evaluation of foods.

Keywords: affective evaluation, implicit, arousal, valence, food, eating

PUBLIC ABSTRACT

This work examines what contributes to how women feel about foods. Knowing more about women's evaluations of foods can improve our understanding and treatment of disordered eating behaviors such as restriction of food intake (seen in anorexia nervosa) and loss of control over eating (seen in bulimia nervosa and binge eating disorder). We use food photos for which we know nutritional information and focus on added fat and added sugar content. We also examine aspects of the women that may influence their evaluations of foods, including symptoms of depression, mood, evaluations of non-food images, current hunger, binge eating, restriction of food intake, and body mass index (BMI). The study examines both more automatic, gut reactions to foods (called *implicit)* as well as more controlled, deliberate opinions about foods (called *explicit)*, which can help us to understand both more impulsive and more restrictive forms of disordered eating. We measured emotional reactions involving both positivity-negativity (called *valence)* and a sense of energy or intensity (called *arousal).* Added fat and added sugar enhance the pleasantness and arousal of foods. Hunger and binge eating are associated with higher arousal, whereas BMI and restriction are related to higher pleasantness. Women who are heavier, hungrier, or who endorse greater restriction respond to added fat; in contrast, less hungry women respond to added sugar. Restriction is related only to pleasantness, whereas binge eating is related only to arousal. Patterns of findings are stronger for explicit, but otherwise similar for implicit and explicit affective evaluations.

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CHAPTER I INTRODUCTION

Introduction

Disordered eating is highly prevalent among college-age women, and obesity constitutes a costly national public health concern (e.g., Croll, Neumark-Sztainer, Story, & Ireland, 2002; Wang, McPherson, Marsh, Gortmaker, & Brown). Understanding the psychological underpinnings of clinically relevant eating behavior is therefore of significant psychological and public health interest. Affective evaluations of foods are an important contributor to clinically relevant eating behaviors. It may come as no surprise that how we feel about a food shapes what, when, and how much we eat (e.g., Berridge, Ho, Richard, & DiFeliceantonio, 2010; Drewnowski, Henderson, Levine, & Hann, 1999). If we think chocolate cake is very pleasant and desirable, we are more likely to eat the cake in the break room than our colleague who neither likes nor wants cake. Affective evaluations also appear to play a role in a number of other clinically and socially relevant domains, including psychopathology (Roefs et al., 2011), stigmatization of mental illness (Rüsch, Corrigan, Todd, & Bodenhausen, 2010), addictive disorders (Wiers & de Jong, 2006), and race bias (Blair, 2002). Thus, the present study aims to improve assessment of the role of affective evaluations of foods across the spectrum of disordered eating behaviors by 1) exploring both nomothetic and idiographic correlates of evaluations of foods; 2) including both restrictive and disinhibited eating measures, as well as body mass index (BMI) and state hunger; 3) examining the applicability of a dual-process model to evaluations of foods using measures that control method variance; and 4) investigating arousal-based evaluations of foods in addition to valenced evaluations.

Most models of affect converge on not only a pleasant-unpleasant *valence* dimension, but also an activating-unactivating *arousal* dimension (e.g., Lang, 1995). We can learn a great deal

about eating behavior by examining both the valence and the arousal components of affective evaluations of foods (e.g., Craeynest, Crombez, Koster, Haerens, & De Bourdeaudhuij, 2008; Czyzewska & Graham, 2008; Drobes et al., 2001; Rodríguez, Fernández, Cepeda-Benito, & Vila, 2005). Understanding the role of arousal in women's evaluations of foods may enhance our conceptions not only of disordered eating, but also of more general appetitive influences such as motivation, craving, and approach (e.g., Berridge, 1996; Rodríguez et al., 2005). For instance, liking (i.e., hedonic response to a food) and wanting (i.e., incentive salience, akin to appetite or motivation to approach) are dissociable (e.g., Berridge, 1996; Berridge et al., 2010). The motivational salience of wanting is akin to positive arousal-based evaluations (e.g., Berridge, Robinson, & Aldridge, 2009; Lang, 1995), whereas liking corresponds to pleasantness, and thus valence (e.g., Berridge, 1996; Berridge et al., 2010; Finlayson, King, & Blundell, 2007). Valence and arousal dimensions of affective evaluations may have dissociable associations with eating-related correlates. A dieter may *want* cookie dough ice cream but may not *like* it because consuming high-fat, high-sugar foods is inconsistent with her weight-loss goal; she has evaluated cookie dough ice cream to be activating but not pleasant.

Additionally, classic dual process models posit that *automatic* and *controlled* processes interact to predict socially and clinically relevant behaviors (e.g., Jacoby, 1991; Strack & Deutsch, 2004; Wilson, Lindsey, & Schooler, 2000). Few processes demonstrate only features of automaticity, or only features of control. Thus, processes are thought to be relatively more automatic or relatively more controlled, signifying that a given process may demonstrate a combination of relevant features dominated by automaticity or by control, respectively. Automatic processes are often described as possessing one or more of the following features: *efficiency*; *unawareness* (of the stimulus, one's affective evaluation thereof, or the cause of one's

affective evaluation); *unintentionality* (i.e., to initiate the evaluation); and *lack of control* (i.e., the ability to cease or override affective evaluation once started; Bargh, 1994). For instance, stimuli are unintentionally categorized along unpleasant/pleasant or negative/positive dimensions very early in processing (De Houwer & Hermans, 1994). Affective evaluations can occur following valenced stimuli presented too rapidly to be consciously perceived (e.g., Robinson, Storbeck, Meier, & Kirkeby, 2004). Affective evaluations may even occur wholly unconsciously, influencing behavior and physiology without conscious awareness of any affective experience (e.g., Winkielman, Berridge, & Wilbarger, 2005). Controlled affective evaluations, on the other hand, are often described with features that may include requiring cognitive resources for their implementation, operating consciously and/or intentionally, and/or being under volitional control (Bargh, 1994; Moors & De Houwer, 2006). The current work relies on De Houwer and colleagues' formulation of *implicit* and *explicit* as synonyms for *automatic* and *controlled*, respectively (De Houwer, 2006; De Houwer & Moors, 2007; De Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009). Thus, I will refer to indirectly assessed, relatively more automatic affective evaluations as *implicit*, and to directly assessed, relatively more controlled affective evaluations as *explicit*.

Disordered Eating Spectrum

Affective evaluations of foods may play different roles across the spectrum of disordered eating concerns, depending on the nature of the behavior to be predicted. The American Psychiatric Association (APA) currently distinguishes among several eating disorder diagnoses, including anorexia nervosa, defined by restriction of food consumption, distorted body image, and low body weight; bulimia nervosa, marked by recurrent episodes of binge eating and compensatory behaviors, such as purging; binge eating disorder, which shares with bulimia

nervosa a tendency to engage in eating binges, but without subsequent compensatory strategies; and other specified eating disorder, which is characterized by clinically significant impairment among those who fail to meet diagnostic criteria for other eating disorder diagnoses (American Psychiatric Association, 2013). Several other patterns of disordered eating are not formally recognized by the APA but may nevertheless affect individuals' well-being. For instance, dieters who do not attain a clinically low body weight may engage in deliberate, restrictive eating behaviors that are similar to those exhibited by patients with anorexia nervosa. Those who successfully restrict their intake with the intent to reduce or maintain their body weight may therefore provide a non-clinical proxy sample for the study of the more restrictive end of the eating pathology spectrum. Similarly, many individuals experience subjective eating binges, wherein they consume amounts of food that feel subjectively (but not clinically) excessive and they experience a sense of having lost control over their eating behavior. Such subjective binging behaviors may serve as a non-clinical proxy for those who struggle with more disinhibited disordered eating symptoms (Masheb & Grilo, 2006; Van Strien, Frijters, Bergers, & Defares, 1986). Examination of these non-clinical and sub-clinical disordered eating patterns allows us to consider food-related affective evaluations along a spectrum of eating pathology.

Dual Process Models and the Disordered Eating Spectrum

Disentangling the roles of automatic and controlled processes underlying affective evaluations of foods can further illuminate contributors to disordered eating. Just as disordered eating can be thought to fall along a spectrum from deliberately restrictive (e.g., anorexia nervosa, successful dieting) to disinhibited (e.g., binge eating disorder, overeating episodes), so too can processes fall along a spectrum from completely controlled to completely automatic. Relatively more automatic and relatively more controlled processes may be differentially

associated with different types of disordered eating. Classic dual-process models would predict that, on the one hand, automatic evaluations of foods may play a greater role than controlled evaluations in the disinhibited consumption of foods high in fat and sugar, particularly when there are insufficient resources to inhibit the initial positive or activating evaluation (e.g., Hofmann, Rauch, & Gawronski, 2007). For example, when our cognitive resources are harnessed by an engrossing movie, we may be surprised to find that we have emptied the popcorn bucket, despite our intention to eat only a few handfuls. On the other hand, traditional dual-process models would posit that more effortful controlled evaluations may contribute to successful restriction of food intake to a greater degree than automatic evaluations. For instance, when our self-control resources have been bolstered by a good night's sleep, we may choose to forego a tasty pastry at the meeting, despite our initial desire for a baked good. Knowing for whom and under what circumstances automatic and controlled affective evaluations shape eating behavior may inform intervention choice (e.g., Payne, Jacoby, & Lambert, 2005), though both types of processes likely contribute to both types of eating behavior to varying degrees. For example, greater automatic influences on eating pathology may necessitate a greater focus on modification of cognitive and affective processing in interventions (e.g., Kemps, Tiggemann, & Hollitt, 2014; Kemps, Tiggemann, Orr, & Grear, 2014; Verplanken & Tangelder, 2011). Measures of automatic affective evaluation could even be employed as diagnostic tools (Veenstra & de Jong, 2011), helping to predict who might struggle with eating pathology and how best to help those who do (Verplanken & Tangelder, 2011). In sum, finding empirical support for a dual process model of food-related affective evaluation, as well as specifying the relative contributions of automatic and controlled processes to such evaluations, may

substantively inform understanding, prediction and treatment of eating behaviors across the spectrum of disordered eating.

Measurement of Automatic and Controlled Affective Evaluations

Researchers interested in automatic and controlled processes often juxtapose the results of indirect affective evaluation measures, such as the implicit association test (IAT) or the affective priming paradigm (APP), with the results of self-reported direct measures, such as feeling thermometers or Likert scale ratings. In fact, the most widely cited study in the field of disordered eating- and weight-related implicit affective evaluations utilized this approach (Roefs & Jansen, 2002). Roefs and Jansen (2002) paired an IAT with explicit palatability ratings on a 9-point scale and found that both normal weight and obese individuals held negative implicit associations with high-fat foods, though this effect was stronger for obese individuals. Both normal weight and obese individuals explicitly preferred low-fat foods over high-fat foods. In addition, participants' explicit ratings of the palatability of each food stimulus were not correlated with the IAT effect, which could reflect differential contributions of automatic and controlled processes on the two tasks, consistent with a dual process model. Indeed, the authors concluded that participants held negative implicit and explicit attitudes toward fat content in foods.

Structural fit. It is possible that pairing disparate indirect and direct measures in order to delineate the effects of underlying automatic and controlled processes may compromise inferential strength. This is because indirect and direct assessments of affective evaluations typically differ in ways beyond the "directness" of the assessment strategy (e.g., response scale, timescale of response). Such procedural discrepancies—referred to as *poor structural fit*—allow for method variance to inflate differences between implicit and explicit assessments (Payne,

Burkley, & Stokes, 2008). In other words, preferences toward high-fat foods on an IAT and self-report scale may fail to correlate in part because they are methodologically very different tasks, and not entirely because of the dual processes of affective evaluation. Maximizing procedural similarities between indirect and direct assessments can reduce method variance, and potentially increase the validity of inferences about dual processes (Payne et al., 2008).

One strategy for improving structural fit involves using structurally identical indirect and direct assessments of affective evaluations. Direct and indirect measures with good structural fit would share as many procedural features as possible and would vary only in terms of one or two specific features that distinguish automatic and controlled processes. For instance, structurally similar indirect and direct tasks with identical trial structures, presentation times, stimuli, response options and response timescales that differed only in the intentionality of responding have been used to understand implicit-explicit correlations in the context of race bias (Payne et al., 2008). This strategy provides a more conservative test of dissociations between automatic and controlled processes than has been implemented in previous work, where implicit affective evaluations provided by speeded computer tasks like the IAT or APP have been juxtaposed with explicit affective evaluations assessed by untimed self-report questionnaire responses. For instance, Roefs and Jansen (2002) used an explicit measure that assessed palatability, while their IAT assessed associations with positive and negative target categories. These measures differ in response scale, speed of response, and construct of interest (i.e., palatability versus valenced association). Thus, I build on this seminal work by using measures with improved structural fit. This more conservative strategy allows us to evaluate the validity of dual-process models that highlight distinctions between automatic and controlled processes.

The affect misattribution procedure (AMP) provides one means of improving structural fit and thus controlling method variance between indirect and direct measures of affective evaluation. In the AMP, participants view a series of rapidly presented images, including a photo followed by a neutral Chinese character. In the direct AMP, participants are told to rate the pleasantness of the photo and ignore the character; in the indirect AMP, participants are told to ignore the photo and rate the pleasantness of the character. The AMP's indirect (Payne, Cheng, Govorun, & Stewart, 2005) and direct (Payne et al., 2008) assessments of affective evaluations differ only in the instructions given to participants, and thus only in the intentionality of participants' responses (Payne et al., 2013). Unlike the IAT, the indirect AMP relies on a mechanism of semantic and affective misattribution (Blaison, Imhoff, Hühnel, Hess, & Banse, 2012; Gawronski & Ye, 2013; Payne & Lundberg, 2014); participants erroneously attribute their evaluations of the food photos to the neutral Chinese characters, providing an indirect assessment of their evaluations of the foods. The AMP's psychometrics are comparable to those of the IAT; the indirect AMP has demonstrated meta-analytic predictive validity ($r = .35$ with behavior and .30 with direct measures; Cameron, Brown-Iannuzzi, & Payne, 2012), incremental validity over self-report, and good reliability (mean internal consistency = .88; Payne, Cheng, et al., 2005). Moreover, the indirect and direct AMP tasks demonstrate theoretically expected divergence (e.g., performance on the direct AMP, but not the indirect AMP, is associated with motivation to control racial prejudice; Payne et al., 2013). Thus, these versions of the AMP serve as a tool for examining both implicit and explicit affective evaluations while also improving structural fit, so that more accurate inferences about dual processes of affective evaluations about foods can be drawn. The utility of the indirect AMP for examining valenced (but not arousal-based) affective

evaluations of foods has been demonstrated in two studies (Spring & Bulik, 2014; Woodward & Treat, 2015) which are described in greater detail subsequently.

Affective Dimensions of Affective Evaluations of Foods

Valenced affective evaluations. Research in the domain of problematic eating behavior using paradigms other than the AMP underscores the importance of affective evaluation. A recent review of the studies that have employed indirect measures of valenced affective evaluations found that patients with anorexia nervosa evaluated foods more negatively than healthy controls, as expected, but found mixed support for the hypothesis that obese and unsuccessful chronic dieters would evaluate high-calorie foods more positively than healthy controls (Roefs et al., 2011). Moreover, craving, hunger, and manipulations to make palatability (versus health) salient enhanced the positivity of eating-related affective evaluations (Roefs et al., 2011). Also, certain individuals consumed more unhealthy food if their affective evaluations thereof were more positive, particularly when they were low on self-regulatory resources (Hofmann et al., 2007). Taken together, findings from these studies using indirect paradigms other than the AMP suggest that valenced affective evaluations may be an important correlate of eating behavior.

Two studies to date have examined valenced affective evaluations of foods using the indirect AMP (Spring & Bulik, 2014; Woodward & Treat, 2015). Spring and Bulik (2014) examined implicit and explicit affective evaluations of food-relevant, weight-relevant, and unrelated images among healthy controls, patients with current anorexia nervosa, and individuals who have recovered from anorexia nervosa. Consistent with other literature (e.g., Roefs et al., 2011), patients with acute anorexia nervosa implicitly evaluated high-calorie foods and overweight bodies more negatively relative to healthy controls and recovered patients. Patterns

of explicit patient evaluations were similar, albeit with attenuated effect sizes (Spring & Bulik, 2014). However, the authors used Likert-scale ratings to assess explicit affective evaluations of the images, so the similarity of implicit and explicit evaluations may have been underestimated as a result of poor structural fit.

A second AMP study utilized both indirect and direct AMP tasks to assess valenced affective evaluations of foods that varied along dichotomous dimensions of added fat and added sugar (Woodward & Treat, 2015). Eating- and weight-related individual differences correlates included state hunger and eating in response to environmental cues, a non-clinical analogue for disinhibited eating. Normatively, both added fat and added sugar were associated with more positive evaluations. Both hunger and eating in response to external cues correlated positively with explicit fat-based valence evaluations. Few reliable individual differences correlates were found for implicit evaluations (Woodward & Treat, 2015). This pattern may reflect a dissociation between automatic and controlled processes underlying evaluations of valence, such that individual differences are linked more strongly to controlled evaluations than automatic evaluations. The scarcity of implicit individual differences findings may instead reflect the idiosyncratic effects of external cue-controlled eating measures, which model a very particular type of disinhibited eating. Alternatively, the relative lack of implicit findings might reflect the potential influence of more restrictive eating behaviors, which were not assessed. Finally, neither of the food-related investigations using the AMP explored the potential importance of the arousal dimension, which may be especially relevant to our understanding of disinhibited eating behaviors.

Arousal-based affective evaluations. Each affective dimension may contribute to our understanding of affective evaluation relevant to eating behavior; however, with few exceptions,

studies of affective evaluations of foods have been concerned with the valence dimension only. Wiers and colleagues (2002) illustrated the importance of assessing the arousal dimension in a test of affective evaluation in alcohol addiction. Arousal evaluations measured by means of an arousal IAT significantly differed between heavy and light drinkers, particularly among men, while all participants showed an indirectly measured negative evaluation of alcohol on the valence IAT. In other words, arousal—but not valence—distinguished light and heavy drinkers. To the extent that craving for food resembles craving for other addictive substances (e.g., Gearhardt, Yokum, et al., 2011), assessing both arousal and valence dimensions in examinations of food-related affective evaluations may be informative (Wiers & de Jong, 2006).

Findings from the disordered eating-relevant literature support further investigation of the arousal dimension of affect. For instance, high and low cravers of chocolate differed not only in their direct valence and dominance (i.e., sense of control) ratings of chocolate images, but also in direct arousal ratings, with high cravers reporting greater positivity and arousal and a lesser sense of control than low cravers (Rodríguez et al., 2005). Participants who had gone without food for either six or twenty-four hours directly rated food images as more arousing, more interesting and lower in dominance than non-deprived (i.e., less hungry) subjects; no such differences emerged for the valence of food images (Drobes et al., 2001). Though these studies relied on direct measures, findings from indirect measures also corroborate this pattern. Within two studies of severely obese, overweight, and normal-weight youths, Craeynest and colleagues (2008) explored the effects of stimulus arousal on affective evaluations measured by the IAT. Both studies found that all youths associated high-fat food images with arousal more than they associated lean food images with arousal, that weight status did not moderate associations with target word arousal, and that high-fat foods were implicitly associated with both positive and

negative high arousal (Craeynest et al., 2008, exp. 1 and 2). The potential importance of stimulus arousal, in addition to valence, is echoed in a study of undergraduate women which found that indirectly measured affective evaluations of food images reliably differed between BMI groups only on trials with high-arousal target words (Czyzewska & Graham, 2008). Though these findings still await replication, they suggest that it might prove useful to examine both the arousal and the valence dimensions of experimental stimuli when using indirect measures to explore food-relevant affective evaluations (Czyzewska & Graham, 2008).

In addition, craving for food occurs when the affective evaluation of that food includes positive valence and some degree of arousal (e.g., Craeynest et al., 2008), which echoes another predominant theory of craving and food incentive. The theory of food reward proposed by Berridge (1996) holds that two independent processes determine motivation to eat: liking and wanting. Liking is thought to be related to pleasure resulting from the food's taste properties, while wanting is more akin to appetite or motivation (Berridge, 1996; Winkielman & Berridge, 2003); both processes can be automatic in the sense that they can occur without conscious awareness (Berridge, 1996). Thus, Berridge's theory of food reward would predict that the valence and arousal dimensions of affective evaluations would have dissociable associations with eating-related correlates. Perhaps valenced affective evaluations of foods are not strongly related to disinhibited disordered eating, while arousal-based affective evaluations of foods are meaningfully associated with disinhibited disordered eating. Perhaps the more negative valenced affective evaluations of foods seen among those who restrict their food intake would occur alongside lower arousal-based affective evaluations. Given the unexpectedly weak associations among the individual differences correlates in our prior work and valenced affective evaluations of foods, it is all the more important to investigate arousal-based affective evaluations of foods.

Further, it will be important to examine both disinhibited and restrictive eating behaviors within the same study in order to understand the role of valenced and arousal-based affective evaluations across the spectrum of disordered eating behavior.

Overview of the Present Study

In the present study, we examine the nomothetic (i.e., food-specific) and idiographic (i.e., person-specific) relevance of automatic and controlled processes to valenced and arousal-based affective evaluations of foods. We extend previous work by 1) investigating arousal-based evaluations of foods in addition to valenced evaluations, 2) examining the applicability of a dual-process model to evaluations of foods using measures that control method variance, 3) exploring both nomothetic and idiographic correlates of evaluations of foods, and 4) including both restrictive and disinhibited eating measures, as well as body mass index (BMI) and state hunger, to better assess the role of affective evaluations of foods across the spectrum of disordered eating. We also control for more global affective evaluation processes by including evaluations of images with known affective properties as a covariate; depressive symptoms and state mood are also included as covariates.

Nomothetic, Food-Specific Correlates

Given the well-documented negative health consequences of immoderate consumption of refined sugar and added fat in hyperpalatable processed foods (e.g., Francis & Stevenson, 2011; Pritchett & Hajnal, 2011; Swinburn et al., 2011), it is critical to understand how these nutritional characteristics shape affective evaluations. Most previous work has relied on coarse distinctions among food stimuli, contrasting foods that are healthy and unhealthy, unpalatable and palatable, high and low fat, or high and low calorie. These coarse distinctions confound nutritional characteristics, such as fat and sugar content; for instance, when affective evaluations of pizza

and ice cream (i.e., unhealthy) are contrasted with those of vegetables (i.e., healthy), one cannot draw conclusions about the specific importance of added fat or added sugar to affective evaluations of foods, as these dimensions are confounded within the “unhealthy” category. Roefs and Jansen (2002) relied on 6 high-fat and 6 low-fat food word stimuli; however, both the high-fat and the low-fat stimuli also included exemplars with high added-sugar content (High Fat: ice cream, chocolate; Low Fat: jelly, licorice) and low added-sugar content (High Fat: potato chips, french fries, sausage; Low Fat: popcorn, rice, chicken). However, nutritional characteristics, like added fat and added sugar content, may independently influence affective evaluations (e.g., Woodward & Treat, 2015). The present study examines the dimensions of added fat and added sugar separately, to provide a more fine-grained examination of normative influences on affective evaluations of foods. I focus on *added* fat and sugar, because processing of foods tends to contribute substantial amounts of fat and sugar to foods, which may enhance preferences for such processed foods; indeed, such foods constitute an increasing proportion of modern diets, to the exclusion of foods lower in processing (Gearhardt, Grilo, DiLeone, Brownell, & Potenza, 2011; Monteiro, Levy, Claro, Ribeiro de Castro, & Cannon, 2011).

Fat content is likely to contribute to affective evaluations of foods. On average, women report frequent cravings for high-fat foods (Drewnowski, Kurth, Holden-Wiltse, & Saari, 1992; Pelchat, 1997), though it is unclear to what extent other factors (such as sugar or processing) may be confounded with fat content. Indeed, studies including fine-grained distinctions among their food stimuli have found mounting evidence that nutritional characteristics shape attention to, perceived healthiness of, and both liking and craving of foods (e.g., Gearhardt, Rizk, & Treat, 2014; Gearhardt, Treat, Hollingworth, & Corbin, 2012; Rizk & Treat, 2014). One study of craving (akin to arousal) and liking (akin to valence) among overweight and obese women

examined fat, sugar, and processing separately and found that higher levels of fat were associated with greater craving, but were unrelated to liking of foods (Gearhardt et al., 2014). Thus the limited available literature appears to suggest that added fat may enhance women's directly measured arousal-based, but not valenced, affective evaluations of foods.

Gearhardt and colleagues also found negative associations between liking ratings and both degree of food processing and sugar content, another potential influence on affective evaluations of foods; craving was also negatively related to sugar content within this sample (Gearhardt et al., 2014). These findings contrast with literature examining sugar independently of fat, which indicate that sweetness is intensely rewarding, potentially more so than cocaine (Lenoir, Serre, Cantin, & Ahmed, 2007), and that sweetness can precipitate behaviors consistent with addiction in animal models (Avena, Rada, & Hoebel, 2008). Similarly, prior work with indirectly and directly measured valenced affective evaluations of foods found that added fat and added sugar enhanced pleasantness ratings of foods, especially for directly measured affective evaluations (Woodward & Treat, 2015). Thus the findings with respect to associations between added sugar and affective evaluations of foods are mixed, which may suggest a moderating role of additional nutritional characteristics or individual differences factors.

Our prior work using structurally similar AMP tasks also demonstrated that added fat and added sugar exert independent positive influences on valenced affective evaluations of foods (Woodward & Treat, 2015). Thus, the present study employed a large number of food images with known nutritional properties and examined the normative effects of added sugar, added fat, and their interaction on evaluations of foods. Consistent with our prior work, I expected that foods high in added fat, added sugar, or both would be more likely to receive a positive evaluation, especially when affective evaluations are relatively more controlled (i.e., explicit). I

expected that women would like foods high in added fat, added sugar, or both more than foods low in these dimensions (e.g., Berridge et al., 2010; Finlayson et al., 2007). On the basis of the limited available literature (e.g., Craeynest et al., 2008), I expected that foods high in added fat, added sugar, or both would be more likely to receive an activating evaluation than foods low in added fat and sugar. In other words, I anticipated that women would crave these reinforcing foods to a greater degree than foods low in added fat and added sugar (e.g., Berridge et al., 2009). In light of the mixed literature regarding sugar, I tentatively hypothesized that added sugar would be positively associated with valenced affective evaluations of foods, consistent with our prior work which utilized similar methods and made similarly fine-grained distinctions between nutritional characteristics in the stimuli. I also expected that foods high in added sugar would be evaluated as more arousing than foods low in added sugar.

Idiographic Correlates

The present study included BMI, hunger, binge eating concerns, and restrictive eating as individual differences correlates of affective evaluations of food. Readers are invited to consult Table 1, which provides a representation of the theoretically expected associations between the individual differences factors and the affective dimensions within a dual-process model framework. In general, dual process models suggest that more spontaneous eating behaviors will be more strongly associated with indirect affective evaluations, whereas more deliberative eating behaviors will be more strongly associated with direct affective evaluations (Fazio & Olson, 2014; Perugini, 2005; Strack & Deutsch, 2004). As discussed in greater detail below, I expected that valence- and arousal-based affective evaluations would differentially relate to eating restriction and binge eating, respectively, and would both be associated with hunger.

Table 1. Current theoretical framework of affective evaluations of foods drawn from dual-process models: Expected associations between affective evaluations of foods and eating- and weight-related individual differences variables.

		Affective Dimensions	
		Valence	**Arousal**
Dual-Process Model	**Explicit**	Hunger* Restriction***	Hunger** Binge Eating*
	Implicit	Hunger* Restriction*	Hunger ** Binge Eating***

Note: * indicates the expected strength of the effect. Note: BMI is not listed in any of the cells given the equivocal literature.

Body mass index. Automatic evaluations of foods may predict overeating and subsequent weight gain (e.g., Roefs & Jansen, 2002), suggesting that BMI may be an important correlate of implicit affective evaluations of foods. Obese individuals exhibit different patterns of implicit affective evaluations than their overweight or normal-weight counterparts much of the time. However, support for this hypothesis has not always been found (e.g., Roefs et al., 2006). These mixed findings may result in part from differences in measurement strategies. Thus, the improved structural fit of the present study's measures will provide a more conservative test of the associations between BMI and both dimensions of affective evaluations of foods.

State hunger. The study included a measure of self-reported hunger as prior work has shown that hunger may enhance the positivity of affective evaluations of foods (Seibt, Häfner, & Deutsch, 2007; Stoeckel, Cox, Cook, & Weller, 2007), and spontaneously reduce disgust (Hoefling et al., 2009). Hunger may also increase the influence of immediate availability on food

choice over that of other salient dimensions like palatability (Hoefling & Strack, 2010). I expected that hunger would positively relate to pleasantness and activation ratings of all foods, but do so more robustly for highly reinforcing foods high in added fat and sugar (Berridge et al., 2010). I further expected that hunger would relate to explicit evaluations of foods more strongly than implicit evaluations, consistent with our prior findings. To the extent that state hunger enhances craving and wanting for unhealthy food, I expected that greater hunger would be associated with a greater likelihood of an activating arousal-based evaluation of foods high in added fat and/or sugar (Berridge et al., 2010; Drobes et al., 2001).

Disinhibited eating. A measure of participants' behavioral, emotional, and cognitive experiences of binge eating was included as a correlate of their affective evaluations of foods (Gormally, Black, Daston, & Rardin, 1982). Binge eating, of course, is an important component of both bulimia nervosa and binge eating disorder (American Psychiatric Association, 2013), and falls at the more impulsive, disinhibited end of the disordered eating spectrum. Similar to the findings from our prior study (Woodward & Treat, 2015), which included a measure of externally induced eating, I expected binge eating to associate positively with both valenced and arousal-based affective evaluations of foods. In our prior work, disinhibited eating correlated more strongly with explicit evaluations of foods. Theoretically, however, disinhibited eating should be more strongly related to implicit evaluations of foods, given the impulsive and thus more automatic nature of the phenomenon. I tentatively hypothesized that implicit food-related evaluations would be more strongly associated with binge eating than explicit evaluations of foods. I expected implicit evaluations, with their presumed greater reliance on automatic processes, would reflect the impulsive, out-of-control nature of binge eating. I also anticipated

that binge eating would be associated with more activating affective evaluations of foods, since arousal is implicated in motivation to approach palatable food.

Eating restriction. Restricting individuals (i.e., those with anorexia nervosa and successful dieters) evaluate foods more negatively than healthy control subjects (e.g., Roefs et al., 2011). Therefore, I expected that greater endorsement of successful eating restriction would be associated with more negative evaluations of foods. Successful eating restriction is deliberate and overcontrolled by nature. Explicit food-related affective evaluations are presumed to rely on primarily controlled processes. Thus, I expected that eating restriction would be more strongly associated with explicit than implicit evaluations of foods. At present, the literature does not provide a clear prediction with respect to eating restriction and arousal-based evaluations; however, I tentatively expected that restriction would be related to valenced, but not arousal-based, affective evaluations of foods (e.g., Keating, Tilbrook, Rossell, Enticott, & Fitzgerald, 2012).

Interactions of Nomothetic and Idiographic Correlates

Given the coarseness of the stimuli in previous work, it is unclear to what extent individual differences may moderate associations between food-specific characteristics and affective evaluations. For instance, significant individual variability has been demonstrated in the degree to which people find sweet tastes to be pleasant (Conner, Haddon, Pickering, & Booth, 1988). In the context of disordered eating, several individual differences may moderate associations between food-specific characteristics and affective evaluations of foods, including BMI, state hunger, disinhibited eating, and eating restriction. Only one study to date has addressed the extent to which individual differences moderate associations between food-specific characteristics and affective evaluations, as most prior work has examined food-specific

characteristics only coarsely. Woodward and Treat (2015) found that hunger and external eating were associated with more positive fat-based valenced affective evaluations. Thus, in the current study, I examined the interactions between individual differences correlates and each of the food-specific factors.

Moderation of food-specific effects by BMI. Obese women's directly measured food preferences tend to favor high-fat foods, sweets high in fat, and sources of carbohydrates (e.g., Drewnowski et al., 1992). However, it is unclear which nutritional characteristics in particular drive these preferences. Are heavier women's preferences driven by fat per se, or perhaps by fat in interaction with sugar? Additionally, college-age individuals of normal weight are sensitive to both fat and sugar content when directly rating the pleasantness of beverages; in contrast, their overweight counterparts' preferences rely predominantly on sugar content (Warwick & Schiffman, 1990). Finally, higher BMI is associated with lower craving and (trend-level) lower liking for high fat foods (Gearhardt et al., 2014); however, this sample consisted of overweight and obese women and did not include normal weight women. Taken together, the somewhat mixed self-report literature would largely suggest that BMI may moderate the effects of added fat, added sugar, and perhaps their interaction on affective evaluations of foods. A review of implicit evaluations of foods concluded that overweight populations tended to evaluate high fat foods negatively (Roefs et al 2011). However, this literature has not made fine-grained food-specific distinctions, typically confounding fat content with sugar and/or caloric content. As a result, I explore the extent to which BMI may moderate the effects of added fat, added sugar, and their interaction on both directly and indirectly assessed affective evaluations of foods.

Moderation of food-specific effects by hunger. State hunger may moderate food-specific effects on affective evaluations, beyond the expected positive main effect of hunger. Hunger may enhance increased attentional vigilance for sweets and candies (both high in added sugar; Gearhardt et al, 2012). When hungry, subjects wanted high fat savory foods more than low fat savory foods, but liked high fat sweet foods more than low-fat sweet. In contrast, following pizza consumption in the lab, subjects wanted (but did not like) low fat sweet foods more than high fat sweet foods and liked (but did not want) high fat savory foods more than low fat savory foods (Finlayson et al., 2007). Thus, state hunger may moderate the effects of fat and sugar on both arousal-based and valenced affective evaluations of foods, to the extent that wanting involves arousal and that liking involves valence. In our prior work, hunger enhanced the positive effect of added fat, but not added sugar, on pleasantness ratings (Woodward & Treat, 2015). However, among overweight and obese women, hunger did not moderate food-specific effects, though it exerted a positive main effect on craving (Gearhardt et al., 2012). Given the mixed findings within the limited relevant literature, I investigated whether hunger moderates the effects of added sugar, added fat, and their interaction on affective evaluations. I expected that hunger would be positively associated pleasantness and activation ratings of all foods, but do so more robustly for highly reinforcing foods high in added fat and sugar (Berridge et al., 2010).

Moderation of food-specific effects by disinhibited and restrictive eating. The literature examining the extent to which disordered eating may moderate the effects of specific nutritional characteristics is also limited by coarse characterizations of food stimuli. Disinhibited eating was associated with elevated liking and trend-level craving for high-fat food among overweight and obese women, and moderated the positive effects of added fat on directly assessed valenced affective evaluations ratings of foods among undergraduate women but was

unassociated with sugar content among overweight and obese women (Gearhardt et al., 2014; Woodward & Treat, 2015). Neither study found that disinhibited eating was associated with the effect of sugar content. Thus, in the present study, I anticipated that disinhibited eating would moderate normative effects of added fat, but not sugar, on valenced affective evaluations of foods. I also tentatively hypothesized that disinhibited eating would moderate the effects of added fat and/or sugar on arousal-based affective evaluations.

Although eating restriction has been linked to negative affective evaluations of foods, especially of foods high in calories (e.g., Roefs, et al. 2011; Spring & Bulik, 2014), coarse distinctions among foods limit my ability to make specific hypotheses about undereating and moderation of effects of food-specific characteristics. I tentatively hypothesized that restrictive eating would reduce the likelihood of a pleasant rating for foods high in added fat and/or sugar. I also examined whether restrictive eating would moderate the effects of added fat, added sugar, and their interaction on arousal-based affective evaluations.

Summary

The current study addressed two primary theoretical limitations of prior work. First, it examined the relevance of a dual process theoretical model to disordered eating-relevant affective evaluations of foods by using structurally identical indirect and direct AMP tasks to assess affective evaluation. Second, the current study extended the existing literature by examining the role of food-related affective evaluations in disordered eating across the two fundamental affective dimensions: valence and arousal. The automatic-controlled distinction is orthogonal to the valence-arousal distinction, as both valence-based and arousal-based affective evaluations of food can occur both automatically and through deliberate control. Although dual process models typically assume that automatic and controlled processes interact, automatic

processes are often thought to be more predictive of spontaneous behaviors, while controlled processes are often thought to be more predictive of deliberative behaviors (Fazio & Olson, 2014; Perugini, 2005; Strack & Deutsch, 2004). Furthermore, this study employed a number of food images with known nutritional properties to assess food-specific correlates of evaluations of foods that vary along dimensions of added fat and added sugar. The use of images, relative to words, may facilitate affective responses (Codispoti, Bradley, & Lang, 2001), enhancing ecological validity. Moreover, I investigated person-specific correlates of affective evaluations of foods across the disordered eating spectrum, by including not only a measure of state hunger, which is implicated in craving, but also measures of both disinhibited eating (i.e., subjective binge eating) and restrictive eating (i.e., deliberate attempts to restrict intake). BMI was included to ensure that any effects are not better accounted for by body size, per se. I included indirectly and directly measured affective evaluations of IAPS stimuli as covariates. Doing so provided both an indirect and a direct measure of individual differences in affective evaluations of emotionally evocative non-food images (Bradley & Lang, 2007), which permitted modeling of both global and food-specific aspects of affective evaluation. The present design further permitted the investigation of moderation of food-specific effects by person-specific factors.

CHAPTER II METHOD

Method

Participants

I planned to run as many subjects as were necessary to obtain a final sample over 275 subjects, so that I would be adequately powered to detect main and interactive effects of small-to-moderate magnitude. Thus, a sample of 384 undergraduate women was recruited from the Psychology Departmental Research Pool, which consists of University of Iowa undergraduates enrolled in introductory psychology classes. To be eligible for participation in the study, women must have been between 18 and 30 years of age, enrolled as an undergraduate student, and proficient in English. Only female undergraduates were invited to participate because the primary focus of the current work was on the associations among affective evaluations of food and disordered eating-relevant individual differences, and disordered eating is much more prevalent in women than men. In addition, only those under the age of 30 were eligible to participate because aging begins to affect executive function and working memory around age 30 and the study investigated how women process affective information. Participants were excluded from analyses if their performance on the conceptual check (described below) was under 75% correct (n = 27) or if they endorsed any of the following: food allergies (n = 30), familiarity with Chinese (n = 3), low motivation to follow the directions (n = 13) or poor understanding of the directions (n = 14)[1]. An additional 15 participants' AMP data were incomplete due to technical

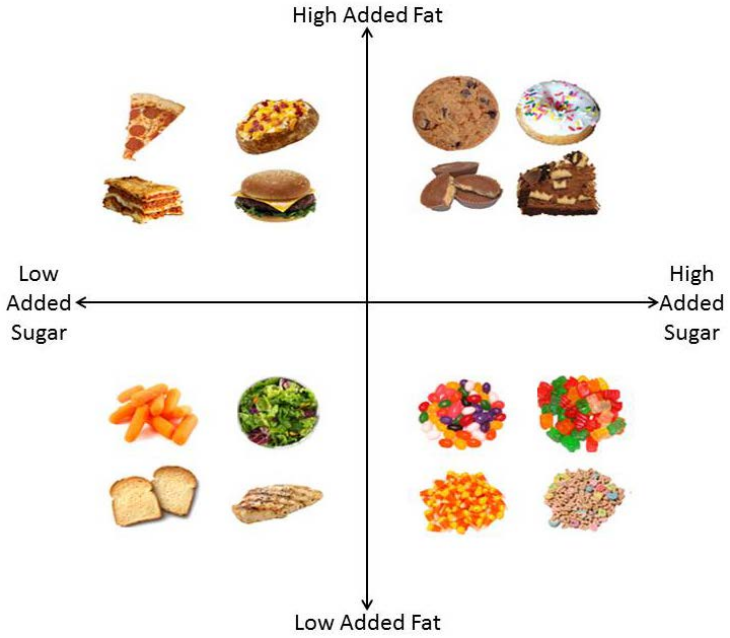
[1] Note when subjects who reported poor understanding of the instructions (n = 14) or low motivation to follow the instructions (n = 13) were included in the sample, the pattern of findings changed only minimally. For arousal evaluations, the Measurement Type by BMI interaction dropped to trend level (z = 1.880, *p* = .060), and the three way interaction between BMI, Measurement Type, and Added Sugar became significant (z = -2.181, *p* =.029). For valence evaluations, the three way interaction between BMI, Measurement Type, and Added Sugar also became significant (z = -2.511, *p* = .012). Otherwise, findings did not change appreciably in either direction or magnitude.

errors. The mean age of the final sample (n = 283) was 19.08 (*SD* = 1.40) years and 89.9% identified as White.

Stimuli

Food stimuli consisted of 120 images of foods (30 for each of 4 food types) publicly available on the internet or photographed by study personnel. Nutrition facts for each food were compiled from nutritional labels, brand websites, and www.nutritiondata.com. The food stimuli varied along dichotomous dimensions of added sugar and added fat (high or low), resulting in 4 food types (see Figure 1): Sweets (high added fat, high added sugar), Fried Foods (high added fat, low added sugar), Candies (low added fat, high added sugar), and Healthy Foods (low added sugar, low added fat).

Figure 1. Sample stimuli across dimensions of Added Fat and Added Sugar.



Scene stimuli consisted of scene images with known normative affective properties drawn from the IAPS stimulus set (Bradley & Lang, 2007). These 96 scene images vary along dichotomous dimensions of valence and arousal (high or low), resulting in 4 scene types (i.e.,

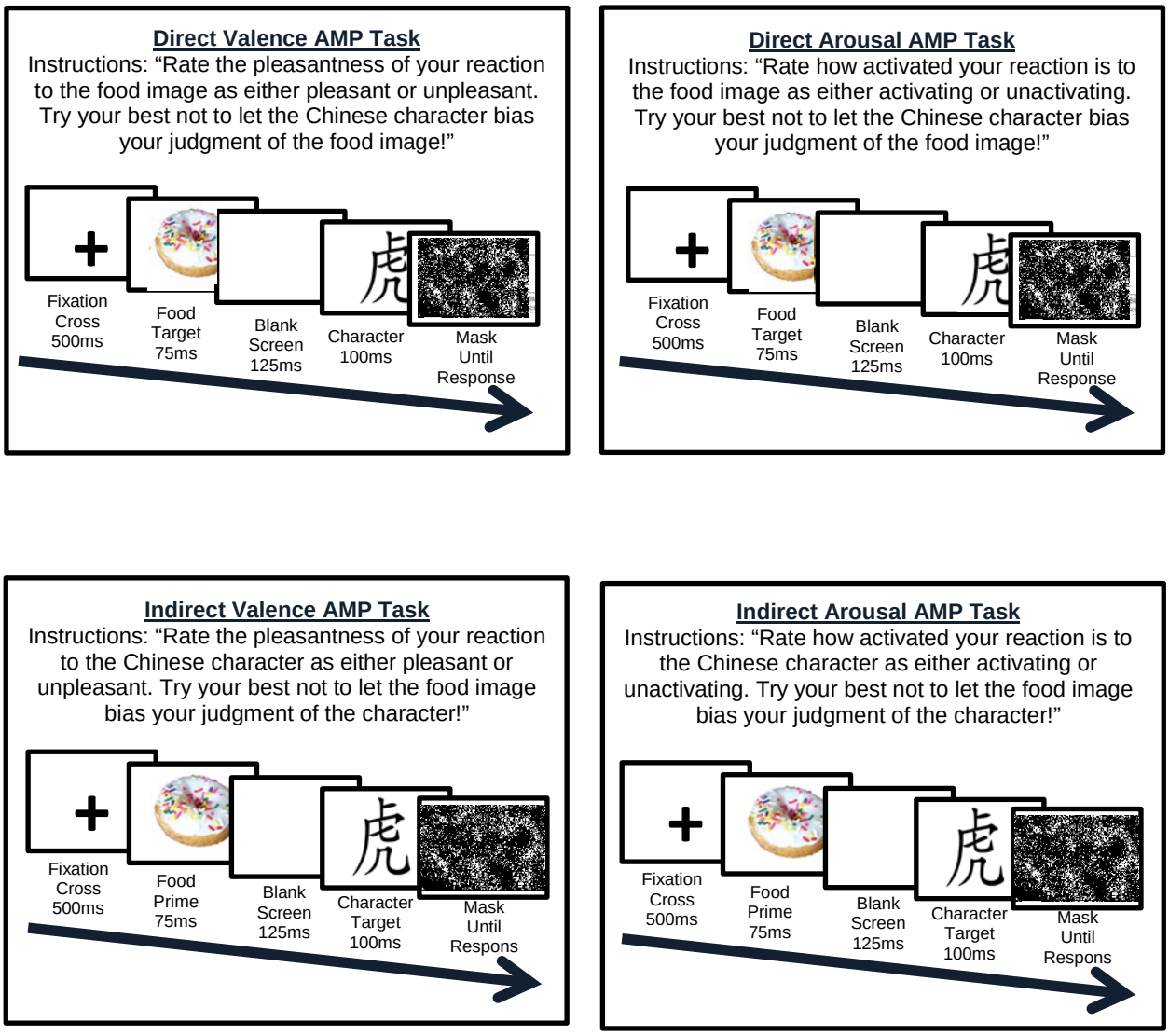
negative low arousal, positive low arousal, negative high arousal, positive high arousal; 24 images per scene type). Negative (i.e., low valence) images were operationalized as those for which the women's normative valence ratings fall between 2 and 4; positive (i.e., high valence) images were operationalized as those for which normative valence ratings fall between 6 and 8. Low arousal images were operationalized as those for which normative arousal ratings fall between 3 and 4.5; high arousal images were operationalized as those for which normative arousal ratings fall between 5.5 and 7.

Neutral Chinese character stimuli were identical to those used in prior AMP studies, as they were downloaded directly from Keith Payne's website for this express purpose (http://www.unc.edu/~bkpayne/materials.html).

Measures

AMP tasks. Each AMP task was structured such that participants viewed a series of randomly selected, rapidly presented pairs of images: a food image (75ms); 125ms later, a Chinese character (100ms); and a mask that remained on the screen until response (see Figure 2 for task structure). For direct tasks, the participant made a dichotomous judgment about the food image (i.e., an explicit evaluation of the food image; Payne et al., 2008). For indirect tasks, the participant made a dichotomous judgment about the Chinese character (i.e., an implicit evaluation of the food image; Payne, Cheng, et al., 2005). For the valence AMPs, participants indicated whether the specified image was "pleasant" (effect coded +1) or "unpleasant" (effect coded -1), without allowing the other image to affect their rating.

Figure 2. Sample trials for direct (top row) and indirect (bottom row) versions of the valence (left column) and arousal-based (right column) food AMP tasks.



For the arousal-based AMPs, participants received the following orientation to the arousal dimension derived from Bradley and Lang (1999): "At the activated end of the scale, the specified image would make you feel things like excited, agitated, frenzied, jittery, wide-awake, et cetera. At the unactivated end of the scale, the specified image would make you feel things like dull, calm, sleepy, sluggish, bored, et cetera. These activation ratings are ONLY about whether the specified image makes you feel activated or not, COMPLETELY SEPARATE

FROM how positive or negative the specified image makes you feel." Thus, on the arousal-based AMPs, participants judged the specified image to be "activating" (effect coded +1) or "unactivating" (effect coded -1), without allowing the other image to affect their rating.

For example, during the indirect arousal AMP, participants would indicate whether the Chinese character was activating or unactivating without regard for the food photo that preceded it. Participants completed 120 trials in each task (Payne, Cheng, et al., 2005). Good to excellent reliability was demonstrated. Average split-half correlations for direct valence and arousal-based food AMPs were .91 and .89, respectively; average split-half correlations for indirect valence and arousal-based food AMPs were .93 and .96, respectively. The implicit-explicit correlations for valenced and arousal-based food AMPs were r = .41 and r = .47, respectively. The valence-arousal correlations for direct and indirect food AMPs were r = .54 and r = .13, respectively. The food-scene correlations for indirect and direct valence AMPs were r = .800 and r = .288, respectively. The food-scene correlations for indirect and direct arousal AMPs were r = .871 and r = .493, respectively.

In addition to the four food AMP tasks (i.e., direct valence, indirect arousal, direct valence, indirect arousal) described above, participants also provided indirect and direct arousal and valence evaluations of IAPS scenes with known affective properties. Thus, participants completed a total of 8 AMP tasks (i.e., Food: direct valence, indirect valence, direct arousal, indirect arousal; IAPS scenes: direct valence, indirect valence, direct arousal, indirect arousal). For each subject, the average proportion pleasant and proportion activating was calculated separately for indirect and direct IAPS scene AMP tasks. This resulted in four indices of non-food affective evaluations (i.e., direct valence, indirect valence, direct arousal, indirect arousal). The two relevant indices were included as covariates in each logistic mixed effect model (i.e.,

direct and indirect IAPS proportions pleasant were included in the valence logistic mixed effects model; direct and indirect IAPS proportions activating were included in the arousal logistic mixed effects model).

Questionnaires. Following the completion of the eight AMP tasks, participants completed a series of self-report questionnaires as follows (please see Appendix for all questionnaires).

Demographics. Participants completed a personal information questionnaire (PIQ). They self-reported their height and weight, from which BMI was computed. They also indicated if they knew or were familiar with Chinese, and whether they had any food allergies or dietary restrictions. They also indicated their age, year in school, race and ethnicity, marital status, et cetera. Finally, they rated the extent to which they understood the study instructions and the extent to which they were motivated to follow the instructions.

Disordered eating across the spectrum. All participants also completed the Binge Eating Scale (BES; Gormally et al., 1982), a 16-item questionnaire assessing which assesses cognitive, emotional and behavioral experiences that comprise binge eating ($\alpha = .88$). In addition, participants completed the cognitive restraint subscale of the Three Factor Eating Questionnaire (TFEQ-R; Stunkard & Messick, 1985), the deliberate control of food intake ($\alpha = .83$). In contrast to many other dietary restraint self-report measures, the restraint subscale of the TFEQ successfully differentiates between those who successfully restrict their food intake and those who intend to do so, but instead repeatedly engage in disinhibited eating behavior (Stunkard & Messick, 1985). Prior to beginning the AMP tasks, participants marked their current hunger rating on a 100mm visual analogue scale (VAS; Flint, Raben, Blundell, & Astrup, 2000) with anchors reading “I am not hungry at all” and “I have never been more hungry.”

Depressive symptoms. Participants also completed the Beck Depression Inventory, 2nd Edition (BDI-II; Brown, Beck, & Steer, 1996), a 21-item measure of self-reported depression symptoms with excellent internal consistency. This widely used measure of depressive symptoms served as a covariate. Given how frequently disordered eating and depressive symptoms co-occur, including the BDI-2 as a covariate provided a test of whether any observed disordered eating-relevant findings could be attributed to depression.

State mood. Prior to beginning the AMP tasks, participants also completed the Affect Grid (Russel, Weiss, & Mendelsohn, 1989), a single-item measure of current mood along valence and arousal dimensions. Participants mark an X in the box within a 9 by 9 grid that corresponds with their current mood, providing assessments of pleasantness of mood and degree of activation each on a 9-point scale. The vertical coordinate of the X corresponds with degree of arousal, while the horizontal coordinate of the X corresponds with degree of pleasantness.

Conceptual check. The conceptual check required participants to categorize 10 verbal exemplars each for valence and for arousal. Participants first indicated whether each of the descriptors used to define the valence dimension in the instructions (e.g., happy, sad) were unpleasant or pleasant, and then indicated whether the descriptors used to define the arousal dimension (e.g., calm, jittery) were unactivating or activating.

Procedure

Recruitment. Undergraduate females between the ages of 18 and 30 were invited to participate if they were enrolled in the Psychology Department Research Pool. Participants who were interested in participating registered for a 90-minute session via Sona Systems, a participant registration website administered by the Department of Psychology. Participants received 1.5 credits in partial fulfillment of course requirements.

Session structure. All study procedures were approved by the University of Iowa Institutional Review Board. Participants provided informed consent and were seated in front of a computer terminal in a private cubicle. They rated their current hunger and mood and then began the series of AMP tasks described in greater detail above. Each participant completed four pairs of AMP tasks: 1) an indirect and a direct valence food AMP; 2) an indirect and a direct valence IAPS scene AMP; 3) an indirect and a direct arousal food AMP; and 4) an indirect and a direct arousal IAPS scene AMP. The order of the valence and arousal AMP blocks were counterbalanced, such that participants were randomly assigned to one of two study session sequences (see Table 2). For each block of four AMP tasks (arousal or valence), the food tasks always preceded the IAPS scene tasks; within each pair of tasks (food or IAPS scene), the indirect task always preceded the direct task. On average, participants completed the four pairs of AMP tasks within 45 minutes. They then completed the conceptual check, the self-report questionnaires and were debriefed.

Analytic Approach

Two separate logistic mixed effects models, one for valenced and one for arousal-based evaluations, were fit to the data using the glmer function in package lme4 (Bates, 2005; version 3.1.0), in R software (R Development Core Team, 2008). Values for *p* and *df* were estimated using lmerTest (Kuznetsova, Brockhoff, & Christensen, 2013). At present, there is no widely accepted means of estimating effect sizes with logistic mixed-effects methods. Added Sugar, Added Fat, and Measurement Type (i.e., whether the affective evaluation was directly or indirectly measured) were effect coded; +1 corresponded to high sugar, high fat, and direct measurement. Model comparison procedures (Crawley, 2012) indicated that the maximal random effects structure supported by the data included random intercepts across subjects and food

photos, as well as random slopes for Measurement Type, Added Fat and Added Sugar across subjects (Jaeger, 2008). Fixed effects included main effects for BMI, Hunger, Binge Eating, Restriction, Measurement Type (direct or indirect), Added Fat (high or low), and Added Sugar (high or low). Depressive symptoms were strongly correlated with binge eating symptoms (r = .51) and thus depressive symptoms were excluded from all analyses. Otherwise, multicollinearity was examined and found to be within acceptable limits. In addition, to control for individual differences in affective evaluation of emotionally evocative non-food images, each participant's average indirect and direct IAPS proportions pleasant or activating were included as covariates in each logistic mixed effect model (e.g., direct and indirect IAPS proportions pleasant were included in the valence logistic mixed effects model). Neither the average IAPS indices nor the initial mood ratings were associated with either valenced or arousal-based affective evaluations of foods and thus were dropped from subsequent analyses. The nomothetic effects (i.e., Measurement Type, Added Fat, Added Sugar, and their interactions) were permitted to interact with the individual differences factors (i.e., BMI, Hunger, Binge Eating, Restriction). Individual differences factors were not permitted to interact with one another, to simplify the model being evaluated.

Table 2. Sequence of study session for counterbalancing conditions 1 and 2

Condition 1		**Condition 2**	
Baseline Hunger Affect Grid 1		Baseline Hunger Affect Grid 1	
Valence	Food Indirect AMP Task Food Direct AMP Task	Arousal	Food Indirect AMP Task Food Direct AMP Task
Affect Grid 2		Affect Grid 2	
Valence	IAPS Indirect AMP Task IAPS Direct AMP Task	Arousal	IAPS Indirect AMP Task IAPS Direct AMP Task
Affect Grid 3		Affect Grid 3	
Arousal	Food Indirect AMP Task Food Direct AMP Task	Valence	Food Indirect AMP Task Food Direct AMP Task
Affect Grid 4		Affect Grid 4	
Arousal	IAPS Indirect AMP Task IAPS Direct AMP Task	Valence	IAPS Indirect AMP Task IAPS Direct AMP Task
Affect Grid 5		Affect Grid 5	
Questionnaires: TFEQr (21 items) BES (16 items) BDI (21 items) PIQ (includes BMI)		Questionnaires: TFEQr (21 items) BES (16 items) BDI (21 items) PIQ (includes BMI)	

Note: AMP = Affect Misattribution Procedure. IAPS = International Affective Picture Set. PIQ = Personal Information Questionnaire. TFEQr= Three Factor Eating Questionnaire, Restraint Subscale. BES = Binge Eating Scale. BDI = Beck Depression Inventory.

CHAPTER III RESULTS

Results

Sample Characteristics

Average self-reported BMI was 23.65 (*SD* = 4.61); 70.8% of the sample was of normal weight, with 23.8% overweight or obese and 5.0% underweight. The average Hunger rating (out of 100) was 32.76 (*SD* = 24.75) and average endorsement of Restriction (TFEQ-R) was 9.61 (*SD* = 5.42), which fell within the middle range of cognitive restraint or restriction (Timko, 2007). 27.5% of the sample met or exceeded the cutoff score of 17 for greater than mild Binge Eating (Greeno, Marcus, & Wing, 1995); on average, participants endorsed a BES score of 12.46 (*SD* = 7.69).

Valenced Affective Evaluations of Foods

Nomothetic findings. All reliable findings are presented in Table 3. I examined the extent to which Added Fat, Added Sugar, and their bivariate interaction influenced women's implicit and explicit pleasantness judgments of foods (see Figure 3). The average probability of a pleasant response was .57; foods were slightly more likely to be rated pleasant than unpleasant, on average. In general, foods higher in Added Fat or Sugar were more likely to receive a pleasant rating, on average, than those lower along one or both dimensions (Added Fat: z = 3.049, p = .002; Added Sugar: z = 3.004, p = .003; Fat by Sugar: z =1.993, p = .046). However, the relationships between pleasantness ratings and the nutritional characteristics varied as a function of Measurement Type (Measurement Type by Fat: z = 16.650, p < .001; Measurement Type by Sugar: z =6.850, p < .001; Measurement Type by Fat by Sugar: z = 6.031, p < .001; see Figure 4). On the direct AMP, a two-way interaction between Added Fat and Added Sugar emerged (z = 2.177, p = .030), as did main effects of both Added Fat (z = 4.231, p < .001) and Added Sugar (z

= 2.801, *p* = .005). Sweets were more likely to be judged explicitly as pleasant than foods low in Added Sugar and Fat, and foods high in Added Fat or high in Added Sugar were each more likely to be rated as pleasant than foods low in either dimension. On the indirect AMP, only a positive main effect of Added Sugar (z = 2.686, *p* = .007) emerged; foods high in Added Sugar were more likely to be judged to be pleasant implicitly than foods low in Added Sugar.

Figure 3. Nomothetic effects of added fat, added sugar, and their interaction on valenced affective evaluations.

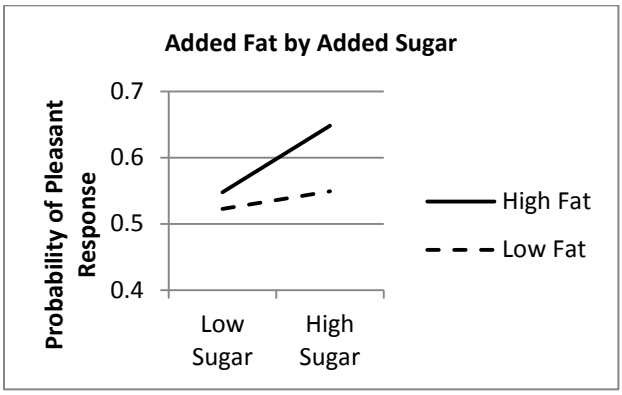


Figure 4. Moderation of nomothetic effects of added fat, added sugar, and their interaction by measurement type.

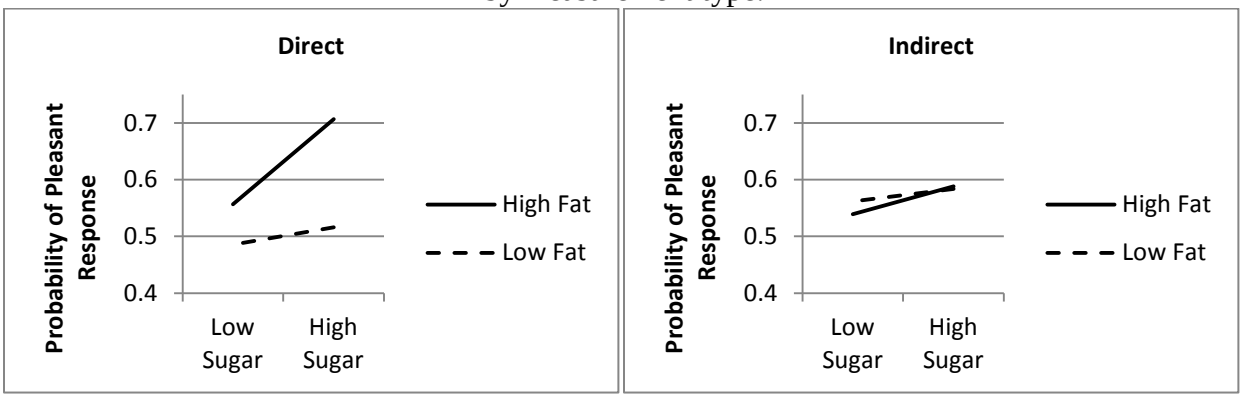


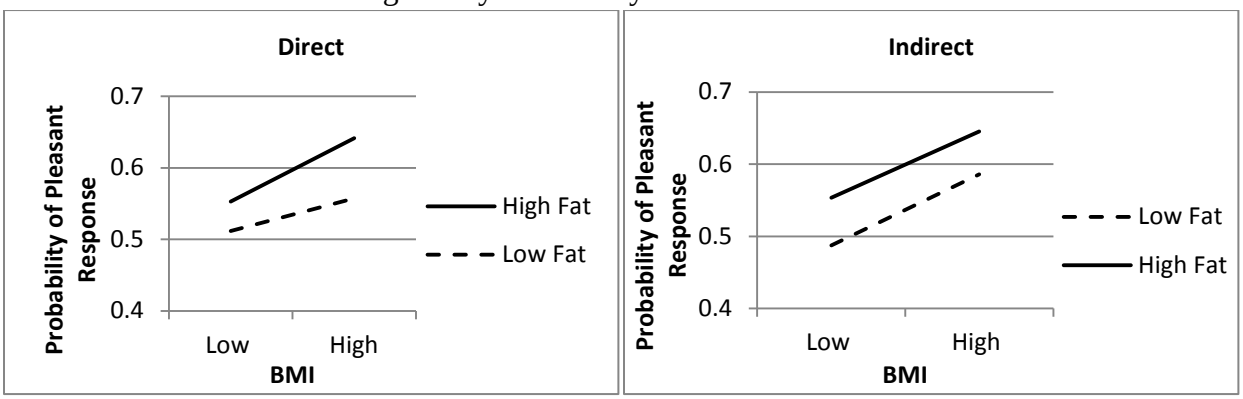
Table 3. Summary of reliable mixed effects results.

		Valenced		Arousal-Based	
		z	*p*	*z*	*p*
Nomothetic Main Effects and Interactions					
Nutrients					
	Added Fat	3.049	.002	3.046	.002
	Added Sugar	3.004	.003	3.284	.001
	Added Fat*Added Sugar	1.993	.046		
Measurement Type					
	Measurement Type			3.355	<.001
	Measurement Type * Added Fat	16.650	<.001	13.629	<.001
	Measurement Type * Added Sugar	6.850	<.001	10.645	<.001
	Measurement Type * Added Fat * Added Sugar	6.031	<.001	2.444	.015
Idiographic Main Effects and Nomothetic by Idiographic Interactions					
BMI					
	BMI	2.616	.009		
	BMI* Measurement Type			2.245	.025
	BMI* Measurement Type * Added Fat	2.986	.003	2.343	.019
Hunger					
	Hunger			3.668	<.001
	Hunger* Measurement Type	2.664	.008		
	Hunger* Measurement Type * Added Sugar	-2.569	.010	-2.814	.005
	Hunger* Added Fat	3.027	.002		
Restriction					
	Restriction* Measurement Type * Added Fat	-2.086	.037		
Binge Eating					
	BES			2.716	.006
	BES* Measurement Type			-2.159	.031

Idiographic findings. The main effects of the individual differences factors, including BMI, Hunger, Restriction, and Binge Eating, on valenced affective evaluations were examined. In each case, I also examined whether the individual differences factor moderated the normative effects described above. All reliable individual differences effects are reported below and presented in Table 3.

BMI. BMI exerted a positive main effect on the likelihood of a pleasantness rating (z = 2.616, p = .009), regardless of measurement strategy; heavier women were more likely to judge foods to be pleasant, on average. However, BMI did not moderate either the positive main effect of Added Fat, or that of Added Sugar, on the likelihood of a pleasant rating. BMI did moderate the bivariate interaction between Added Fat and Measurement Type (z = 2.986, p = .003; see figure 5), such that the bivariate BMI by Added Fat interaction was only reliably related to explicit (z = 2.149, p = .032), and not implicit, pleasantness ratings. Added Fat enhanced the likelihood of an explicit pleasant rating to a greater degree for heavier women (z = 4.023, p < .001) relative to lighter women (z = 2.894, p = .004).

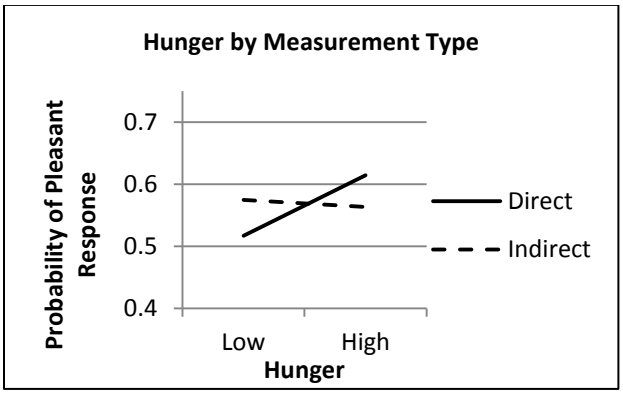
Figure 5. Interactive effects of BMI and added fat on probability of a pleasant response emerged only for directly measured evaluations



Hunger. No main effect of Hunger emerged on the likelihood of a pleasant response, contrary to expectations. A bivariate interaction emerged between Hunger and Measurement

Type (z = 2.664, *p* =.008), such that Hunger was reliably positively associated with only explicit pleasantness ratings (z = 3.060, *p* = .002) and not implicit ratings (see Figure 6).

Figure 6. Hunger enhanced likelihood of pleasant response only for directly measured affective evaluations



However, Hunger did not moderate the normative interaction between Added Sugar and Added Fat, nor the positive main effect of Added Sugar, on the likelihood of a pleasant rating. Hunger moderated the nomothetic bivariate interaction between Added Sugar and Measurement Type (z = -2.569, *p* =.010; see Figure 7), such that the Measurement Type by Sugar interaction was only reliable for women whose hunger fell at or below the median (z = 8.081, *p* < .001). Among women whose hunger was low, the main effect of Added Sugar on the likelihood of an explicit pleasant rating (z = 3.825, *p* < .001) was stronger than for an implicit pleasant rating (z = 2.987, *p* = .003). The nomothetic main effect of Added Fat, but not of Sugar, on valenced affective evaluations was also moderated by Hunger (z = 3.027, *p* =.002; see Figure 8), such that Added Fat only influenced the likelihood of a pleasant response for women whose hunger fell above the median (z = 3.772, *p* < .001). When women were hungry, fat—but not sugar—potentiated the likelihood of a pleasant rating. When women were less hungry, however, sugar—but not fat—

was associated with a higher likelihood of a pleasantness rating, especially for explicit affective evaluations.

Figure 7. Hunger moderated the added sugar by measurement type interaction.

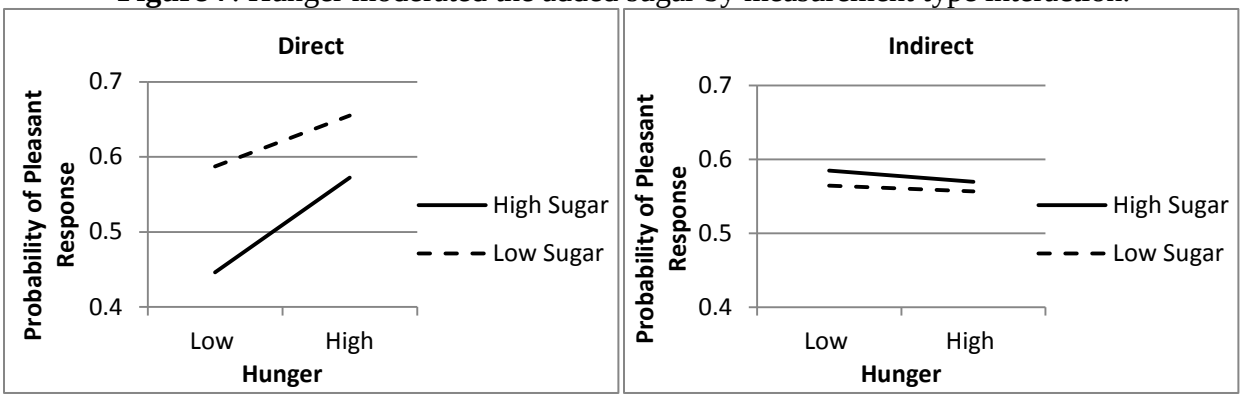
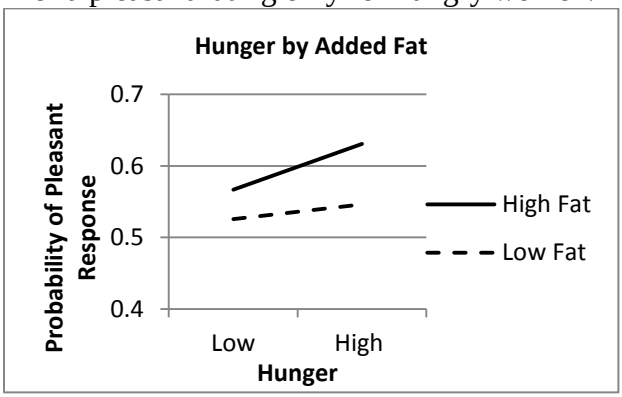


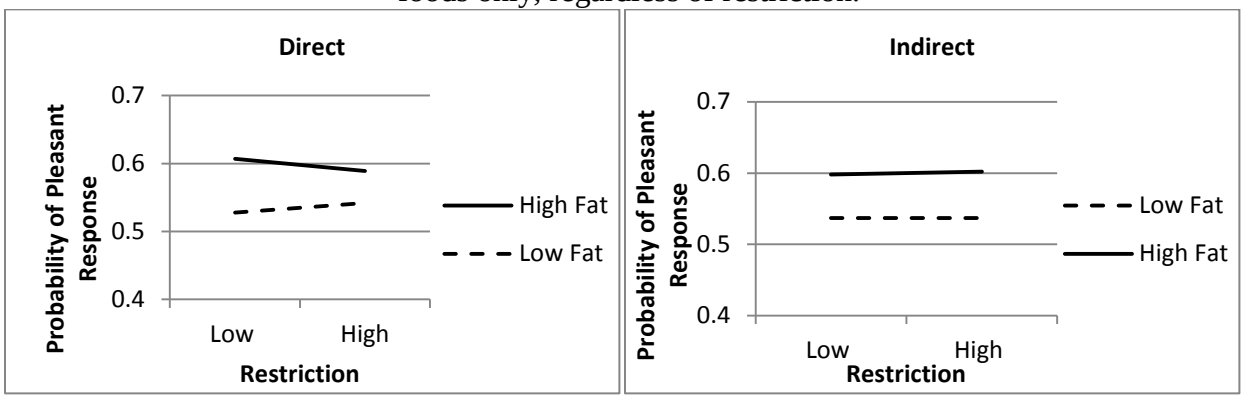
Figure 8. Added fat enhanced the likelihood of a pleasant rating only for hungry women.



Restriction. Like Hunger, but unlike BMI, Restriction had no main effect on the probability of a pleasant rating. Similarly, Restriction did not moderate the positive main effect of Added Fat, that of Added Sugar, or the Sugar by Fat interaction on the likelihood of a pleasant rating. Restriction moderated the normative interaction between Measurement Type and Added Fat (z = -2.086, p = .037; see Figure 9). However, follow-up tests indicated that Added Fat influenced explicit pleasantness ratings to a similar degree for those who reported more restriction (z = 4.014, p < .001) and those who reported less restriction (z = 3.960, p <.001). In contrast, Added Fat did not influence implicit pleasantness ratings for those who reported more

versus less restriction (z = -0.371, *p* >.05; z = -1.0341, *p* >.05, respectively). Thus, Added Fat influenced the perceived pleasantness of directly evaluated foods, but not indirectly evaluated foods.

Figure 9. Added fat influenced the likelihood of a pleasant rating for directly evaluated foods only, regardless of restriction.



Binge eating. There was no main effect of Binge Eating on valenced affective evaluations. In contrast to BMI, Hunger, and Restriction, Binge Eating did not moderate any of the nomothetic effects of Fat and Sugar on pleasantness ratings of foods, which was consistent with expectations.

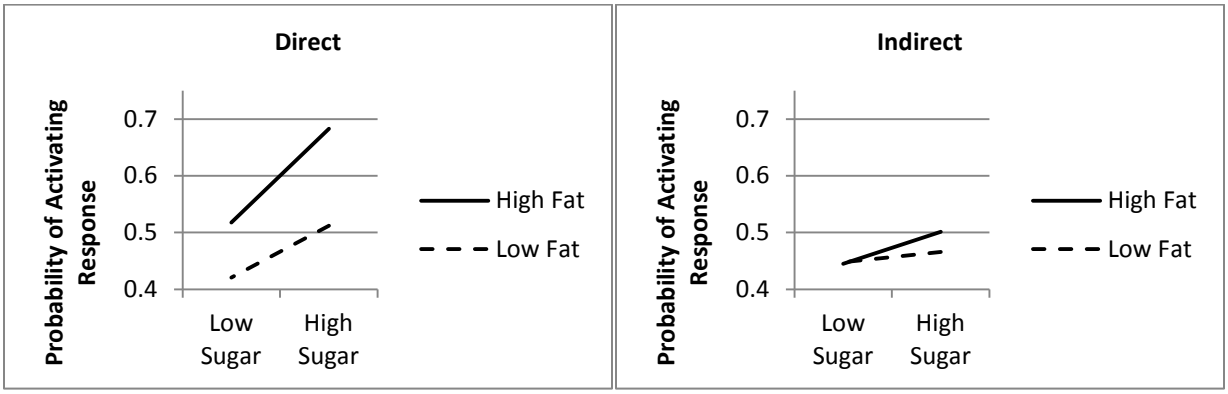
Summary of valence results. Normative results on the valence AMPs revealed that foods high in added fat, added sugar, or both added fat and added sugar were rated as more pleasant than foods low in these dimensions. Idiographically, heavier women found foods to be more pleasant, on average, than less heavy women, and the positive effect of added fat on explicit pleasantness ratings was potentiated for heavier relative to lighter women. Hunger reliably enhanced only explicit pleasantness ratings. For hungry women, fat—but not sugar—was associated with a higher likelihood of a pleasantness rating. For less hungry women, however, sugar—but not fat—potentiated the likelihood of a pleasant rating, especially for explicit affective evaluations. Across levels of dietary restriction, added fat enhanced the pleasantness of explicit—and not implicit—affective evaluations. Binge eating was unrelated to

valence ratings. In general, the direct valence AMP revealed stronger nomothetic and idiographic links than the indirect valence AMP.

Arousal-Based Affective Evaluations of Foods

Nomothetic findings. A main effect of Measurement Type arose, such that explicit arousal-based affective evaluations were more likely to be activating than implicit affective evaluations ($z = 3.355$, $p < .001$; see Figure 10). The extent to which Added Fat, Added Sugar, and their interaction influenced women's implicit and explicit activation ratings of foods was also examined. The average probability of an activating response was .49. Nomothetically, women were more likely to judge foods that are higher in Fat or Sugar to be activating, on average, than those low in these dimensions (Added Fat: $z = 3.046$, $p = .002$; Added Sugar: $z = 3.284$, $p = .001$), though the Fat by Sugar bivariate interaction was not reliable. In addition, the relationships between activation ratings and the nutritional characteristics varied as a function of Measurement Type (Measurement Type by Fat: $z = 13.629$, $p < .001$; Measurement Type by Sugar: $z =10.645$, $p < .001$; Measurement Type by Fat by Sugar: $z =2.444$, $p = .015$). On the direct AMP, main effects emerged for both Added Fat ($z = 4.194$, $p < .001$) and Added Sugar ($z = 3.899$, $p < .001$), such that foods high in Added Sugar and foods high in Added Fat were more likely to be judged explicitly to be activating than foods low in either dimension. On the indirect AMP, Added Fat, Added Sugar, and their interaction did not reliably contribute to the likelihood of an activating response.

Figure 10. Nomothetic effects of added fat, added sugar, and their interaction on arousal-based affective evaluations.



Idiographic findings. I tested the main effect of the individual differences factor on arousal-based affective evaluations, as well as whether individual differences factors moderated the nomothetic findings for arousal-based affective evaluations.

BMI. No main effect of BMI on arousal-based affective evaluations emerged. BMI interacted with Measurement Type (z = 2.245, *p* = .025; see Figure 11) and this interaction was associated with activating ratings, such that the likelihood of an explicit activation rating significantly exceeded that of an implicit activation rating for those above the median in BMI (z = 3.210, *p* = .001) and not for those at or below the median (z = 1.208, *p* = .227). BMI did not moderate either the nomothetic, positive main effect of Added Fat, or that of Added Sugar, on the likelihood of an activating rating. However, BMI moderated the two-way interaction of Fat and Measurement Type on arousal ratings (z = 2.343, *p* = .019; see Figure 12, such that Added Fat enhanced the likelihood of an explicit activating rating to a slightly greater degree for heavier women (z = 2.837, *p* = .005) relative to lighter women (z = 2.423, *p* = .015).

Figure 11. Measurement type moderated the likelihood of activating rating only for BMI above the median.

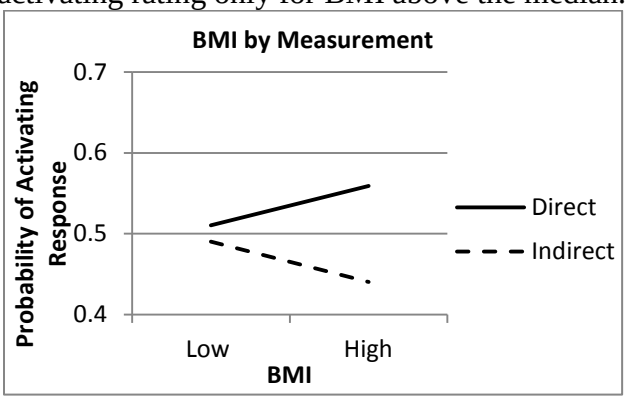
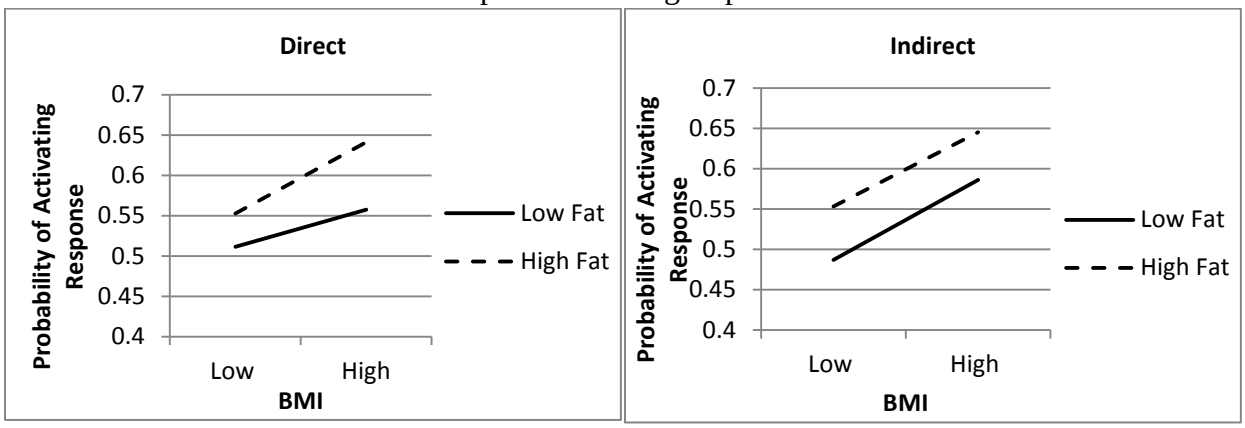


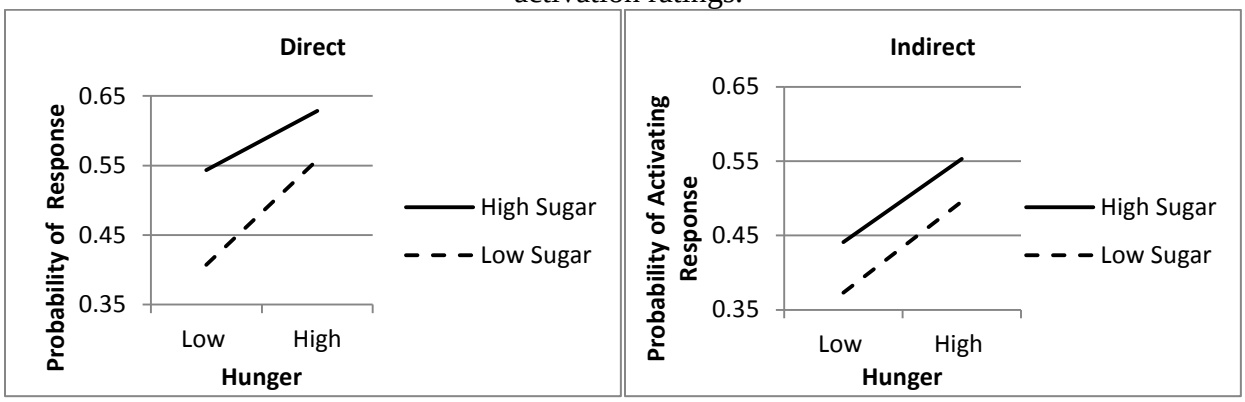
Figure 12. BMI potentiated the effect of added fat on the probability of explicit activating response.



Hunger. Consistent with expectations, Hunger was positively associated with arousal-based affective evaluations (z = 3.668, $p < .001$), such that hungry people more often found food to be activating, on average, than less hungry people. Though Hunger did not moderate the main effects of Added Fat and Added Sugar, Hunger moderated the bivariate interaction between Measurement Type and Added Sugar (z = -2.814, $p = .005$; see Figure 13). Specifically, the bivariate Added Sugar by Hunger interaction reliably attenuated the likelihood of an explicit activation rating (z = -2.008, $p = .045$) but was not associated with implicit activation ratings. Contrary to expectations, the effect of Added Sugar on the likelihood of an explicit activating

rating was stronger for those who were less hungry (z = 4.702, $p < .001$) relative to those who were more hungry (z = 2.438, $p = .015$).

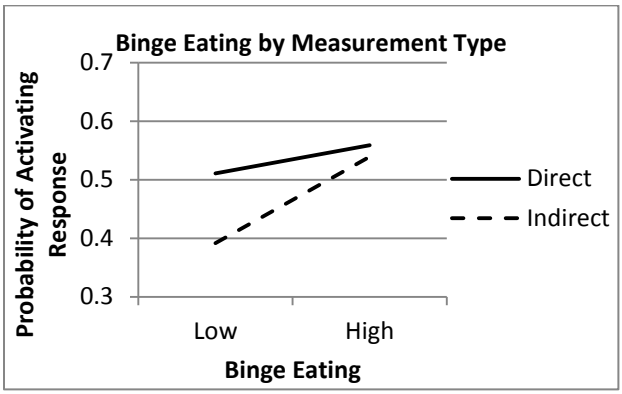
Figure 13. Added sugar by hunger interaction related only to directly assessed activation ratings.



Restriction. Consistent with expectations, successful Restriction was neither related to arousal ratings, nor moderated the normative effects of Added Fat and Added Sugar on arousal-based affective evaluations.

Binge eating. A main effect of Binge Eating emerged, such that those who endorsed more Binge Eating were also more likely to rate foods as activating (z = 2.716, $p = .006$). Though Binge Eating did not moderate the normative effects of Added Fat and Added Sugar on activation ratings, a bivariate interaction between Measurement Type and Binge Eating emerged (z = -2.159, $p = .031$; see Figure 14). Binge Eating was related to an enhanced likelihood of only an implicit activating rating (z = 3.009, $p = .002$), and not an explicit (z = 1.263, $p = .206$) arousal-based affective evaluation. Relatively more automatic evaluations of foods as activating were associated with greater endorsement of binge eating.

Figure 14. Binge eating enhanced likelihood of activating response only for indirect arousal-based evaluations.



Summary of arousal results. Nomothetically, added fat and added sugar were both associated with an increased likelihood of an explicit activating rating, and the likelihood of an activating rating was higher on the explicit AMP than on the implicit AMP. Idiographically, explicit activation ratings exceeded implicit activation ratings to a greater degree for heavy women relative to light women, and this effect was potentiated by added fat. On average, hunger was related to an enhanced likelihood that foods would be rated as activating. When women were less hungry, sugar was positively associated with activating ratings, especially for explicit affective evaluations. Restriction was unrelated to arousal. Those who endorsed more binge eating were more likely to rate foods as activating. Implicit evaluations of foods as activating were associated with greater endorsement of binge eating.

CHAPTER IV DISCUSSION

Discussion

Many prior investigations of the role of affective evaluations of foods in eating- and weight-related concerns have examined only a single affective dimension, valence or arousal; assumed that structurally dissimilar indirect and direct tasks tap only automatic and controlled processes, respectively; distinguished food stimuli coarsely; and investigated disordered eating-related individual differences factors in isolation. The present study extended previous work by 1) investigating both arousal-based and valenced affective evaluations of foods, 2) examining the applicability of a dual process model to affective evaluations of foods using structurally identical indirect and direct assessments that control method variance and help to isolate the construct variance of interest, 3) exploring both nomothetic (i.e., food-specific) and idiographic (i.e., person-specific) correlates of affective evaluations of foods, and 4) including both restrictive and disinhibited eating measures, as well as hunger and BMI, to better assess the role of affective evaluations of foods across the spectrum of disordered eating. The discussion will address the findings, beginning with nomothetic effects and then moving to a discussion of idiographic main effects and moderation of nomothetic effects by idiographic factors. It will then broaden the focus to commenting on the importance of examining both of the fundamental affective evaluation dimensions: valence and arousal. Finally, the validity of dual-process models in affective evaluations of food will be considered by comparing patterns of findings across indirect and direct affect misattribution procedures. Future directions and study strengths and limitations will be examined throughout the discussion. Readers are invited to consult Table 4, which depicts the observed idiographic associations with the affective dimensions within a dual-process

model framework. The observed associations depicted in Table 4 can be readily compared to Table 1, which represented the theoretically expected individual differences associations.

Table 4. Theoretical framework of affective evaluations of foods drawn from dual-process models: Observed associations between affective evaluations of foods and eating- and weight-related individual differences variables.

		Affective Dimensions	
		Valence	**Arousal**
Dual-Process Model	**Explicit**	Hunger BMI Restriction	Hunger BMI
	Implicit	BMI	Hunger Binge Eating

On the basis of classic dual process models, we had anticipated that more spontaneous eating behaviors would be more strongly associated with implicit affective evaluations, whereas more deliberative eating behaviors would be more strongly associated with explicit affective evaluations (Fazio & Olson, 2014; Perugini, 2005; Strack & Deutsch, 2004). Consistent with this expectation, we found that binge eating was associated with implicit arousal evaluations, whereas restriction was associated with explicit valence ratings. We further expected hunger would be associated with both valence- and arousal-based affective evaluations, which is consistent with what we found. Finally, we both expected and found valence and arousal dimensions to differentially relate to eating restriction and binge eating, respectively. We did not posit specific directional hypotheses about associations with BMI given the equivocal existing literature, but found that BMI was associated with valence evaluations but only with explicit arousal evaluations.

Food- and Person-Specific Correlates of Affective Evaluations

Nomothetic findings. This study found consistent support for the notion that added fat and added sugar enhance women's pleasantness ratings of food (see top half of Table 3). Both added sugar and added fat were positively and independently associated with both valence and activation ratings, particularly for explicit affective evaluations, but not necessarily for implicit affective evaluations. This extends prior work documenting nutrient-specific effects on valenced affective evaluations (Woodward & Treat, 2015) and on ratings of craving and liking of foods (Gearhardt et al., 2014). Moreover, the arousal-based findings extend prior work establishing positive links between fat content and explicit craving ratings (Gearhardt et al., 2014) by demonstrating the importance of both added fat and added sugar to explicit evaluations of arousal. Taken together, these findings underscore the utility of continuing to use fine-grained stimulus sets to investigate affective evaluations of foods. Future work should examine the effects of other nutritional characteristics –including sodium, carbohydrates, protein, and fiber—on affective evaluations of foods, although multicollinearity may preclude the simultaneous examination of highly related nutritional characteristics.

Idiographic findings. This section discusses both idiographic main effects and moderation of nomothetic effects by individual differences, which are presented in the lower half of Table 3. Idiographic correlates emerged as reliable either in isolation (i.e., main effects) or in interaction with nomothetic factors. Typically, individual differences exerted their effects explicitly, or in conjunction with food-specific characteristics.

BMI. Although a priori directional hypotheses were not made and thus not included in Table 1, BMI was positively associated with both valence and arousal-based affective evaluations, though the latter held only for explicit evaluations. BMI also moderated the

interaction between added fat and measurement type. In short, heavier women were more likely to find foods—especially foods high in added fat, but not those high in added sugar—to be both pleasant and arousing than their lighter peers. This pattern is largely consistent with the explicit preferences for high-fat foods among overweight individuals (e.g., Drewnowski, 1985) but contradicts the limited literature finding no BMI-related differences in youths' arousal associations with foods (Craeynest et al., 2008). The absence of implicit BMI findings here adds to the mixed literature on the relations between BMI and implicit valenced affective evaluations (e.g., Roefs et al., 2011). Furthermore, this pattern suggests that BMI is related more strongly to controlled affective evaluations of foods, rather than to automatic evaluations. Prospective studies will be necessary to characterize precisely this relationship and to disentangle causal mechanisms.

Hunger. Women's perceptions of food pleasantness were not independently affected by hunger, consistent with our prior work (Woodward & Treat, 2015) yet inconsistent with much of the prior literature demonstrating that hunger enhances the pleasantness of foods (e.g., Seibt et al., 2007; Stoeckel et al., 2007). However, this study moved beyond this prior work to find that hungry women were more activated by food, which is consistent with theoretical expectations. In addition, hunger moderated the normative effects of added fat, added sugar, and measurement type. Consistent with expectations (Table 1), hunger exerted a main effect on arousal ratings but was associated with only explicit valence evaluations. When not particularly hungry, women found foods high in added sugar to be both pleasant and arousing; when hungry, however, women found foods high in added fat to be pleasant, but not arousing. Hunger's positive association with fat-based valenced evaluations may reflect the role of dietary fat in acute satiety signaling after consumption (e.g., Cecil, Francis, & Read, 1999; Maljaars et al., 2008). Food-

seeking is driven not only by physiological processes, such as hunger, but also by emotional, hedonic processes (Berridge et al., 2009). Thus, when people are not hungry, they may be most activated by sweet, hedonically pleasant foods. In the future, the role of hunger in affective evaluations of foods may be further clarified through experimentally manipulating participants' hunger levels. Participants may be randomly assigned to complete study procedures in a fasted or sated state. Under such conditions, I would expect that fasted participants would rely on fat content to a greater degree when making pleasantness evaluations. Sated participants would presumably find high added sugar foods to be both pleasant and arousing. Alternatively, an experimental craving induction could illuminate boundary conditions under which valence and arousal evaluations of foods work in concert. The likelihood of activating ratings, but not pleasant ratings, would be expected to increase for foods high in added fat and sugar after participants completed a craving induction in which they were required to interact with foods high in added fat and added sugar using their senses of touch, sight, and smell (but not taste).

Restriction. Consistent with expectations (Table 1), successful restriction of food intake was associated with explicit fat-based affective evaluations of food. Unexpectedly, however, the direction of this effect was positive. Typically, restriction is associated with more negative evaluations of foods—especially unhealthy foods—at least for implicit affective evaluations (e.g., Roefs et al., 2011) but also for explicit evaluations (e.g., Spring & Bulik, 2014). In contrast to the current findings, patients with anorexia nervosa explicitly liked low-fat foods more than high-fat foods to a greater degree than healthy controls (Stoner, Fedoroff, Andersen, & Rolls, 1996). However, most prior work has examined restriction or anorexia nervosa diagnostic status alone as a correlate of affective evaluations of foods, whereas the present study investigated successful restriction in the context of BMI, hunger, and binge eating. Upon reanalysis with only

restriction as an individual differences correlate, the expected negative association with valenced affective evaluations shown in prior literature still did not emerge. Thus, the other eating- and weight-related correlates did not obscure the typical negative association. We did not find the expected weak link between restriction and implicit valence evaluations (Table 1). Pending replication, this pattern suggests that controlled affective evaluations may predominate in restriction, at least among non-treatment seeking undergraduate women. Future work also should extend these investigations to clinical samples with better representation of restrictive eating pathology. It could be that a sample troubled by more clinically significant restriction would demonstrate the typical negative affective evaluations of high-fat foods. It could also be that the unexpected direction of the current finding may result from the use of a more tightly controlled food stimulus set. Nevertheless, future work using similarly nuanced stimuli among samples with more severe eating pathology would illuminate the extent to which patterns of affective evaluations of foods vary as a function of food-specific characteristics in the context of clinically significant eating pathology. Finally, as expected, restriction was associated with valenced—but not arousal-based—affective evaluations of foods (e.g., Keating et al., 2012). Thus, pleasantness, but not activation, is implicated in successful cognitive efforts to restrict food intake.

Binge eating. Women who were more concerned about binge eating were more likely to judge foods to be activating, but only for implicit affective evaluations (Tables 3 and 4). Thus, largely consistent with expectations (Table 1), impulsive eating behavior is associated with enhanced arousal, but not valence, evaluations. The expectation of a weak association between binge eating and explicit arousal evaluations (Table 1) was not upheld (Table 4), which contrasts somewhat with the work of Gearhardt and colleagues (2014) who found that addictive-like (disinhibited) eating was associated with greater *explicit* food craving, especially for foods high

in added fat or sugar. Indeed, activation ratings likely reflect incentive salience or action dispositions to approach and consume emotionally salient stimuli, such as food (e.g., Berridge et al., 2009; Lang, 1995), and when positive are akin to wanting or craving, whereas valence ratings are more akin to liking (e.g., Berridge, 1996; Berridge et al., 2010; Finlayson et al., 2007). This finding supports associations among disinhibited eating, craving, and sensitivity to food reward. In contrast to prior work where disinhibited eating was implicated in more positive evaluations of foods high in added fat (Gearhardt et al., 2014; Woodward & Treat, 2015), binge eating did not moderate the normative effects of either added fat or added sugar content. Pending replication, this pattern of findings may suggest that overeating is reinforced by factors other than the nutritional characteristics and thus taste properties of specific foods.

Consistent with expectations (Table 1), relatively more automatic arousal-based affective evaluations are implicated in binge eating to the exclusion of both controlled and valenced affective evaluations (Table 4). The role of automatic activation evaluations in binge eating suggests that treatments for overeating might be enhanced by including non-verbally mediated, performance-based interventions that can influence unconscious, unintentional processing of foods. Indeed, emerging work suggests that implicit interventions can reduce undergraduate women's cravings for and consumption of chocolate (Houben & Jansen, 2011; Kemps, Tiggemann, & Hollitt, 2014; Kemps, Tiggemann, Orr, et al., 2014). It will also be critical to extend these investigations to samples struggling with clinically significant binge eating symptoms, for whom implicit activation ratings may play an even greater role relative to undergraduate women with subclinical binge eating concerns.

Affective Dimensions: Arousal and Valence

The present study extended typical investigations of valenced affective evaluations by examining both fundamental dimensions of affective evaluations: valence and arousal. As can be seen in Table 3, some patterns of findings converged across these affective dimensions. For instance, normatively, added fat and added sugar enhanced affective evaluations for both valence and arousal. However, intriguing idiographic divergence also emerged in patterns of results across affective dimensions (see lower half of Table 3). Prior work in the domain of alcohol research has demonstrated that implicit arousal evaluations—but not valenced—could distinguish light from heavy drinkers (Wiers et al., 2002). Similarly, participants who have fasted for either six or twenty-four hours differ in their explicit arousal ratings of food images, but not in their valence ratings (Drobes et al., 2001). Important idiographic dissociations occurred between valenced and arousal-based affective evaluations in the present study, largely consistent with expectations (Tables 1 and 4). Specifically, restriction was associated only with valenced affective evaluations, and binge eating was associated only with arousal-based affective evaluations, whereas hunger and BMI were related positively to both affective dimensions. Thus, the arousal dimension of affective evaluations seems to matter. This pattern of findings demonstrates what may be overlooked when researchers focus on a single affective dimension, or a single eating- and weight-related correlate. Future affective evaluation studies should continue to consider both arousal and valence dimensions, as doing so may provide a window onto other hedonic and affective processes implicated in eating behavior, such as liking, wanting, and learned associations with reward cues (e.g., Berridge et al., 2009; Berridge et al., 2010).

Validity of a Dual Process Model of Affective Evaluations of Foods

These findings provide modest support for dual-process conceptualizations of affective evaluations. For valence, associations with explicit affective evaluations were consistently stronger than those with implicit affective evaluations, though the directions of implicit and explicit findings were largely comparable. Though a similar pattern of implicit and explicit valence findings emerged, the frequent evidence of moderation by measurement type provides some support for a dual-process model for valence. For arousal, individual differences factors were related to explicit affective evaluations, with the exception of a single reliable implicit effect: Binge eating enhanced the likelihood of arousing judgments only for implicit affective evaluations. Evidence in support of a dual-process model is more compelling for arousal-based affective evaluations, given that implicit and explicit associations diverged in all but one instance. The similar patterns of findings between implicit and explicit affective evaluations seen here is somewhat unusual in the existing literature. For example, in their comprehensive review, Roefs & colleagues reported implicit-explicit correlations that are typically small to moderate in magnitude (Roefs et al., 2011). In contrast, the present study found moderate-to-strong implicit-explicit correlations of $r = .41$ and $r = .47$ for proportions pleasant and activating, respectively. The greater degree of convergence in the current implicit and explicit findings may reflect our more conservative approach to estimating the validity of dual-process models. Unlike most previous work, the present study employed indirect and direct assessments that were structurally matched and that differed only in the intentionality of participants' responses. Thus, I see modest evidence in support of a dual-process model of affective evaluations when method variance is controlled. Effects were consistently stronger for explicit than implicit affective evaluations, yet the significant effects associated with implicit affective evaluations of foods were consistent with

theoretical predictions and support the validity of the indirect AMP for both valence and arousal-based affective evaluations. Controlled processes appear to underlie arousal-based affective evaluations, with the sole exception of the binge eating-implicit link.

One possible explanation for the preponderance of controlled processes in arousal evaluations may be procedural. The timescale on which arousal information is extracted from a stimulus is longer than that on which valence information is extracted (e.g., Gianotti et al., 2008). Performance on the indirect AMP requires sufficient time for arousal information to be extracted from both the food photo and the neutral Chinese character, as well as time for food-related arousal to be misattributed to the character (Payne, Hall, Cameron, & Bishara, 2010). Participants provide their evaluation of the food on the direct AMP while ignoring their evaluation of the Chinese character. Thus, the misattribution process thought to occur on the direct AMP is presumably easier for subjects to resolve, as the stimulus of interest in the direct AMP is the more affectively evocative stimulus relative to the neutral character. Here, it may have been the case that stimulus presentation was long enough for arousal information to be extracted on the direct AMP but too brief for arousal information to be extracted on the indirect AMP, except by those who eat impulsively. It may be of interest in future work to examine longer presentation times on the arousal-based indirect AMP.

More generally, additional work investigating the validity, psychometric properties, and utility of the arousal-based AMP is needed. The current investigation serves as an initial step toward examining this new procedure. The split-half reliability of the arousal-based AMP was excellent (.89 and .96 for direct and indirect arousal-based AMPs, respectively). The present investigation has demonstrated the convergent validity of the arousal AMP, as evidenced by its theoretically expected associations with hunger and binge eating. The low correlation with the

valence AMP for indirect tasks (r = .13) and the notable absence of associations with restriction provided support for the arousal-based AMP's discriminant validity. However, a moderate to large correlation emerged between direct valence and arousal-based AMPs. A correlation of this magnitude is perhaps not surprising given the efforts to improve structural fit and reduce uncontrolled method variance in this study. However, such a strong correlation may suggest that the affective dimensions of arousal and valence cannot be independently assessed. Indeed, recent evidence suggests that directly measured (i.e., self-reported) arousal may not provide incremental validity over directly measured valence, at least in predicting electrodermal activity (Kron, Pilkiw, Banaei, Goldstein, & Anderson, 2015). Future work in this vein would provide evidence of the boundary conditions under which the arousal AMP is most informative.

Future research should continue to use structurally matched indirect and direct assessments, which may inform interpretations of the implicit-explicit dissociations widely reported in the affective evaluation of food literature (e.g., Roefs et al., 2011). Moreover, both automatic and controlled processes can contribute to performance on indirect and direct assessments (De Houwer, 2006; De Houwer et al., 2009; Jacoby, 1991; Jacoby, Begg, & Toth, 1997; Moors & De Houwer, 2006), even when assessments are structurally similar. In other words, even using structurally similar indirect and direct assessments does not provide *process-pure* estimates of automatic and controlled aspects of affective evaluations.

In keeping with the process purity assumption, most evaluations of dual process models rely on what can be termed a task dissociation approach, in which an indirect and a direct measure are each employed to estimate automatic or controlled processes, respectively. The current structurally similar direct and indirect AMP tasks are an example of a task dissociation approach, though improving structural fit and reducing uncontrolled method variance in this way

remains a significant improvement upon pairings of response interference indirect tasks, such as the IAT, and direct Likert scale self-report ratings. A process dissociation approach, in contrast, uses formal mathematical modeling techniques to examine the interactive influences of automatic and controlled processes (e.g., Jacoby, 1991). These formal mathematical modeling techniques rigorously instantiate theory with mathematical equations that provide estimates of the processes thought to underlie task performance (see Gawronski & Creighton, 2012; and Smith & Collins, 2009 for recent reviews). Using this process dissociation approach, one can more accurately estimate the interactive effects of automatic and controlled processes on performance within a single task. Moreover, this rigorous instantiation of assumptions allows one to ask less abstract and more readily testable questions, and to move beyond correlating task performance with a given behavior. Instead, one can test how underlying processes influence specific behaviors, and for whom, under what circumstances (Payne & Bishara, 2009). Such nuanced investigation is likely to drive our theoretical understanding rapidly forward. Indeed, researchers are working on ways to leverage formal process models to inform our understanding of the processes underlying affective evaluation (e.g., Payne et al., 2010). The extent to which the relative contributions of automatic and controlled processes differ as a function of individual or group-level differences remains an empirical question that is clouded by poor structural fit between (non-AMP) indirect and direct measures but improved by the enhanced structural fit provided by the juxtaposition of indirect and direct AMP tasks.

Though pairing indirect and direct AMP tasks can facilitate the extension of process dissociation models to food related affective evaluations, the problematic process purity assumption has not yet been adequately addressed. Fitting formal process dissociation models to performance on structurally identical indirect and direct versions of the AMP should provide

even more pure estimates of automatic and controlled influences on affective evaluation. Payne and colleagues (2010) have proposed such a process model of affective evaluation for the indirect AMP, but a model that integrates automatic and controlled processes for the direct AMP has not yet been developed (Payne, Jacoby, et al., 2005).

Once a formal process model can be fit to performance on both the indirect and direct versions of the AMP, it will be possible to evaluate hypotheses about the role of automatic and controlled influences on affective evaluation in a far more rigorous, precise, and valid manner than has been possible to date (Payne et al., 2010). Such formal process modeling will be able to address theoretically compelling questions such as whether clinically relevant individual or group-level differences in a tendency to misattribute affect are present, and whether other meaningful individual differences emerge. Moreover, combining formal process models and structurally identical indirect and direct measurement strategies will permit examination of the incremental validity of a dual process versus single process model of clinically relevant affective evaluations, which will in turn enhance the prediction and treatment of disorder across a wide array of psychopathology. Thus, the use of formal process dissociation techniques to isolate more precise estimates of the contributions of automatic and controlled processes would further enhance our understanding of affective evaluations of foods. Payne, Jacoby and Lambert (2005) rightly suggested that identifying the process model appropriate for affective evaluations “is as relevant to pragmatics as it is to processes;” furthermore, theories about and interventions for psychopathology could benefit from the adoption of these methodological, theoretical, and analytical strategies (p. 410).

Conclusion

The present work demonstrated that added fat and added sugar contributed to nomothetic affective evaluations of foods, supporting the utility of continuing to consider nutrient-specific effects of food stimuli. Idiographically, hunger and binge eating were associated with a higher likelihood of activating ratings, whereas BMI and restriction enhanced the likelihood of positive ratings. Moreover, individual differences factors moderated the normative effects of measurement type, added fat, and added sugar. Added fat appears to be especially salient for women who are heavier, hungrier, or who endorse greater restriction. In contrast, added sugar is especially influential for women who are less hungry. The discrepancy in the findings for added fat and added sugar further supports the utility of distinguishing nutrients in future work. Food restriction was related only to valence, whereas binge eating related only to arousal evaluations. Dissociations such as these underscore the importance of examining both the valence and the arousal dimensions of affective evaluations. Finally, results were largely similar across implicit and explicit affective evaluations, albeit stronger for explicit. Future research pertaining to affective evaluations of foods and other disorder-relevant stimuli would benefit from continuing to employ several of the current study's innovations: 1) reliance on structurally similar measures of implicit and explicit affective evaluations, 2) assessments of both valence and arousal-based affective evaluations, 3) use of more stringently characterized image stimuli with known nutritional properties, and 4) inclusion of a more comprehensive set of theoretically relevant individual differences correlates. Use of such rigorous methods, nuanced stimuli, and varied individual differences correlates permits the examination of more complex theoretical questions about what nutritional and individual-specific characteristics shape pleasantness and activation evaluations and downstream eating behaviors. Improving structural fit moves us closer to

obtaining pure estimates of the relative contributions of underlying automatic and controlled processes, as well as a clearer understanding of the relevance of single versus dual process models to clinically relevant affective evaluations. The use of formal process models will provide even more valid estimates. Ultimately, the study of affective evaluation in psychopathology leaves many unanswered questions. However, such investigations provide a context in which thorny theoretical and methodological issues can be evaluated and addressed. Advances in the theory and methods of affective evaluation seem likely to enhance our understanding of and our ability to treat clinical phenomena, and may serve as the basis for a more rigorous approach to examining many complex clinical issues, more generally.

APPENDIX

Self-Report Questionnaires

Appendix Contents:

Visual Analog Scale (VAS)

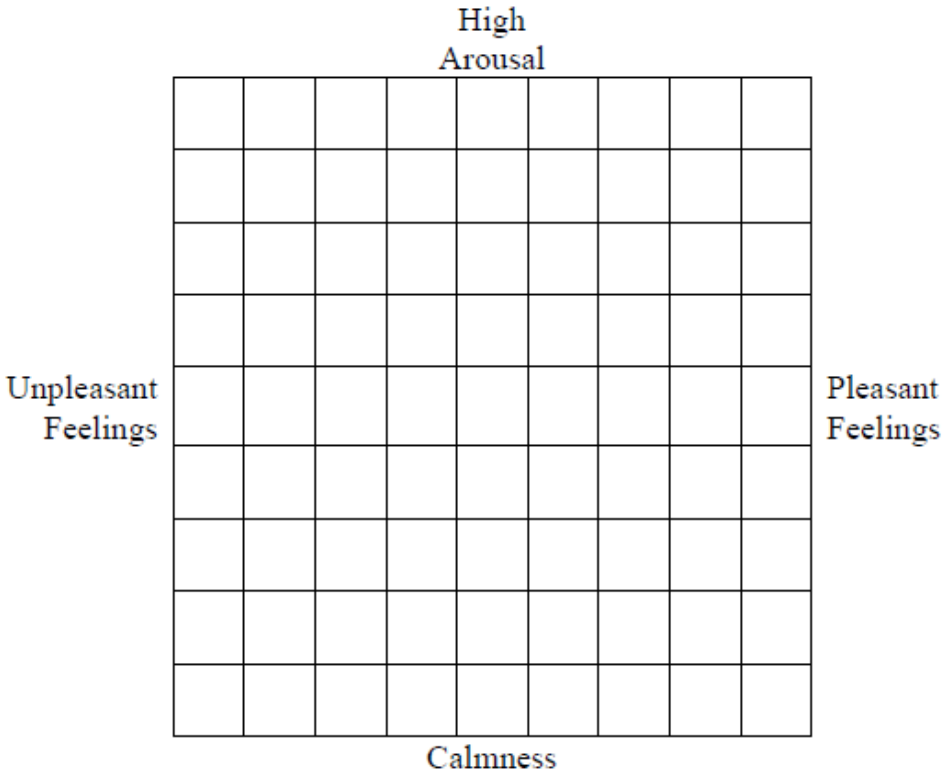
How hungry are you right now? Place a vertical mark on the line below to indicate how hungry you are right now.

I am not hungry at all	_____	I have never been more hungry

Affect Grid (AG)

Use the grid below to describe how you currently feel. The right half of the grid represents pleasant feelings. The farther to the right the more pleasant. The left half represents unpleasant feelings. The farther to the left the more unpleasant. The vertical dimension of the map represents degree of arousal. Arousal has to do with how awake, alert, or activated a person feels---independent of whether the feeling is positive or negative. The top represents a state of extremely high arousal, and the bottom represents a state of extreme calmness.

Write an "X" inside the box that corresponds to how you currently feel.



Three Factor Eating Questionnaire – Restraint Scale (TFEQ-R)

1. When I have eaten my quota of calories, I am usually good about not eating any more.

   False True

2. I deliberately take small helpings as a means of controlling my weight.

   False True

3. Life is too short to worry about dieting.

   False True

4. I have a pretty good idea of the number of calories in common food.

   False True

5. While on a diet, if I eat food that is not allowed, I consciously eat less for a period of time to make up for it.

   False True

6. I enjoy eating too much to spoil it by counting calories or watching my weight.

   False True

7. I often stop eating when I am not really full as a conscious means of limiting the amount that I eat.

False True

8. I consciously hold back at meals in order not to gain weight.

False True

9. I eat anything I want, any time I want.

False True

10. I count calories as a conscious means of controlling my weight.

False True

11. I do not eat some foods because they make me fat.

False True

12. I pay a great deal of attention to changes in my figure.

False True

13. How often are you dieting in a conscious effort to control your weight?

Rarely Sometimes Usually Always

14. Would a weight fluctuation of 5lbs affect the way you live your life?

Not at all Slightly Moderately Very Much

15. Do your feelings of guilt about overeating help you to control your food intake?

Never Rarely Often Always

16. How conscious are you of what you are eating?

Not at all Slightly Moderately Extremely

17. How frequently do you avoid 'stocking up' on tempting foods?

Almost Never Seldom Usually Almost Always

18. How likely are you to shop for low calorie foods?

Unlikely Slightly Unlikely Moderately Likely Very Likely

19. How likely are you to consciously eat slowly in order to cut down on how much you eat?

Unlikely Slightly Unlikely Moderately Likely Very Likely

20. How likely are you to eat less than you want?

Unlikely Slightly Unlikely Moderately Likely Very Likely

21. On a scale of 0 to 5 where 0 means no restraint in eating (eating whatever you want, whenever you want it) and 5 means total restraint (constantly limiting food intake and never 'giving in'), what number would you give yourself?

0. eat whatever you want, whenever you want it

1. usually eat whatever you want, whenever you want it
2. often eat whatever you want, whenever you want it
3. often limit food intake, but often 'give in'
4. usually limit food intake, rarely 'give in'
5. constantly limit food intake, never 'give in'

Binge Eating Scale (BES)

Instructions. Below are groups of numbered statements. Read all of the statements in each group and indicate which one best describes the way you feel about the problems you have controlling your eating behavior.

#1

a. I don't feel self-conscious about my weight or body size when I'm with others.

b. I feel concerned about how I look to others, but it normally does not make me feel disappointed with myself.

c. I do get self-conscious about my appearance and weight which makes me feel disappointed in myself.

d. I feel very self-conscious about my weight and frequently, I feel intense shame and disgust for myself. I try to avoid social contacts because of my self-consciousness.

#2

a. I don't have any difficulty eating slowly in the proper manner.

b. Although I seem to "gobble down" foods, I don't end up feeling stuffed because of eating too much.

c. At times, I tend to eat quickly and then, I feel uncomfortably full afterwards.

d. I have the habit of bolting down my food, without really chewing it. When this happens I usually feel uncomfortably stuffed because I've eaten too much.

#3

a. I feel capable to control my eating urges when I want to.

b. I feel like I have failed to control my eating more than the average person.

c. I feel utterly helpless when it comes to feeling in control of my eating urges.

d. Because I feel so helpless about controlling my eating I have become very desperate about trying to get in control.

#4

a. I don't have the habit of eating when I'm bored.

b. I sometimes eat when I'm bored, but often I'm able to "get busy" and get my mind off food.

c. I have a regular habit of eating when I'm bored, but occasionally, I can use some other activity to get my mind off eating.

d. I have a strong habit of eating when I'm bored. Nothing seems to help me break the habit.

#5

a. I'm usually physically hungry when I eat something.

b. Occasionally, I eat something on impulse even though I really am not hungry.

c. I have the regular habit of eating foods that I might not really enjoy, to satisfy a hungry feeling even though physically, I don't need the food.

d. Even though I'm not physically hungry, 1 get a hungry feeling in my mouth that only seems to be satisfied when I eat a food, like a sandwich, that fills my mouth. Sometimes,

when I eat the food to satisfy my mouth hunger, I then spit the food out so I won't gain weight.

#6

a. I don't feel any guilt or self-hate after I overeat.

b. After I overeat, occasionally I feel guilt or self-hate.

c. Almost all the time I experience strong guilt or self-hate after I overeat.

#7

a. I don't lose total control of my eating when dieting even after periods when I overeat.

b. Sometimes when I eat a "forbidden food" on a diet, I feel like I "blew it" and eat even more.

c. Frequently, I have the habit of saying to myself, "I've blown it now, why not go all the way" when I overeat on a diet. When that happens I eat even more.

d. I have a regular habit of starting strict diets for myself, but I break the diets by going on an eating binge. My life seems to be either a "feast" or "famine."

#8

a. I rarely eat so much food that I feel uncomfortably stuffed afterwards.

b. Usually about once a month, I eat such a quantity of food, I end up feeling very stuffed.

c. I have regular periods during the month when I eat large amounts of food, either at mealtime or at snacks.

d. I eat so much food that I regularly feel quite uncomfortable after eating and sometimes a bit nauseous.

#9

a. My level of calorie intake does not go up very high or go down very low on a regular basis.

b. Sometimes after I overeat, I will try to reduce my caloric intake to almost nothing to compensate for the excess calories I've eaten.

c. I have a regular habit of overeating during the night. It seems that my routine is not to be hungry in the morning but overeat in the evening.

d. In my adult years, I have had week-long periods where I practically starve myself. This follows periods when I overeat. It seems I live a life of either "feast or famine."

#10

a. I usually am able to stop eating when I want to. I know when enough is enough."

b. Every so often, I experience a compulsion to eat which I can't seem to control.

c. Frequently, I experience strong urges to eat which I seem unable to control, but at other times I can control my eating urges.

d. I feel incapable of controlling urges to eat. I have a fear of not being able to stop eating voluntarily.

#11

a. I don't have any problem stopping eating when I feel full.

b. I usually can stop eating when I feel full but occasionally overeat leaving me feeling uncomfortably stuffed.

c. I have a problem stopping eating once I start and usually I feel uncomfortable stuffed after I eat a meal.

d. Because I have a problem not being able to stop eating when I want, I sometimes have to induce vomiting to relieve my stuffed feeling.

#12

a. I seem to eat just as much when I'm with others (family, social gatherings) as when I'm by myself.

b. Sometimes, when I'm with other persons, I don't eat as much as I want to eat because I'm self-conscious about my eating.

c. Frequently, I eat only a small amount of food when others are present, because I'm very embarrassed about my eating.

d. I feel so ashamed about overeating that I pick times to overeat when I know no one will see me. I feel like a "closet eater."

#13

a. I eat three meals a day with only an occasional between meal snack.

b. I eat 3 meals a day, but I also normally snack between meals.

c. When I am snacking heavily, I get in the habit of skipping regular meals.

d. There are regular periods when I seem to be continually eating, with no planned meals.

#14

a. I don’t think much about trying to control unwanted eating urges.

b. At least some of the time, I feel my thoughts are pre-occupied with trying to control my eating urges.

c. I feel that frequently I spend much time thinking about how much I ate or about trying not to eat anymore.

d. It seems to me that most of my waking hours are pre-occupied by thoughts about eating or not eating. I feel like I’m constantly struggling not to eat.

#15

a. I don’t think about food a great deal.

b. I have strong cravings for food but they last only for brief periods of time.

c. I have days when I can’t seem to think about anything else but food.

d. Most of my days seem to be pre-occupied with thoughts about food. I feel like I live to eat.

#16

a. I usually know whether or not I’m physically hungry. I take the right portion of food to satisfy me.

b. Occasionally, I feel uncertain about knowing whether or not I’m physically hungry. At these times it’s hard to know how much food I should take to satisfy me.

c. Even though I might know how many calories I should eat, I don’t have any idea what is a “normal” amount of food for me.

Beck Depression Inventory – II (BDI-II)

Instructions: This questionnaire consists of 20 groups of statements. Please read each group of statements carefully, and then pick out the **one statement** in each group that best describes the way you have been feeling during the **past two weeks, including today.** Place an X beside the statement you have picked. If several statements in the group seem to apply equally well, bubble in the highest number for that group. Be sure that you do not choose more than one statement for any group, including Item 11 (Changes in Sleeping Pattern) or Item 17 (Changes in Appetite)

1. Sadness

_____I do not feel sad.

_____I feel sad much of the time.

_____I am sad all the time.

_____I am so sad or unhappy that I can't stand it.

2. Pessimism

_____I am not discouraged about my future.

_____I feel more discouraged about my future than I used to be.

_____I do not expect things to work out for me.

_____I feel my future is hopeless and will only get worse.

3. Past Failure

_____I do not feel like a failure.

_____I have failed more than I should have.

_____As I look back, I see a lot of failures.

_____I feel I am a total failure as a person.

4. Loss of Pleasure

_____I get as much pleasure as I ever did from the things I enjoy.

_____I don't enjoy things as much as I used to.

_____I get very little pleasure from the things I used to enjoy.

_____I can't get any pleasure from the things that I used to enjoy.

5. Guilty Feelings

_____I don't feel particularly guilty.

_____I feel guilty over many things I have done or should have done.

_____I feel quite guilty most of the time.

_____I feel guilty all of the time.

6. Agitation

_____I am no more restless or wound up than usual.

_____I feel more restless or wound up than usual.

_____I am so restless or agitated that it's hard to stay still.

_____I am so restless or agitated that I have to keep moving or doing something.

7. Punishment Feelings

_____I don’t feel I am being punished.

_____I feel I may be punished.

_____I expect to be punished.

_____ I feel I am being punished.

8. Self-Dislike

_____I feel the same about myself as ever.

_____I have lost confidence in myself.

_____I am disappointed with myself.

_____I dislike myself.

9. Suicidal Thoughts or Wishes

_____ I don’t have any thoughts of killing myself.

_____I have thoughts of killing myself, but I would not carry them out.

_____I would like to kill myself.

_____ I would kill myself if I had the chance.

10. Self-Criticalness

_____I don’t criticize or blame myself more than usual.

_____I am more critical of myself than I used to be.

_____ I criticize myself for all of my faults.

_____ I blame myself for everything bad that happens.

11. Crying

_____I don't cry any more than I used to.

_____I cry more than I used to.

_____I cry over every little thing.

_____I feel like crying, but I can't.

12. Changes in Sleeping Pattern

_____I have not experienced any change in my sleeping pattern.

_____I either a) sleep somewhat more than usual or b) sleep somewhat less than usual.

_____ I either a) sleep a lot more than usual or b) sleep a lot less than usual.

_____ I either a) sleep most of the day or b) wake up 1-2 hours early and can't get back to sleep.

13. Loss of Interest

_____I have not lost interest in other people or activities.

_____I am less interested in other people or things than before.

_____I have lost most of my interest in other people or things.

_____It's hard to get interested in anything.

14. Indecisiveness

_____I make decisions about as well as ever.

_____I find it more difficult to make decisions than usual.

_____I have much greater difficulty in making decisions than I used to.

_____I have trouble making decisions.

15. Worthlessness

_____I do not feel I am worthless.

_____I don't consider myself as worthwhile and useful as I used to.

_____I feel more worthless as compared with other people.

_____I feel utterly worthless.

16. Loss of Energy

_____ I have as much energy as ever.

_____ I have less energy than I used to have.

_____ I don't have enough energy to do very much.

_____ I don't have enough energy to do anything.

17. Irritability

_____ I am no more irritable than usual.

_____ I am more irritable than usual.

_____ I am much more irritable than usual.

_____ I am irritable all the time.

18. Changes in Appetite

_____I have not experienced any change in my appetite.

_____My appetite is a) somewhat less than usual or b) somewhat greater than usual.

_____ My appetite is a) much less than usual or b) much greater than usual.

_____ I have no appetite at all or I crave food all the time.

19. Concentration Difficulty

_____I can concentrate as well as ever.

_____I can't concentrate as well as usual.

_____It's hard to keep my mind on anything for very long.

_____I find I can't concentrate on anything.

20. Tiredness or Fatigue

_____ I am no more tired or fatigued than usual.

_____ I get tired or fatigued more easily than usual.

_____ I am too tired or fatigued to do a lot of the things I used to do.

_____ I am too tired of fatigued to do most of the things I used to do.

21. Loss of Interest in Sex

_____ I have not noticed any recent change in my interest in sex.

_____I am less interested in sex than I used to be.

_____I am much less interested in sex now.

_____ I have lost interest in sex completely.

Personal Information Questionnaire (PIQ)

SECTION A: Identifying Information

_____ _____lbs. _____ft. _____inches

Age Weight Height

Highest year of school completed: (circle one)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 Masters Doctorate

High School College

Ethnicity (Circle all that apply.):

American-Indian Asian African-American Hispanic White Other:_____

How familiar are you with Japanese?

Not At All Familiar Somewhat Familiar Familiar Very Familiar

Do you know Japanese? YES NO

How familiar are you with Chinese?

Not At All Familiar Somewhat Familiar Familiar Very Familiar

Do you know Chinese? YES NO

How well did you understand the instructions of the computer tasks?

Did not Understand Somewhat Understood Mostly Understood Completely Understood

How hard did you try to follow the instructions of the computer tasks?

Did not Try Tried Some of the time Tried Most of the time Tried the whole time

SECTION B: Weight History

At what age were you first overweight by 10 pounds or more? _____yrs. old (Skip if not applicable to you)

What has been your highest weight after age 17? _____lbs. _____yrs old

How many times in an average year would you say you lose the number of pounds shown below?

5 pounds _____	20 pounds_____
10 pounds_____	30 pounds_____
15 pounds_____	40 pounds_____

Do you feel that you are "addicted" to food? Yes No

Do you have food allergies? Yes No If so, what are you allergic to?

_____

Are your currently dieting? Yes No

If so, what type of diet are you on (e.g., low carbohydrate, low fat, Weight Watchers, etc.)

Conceptual Check for Valence

Please rate whether the following experiences are pleasant or unpleasant.

1. Unhappy	Unpleasant	Pleasant
2. Pleased	Unpleasant	Pleasant
3. Sad	Unpleasant	Pleasant
4. Happy	Unpleasant	Pleasant
5. Hopeful	Unpleasant	Pleasant
6. Unsatisfied	Unpleasant	Pleasant
7. Bored[2]	Unpleasant	Pleasant
8. Content	Unpleasant	Pleasant
9. Satisfied	Unpleasant	Pleasant
10. Annoyed	Unpleasant	Pleasant

[2] Note: Bored was erroneously included in the conceptual check for the valence dimension, although it served as an instructional anchor for the arousal dimension. Thus, this item was not considered when calculating subjects' accuracy on the conceptual check.

Conceptual Check for Arousal

Please rate whether the following experiences are activating or unactivating.

1. Stimulated	Unactivating	Activating
2. Frenzied	Unactivating	Activating
3. Sleepy	Unactivating	Activating
4. Jittery	Unactivating	Activating
5. Excited	Unactivating	Activating
6. Calm	Unactivating	Activating
7. Relaxed	Unactivating	Activating
8. Dull	Unactivating	Activating
9. Wide-awake	Unactivating	Activating
10. Sluggish	Unactivating	Activating

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