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Distinctions Between Two Expectancies in the Prediction of Maladaptive Eating Behavior

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Abstract

In this longitudinal study, the authors provide support for the validity of the claim that differences in the nature of the reinforcement that adolescent girls expect from eating contribute to the development of different forms of maladaptive eating. The learned expectancy that eating is pleasurable and rewarding predicted higher levels of social/celebratory overeating across the first year of middle school but did not predict higher levels of clinical binge eating. In contrast, the expectancy that eating helps one manage negative affect predicted higher levels of binge eating but not of social/celebratory overeating across the same time period ($n = 394$). The results also supported a reciprocal model in which binge eating predicted higher levels of the expectancy that eating will manage negative affect but not that eating is pleasurable and rewarding; conversely, social/celebratory overeating predicted higher levels of the expectancy that eating is pleasurable and rewarding but not that eating will manage negative affect.

Introduction

Women expect food consumption to provide a variety of different forms of reinforcement (Hohlstein, Smith, & Atlas, 1998). We offer a distinction between two domains of expected reinforcement from eating and their different roles with respect to eating disorder risk. One domain involves the expectation that eating alleviates distress, and the other involves the expectation that eating is pleasurable and rewarding. We will demonstrate that the two expectancy domains differentially predict two different forms of maladaptive eating behavior one year later among early adolescents, and also that two different forms of maladaptive eating behavior differentially predict each of the two expectancy domains. These findings support the distinction between the two expectancy domains and the domains' different roles in the risk process.

We first review the current state of eating expectancy measurement and the theoretical distinction we make between two different types of expectancy. We then test our proposed distinction longitudinally.

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Expectancies for Reinforcement from Eating

The basic science literature has identified expectancies as learned anticipations of the likely consequences of behavioral choices (Tolman, 1932; Bolles, 1972; MacCorquodale and Meehl, 1953; Rotter, 1954). Expectancies are understood to represent summaries of individuals' learning histories; they are formed based on the direct and vicarious learning experiences that individuals undergo. The expectancies one forms then influence one's future behavioral choices: one tends to choose behaviors from which one expects rewards and avoid behaviors for which one expects punishment. Application of this perspective has led to useful examinations of many psychological phenomena, including psychopathology (Alloy & Tabachnick, 1984), gambling behavior (Walters & Contri, 1998), risk for alcohol abuse (Smith, Goldman, Greenbaum, & Christiansen, 1995), and risk for smoking (Brandon & Baker, 1991).

Expectancy theory also has been applied to eating disorders: individuals form different eating expectancies, in part, because they are exposed to different learning experiences concerning eating. Eating disorder symptoms can be understood as extreme eating and dieting behavior, which is thought to stem from extreme or unusual learning histories (Fischer, Smith, & Cyders, 2006; Hohlstein et al., 1998; Simmons, Smith, & Hill, 2002; Smith, Simmons, Flory, Annus, & Hill, 2007). Eating expectancies, as summaries of individuals' learning histories regarding reinforcement from eating, are thought to play a causal role in disordered eating behavior (Combs, Pearson, & Smith, in press-a; Combs, Smith, Flory, Simmons, & Hill, in press-b; Hohlstein et al., 1998; Pearson, Combs, & Smith, in press; Smith et al., 2007).

The Eating Expectancy Inventory (EEI) has been widely used to measure learned consequences from eating (Hohlstein et al., 1998). An important distinction has been made between two subscales of the inventory. One subscale, Eating is Pleasurable and Rewarding, reflects the expectancy that eating provides the positive reinforcement of fun and pleasure. Indeed, the body does respond with pleasure to eating through dopaminergic release (Small et al., 2003). It may be that individual differences on this scale reflect individual differences in what is essentially an adaptive response to food: survival is facilitated because eating is pleasurable. Endorsement of this expectancy has not been thought to increase risk for maladaptive eating behavior, such as clinical binge eating, and it does not differentiate women with bulimia nervosa from psychiatric or normal controls (Hohlstein et al., 1998).

The other scale, Eating Helps One Manage Negative Affect, reflects the expectancy that eating provides the negative reinforcement of relief from subjective distress. This expectancy may assign a role to eating that is less adaptive. A strong endorsement of this expectancy has been hypothesized to increase risk for binge eating behavior (Combs & Smith, 2009; Fischer, Smith, & Cyders, 2006; Hayaki, 2009; Hohlstein et al., 1998). Consistent with the expectancy hypothesis, the expectancy that eating helps manage negative affect predicted subsequent increases in binge eating behavior in middle school girls (Combs et al., in press-b; Smith et al., 2007) and distinguished women with a diagnosis of bulimia nervosa from other women (Hohlstein et al., 1998).

Although this theoretical distinction exists between the two eating expectancies, and although measures of the two expectancies have different cross-sectional associations with bulimia nervosa diagnosis consistent with theory, to date there have been no prospective studies investigating whether these two different forms of learning lead to different eating behaviors. To provide such a test, we used the first two waves of the longitudinal sample described by Smith et al. (2007); we thus measured 394 girls at the start of middle school and again one year later. We tested differential prospective prediction hypotheses, by contrasting two different eating outcomes: binge eating and social or celebratory overeating,

which we describe as a behavior that reflected the fun, pleasurable aspect of eating. Although such overeating can certainly be maladaptive, it likely reflects a form of excessive positive reinforcement that is unlikely (by itself) to be associated with clinical eating disorders.

We anticipated that the expectancy that eating helps one manage negative affect would be associated with higher levels of binge eating behavior but not higher levels of social/celebratory overeating, and that the expectancy that eating is pleasurable and rewarding would be associated with social/celebratory overeating but not binge eating.¹ Because expectancies are understood to be a summary of individuals' learning histories, we also anticipated reciprocal effects from behavior to expectancy. Binge eating may well reduce the immediate experience of negative affect, through distraction and other means (Fischer et al., 2006); accordingly, we anticipated that binge eating behavior would lead to stronger endorsement of the expectancy that eating helps one manage negative affect. Similarly, social/celebratory overeating is likely experienced as pleasurable, so we anticipated that this behavior would lead to stronger endorsement of the expectancy that eating is pleasurable and rewarding. We thus examined prospective prediction both from expectancies to subsequent behavior and from behavior to subsequent expectancies. Specifically, we hypothesized that each expectancy, measured at Time 1, would predict higher levels of its associated behavior at Time 2. We also tested whether each behavior at time 1 predicted higher levels of its associated expectancy at Time 2. These tests provide the first evaluation of the hypothesis that different forms of eating-related learning predict different forms of eating behavior, and that eating behavior shapes eating-related learning. Of course, prospective prediction is not demonstration of causality, for which experimental manipulation is required.

Method

Participants

The participants in this study were 394 middle school girls assessed in the fall of their first year of middle school (7th grade; Time 1), and again in the fall of their 8th grade year (Time 2). At Time 2, 343 participants remained in the study (87%). As described in Smith et al. (2007), missing data appear to have been missing at random, so we used the expectation maximization procedure to impute missing values (Enders, 2006); doing so enabled us to report results from the full $N = 394$ sample. The mean age of the participants at the initiation of the study was 12.8 years. Most were Caucasian (78.7%), followed by African American (10.5%); the remainder of the sample identified themselves as Asian (3.3%), Hispanic (2.9%), American Indian (1.7%), or Arab (1.7%). The socioeconomic makeup of the sample was diverse, with 26% of the reported family incomes less than \$25,000, 50% of the reported family incomes between \$25,000 and \$50,000, and the remaining 24% of reported family incomes more than \$50,000.

Measures

Demographic and Background Questionnaire—This measure provided the assessment of the demographic information reported above.

Eating Expectancy Inventory (EEI; Hohlstein et al., 1998)—This 34-item five-factor measure reflects expectancies for reinforcement from eating. For this study, we used

¹In a prior study with this longitudinal sample (Smith, Simmons, Flory, Annus, & Hill, 2007), we showed that the expectancy that eating helps manage negative affect differentiated among different trajectories of binge eating behavior, across a longer longitudinal time frame.

two expectancies: eating helps one manage negative affect (EEI 1; sample item: “Eating can help me bury my emotions when I don’t want to feel them.”) and eating is pleasurable and rewarding (EEI 2; sample item: “Eating is fun and enjoyable.”). The development sample found estimates of internal consistency to be $\alpha = .94$ for EEI 1 and $\alpha = .78$ for EEI 2. In the current sample, for EEI I, $\alpha = .95$; for EEI II, $\alpha = .81$. Women with bulimia nervosa score higher than other women on EEI 1, but not on EEI 2 (Hohlstein et al., 1998). In a prior study with this longitudinal sample, EEI 1 predicted membership in trajectory classes characterized by increased binge eating over time (Smith et al., 2007).

Assessment of Binge Eating: the Binge Eating Scale from the Bulimia Test-Revised (BULIT-R: Thelen, Farmer, Wonderlich, & Smith, 1991)—In two independent studies, the BULIT-R had sensitivity, specificity, and negative predictive values over .90, and positive predictive values over .70 with respect to DSM-IV criteria as diagnosed by interview (Thelen, Mintz, & Vander Wal, 1996; Welch, Thompson, & Hall, 1993). It has a four-factor structure, including binge eating and purging factors, among adolescents (Vincent, McCabe, & Ricciardelli, 1999). Smith et al. (2007) slightly modified the binge eating scale from this measure to create a ten item measure. An example item is “I would presently rate myself a compulsive eater (one who engages in episodes of uncontrolled eating)”; internal consistency for the scale was $\alpha = .88$ in this sample.

Assessment of Social/Celebratory Over-Eating—We used the following dichotomous behavioral index to assess this construct: *I usually eat too much at social occasions, like parties and picnics*. This behavioral index proved to be stable over time in a supplementary sample ($n = 28$): 2-4 week test-retest $r = .79$; and 10-12 week test-retest $r = .65$.

Procedure

Data Collection—Students were tested in the fall, annually, over a one to two day period either in their regular classrooms or in one central location.

Data Analytic Method—We tested a longitudinal model with two sets of predictions. The first set tested the hypothesis that EEI 1 predicted higher levels of binge eating behavior across the first year of middle school, but not social/celebratory overeating; and EEI 2 predicted higher levels of social/celebratory overeating, but not binge eating across the same period of time. The second set was that the behaviors of interest (binge eating and social/celebratory overeating) also predicted higher levels of the corresponding expectancies. We adopted a structural equation modeling approach (SEM) in order to test these relations. The model we tested included these measured variables at each of two waves: EEI 1, EEI 2, binge eating, and social/celebratory overeating. We also modeled auto-correlations between variables across time, to show the stability of each particular concept and to enable prediction of change over time.

We measured the fit of the model by assessing four conventional indices: Confirmatory Fit Index (CFI), Non-Normed Fit Index (NNFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). CFI and NNFI are representations of the amount that the structural model improves over a null model in which no variables intercorrelate. Guidelines for interpretation of these indices vary: values of .90 or .95 are thought to represent very good fit between the model and the data (Hu & Bentler, 1999; Kline, 2005). The SRMR represents the deviation between actual covariances and the covariances implied by the model, averaged across all relationships. RMSEA is similar but adjusts for the complexity of the model and provides more favorable results for smaller models. RMSEA indices of .06 or smaller are thought to indicate a close fit, .08 a fair fit,

and .10 a marginal fit (Browne & Cudeck, 1993; Hu and Bentler, 1999). SRMR indices of .09 or smaller typically indicate a good fit (Hu & Bentler, 1999). Models that fit well on most indices are generally considered well-fitting models. The chi-square statistic provides an overly sensitive index and so was not used. However, we used it to interpret the difference in fit between models: by subtracting chi-square values and the corresponding degrees of freedom, one obtains a chi-square test for the significance of the difference between two models.

Results

Participant Attrition Analysis and Treatment of Missing Data

Smith et al. (2007) described attrition analyses for this sample. Briefly, they noted that retention rates were high, given the rate at which students moved out of the school system. The completers and non-completers did not differ on binge eating, purging, or any expectancy score. We therefore proceeded on the assumption that scores were missing at random and used expectation maximization to impute missing data (Enders, 2006). Descriptive statistics for study variables can be found in Table 1. There were no significant mean levels of change across the one year period.

Eating Expectancy 1, Eating Expectancy 2, Binge Eating, and Social/Celebratory Overeating

To test our hypotheses, we compared two alternative structural models of the relationships between the expectancies and the behaviors across the two time points. We first tested a model (referred to in Table 2 as Model A) that included autoregressive paths (each variable measured at time 1 predicted itself at Time 2) and specified prospective relationships between both expectancies at Time 1 and both behaviors at Time 2. The variables were also allowed to correlate with each other cross-sectionally at Times 1 and 2. Both expectancies and both behaviors were reasonably stable across the first year of middle school, with autoregressive correlations ranging from .29 to .47, $p < .001$ in each case. As indicated in Table 2, this model fit marginally well; two of the four fit index values were consistent with good fit. There were two significant pathways from Time 1 expectancies to Time 2 behavior, and they were the paths predicted by our theory: the manage negative affect expectancy predicted higher levels of binge eating, and the pleasure and rewarding expectancy predicted higher levels of social/celebratory overeating. Also consistent with our theory, the expectancy that eating helps manage negative affect did not predict higher levels of social/celebratory overeating over the first year of middle school, and the expectancy that eating is pleasurable and rewarding did not predict higher levels of binge eating during that year.

We next tested a second model (Model B) in which we removed the nonsignificant pathways from Model A and, most importantly, added in two prospective pathways from Time 1 behavior to Time 2 expectancy: from binge eating at Time 1 to the expectancy that eating helps manage negative affect at Time 2, and from social/celebratory overeating at Time 1 to the expectancy that eating is pleasurable and rewarding at Time 2. Model B is depicted in Figure 1. For simplicity of presentation, we did not include the cross-sectional correlations in the figure; they are presented in Table 3.

Model B fit significantly better than Model A, and all four fit index values reflected very good fit between the model and the data (see Table 2). As indicated in Figure 1, there was reciprocal prediction between expectancies and behavior that was consistent with our theory. Not only did Time 1 expectancies that eating helps manage negative affect predict subsequent higher levels of binge eating, but Time 1 binge eating also predicted subsequent

higher levels of the expectancy. And not only did Time 1 expectancies that eating is pleasurable and rewarding predict subsequent social/celebratory overeating, but Time 1 social/celebratory overeating also predicted subsequent higher levels of that expectancy.

Discussion

This study provides the first longitudinal confirmation of the hypothesized distinction between two different forms of learned expectancies for reinforcement from eating. Among middle school girls, the expectancy that eating provides the negative reinforcement of relief from distress predicted higher levels of binge eating behavior over the following year but did not predict higher levels of a different, less maladaptive form of overeating: eating too much in social or celebratory contexts. In contrast, the expectancy that eating provides the positive reinforcement of fun and pleasure did predict subsequent higher levels of social or celebratory overeating, but it did not predict higher levels of binge eating. In both cases the reverse was true as well; each behavior predicted subsequent higher levels of its associated expectancy. These differential predictions support the theoretical distinction between the two expectancy constructs with respect to their role in the risk process.

The expectancy that eating is fun and pleasurable is consistent with its role in survival. In a cultural context in which food is abundant, eating's naturally reinforcing quality can sometimes lead to over-consumption, and this can occur during social, celebratory experiences. Binge eating behavior involves the maladaptive, rapid consumption of unnecessary calories and a lack of control over one's consumption. This maladaptive behavior was not predicted by, and hence is not caused by, the expectancy that eating is pleasurable. Social or celebratory overeating is relatively common (over 50% of middle school girls reported doing so); it appears, by itself, to have little association to binge eating behavior.

In contrast, expecting eating to help manage negative affect requires food consumption to meet a psychological need, not a nutritional need. This expectancy, that eating helps manage negative affect, predicted higher levels of binge eating across the first year of middle school. Researchers have proposed that this expectancy leads to higher levels of binge eating risk for two primary reasons. First, excessive consumption provides a distraction from one's distress. Attention is focused on the binge, rather than on other things (Heatherton & Baumeister, 1991). Second, some individuals are more disposed to act in excessive, impulsive ways when distressed. Binge eating is thus viewed as an impulsive action that (a) initially provides positive reinforcement due to food consumption and (b) provides the negative reinforcement of distraction, and so is reinforced (Fischer et al., 2006; Fischer, Smith, & Cyders, 2008). Consistent with this model, there is considerable evidence that binge eating occurs at times of high negative affect and leads to reduction in the negative affect (Smyth et al., 2007). To expect eating to serve a function it does not inherently serve appears to reflect learning that is associated with risk for eating disorders.

In addition, behavior at the start of middle school predicted subsequent changes in eating expectancies. This finding is important for several reasons. First, it suggests that early adolescence may prove to be a fruitful time for preventive interventions designed to alter expectancies. Second, if it is true that binge eating leads to stronger endorsement of the high-risk expectancy that eating helps manage distress, as suggested by the prospective data, then early onset binge eating is likely to increase risk further, through its influence on learning. It may therefore be particularly important to intervene with early-onset binge eating. Third and not surprisingly, overeating in social, celebratory contexts may lead to yet stronger endorsement of the expectancy that eating provides pleasure and reward.

The findings of this study provide important support for the theoretical distinction between two kinds of expected reinforcement from eating and their different roles in the eating disorder risk process. One form of expectancy, that eating is pleasurable and rewarding, appears to reflect learning that is consistent with eating's adaptive role, that eating is essential to survival. The other form of expectancy, that eating helps manage negative affect, assigns to eating the psychological function of mood management.

That the two expectancies predict the development of different behaviors in early adolescence suggests that researchers and clinicians can confidently take advantage of the distinction between the two constructs. Of course, these positive findings must be understood within the context of the limitations of the study. First, we did not assess binge eating behavior with clinical interviews. Although doing so would have proven difficult with such a large sample, and although there is considerable evidence for the validity of the measures we used, semi-structured interviews might well have increased the accuracy of the clinical assessment. Second, we used a single behavioral index to measure social/celebratory overeating. The use of very brief measures is often necessary in longitudinal research that includes measures of many constructs, and often such measures have been shown to have solid reliability and validity, to go with their efficiency (Burish, 1997; Gosling, Rentfrow, & Swann, 2003; Robins, Hendin, & Trzesniewski, 2001; Smith, Combs, & Pearson, in press). The behavioral index we used was reliable; nevertheless, it is possible that we have slightly underestimated the magnitude of effects involving that form of overeating. Third, we were unable to test whether the effects we observed varied as a function of ethnicity. Future research with a larger sample of women from minority groups is essential.

Despite these limitations, this study provides the first support for the distinction between these two different forms of learning about eating across time and thus about the nature of the risk process in early adolescence. Researchers and clinicians can use the EEI to assess these different forms of learning, with their different clinical implications.

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Figure 1. Model B: Binge Eating, Social/ Celebratory Overeating, EE1, EE2

Figure 1 depicts Model B and the tested relationships between binge eating, social/celebratory overeating, eating expectancy 1 (EE1; the expectation that eating will help manage negative affect) and eating expectancy 2 (EE2; the expectation that eating is pleasurable and rewarding) at Years 1 (7th grade) and 2 (8th grade). The arrows represent the significant tested pathways; the corresponding numbers refer to the maximum likelihood coefficient for each respective relationship. This model fit the data well: CFI = .98, NNFI = .96, RMSEA = .06 (.02-.09), SRMR = .03. ** $p < 0.01$.

Table 1

Descriptive statistics for variables of interest across time.

	Year 1			Year 2		
	M	SD	Range	M	SD	Range
Eating Expectancies 1	2.06	1.10	1.00 – 5.56	2.14	1.18	1.00 – 7.00
Eating Expectancies 2	2.90	1.53	1.00 – 7.00	2.96	1.36	1.00 – 7.00
Binge Eating	15.12	6.68	8.56 – 41.00	13.79	5.28	9.00 – 36.00
Celebratory Overeating	Year 1 (percent endorsed)			Year 2 (percent endorsed)		
	51.9%			55.4%		

Table 2

Models with Structural Equation Modeling fit indices.

	DF	Chi Square	Chi Square Change	CFI	NNFI	RMSEA (95% CI)	SRMR
Model A	8	53.15*	---	.93	.80	.12 (.09-.15)	.06
Model B	8	17.83	35.34*	.98	.96	.06 (.02-.09)	.03

NOTE: CFI = comparative fit index; NNFI = non-normed fit index; RMSEA = the root mean square of approximation; CI = confidence interval; SRMR = the standardized root mean square residual;
* Significant at p<.001

Table 3

Intercorrelations for Year 1 and Year 2

	Year 1 Binge	Year 1 SOE	Year 1 EEI 1	Year 1 EEI 2
Year 1 Binge	--	--	--	--
Year 1 SOE	.19*	--	--	--
Year 1 EEI 1	.52*	.23*	--	--
Year 1 EEI 2	.33*	.16*	.58*	--
	Year 2 Binge	Year 2 SOE	Year 2 EEI 1	Year 2 EEI 2
Year 2 Binge	--	--	--	--
Year 2 SOE	.17*	--	--	--
Year 2 EEI 1	.46*	.21*	--	--
Year 2 EEI 2	.16*	.18*	.52*	--

NOTE: SOE = Social/Celebratory Overeating; EEI 1 = Eating Expectancy Inventory Scale 1 (Eating Helps to Manage Negative Affect); EEI 2 = Eating Expectancy Inventory Scale 2 (Eating is Pleasurable and Rewarding);

* Significant at $p < .001$