

Food for thought: Cognitive regulation of food intake

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Objectives. Two studies examined the cognitive regulation of restrained eaters' eating behaviour. It was hypothesized that restrained dieters should have more restraint-related cognitions in the presence of food stimuli than unrestrained eaters, whereas restrained non-dieters should occupy an intermediate position. The correlation between cognition and consumption should be zero for unrestrained eaters and negative for restrained eaters.

Design. Participants currently dieting or not dieting and of high or low restraint status (median split) were presented in Study 1 with high and low calorie food words and asked to list their thoughts. In Study 2, participants listed thoughts following a taste test. In both studies diet and restraint status were related to restraint relevant thoughts. In Study 2 thoughts were also related to actual consumption.

Methods. Participants were female students; restraint status was measured with the Restraint Scale; current diet status was assessed with one question. Fifty-two unrestrained eaters, 38 restrained non-dieters and 18 restrained dieters participated in Study 1; 33 unrestrained eaters, 19 restrained non-dieters and 11 restrained dieters participated in Study 2.

Results. Food stimuli elicited more eating control, weight- and shape-related thoughts in restrained dieters than in unrestrained eaters, with the restrained non-dieters occupying an intermediate position. Consistent with predictions, the cognition–consumption correlation was zero for unrestrained eaters and negative (trend) for restrained dieters. Contrary to prediction, this correlation was positive for restrained non-dieters.

Conclusions. Results show that cognitions play an important role in the regulation of the eating behaviour of restrained individuals. They further suggest that the cognitive regulation of food intake in restrained eaters may be based on different mechanisms in dieters as compared to non-dieters.

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One of the major postulates of the boundary model for the regulation of eating states that as soon as restrained eaters transgress their self-installed cognitive diet boundary, disinhibitive cognitions will lead to overeating (Herman & Polivy, 1984). A typical example of a disinhibitive cognition is the thought 'I've blown my diet, now I might as well continue to eat' (the 'what-the-hell effect', Herman & Polivy, 1984, pp. 150–151). Indeed, restrained eaters were found to eat more than unrestrained eaters after they had consumed a high caloric preload of food which supposedly had induced them to transgress their diet boundary (for an overview see Ruderman, 1986).

Underlying this postulate seems to be the more general assumption that restrained eaters regulate their eating behaviour cognitively, regardless of whether or not they transgress their diet boundary. Empirical support for the latter assumption is provided by various studies which indicate that restrained eaters can be induced to overeat by factors other than the *actual* transgression of their diet boundary, e.g. the *perception* of having eaten a high caloric preload regardless of the actual caloric content of the preload (e.g. Spencer & Fremouw, 1979; Woody, Constanzo, Liefer & Conger, 1981), the anticipation of high caloric food (Knight & Boland, 1989; Ruderman, Belzer & Halperin, 1985; Tomarken & Kirschenbaum, 1984) or the experience of negative emotions (e.g. Baucom & Aiken, 1981; Cools, Schotte & McNally, 1992; Frost, Goolkasian, Ely & Blanchard, 1982; Heatherton, Polivy, Herman & Baumeister, 1993; Polivy, Herman & McFarlane, 1994; Schotte, Cools & McNally, 1990; Wardle & Beales, 1988).

Clinical findings support the assumption that thoughts or cognitions play an important role in the eating behaviour of eating disordered patients. Individuals with eating disorders are known to be mentally focused on food, weight and shape (Herman & Polivy, 1993). Bonifazi & Crowther, 1996; Zotter & Crowther 1991) reported empirical evidence demonstrating that bulimics had relatively more eating- and weight-related thoughts than non-eating-disordered controls. Cooper & Fairburn (1992) reported compared findings. They had participants think aloud while looking at themselves in a full-length mirror, weighing themselves, and eating a chocolate-covered mint. Patients with eating disorders were found to have more negative thoughts related to eating, weight and shape than non-dieting controls, while dieting groups appeared to occupy an intermediate position.

Much less is known, however, about the precise role that cognitions play in influencing the eating behaviour of restrained eaters. Several studies used indirect measures of cognitions (e.g. King, Polivy & Herman, 1991; Ogden & Greville, 1993; Ogden & Wardle, 1991; Stotland, Zuroff & Roy, 1991). Ogden & Wardle (1991) and Ogden & Greville (1993) measured cognitive states that represented thoughts related to surrendering to drives or reacting against self-constraints. They reported that restrained eaters scored higher on ratings of rebelliousness than unrestrained eaters. Stotland *et al.* (1991) reported that restrained eaters spent more time thinking about their diet while performing a taste test than unrestrained eaters, and King *et al.* (1991) found that restrained eaters displayed a significantly better recall for weight and food items than unrestrained eaters.

Recently, Bonifazi & Crowther (1996) used a newly constructed Bulimic Cognition Inventory as a way of measuring cognitions in real-life settings. Their bulimic, restrained and control participants had to respond to this measure repeatedly according to a time-sampling schedule. They found that restrained eaters reported significantly more

thoughts of weight and body image and low self-efficacy than the non-eating disordered control group, whereas they did not differ from the bulimic group. Bulimia and restrained groups also rated their food and eating thoughts as more intense than the control group.

To date, few studies have attempted to examine the exact content of restrained eaters' cognitions as compared to those of unrestrained eaters (Butow, Beumont & Touyz, 1993; French, 1992; Hickford, Ward & Bulik, 1997; Jansen, Merckelbach, Oosterlaan, Tuiten & Van den Hout, 1988) and only two of these have related these cognitions to actual eating behaviour, i.e. food intake in a taste test. Hickford *et al.* (1997) assessed cognitions under fasting and non-fasting conditions and reported no differences between restrained and unrestrained eaters. Likewise Butow *et al.* (1993), who measured dysfunctional cognitions, found no difference between restrained and unrestrained eaters. Jansen and colleagues, who made the first attempt to measure cognitions directly in a 'think aloud on tape' task, did not report differences between restrained and unrestrained eaters (Jansen *et al.*, 1988). French (1992) found that preloaded restrained eaters expressed more control-related thoughts regarding food than non-preloaded restrained eaters and unrestrained eaters. However, these thoughts did not mediate disinhibited eating.

The present study has therefore been designed to study eating-related cognitions of restrained and unrestrained eaters and to clarify the relationship between eating cognitions and food intake. We hypothesized that the thoughts of restrained eaters in reaction to the presentation of food stimuli would differ from those of unrestrained eaters. Restrained eaters were expected to express more food, weight-, shape- and eating-control-related cognitions than unrestrained eaters. We further assumed that the thoughts of restrained but not of unrestrained eaters play an important role in eliciting and controlling their eating behaviour. Or, as Herman & Polivy phrased it, '...cognitive pressures are demonstrably effective in influencing, if not absolutely controlling, eating' (1984, p. 144). Thoughts of the positive aspects of food ('eating this is good for my health') should be related to increased eating. Thoughts of the negative aspects of food ('this contains many calories'), or diet/eating-control-related thoughts ('I have to keep my diet') should be related to decreased eating.

Preliminary evidence for the latter hypothesis has been provided by Cooper, Clark & Fairburn (1993) who activated thoughts of eating, weight and shape in an experimental group, but not in a control group. Their experimental group reported more negative thoughts following the experimental manipulation and ate less in the taste test than the control group. Unfortunately, the authors give no information on the exact content of the thoughts of both groups, thus there was no direct evidence for our hypothesis that eating-control thoughts are related to decreased eating. Moreover, the study did not include groups of restrained and unrestrained eaters.

Our participants were also categorized according to whether or not they were presently dieting. The importance of assessing current diet status was suggested by the findings of Lowe and colleagues (Lowe, 1993, 1995; Lowe, Whitlow & Bellwoar, 1991) that counter-regulation after consuming a preload only appeared in restrained eaters not currently on a diet whereas restrained dieters ate most without a preload. These findings tend to suggest that different cognitive mechanisms may be at work for restrained dieters and restrained non-dieters. We therefore hypothesized that restrained dieters would be most likely to show the predicted negative correlation between the number of restraint-relevant

thoughts and the consumption of high caloric food. Current dieters try to restrict their food intake, and since their food intake is thought to be regulated cognitively, their thoughts are aimed at eating little. They will manage to do so as long as their diet boundary is not transgressed and no negative emotions are induced. For restrained eaters who are not currently dieting, a negative but less strong correlation between the number of restraint-thoughts and consumption is expected.

In order to test these hypotheses a method was used which induced restrained (dieting as well as non-dieting) and unrestrained eaters to report their thoughts. Correlational analyses between individual food intake and reported thoughts could then provide information about the relationship between amount of food intake and eating-control cognitions. It was decided to collect participants' thoughts by means of thought listings, based on the assumption that frequency of output reflects chronically accessible attitudes (see for example Bargh, Lombardi & Higgins, 1988; Higgins, King & Mavin, 1982). Chronically accessible constructs are assumed to develop from frequent and consistent direct experience with a specific domain of behaviour (Bargh *et al.*, 1988; Fazio, Chen, McDonel & Sherman, 1982). Restrained eaters who frequently and consistently try to control their food intake and their weight, may thus be expected to have highly accessible restraint- and weight-related constructs (e.g. 'I will gain weight if I eat this', 'This contains too many calories', 'I am allowed to eat this', etc.). In contrast, unrestrained eaters, who are not particularly interested in food- and weight-related matters, will not show highly accessible constructs for these factors.

Chronic accessibility of constructs or attitudes can be measured by confronting participants with attitude-relevant objects (Bargh *et al.*, 1988; Higgins *et al.*, 1982). Thoughts elicited by food stimuli should thus define which constructs are highly accessible in restrained eaters as compared to unrestrained eaters. The content of these thoughts should then (if eating is cognitively controlled) determine how much food they will consume.

The present article describes two experiments. The first study tested the hypothesis that restrained eaters—especially the current dieters—had more accessible restraint- and weight-related constructs than unrestrained eaters. In this study, thoughts were elicited by presenting participants with a series of food words. Relative frequency of output was considered to reflect the level of accessibility of constructs. The second experiment assessed thoughts elicited in an experimental eating situation. This situation also allowed us to assess the relationship between food-related thoughts and eating behaviour and to test the hypothesis that the content of restrained individuals' thoughts determines the amount they eat. In both studies participants were asked whether they were currently dieting.

STUDY 1 Method

Participants

Participants were 125 female psychology students who participated in workshops on eating behaviour. The study was conducted in group sessions. The questionnaires of 10 participants were used to train independent judges in rating the thoughts. The remaining 115 participants were categorized as restrained or unrestrained

eters according to the median split score (11)¹ on the Restraint Scale (RS). Participants scoring less than 11 were classified as unrestrained eaters. Scorers above 11 were classified as restrained eaters. Seven participants scored exactly 11; they were excluded from the analyses. Of our restrained eaters ($N = 56$), 18 were currently dieting, whereas 38 were not on a diet at that point in time. Table 1 shows the mean age, body mass index (BMI) and RS score of the restrained dieters, restrained non-dieters and unrestrained eaters.

Table 1. Participant characteristics: Study 1

	Unrestrained eaters ($N = 52$)	Restrained non-dieters ($N = 38$)	Restrained dieters ($N = 18$)		
	M (SD)	M (SD)	M (SD)	F	p
Age	21.4 (4.5)	21.1 (2.3)	20.9 (1.9)	0.1	n.s.
RS score	7.2 (2.0)	15.3 (3.1)	18.9 (4.2)	151.2	.000
BMI ^a	20.5 (1.8)	21.5 (2.1)	21.9 (2.2)	4.6	.013

^a BMI = body mass index = weight (kg)/height² (m).

Procedure

At the beginning of the session, participants were given a form containing six food words (french fries, cake, cucumber, chocolate, apple and cheese sandwich). After reading each food word, they were asked to list the first five thoughts that occurred to them. Participants subsequently completed the Restraint Scale (Polivy, Herman & Warsh, 1978) used to categorize them as restrained or unrestrained eaters and some additional questions (about age, gender, weight, height). Current diet status was assessed by the question 'Are you on a diet at this very moment?' Answer categories were 'no', 'a little', or 'yes'. Participants who answered a little or yes were considered to be current dieters. Participants were debriefed at the end of the session.

Materials

Thought listings. Thought listing was induced with the following instruction: 'Please write down, after every following word, the first five thoughts that come into your mind'. Each of the six food words was displayed on a separate page.

Restraint Scale. The RS (Herman, Polivy & Warsh, 1978) is a 10-item questionnaire, designed to measure the level of eating restraint. It contains questions on dieting, concerns about weight and eating and weight variation over different time periods. The RS is well validated (Ruderman & Besbeas, 1992) and widely used to identify restrained and unrestrained eaters, for whom behaviour was successfully predicted in a series of laboratory studies (for an overview, see e.g. Ruderman, 1986).

Results

Analysis of thoughts

Based on an overall inspection of the content of the thought listings, nine categories were generated in which each thought could be classified. To train two raters in classifying the thoughts, each blind to participants' RS scores, the thought listings of 10 participants were first coded and discussed. The inter-rater agreement (Cohen's kappa; Cohen, 1960)

¹ The median score for RS is lower in our studies than is usual in American research; however, this pattern is typical for the research conducted in The Netherlands (e.g. Jansen *et al.*, 1988).

was .95. The data of these 10 participants were excluded from further analyses. The same two raters then, independently, coded each thought of 50 participants. This resulted in a Cohen's kappa of .96, which indicated a satisfactory inter-rater agreement. The rest of the thought listings was rated by one of the two raters.

Table 2 shows the categories, examples and mean percentages of thoughts in each category for unrestrained eaters, restrained non-dieters and restrained dieters. The nine categories are incorporated into three general categories 'restraint-relevant', 'restraint-irrelevant' and 'consumer-descriptive'.

Table 2. Categories, examples and mean percentages of thoughts in each category for unrestrained eaters, restrained non-dieters and restrained dieters: Study 1

Categories	Examples of thoughts	Unrestr. (N = 52)	Restr. no diet (N = 38)	Restr. diet (N = 18)
Restraint relevant		8.4	9.6	16.4
Diet or weight	I will become fat if I eat this	1.9	2.1	4.0
Calories	This contains many calories	5.3	5.7	10.1
Restraint, no diet or weight mentioned	I shouldn't eat too much of this	1.2	1.7	2.2
Consumer descriptive		20.0	19.1	21.9
Liking of the food	I like french fries a lot	14.2	13.6	14.3
Not liking of the food	I hate cheese	1.7	1.7	1.4
Information about eating behaviour	I always eat chocolate when I drink coffee	4.1	3.9	6.2
Restraint irrelevant		71.6	71.3	61.8
Taste/appearance	An apple is round and sour	14.8	15.5	12.7
Health	Cucumbers are very healthy	11.5	9.4	10.6
Miscellaneous	I just passed my exam	45.3	46.5	38.5

Restrained dieters vs. restrained non-dieters vs. unrestrained eaters

Inspection of the thoughts of restrained dieters, restrained non-dieters and unrestrained eaters indicated that restrained dieters had most thoughts in the 'restraint-relevant' category while the unrestrained eaters had the smallest percentage of thoughts in this category. A one-way ANOVA revealed a main effect for restraint group ($F(2,105) = 9.6$, $p < .001$) and contrasts in a MANOVA showed that this difference was significant when restrained dieters were compared with either the unrestrained eaters ($F(1,105) = 18.8$, $p < .001$) or the restrained non-dieters ($F(1,105) = 12.5$, $p < .005$). The difference in restraint-relevant thoughts between unrestrained eaters and restrained non-dieters was not significant ($F(1,105) = 0.7$, n.s.). The main effect for restraint group on the percentage of thoughts in the general category 'restraint-relevant' was due to a main effect for restraint group in the subcategory 'calories' ($F(2,105) = 9.8$, $p < .001$), as well as to a main effect for restraint group in the subcategory 'diet or weight' ($F(2,105) = 3.1$, $p < .05$).

Since restrained individuals who were currently on a diet have somewhat higher restraint scores than the restrained eaters not on a diet (Table 1), it is unclear whether the

difference between these two groups should be attributed to differences in dieting status or in restraint scores. We therefore conducted a one-way ANCOVA on restraint group, using restraint score as a covariate. This ANCOVA revealed a main effect for restraint group ($F(2,104) = 4.0, p < .05$) even with differences in restraint score statistically controlled for, indicating that this effect was at least partly due to differential dieting status. This assumption was confirmed by the fact that the difference between restrained dieters and restrained non-dieters remained significant ($F(1,104) = 6.10, p < .02$), albeit with the F value halved from 12.5 to 6.10, when restraint score was used as a covariate in testing contrasts in a MANCOVA.

To be able to compare the thoughts elicited by fat food-words (french fries, cake and chocolate) vs. non-fat food-words (apple and cucumber) in one analysis, a 2 (fat/non-fat) \times 3 (restraint) MANOVA with repeated measures was conducted with the percentage of thoughts in the category 'calories' as the dependent variable. (The sixth word 'cheese sandwich' was not included in either the fat or non-fat food-words, since it can be defined as fat as well as non-fat.) The MANOVA revealed a main effect for restraint group ($F(2,105) = 11.1, p < .001$), as well as a main effect for fatness of the word ($F(1,105) = 139.3, p < .001$), the latter indicating that the fat words elicited more thoughts in this category than the non-fat words. There was no restraint \times word interaction effect ($F(2,105) = 1.4, n.s.$). The MANOVA with repeated measures was also conducted with the percentage of thoughts in the category 'diet or weight' as the dependent variable. Again the analysis revealed a main effect for restraint group ($F(2,105) = 3.1, p < .05$), a main effect for word ($F(1,105) = 11.3, p < .01$) and no interaction ($F(2,105) = 0.9, n.s.$). There were also no indications of interactions when these analyses were repeated on restrained individuals only, using 'fatness' and 'dietary status' as factors.

Discussion

As expected, restrained dieters expressed more eating-control, weight- and shape-related thoughts than unrestrained eaters, with the restrained non-dieters occupying an intermediate position. This pattern was particularly evident for the category 'calories'. Because the relative frequency of output is an accepted indicator of accessibility (e.g. Bargh *et al.*, 1988), it can be concluded from these findings that the constructs of restrained eaters about calories and other restraint relevant attitudes are more accessible than those of unrestrained eaters.

The findings also showed that this effect was almost exclusively due to restrained eaters who were currently dieting. Restrained eaters not on a diet did not differ very markedly from unrestrained eaters. Although the substantial difference in restraint-relevant thoughts observed between restrained dieters and non-dieters can be partly attributed to the relatively higher restraint scores of the restraint dieters, the fact that the difference between these two groups remained significant (albeit with a reduced F value), even with differences in restraint scores statistically controlled for, indicates that dietary status is an independent contributory factor. This suggests that we are dealing with a combination of chronic and acute (hunger-related) accessibility.

Thus, our finding that restrained eaters had more thoughts relating to eating control than unrestrained eaters is in line with the assumption underlying the boundary model

that restrained eaters regulate their eating behaviour cognitively. However, the fact that there was no interaction between restraint group and the calorie content of the food to which the words referred (i.e. references to high as compared to low caloric food resulted in the same increase in restraint-related thoughts in unrestrained as in restrained eaters) suggests that cues to calorie content are attended to by both groups. These findings therefore raise a second and even more important question, namely whether these thoughts about eating control are in fact related to eating behaviour. This hypothesis was tested in Study 2.

STUDY 2

Method

This study examined both the quantity of restraint-relevant thoughts produced in an experimental eating situation and the role of thoughts in controlling participants' consumption of high caloric food.²

Participants

Participants were 70 female students from several schools and university departments in Utrecht who had completed the RS as part of a questionnaire study conducted a month before the experiment and whose weight was within the normal BMI range (self-report).

As in Study 1, participants were classified as restrained or unrestrained eaters by using the median split method on the RS scores. Two participants did not fully complete the RS. For the remaining 68 participants the median score was 10. Five participants who scored exactly at the median were excluded from the analyses. Of our restrained eaters ($N = 30$), 11 reported that they were currently dieting, whereas 19 were not. Table 3 presents the mean age, BMI and RS score of the restrained dieters, restrained non-dieters and unrestrained participants.

Table 3. Participant characteristics: Study 2

	Unrestrained eaters ($N = 33$)	Restrained non-dieters ($N = 19$)	Restrained dieters ($N = 11$)	<i>F</i>	<i>P</i>
	<i>M</i> (SD)	<i>M</i> (SD)	<i>M</i> (SD)		
Age	21.6 (2.1)	22.5 (3.6)	22.0 (2.0)	0.7	n.s.
RS score	5.8 (2.2)	16.2 (2.7)	20.1 (4.4)	141.8	.000
BMI ^a	20.7 (1.6)	23.5 (2.6)	23.0 (2.1)	12.9	.000

^a BMI = body mass index = weight (kg)/height² (m).

Design and procedure

Participants performed a taste test in which they were presented with three bowls of different peanuts (plain peanuts, sugared peanuts and cocktail-nuts) each bowl containing approximately 1000 grams. They were instructed to taste at least one nut from each bowl and were told to feel free to eat as much as they wanted or as much as they needed for reliable taste ratings. Participants were given separate taste rating forms for each

² The study was part of a larger study which also assessed the effects of positive and negative mood on eating behaviour. However ANOVAs indicated that mood did not affect the number of thoughts in different categories, nor did it affect participants' subsequent food intake. We thus collapsed our mood conditions to look at restrained and unrestrained eaters' thoughts and food intake independently of their mood.

type of nut and they were instructed to answer the questions after having tasted the nuts. They were then left alone for 10 minutes to do the test.

After 10 minutes the experimenter returned and participants were given a form on which they were asked to list all the thoughts (maximum 10) they had had while performing the taste test. Finally, participants' height and weight were measured and they were debriefed, thanked and paid for participation. After the participants had left, their food intake was measured (the bowls with nuts were weighed before and after participants performed the taste test).

Results

Analysis of thoughts

Participants' thoughts were classified into the same categories as in our first study. The same two raters, again unaware of participants' restraint scores, independently coded the thoughts of all the participants. The inter-rater agreement, Cohen's kappa, was .93; again a satisfactory outcome. The mean percentages of thoughts in each category are presented in Table 4.

Table 4. Categories and mean percentages of thoughts in each category for unrestrained eaters, restrained non-dieters and restrained dieters: Study 2

Categories	Unrestr. (N = 33)	Restr. no diet (N = 19)	Restr. diet (N = 11)
Restraint relevant	2.8	6.8	13.5
Diet or weight	0.6	3.6	10.1
Calories	1.0	2.7	1.3
Restraint, no diet or weight mentioned	1.2	0.5	2.2
Consumer descriptive	18.6	10.7	18.5
Liking the food	13.2	5.6	9.1
Not liking the food	3.9	2.6	5.1
Information about eating behaviour	1.6	2.6	4.3
Restraint irrelevant	78.5	82.5	68.0
Taste/appearance	10.8	10.8	10.4
Health	0.0	0.6	0.0
Miscellaneous	67.7	71.1	57.6

Restrained dieters vs. restrained non-dieters vs. unrestrained eaters

An ANOVA, comparing restrained dieters with restrained non-dieters and unrestrained eaters, revealed a main effect for the restraint group on the percentages of thoughts in the 'restraint relevant' category ($F(2,60) = 3.54, p < .05$). Restrained dieters had the most and unrestrained eaters the least number of restraint-relevant thoughts. Contrasts in a MANOVA showed that this difference was only significant when restrained dieters were compared with the unrestrained eaters ($F(1,60) = 6.9, p < .05$). The differences in

restraint relevant thoughts between restrained dieters and restrained non-dieters ($F(1,60) = 2.3$, n.s.) or between the latter and unrestrained eaters ($F(1,60) = 1.4$, n.s.) were in the expected direction, but non-significant. The main effect for restraint group on the percentages of thoughts in the general category 'restraint-relevant' was due to a main effect for restraint-group in the subcategory 'diet or weight' ($F(2,60) = 5.6$, $p < .01$).

As in Study 1, the analysis of the association of restraint relevant thoughts and restraint group was repeated using restraint score as a covariate to assess whether the differences between dieters and non-dieters were due to their dieting status or to the differences in their restraint scores. Unlike in Study 1, the main effect of restraint group on the percentage of thoughts in the 'restraint-relevant' category now disappeared ($F(2,59) = 1.0$, n.s.) due to the significant effect of the covariate ($F(1,59) = 5.0$, $p < .05$). Furthermore, the introduction of a covariate rendered the previously significant contrast between restrained dieters and unrestrained eaters non-significant ($F(1,59) = 1.38$, n.s.).

Thoughts and food intake

Table 5 presents the mean consumption for the three groups as well as the correlations between consumption and restraint-relevant thoughts. There were no significant differences in consumption between the three groups ($F(2,60) = 1.3$, n.s.), although the dieters did eat somewhat more, which is typical for this group (Lowe, 1993). In line with our predictions, no significant correlation was found between restraint-relevant thoughts and food intake for the unrestrained eaters. For the restrained eaters, the results were as expected if they were currently dieting, but contrary to expectations if they were not currently dieting. Restrained eaters who were not currently dieting showed a significant positive correlation between restraint relevant thoughts and food intake, whereas this correlation for the restrained dieters revealed a negative trend.³ Restrained non-dieters appeared to eat more if they had more restraint-relevant thoughts. Restrained dieters showed a trend of eating less if they had more restraint-relevant thoughts. The difference between the two correlations, with the respective sample sizes taken into account, is significant ($z = 2.12$, $p < .014$).

Table 5. Mean consumption and correlations with restraint-relevant thoughts: Study 2

Consumption correlated with restraint thoughts	Consumption in grams		Correlation with restraint thoughts	
	<i>M</i>	<i>SD</i>	<i>r</i>	<i>p</i>
Unrestrained eaters (<i>N</i> = 33)	41.84	21.41	.04	n.s.
Restrained non-dieters (<i>N</i> = 19)	40.95	19.39	.47	.02 (one-tailed)
Restrained dieters (<i>N</i> = 11)	57.11	53.88	-.42	.10 (one-tailed)

³ The correlations between cognition and consumption for the restrained non-dieters and dieters remain practically unchanged (.50 and -.42) if restraint score is being partialled out.

Discussion

Like exposure to food-words, the actual intake of high calorie food elicited a greater number of eating-control-, weight- and shape-related thoughts in restrained dieters than in unrestrained eaters, with the restrained non-dieters occupying an intermediate position. The fact that the patterns of thoughts elicited by exposure to food words could generally be replicated in an actual (albeit experimental) eating situation increases our trust in the external validity of this relationship.

However, there are also some differences in the findings between the two studies, mainly concerning the association between dieting status and frequency of restraint-relevant thoughts. Although restrained dieters listed twice as many restraint-relevant thoughts as the restrained non-dieters, this difference failed to reach significance. Since the difference in average number of thoughts between the two groups is practically identical to that observed in Study 1, we would tend to attribute the failure of this difference to reach significance in the second study to reduced power, due to the smaller number of participants in the experimental study.

Our findings concerning the relationship between restraint-relevant thoughts and amount eaten were only partly consistent with our hypotheses. In line with predictions, there was no relationship between restraint-relevant thoughts and consumption for unrestrained eaters. This is consistent with our assumption that unrestrained eaters do not engage in cognitive control of their eating behaviour. The negative correlation between restraint-relevant thoughts and eating behaviour predicted for the restrained eaters was only observed for restrained individuals currently on a diet. Although descriptively substantial, this correlation is only marginally significant, due to the small number of dieters who had participated in the second study. The restrained non-dieters, on the other hand, contrary to our predictions, displayed a significant positive correlation between cognition and consumption.

Why do restrained eaters show these opposite patterns depending on their current diet status? Current dieters' explicit behavioural rule may be an important aspect of the explanation. When they are confronted with (eating) high caloric food, their diet rule will immediately become salient. Thoughts about calories and the effects of eating the food will cause them to limit their consumption. By contrast, among the restrained eaters who are not currently dieting, such diet rules are not operational. It is possible that the absence of explicit diet rules in the restrained non-dieters causes an effect that restrained eaters are afraid of, namely, the more they think about food, the more they eat. Herman & Polivy (1993) suggested that thoughts of food and eating represent a danger to restrained eaters, since they presumably make it harder to refrain from eating. Explicit dietary rules, as in current dieters, may prevent this effect. The design of our present experiments, however, does not allow further examination of this explanation.

It is worth noting that the correlations between thoughts and food intake were not accompanied by group differences in average consumption. In fact, the only difference in consumption to be observed was the typical finding (Lowe, 1993) that our dieters ate slightly more ice cream (16.16 g) than the non-dieters. Although according to common-sense notions one might have expected differences in average consumption, with the unrestrained eaters eating most and the restrained dieters eating least, such predictions cannot be derived from the boundary model. After all, it is no coincidence that restrained

eters try to restrain their eating: They have substantially higher BMI values than our unrestrained participants. Although this could be due to differences in metabolism between these groups, it could also be due to differences in eating behaviour. Furthermore, the dieters probably suffered from acute hunger pangs whilst given the opportunity (and the permission) to feed on tasty ice cream. Thus it would be naïve to assume that the average consumption of the unrestrained eaters reflects the baseline of what restrained eaters would have eaten if they had not tried to restrain their consumption.

GENERAL DISCUSSION

The association observed between food stimuli and cognitions in both studies is consistent with our predictions: exposure to food-words as well as actual food intake elicited more eating-control-, weight- and shape-related thoughts in restrained eaters than in unrestrained eaters, with restrained dieters reporting the highest number of thoughts. These findings are supportive of our theoretical assumption that the experience of repeatedly restraining one's food intake to lose weight or keep one's weight down would result in highly accessible restraint- and weight-related constructs for restrained eaters. The findings for current dieting in both studies suggest that these constructs become even more accessible if a restrained eater is currently dieting. The latter effect is most probably a consequence of recent activation of these constructs in the current dieter. Recency of activation is assumed to give a construct relatively greater accessibility, at least for a limited time period (Bargh *et al.*, 1988).

Our findings concerning the relationship between cognition and consumption revealed a pattern which was more complicated than we had expected. They supported our hypothesis that restraint-relevant cognitions were unrelated to consumption in unrestrained eaters but related in restrained eaters. However, contrary to our expectations, the latter relationship was moderated by dieting status. The finding that restraint-relevant cognitions facilitate eating control only for individuals who have formed the intention to diet are in line with research on the attitude-behaviour relationship which generally indicates that intentions mediate the relationship between attitude and behaviour (Ajzen, 1988). They are also consistent with the research on goal-setting, which indicates that setting specific (and difficult) goals is much more effective in influencing behaviour than giving general 'do your best' goals (Locke & Latham, 1990). They are finally supportive of the assumption underlying the transtheoretical theory of behaviour change, that different processes operate in the 'contemplation' and the 'action' stages (Prochaska, DiClemente & Norcross, 1992). Although not implied by these theories, the positive correlation between eating cognition and consumption observed in restrained eaters who have not yet formed the intention to go on a diet is also quite plausible. Whereas food-related cognitions are likely to remind the restrained dieters of their dieting rules, increased thoughts about food might stimulate increased eating in the absence of such dieting rules, even when these thoughts also refer to the negative consequences of eating.

All in all, our findings indicate that the eating behaviour of restrained eaters is not in any simple way controlled by the number and content of their restraint cognitions. The opposite directions of the correlations between restraint cognitions and food intake depending on diet status suggest different pathways along which behaviour may be

related to cognitions in restrained eaters. These findings tend to emphasize that the picture is more complex than implied by the boundary model, and that Lowe *et al.*'s (1991) distinction between the two kinds of restrained eaters is a valuable one. Studies that explore cognitions in restrained dieters and non-dieters in various situations are needed to provide information on the nature of the cognitive regulation. Studies in which specific cognitions are induced, or in which dietary rules are primed while palatable food is present, may offer useful evidence on the cognition-behaviour relationship in current dieters versus non-dieters.

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References

- Ajzen, I. (1988). *Attitudes, Personality and Behavior*. Chicago, IL: Dorsey.
- Bargh, J. A., Lombardi, W. J. & Higgins, E. T. (1988). Automaticity of chronically accessible constructs in person \times situation effects on person perception: It's just a matter of time. *Journal of Personality and Social Psychology*, 55, 599-605.
- Baucom, D. H. & Aiken, P. A. (1981). Effect of depressed mood on eating among obese and non-obese, dieting and non-dieting persons. *Journal of Personality and Social Psychology*, 41, 577-585.
- Bonifazi, D. Z. & Crowther, J. H. (1996). In vivo cognitive assessment in bulimia nervosa and restrained eating. *Behaviour Therapy*, 27, 139-158.
- Butow, P., Beumont, P. & Touyz, S. (1993). Cognitive processing in dieting disorders. *International Journal of Eating Disorders*, 14, 319-329.
- Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement*, 20, 37-46.
- Cools, J., Schotte, D. E. & McNally, R. J. (1992). Emotional arousal and overeating in restrained eaters. *Journal of Abnormal Psychology*, 101, 348-351.
- Cooper, M. J., Clark, D. M. & Fairburn, C. G. (1993). An experimental study of the relationship between thoughts and eating behaviour in bulimia nervosa. *Behaviour Research and Therapy*, 31, 749-757.
- Cooper, M. J. & Fairburn, C. G. (1992). Thoughts about eating, weight and shape in anorexia nervosa and bulimia nervosa. *Behaviour Research and Therapy*, 30, 501-511.
- Fazio, R. H., Chen, J., McDonel, E. C. & Sherman, S. J. (1982). Attitude accessibility, attitude-behaviour consistency, and the strength of the object-evaluation association. *Journal of Experimental Social Psychology*, 18, 339-357.
- French, S. A. (1992). Restraint, food choice, and cognitions. *Addictive Behaviors*, 17, 273-281.
- Frost, R. O., Goolkasian, G.A., Ely, R. J. & Blanchard, F. A. (1982). Depression, restraint and eating behaviour. *Behaviour Research and Therapy*, 20, 113-121.
- Heatherington, T. F., Polivy, J., Herman, C. P. & Baumeister, R. F. (1993). Self-awareness, task failure, and disinhibition: How attentional focus affects eating. *Journal of Personality*, 61, 49-61.
- Herman, C. P. & Polivy, J. (1984). A boundary model for the regulation of eating. In A. J. Stunkard & E. Stellar (Eds), *Eating and its Disorders*, pp. 141-156. New York: Raven.
- Herman, C. P. & Polivy, H. (1993). Mental control of eating: Excitatory and inhibitory food thoughts. In D. M. Wegner & J. W. Pennebaker (Eds), *Handbook of Mental Control*, pp. 491-505. Englewood Cliffs, NJ: Prentice-Hall.
- Higgins, E. T., King, G. A. & Mavin, G. H. (1982). Individual construct accessibility and subjective impressions and recall. *Journal of Personality and Social Psychology*, 43, 35-47.
- Jansen, A., Merckelbach, H., Oosterlaan, J., Tuiten, A. & Van den Hout, M. (1988). Cognitions and self-talk during food intake of restrained and unrestrained eaters. *Behaviour Research and Therapy*, 26, 393-398.
- King, G. A., Polivy, J. & Herman, C. P. (1991). Cognitive aspects of dietary restraint: Effects on person memory. *International Journal of Eating Disorders*, 10, 313-321.

- Knight, L. J. & Boland, F. J. (1989). Restrained eating: An experimental disentanglement of the disinhibiting variables of perceived calories and food type. *Journal of Abnormal Psychology*, 98, 412–420.
- Locke, E. A. & Latham, G. P. (1990). *A Theory of Goal Setting and Task Performance*. Englewood Cliffs, NJ: Prentice-Hall.
- Lowe, M. R. (1993). The effects of dieting on eating behaviour: A three factor model. *Psychological Bulletin*, 114, 100–121.
- Lowe, M. R. (1995). Restrained eating and dieting: Replication of their divergent effects on eating regulation. *Appetite*, 25, 115–118.
- Lowe, M. R., Whitlow, J. W. & Bellwoar, V. (1991). Eating regulation: The role of restraint, dieting and weight. *International Journal of Eating Disorders*, 10, 461–471.
- Ogden, J. & Greville, L. (1993). Cognitive changes to preloading in restrained and unrestrained eaters as measured by the stroop task. *International Journal of Eating Disorders*, 14, 185–195.
- Ogden, J. & Wardle, J. (1991). Cognitive and emotional responses to food. *International Journal of Eating Disorders*, 10, 297–311.
- Polivy, J., Herman, C. P. & Warsh, S. (1978). Internal and external components of emotionality in restrained and unrestrained eaters. *Journal of Abnormal Psychology*, 87, 497–504.
- Polivy, J., Herman, C. P. & McFarlane, T. (1994). Effects of anxiety on eating: Does palatability moderate distress-induced overeating in dieters? *Journal of Abnormal Psychology*, 103, 505–510.
- Prochaska, J. O., DiClemente, C. C. & Norcross, J. C. (1992). In search of how people change: Applications to addictive behaviors. *American Psychologist*, 47, 1102–1114.
- Ruderman, A. J. (1986). Dietary restraint: A theoretical and empirical review. *Psychological Bulletin*, 99, 247–262.
- Ruderman, A. J., Belzer, L. J. & Halperin, A. (1985). Restraint, anticipated consumption and overeating. *Journal of Abnormal Psychology*, 94, 547–555.
- Ruderman, A. J. & Besbeas, M. (1992). Psychological characteristics of dieters and bulimics. *Journal of Abnormal Psychology*, 92, 210–215.
- Schotte, D. E., Cools, J. & McNally, R. J. (1990). Film induced negative affect triggers overeating in restrained eaters. *Journal of Abnormal Psychology*, 99, 317–320.
- Spencer, J. A. & Fremouw, W. J. (1979). Binge eating as a function of restraint and weight classification. *Journal of Abnormal Psychology*, 88, 262–267.
- Stotland, S., Zuroff, D. C. & Roy, M. (1991). Situational dieting self-efficacy and short-term regulation of eating. *Appetite*, 17, 81–90.
- Tomarken, A. J. & Kirschenbaum, D. S. (1984). Effects of plans for future meals on counter-regulatory eating by restrained and unrestrained eaters. *Journal of Abnormal Psychology*, 93, 458–472.
- Wardle, J. & Beales, S. (1988). Control and loss of control over eating: An experimental investigation. *Journal of Abnormal Psychology*, 97, 35–40.
- Woody, E. Z., Constanzo, P. R., Liefer, H. & Conger, J. (1981). The effects of taste and caloric perceptions on eating behaviour of restrained and unrestrained subjects. *Cognitive Therapy and Research*, 5, 381–390.
- Zotter, D. L. & Crowther, J. H. (1991). The role of cognitions in bulimia nervosa. *Cognitive Therapy and Research*, 15, 413–426.

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