THE IMPACT OF MOTIVATIONAL STATES ON HEDONIC SNACK CONSUMPTION AND IMPLICATIONS FOR DISORDERED EATING

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A thesis submitted in fulfilment of the requirements for the degree of

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DECLARATION

This thesis describes original research undertaken in the Department of Psychology at The Australian National University. Apart from the usual support and advice provided by my supervisor Professor Marie Carroll, the ideas and research detailed in this thesis are solely my own, except where otherwise indicated. To the best of my knowledge, any theories and techniques that are not my own have been properly acknowledged within the text. The work contained in this thesis has not been submitted for a higher degree at any other institution.

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Catherine Anne Hunt

December 2011
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ABSTRACT

The research presented in this thesis explores the role of regulatory focus (promotion versus prevention foci), and related attentional scope (global versus local processing), in influencing people’s consumption of pleasurable snack food in the absence of physical need – an eating style that is contributing to growing rates of obesity worldwide. In the first two studies, male and female undergraduates were invited to help themselves to a bowl of M&Ms while they engaged in a global processing, local processing, or control task. Attempts to manipulate local processing using a rhyming task were successful in both studies, evidenced by significant increases in left hemispheric activation from baseline. This local processing, as predicted, had an inhibitory effect on participants’ M&M consumption relative to the control task in both studies, which was interpreted as a regulatory misfit between the food type and the scope of attention. Compared to local processing, the manipulation of global processing proved more difficult. In Study 1, mental rotation was employed as the global processing task, however, against prediction it failed to significantly activate the right hemisphere or facilitate M&M consumption. In Study 2, mental rotation was replaced with insight problem-solving which showed a trend (although non-significant) towards right hemispheric activation and greater M&M consumption relative to the control task, suggestive of a fit between the food type and the attentional scope.

Prompted by evidence that pleasurable snack food may serve a distinct safety/protective function for eating disordered individuals who engage in regular binge eating, the second two studies of this thesis investigated whether promotion and prevention foci impact the snack consumption of these individuals differently. In Study 3, non-clinical female university students were invited to eat M&Ms as they worked on a set of promotion focus, prevention focus, or control mazes. As predicted, consumption by no/mild binge
eaters (based on a sample split of scores on the Binge Eating Scale) was substantially facilitated by the snack-compatible promotion focus mazes. However, against prediction, the supposedly snack-incompatible prevention focus mazes failed to have an inhibitory effect. As hypothesised, moderate binge eaters exhibited a very different pattern of results. Specifically, they showed a significant increase in M&M consumption in response to the prevention focus mazes, and a slight (but non-significant) decrease in consumption in response to the promotion focus mazes, compared to no/mild binge eaters primed with the same foci. These findings were replicated by Study 4 which pre-screened prospective participants to ensure a greater proportion of clinically significant cases of disordered eating. Using a “taste test” cover story, Study 4 also extended Study 3 by adding a follow-up “tasting” period in order to examine the longevity of the foci’s effects on consumption. The results demonstrated that the effects are transient. Regardless of the level of disordered eating, the best predictor of snack consumption at the second tasting period was not regulatory focus, but the amount consumed at the first tasting period.

Consistent across all four studies, the effects of regulatory focus and attentional scope on snack consumption were not associated with changes in hemispheric activation or mood. Furthermore, conscious desire to eat the snack remained unaffected despite impacts on consumption, suggesting that the manipulations were leading participants to approach or avoid the tasty snack at an unconscious or automatic level. In conclusion, this thesis points to motivational and attentional strategies for curbing overeating and binge eating that are highly contingent on where an individual lies on the disordered eating continuum.
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CHAPTER 1.
OVERVIEW AND AIMS

Introduction to the Issue

The prevalence of overweight and obesity has increased so dramatically worldwide that the World Health Organization (WHO) has hailed it a “global epidemic” (WHO, 2000). Current figures of overweight and obesity suggest that Australia is by no means exempt from this problem. The 2007-08 National Health Survey (NHS) conducted by the Australian Bureau of Statistics (ABS) measured the waist-to-hip circumference and height and weight of respondents aged 5 years and over. Body Mass Index (BMI; kg/m²) results from this survey showed that 25% of individuals aged 18 years and over were obese, 37% overweight, 37% normal weight, and 2% underweight. More adult males (68%) were overweight or obese than adult females (55%). When compared with results from the 1995 National Nutritional Survey (NNS), the proportion of persons aged 18 years and over who were classified as overweight or obese has increased. In 1995, 64% of adult males and 49% of adult females were classified as overweight or obese. For children and adolescents aged 5-17 years, the 2007-08 NHS showed that 24.9% were classified as overweight or obese, up four percentage points from 1995 (21%). The obesity rate for children increased from 5% in 1995 to 8% in 2007-08 with the proportion overweight remaining around 17% over this time period (ABS, 2009). Should the growth rates in obesity continue at the current rate, it is predicted that by 2025, approximately one-third of children and three-quarters of adults will be classified as overweight or obese (Department of Human Services, 2008).

Table 1.1 shows WHO’s (2000) graded classification system for categorising overweight and obesity in adults according to BMI. These BMI values are age independent and identical for both sexes. In children, the amount of body fat changes
substantially with age and differs between boys and girls (Sherry & Dietz, 2004). For this reason, BMI is calculated the same way as for adults, but is then compared to typical values for other children of the same age and sex using a BMI-for-age percentile chart. According to guidelines developed by the American Medical Association (AMA; 2007), a child is considered overweight if his or her BMI is greater than or equal to the 85th percentile, but less than the 95th percentile, for age and sex. Obesity in children is defined as a BMI greater or equal to the 95th percentile for age and sex.

Table 1.1.

Classification of Adults According to Body Mass Index

<table>
<thead>
<tr>
<th>BMI (Kg/m²)</th>
<th>Classification</th>
<th>Risk of Co-morbidities</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 18.5</td>
<td>Underweight</td>
<td>Low (but increased risk of clinical problems)</td>
</tr>
<tr>
<td>18.5 – 24.9</td>
<td>Normal weight</td>
<td>Average</td>
</tr>
<tr>
<td>25.0 – 29.9</td>
<td>Overweight</td>
<td>Increased</td>
</tr>
<tr>
<td>30.0 – 34.9</td>
<td>Obese (Class 1)</td>
<td>Moderate</td>
</tr>
<tr>
<td>35.0 – 39.9</td>
<td>Obese (Class 2)</td>
<td>Severe</td>
</tr>
<tr>
<td>≥ 40.00</td>
<td>Obese (Class 3)</td>
<td>Very Severe</td>
</tr>
</tbody>
</table>

*Note. Adapted from Obesity: Preventing and Managing the Global Epidemic (p. 9), by World Health Organization, 2000, Geneva, Switzerland: Author.*

Escalating rates of overweight and obesity in Australia and across the world can be attributed to both a rise in energy intake and a decline in physical and incidental activity (WHO, 2000). For example, Cook, Rutishauser, and Seelig (2001) examined trends in mean energy intake by Australians living in capital cities and observed a significant increase of 3-4% (i.e., about 350 kJ/day) for adults between 1983 and 1995.
An even greater increase was observed for children; 11% for girls and 15% for boys aged 10-15 years between 1985 and 1995. The major source of this increased energy intake was carbohydrate. At the same time, population surveys suggest that the proportion of Australians undertaking at least 30 minutes of moderate physical activity daily has declined from 62% in 1997 to 57% in 2000 (Bauman, Bellew, Vita, Brown, & Owen, 2002).

There are many adverse consequences associated with this rise in overweight and obesity. According to WHO (2000), excess weight is a major risk factor for a number of life-threatening chronic diseases, such as type 2 diabetes mellitus, cardiovascular disease, and some cancers. Substantial epidemiological evidence indicates that obesity (i.e., BMI ≥ 30) is associated with an increased risk of premature death from such diseases (Katzmarzyk, Janssen, & Ardern, 2003). It is less clear, however, whether being overweight (i.e., BMI 25.0 – 29.9) is also associated with increased mortality risk (McGee, 2005). According to WHO (2000), the effects of obesity are related to where the excess weight is carried, with weight stored in the upper body, particularly the abdomen, being more detrimental to health than weight stored on the lower body. Other debilitating but non-fatal health problems related to overweight and obesity include respiratory difficulties, musculoskeletal conditions, skin problems and infertility (WHO, 2000). A new Access Economics report commissioned by Diabetes Australia, estimated the total financial cost of overweight and obesity to the nation in 2008 as $8.283 billion. This was up from $3.767 billion in 2005 (Access Economics, 2008).

In addition to increased morbidity risk, overweight and obesity is associated with adverse social and psychological consequences. Obesity is negatively stereotyped in Western cultures, with obese individuals viewed as less intelligent, less hardworking, less attractive, less popular, less successful, less athletic, and more weak-willed and
self-indulgent than individuals of normal weight (Hebl & Mannix, 2003). Research indicates that obese adults, especially women, are less likely to marry, get accepted into college, and be selected for employment and promotion than their leaner counterparts. They also face discrimination and prejudice in health care settings, which can be a barrier to general and preventative medical treatment (Crandall, Merman, & Hebl, 2009). For overweight children and adolescents, the consequences are equally detrimental. Numerous studies have found that overweight youth are subject to various forms of mistreatment by their peers, including social isolation or marginalisation (Strauss & Pollock, 2003), and weight-related teasing and bullying (Janssen, Craig, Boyce, & Pickett, 2004; Neumark-Sztainer et al., 2002).

Given the social stigma attached to being overweight, it is not surprising that individuals with higher BMIs report greater levels of body dissatisfaction, having internalised the thin ideal (Paxton, Eisenberg, & Neumark-Sztainer, 2006). Body dissatisfaction, in turn, has been shown to be positively correlated with depressive mood and low self-esteem (Friestad & Rise, 2004; Paxton, Neumark-Sztainer, Hannan, & Eisenberg, 2006) and has been identified as a major risk factor for the development and maintenance of disordered eating (Stice, 2002). The adverse consequences associated with overweight and obesity speaks to the need for a greater understanding of why people engage in weight-gaining behaviours, such as overeating and under-exercising. This thesis will focus largely on the factors which lead people to overeat.

Almost everyone overeats from time-to-time (i.e. taking an extra helping of baked spuds at Christmas dinner or devouring a packet of biscuits during a late-night study session), which will lead to weight gain (and potentially overweight or obesity) if done habitually. A distinct type of overeating is referred to in the clinical literature as binge eating (e.g., Fairburn & Wilson, 1993). A binge eating episode is characterised by consuming an objectively large amount of food in a short period of time, accompanied
by a sense of lack of control over eating. Individuals often report feeling guilty, 
disgusted, anxious and/or depressed following a binge. Binge eating is a key 
behavioural feature of anorexia nervosa (binge eating/purging type), bulimia nervosa 
and binge eating disorder. Like overweight and obesity, these eating disorders are 
associated with a range of serious medical and psychosocial complications, which will 
be presented in detail in Chapter 5 of this thesis. Also like overweight and obesity, the 
prevalence of eating disorders for both males and females is on the increase. In South 
Australia, between 1995 and 2005, rates of regular eating disordered behaviour have 
more than doubled: 4.7% to 11% (Hay, Mond, Buttner & Darby, 2008).

Broadly speaking, the objective of the current research program is to better 
understand what motivates people to initiate and/or continue food consumption in the 
absence of physiological hunger or acute energy deprivation (i.e., hedonic eating). 
Specifically, this research aims to investigate the impact of attentional/motivational 
priming on hedonic snack consumption among individuals with varying degrees of 
disordered eating, in order to inform prevention and intervention for overweight/obese 
individuals and clinical binge eaters. The following six research questions were 
developed based on an integrative review of the literature on regulatory focus and 
attentional scope outlined in Chapter 3, and disordered eating outlined in Chapter 5:

1. Does global and local processing affect snack consumption in a similar manner 
to Förster’s (2003) promotion and prevention focus priming? (Studies 1 and 2)

2. Do disordered eaters show a different pattern of snack consumption in response 
to promotion and prevention focus priming? (Studies 3 and 4)

3. Does the priming influence participants’ conscious desire to eat the snack? 
(Studies 1-4)
4. Are the effects of the priming related to changes in relative hemispheric activation from baseline? (Studies 1-4)

5. Is priming apparent after controlling for chronic regulatory focus and mood? (Studies 1-4)

6. Does regulatory focus continue have an influence beyond the cessation of its priming? (Study 4)

**Overview of the Thesis**

This thesis begins with a review of the literature on excessive food consumption, detailing various environmental variables that have been shown to stimulate eating outside of conscious awareness, such as portion size and food visibility. Chapter 2 also reviews three predominant psychological theories that have been developed to explain why some individuals are more susceptible to these cues to overeating than others, including a tendency toward emotional eating, external eating and restrained eating.

Chapter 3 introduces regulatory focus theory (Higgins, 1997, 1998), a motivational theory that allows for equal consideration of the environment and the individual in understanding human goal pursuit. This chapter presents evidence that the two posited foci (promotion and prevention) involve distinct approach-avoidance strategies, as well as more recent evidence that the two foci are associated with global-local processing styles. Initial evidence is also presented in Chapter 3 for a role of regulatory focus in influencing hedonic snack consumption; with a promotion focus facilitating consumption and a prevention focus inhibiting it.

Chapter 4 describes the first two studies of this thesis which sought to determine whether global and local processing affect snack consumption in a similar manner to promotion and prevention focus priming. After making appropriate adjustments to the methodology (specifically, the type of global processing task), it was possible to show in Study 2 that while local processing inhibited snack consumption relative to a control
task, global processing showed a trend (although non-significant) towards greater consumption. Given these findings were applicable to individuals with non-disordered eating attitudes and behaviours, further research was undertaken to determine whether these findings would also be likely to apply to disordered eaters.

As such Chapter 5 reviews key cognitive, behavioural and affective features of clinical eating disorders and subclinical disordered eating, drawing parallels to a prevention focus and avoidance motivation. Based on evidence that pleasurable snack foods serve a distinct safety/protective function for eating disordered individuals who engage in regular binge eating, Chapter 5 hypothesises that regulatory focus priming should lead to a different pattern of snack consumption by these individuals.

Chapter 6 describes Studies 3 and 4, which provide support for this hypothesis. In contrast to low disordered eaters (whose snack intake was facilitated by promotion focus priming and remained relatively unaffected by prevention focus priming), there was a clear trend for high disordered eaters to consume greater quantities of the snack in response to promotion focus priming and prevention focus priming, relative to a control task. Furthermore, high disordered eaters reported that their eating was driven by both nurturance and security needs, in contrast to low disordered eaters who reported that their eating was motivated primarily by nurturance needs.

Finally, Chapter 7 summarises the key findings of this thesis and concludes that hedonic snack consumption is largely an automatic behaviour that is influenced by an interaction between primed motivational states and the psychological meanings we attach to certain foods via a history of learned associations. This chapter also considers the implications of the current findings for the psychological treatment of binge eating and proposes avenues for future research.
CHAPTER 2.
WHY DO PEOPLE EAT TOO MUCH?

Environmental and Individual Influences on Food Consumption

Eating is a complex behaviour, which according to Lowe and Levine (2005), is driven by physiological or “homeostatic” hunger (resulting from nutritional or energy need) along with psychological or “hedonic” hunger (reward-driven eating when not hungry). From an evolutionary perspective, seeking out and consuming food in the absence of physical hunger was adaptive since the storage of extra energy as body fat protected one from starvation during periods of food scarcity. In current times, however, where food is “plentiful, cheap, energy-dense, and enticing, and physical activity is being reduced” (Finlayson, King, & Blundell, 2007, p. 988), hedonic hunger is leading many people to store thousands of unneeded calories. Figure 2.1 encapsulates the abundance of food choice in the Western world, depicting the “World’s Largest Buffet” which was open to the public at the Las Vegas Hilton in 2006. The 500-foot smorgasbord comprised 510 different dishes and was ironically hosted by Alka-Seltzer, a medication marketed for heartburn and indigestion relief. This next section will identify the various aspects of the food and eating environment that encourage and perhaps even exploit people’s hedonic motivation to eat, and will review classic psychological theories of overeating.
A number of studies in recent years have documented the powerful influence of various aspects of the environment on the amount of food people consume, and have shown that these influences typically occur without the person’s awareness. One of the strongest environmental influences on food consumption is portion and packaging size, with people who are presented with larger quantities eating significantly more (Diliberti, Bordi, Conklin, Roe, & Rolls, 2004; Levitsky & Young, 2004; Rolls, Roe, & Meengs, 2006). Intriguingly, package and portion size can even increase the consumption of unfavorable foods, such as 14-day-old stale popcorn (Wansink & Kim, 2005). In explaining this influence, Wansink (2004) hypothesises that larger packages and portions suggest to the consumer that it is “normal” or “appropriate” to eat that amount, and gives them permission to consume beyond the point where they might have stopped with a smaller supply.

In addition to portion and packaging size, there is evidence that increasing the actual or perceived variety of a food increases its consumption. For example, Kahn and Wansink (2004) gave people an assortment of 300 M&M chocolates that were presented in either seven or ten different colours. Although the taste of each colour was

Figure 2.1. Photograph of the 510-dish “all you can eat buffet”.

identical, those who had been given a bowl with ten colours ate 43% more M&Ms over the course of an hour than those who had been given seven colours. Wansink (2004) proposes that perceived variety might lead the consumer to anticipate that they will enjoy the food more, thereby increasing its intake.

Another well-established environmental influence is the ease or convenience with which a food can be consumed. For example, Painter, Wansink, and Hiaggelke (2002) found that office workers who had Hershey’s kisses (i.e., chocolates) placed within reach on their desk ate an average of 5.6 more a day than workers who had the chocolates placed on a shelf two metres away. The consumption volume of a food is also facilitated by its visibility; chocolates placed on workers’ desks in clear jars, for instance, were eaten 46% more quickly than chocolates placed on workers’ desks in opaque jars (Wansink, Painter, & Lee, 2006).

Finally, the context in which eating takes place greatly influences consumption patterns. de Castro and Brewer (1992) found that meals eaten with one other person were 28% larger than meals eaten alone, and increased steadily to 71% when the number of eating companions reached six or more. Furthermore, the nature of the eater’s companions appears to be important, with meals eaten with family and friends significantly larger than meals eaten with strangers and co-workers (Clendenen, Herman, & Polivy, 1994; de Castro, 1994). Listening to music and watching television are other features of the eating context which have been shown to increase intake by prolonging the duration of a meal (Stroebele & de Castro, 2004; 2006). Television, in particular, is thought to be a distracting activity that potentially leads the eater to ignore feelings of satiety and fullness (Wansink, 2004).

Attributing overeating solely to the environment is problematic as not all people exposed to the same weight-promoting environment overeat. Clearly, individuals differ in their susceptibility to food cues. Three main psychological theories have been
developed to explain why some individuals have a tendency to overeat: psychosomatic, externality, and restraint. Psychosomatic theory (Bruch, 1973; Kaplan & Kaplan, 1957) focuses on the phenomenon of emotional eating. It originated from clinical observations that obese individuals overeat when anxious, where the normal response is a loss of appetite and reduction in food intake due to inhibited gastric motility associated with the fight-or-flight reaction. There are two mechanisms through which anxiety could result in overeating: (1) Kaplan and Kaplan (1957) propose that overeating provides temporary relief from anxiety and is thus negatively reinforced; and (2) Bruch (1973) suggests that anxiety (or any other strong emotion) can cause overeating in individuals who fail to learn to differentiate hunger cues from cues that signal emotional states. Bruch attributes this inability to differentiate between cues to experiences in childhood, where a parent may have frequently used food as an expression of love, or to pacify or reward their child rather than as a response to their nutritional needs.

Externality theory (Schachter, 1971; Schachter & Rodin, 1974), like psychosomatic theory, posits that obese individuals are relatively insensitive to physiological hunger and satiety signals. However, in contrast to psychosomatic theory's emphasis on emotional factors, externality theory focuses on the external food environment as a determinant of eating behaviour. It hypothesises that obese individuals are hyper-responsive to food-related cues, such as the taste, sight or smell of food, and the time of day (e.g., dinner-time). These days it is understood that emotional and external eating styles are not exclusive to obese individuals, but are also present in normal-weight individuals (Canetti, Bachar, & Berry, 2002).

A third theory, which explains overeating as a consequence of unsuccessful dieting, is Restraint Theory (Herman & Polivy, 1980). According to this theory, dieters or restrained eaters try to cognitively suppress their internal cues of hunger. However, when this cognitive control is undermined or disinhibited, restrained eaters are more
likely to overeat than non-dieting individuals; this is known as "counter-regulation". Several "disinhibitors" have been established, including alcohol, strong emotional states, and the perception of having crossed the diet boundary (i.e., eaten something "not allowed") manipulated by having subjects eat a high calorie pre-load before a taste test (Ouwens, van Strien, & van der Staak, 2003).

Implicit within each of these psychological theories are the multiple emotional, social and cultural meanings associated with food and eating. According to Ogden (2010), individuals learn from childhood to associate certain foods with pleasure, the need for indulgence, comfort, reward, relief of boredom, celebration and communication within the family, love, sexuality, power, health, religious identity and so on. Ogden states that these meanings are not always straightforward and often generate conflicts for the individual (e.g., guilt versus pleasure, self-control versus out of control). This complex array of food meanings is described by Todhunter (1973):

Food is prestige, status and wealth...It is a means of communication and interpersonal relations, such as an 'apple for the teacher' or an expression of hospitality, friendship, affection, neighborliness, comfort and sympathy in time of sadness or danger. It symbolizes strength, athleticism, health and success. It is a means of pleasure and self-gratification and a relief from stress. It is feasts, ceremonies, rituals, special days and nostalgia for home, family and the 'good old days'. It is an expression of individuality and sophistication, a means of self-expression and way of revolt. Most of all it is a tradition, custom and security...There are Sunday foods and weekday foods, family foods and guest foods; foods with magical properties and health and disease foods (p. 301).
CHAPTER 3.
ACTIVATION AND MEASUREMENT OF MOTIVATIONAL STATES

Regulatory Focus Theory

It has long been recognised that goals play an essential role in both mobilising and organising human behaviour toward the fulfilment of needs and desires. According to regulatory focus theory (Higgins, 1997, 1998), goal-directed behaviour is regulated by two separate motivational foci (i.e., a promotion and prevention focus), each of which serves a distinct survival function. These two foci can be momentarily induced by a situation, or can occur as chronic predispositions of individuals. Theorists agree that promotion and prevention are distinct self-regulatory dimensions rather than lying at opposite ends of the same continuum.

A promotion focus is associated with approach motivation and is active in the pursuit of hopes, aspirations, and accomplishments – what self-discrepancy theory (Higgins, 1987) calls “ideals”. This focus entails an orientation toward “nurturance” (e.g., nourishing food) and sensitivity to positive outcomes (whether they are present or absent). Successful attainment of goals associated with a promotion focus leads to feelings of cheerfulness and joy, whereas failure leads to feelings of dejection and sadness. A prevention focus, on the other hand, is associated with avoidance motivation and is active in the pursuit of responsibilities, duties, and obligations – what self-discrepancy theory calls “oughts”. This focus entails an orientation toward “security” (e.g., shelter from harm) and sensitivity to negative outcomes (present or absent). Successful attainment of goals associated with a prevention focus leads to feelings of quiescence and relaxation, whereas failure leads to feelings of agitation and nervousness. Although promotion and prevention foci produce distinct affective states,
regulatory focus theory suggests that these foci are elicited, and guide behaviour, in the absence of conscious emotional experience.

Regulatory focus theory proposes that the promotion and prevention foci employ qualitatively distinct means of regulating towards desired end-states and do so independent of emotional arousal. It has been shown that individuals with a promotion focus are inclined to use eagerness-related approach means to attain their goals, while individuals with a prevention focus tend use vigilance-related avoidance means (Crowe & Higgins, 1997; Liberman, Molden, Idson, & Higgins, 2001; Shah, Higgins, & Friedman, 1998). For instance, a promotion-focused tennis player who construes winning a tournament as an accomplishment might approach matches to this desired end-state by doing extra training, eating a nutritious diet, purchasing a more powerful tennis racquet, and closely studying her opponents for areas of weakness. During the actual match, she might employ offensive strategies, such as rushing the net, hitting down-the-line shots, and delivering big second serves. Conversely, a prevention-focused tennis player who construes winning a tournament as a responsibility might avert mismatches to this desired end-state by avoiding late nights, the consumption of alcohol, potentially injurious recreational activities (e.g., skiing), and exposure to germs prior to the tournament. Instead of trying to hit “winners” during the match, she might focus on returning every ball and rely on her opponent making mistakes.

The promotion versus prevention strategic inclinations can be conceptualised in signal detection terms (Tanner & Swets, 1954). Specifically, individuals in a state of eagerness from a promotion focus are motivated to ensure “hits” (gains) and ensure against errors of omission or “misses” (non-gains). In contrast, individuals in a state of vigilance from a prevention focus are motivated to ensure “correct rejections” (non-losses) and ensure against errors of commission or “false alarms” (losses). Crowe and Higgins (1997) tested these predicted strategic inclinations in a study on recognition
memory for a list of nonsense syllables. Depending on their experimental condition, the participants were told that success on the memory task meant they could work on a liked task (promotion focus framing) or could avoid working on a disliked task (prevention focus framing). The recognition memory task involved presenting the original nonsense syllables along with some distracters. The participants had to indicate whether each presented stimulus appeared in the original list. As predicted, participants who received the promotion framing had an eager or risky bias of saying “yes”, leading to a greater number of hits as well as false alarms in recognition. Conversely, participants who received the prevention framing had a vigilant or conservative bias of saying “no”, leading to a greater number of correct rejections and misses. Subsequent studies have corroborated this finding of a risky processing style in a promotion focus and a relatively risk-averse processing style in a prevention focus (Fürster, Higgins, & Idson, 1998; Liberman, Idson, Camacho, & Higgins, 1999; Liberman et al., 2001; Roney, Higgins, & Shah, 1995; Shah et al., 1998). Figure 3.1 summarises the different sets of psychological variables discussed thus far that have distinct relations to promotion focus and prevention focus.
Figure 3.1. Psychological variables with distinct relations to promotion focus and prevention focus. Adapted from "Beyond Pleasure and Pain," by E. T. Higgins, 1997, American Psychologist, 52, p. 1283. Copyright 1997 by the American Psychological Association.
Regulatory Fit Theory

Higgins’ (2000, 2002) theory of regulatory fit proposes that when the manner of pursuing a goal matches (versus mismatches) an individual’s regulatory orientation, the value of the goal pursuit increases for them. For example, a promotion-focused person who uses eager means should experience regulatory fit and, consequently, value the goal pursuit process more than a promotion-focused person who uses vigilant means. In contrast, a prevention-focused person who uses vigilant means should experience greater regulatory fit and, consequently, value the goal pursuit process more than a prevention-focused person who uses eager means.

Research has shown that experiencing regulatory fit relative to regulatory non-fit produces feelings of rightness and importance (Camacho, Higgins, & Luger, 2003; Cesario, Grant, & Higgins, 2004; Higgins, Idson, Freitas, Spiegel, & Molden, 2003; Santelli, Struthers, & Eaton, 2009; Vaughn, Hesse, Petkova, & Trudeau, 2009; Vaughn, Malik, Schwartz, Petkova, & Trudeau, 2006; Vaughn et al., 2006), enjoyableness and excitement (Freitas & Higgins, 2002; Freitas, Liberman, & Higgins, 2002), processing fluency and ease (Labroo & Lee, 2006; Lee & Aaker, 2004), confidence in one’s judgments (Cesario et al., 2004), and increases the value people assign to chosen objects (Camacho et al., 2003; Higgins, 2000; Higgins et al., 2003). There is also evidence that regulatory fit increases motivational intensity during actual or imagined goal pursuit, and that this effect is independent of the valence of the outcome, mood, perceived effectiveness of the goal pursuit strategy, and recalled expectations of success ( Förster et al., 1998; Freitas et al., 2002; Higgins et al., 2003; Idson, Liberman, & Higgins, 2004; Spiegel, Grant-Pillow, & Higgins, 2004; Shah et al., 1998).

Effect of Regulatory Foci on Attentional Scope

Semin, Higgins, Gil de Montes, Estourget, and Valencia (2005) propose that in situations with a prevention focus, individuals concentrate on their concrete
surroundings (i.e., vigilantly encode local details) to maintain security. Further, “oughts”, rules, and responsibilities within a prevention focus tend to be described in concrete terms so that an individual knows exactly what should be avoided in order to attain security or fulfil his or her duty. For example, a person who construes going to Sunday morning Mass as an “ought” is likely to concentrate on details that will facilitate meeting this responsibility (e.g., setting an alarm clock, wearing appropriate attire, ensuring one has a donation for the collection plate, arriving on time). According to Semin and his colleagues, the characteristic security concerns of a prevention focus are replaced by fulfilment of growth needs in the case of a promotion focus, and this orientation benefits from going beyond the concrete to the abstract or global (e.g., enriching one’s faith, being part of something greater than oneself).

There is much indirect support in the literature for a link between regulatory focus and global (holistic, abstract) and local (featural, concrete) processing. For instance, Friedman and Förster (2001) primed participants with either a promotion focus (i.e., had them complete an easily-solvable paper and pencil maze in which they were required to lead a cartoon mouse depicted in the centre of the maze to piece of Swiss cheese located outside the maze) or a prevention focus (i.e., had them complete an analogous maze in which they were required to lead the mouse out of the maze to escape a hovering owl). See Figure 3.2. They found that completion of the promotion (cheese) maze, relative to the prevention (owl) maze, facilitated perceptual embedding (Experiment 1) and creative generation (Experiment 2) — tasks which are both held to profit from global processing or a broadened scope of perceptual attention (Friedman, Fishbach, Förster, & Werth, 2003). Conversely, Friedman and Förster (2005) found in a subsequent study, that completion of the prevention (owl) maze, relative to the promotion (cheese) maze, bolstered performance on analytical reasoning problems —
problems which require narrowed attention upon the information provided (i.e., local processing) rather than an expanded attentional focus (Friedman et al., 2003).

Figure 3.2. Example of one of the virtual approach and avoidance maze manipulations used in prior research. Adapted from “Implicit Affective Cues and Attentional Tuning: An Integrative Review,” by R. S. Friedman and J. Förster, 2010, Psychological Bulletin, 136, p. 880. Copyright 2001 by the American Psychological Association.

In another line of research, promotion and prevention foci have also been induced by activating approach and avoidance motor actions, respectively (Friedman & Förster, 2000, 2002). To manipulate approach motor actions, individuals are asked to press their palms upward against a surface (i.e., arm flexion), leading them to enact a motor action invariably used to pull desired objects toward the body. In contrast, avoidance motor actions are operationalised by asking participants to press their palms downward against a surface (i.e., arm extension), leading them to enact a motor action usually associated with pushing undesired objects away from the body (Cacioppo, Priester, & Berntson, 1993). Consistent with the aforementioned findings using the cheese and owl mazes, approach, relative to avoidance, motor actions have been found to facilitate tasks requiring a broader breadth of perceptual and conceptual attention,
such as perceptual embedding (Friedman & Förster, 2000, Experiment 1) and creative
generation and insight problem-solving (Friedman & Förster, 2002, Experiments 1 &
2). Notably, it has also been found that approach, relative to avoidance, motor actions
impair rather than enhance performance on analytical reasoning problems, which as
previously mentioned benefit from a restricted attentional scope (Friedman & Förster,
2000, Experiment 7).

A link between regulatory focus and time construal has also been observed with
Pennington and Roese (2003) showing that a distant future time perspective increases
concerns with promotion goals, whilst a near future time perspective increases concerns
with prevention goals. In further support of a relationship between regulatory focus and
attentional scope, Förster, Friedman, and Liberman (2004) found that having
participants construe a task in the distant future as opposed to the near future, enhanced
performance on a series of insight problem-solving and creative generation tasks, while
undermining analytical reasoning. More recently, Hunt and Carroll (2008) found that
participants who viewed a target face and then imagined their lives in the near future,
showed impaired recognition of that face in a subsequent line-up relative to participants
who imagined their lives in the distant future and those who engaged in the no-
imagining control task. Like insight problem-solving and creative generation, face
processing and recognition rely heavily on a global or holistic processing style (Tanaka

More direct support for a link between regulatory focus and global versus local
processing comes from Förster and Higgins (2005, Experiment 1) who presented
participants with a series of large capital letters comprised of small capital letters (e.g., a
large H made up of small Ts) on a computer screen and asked them to decide if either of
two specific letters appeared on the screen. Chronically promotion-focused individuals,
as measured by the speed in which they could identify three promotion goals, were
faster to respond to global letters (i.e., the large letters made up of small letters) than to local letters (i.e., the small letters which made up the large letters), indicating an expansion of attention enabling them to see the “forest for the trees”. In contrast, prevention-focused individuals, as measured by the speed in which they could identify three prevention goals, were faster to respond to local than to global letters, suggesting that their perceptual attention was narrowed upon the “trees” at the expense of the “forest” (see also Förster, Friedman, Özelsel, & Denzler, 2006, Experiment 1).

Even more compelling, Förster and Higgins (2005) demonstrated in a second experiment that the relationship between regulatory focus and attentional scope is reciprocal, such that an individual’s attentional scope (i.e., global versus local) can also influence their motivation. In this experiment, participants were first asked to decide whether a global or local letter appeared on the screen (i.e., primed for global or local processing), and were then given the choice between two objects: a mug and a pen. Half of the participants were asked to think of what they would gain by choosing the mug or the pen (promotion framing) and half were asked to think of what they would lose by not choosing the mug or the pen (prevention framing). Afterwards, participants were required to assign a monetary value to their chosen object. Consistent with a regulatory fit proposal, participants who had performed the global task assigned a higher price to their chosen object if they had chosen it under promotion framing than if they had chosen it under prevention framing. The reverse was true for participants who had performed the local task.

**Effect of Regulatory Foci on Hemispheric Activation**

There is some preliminary evidence to suggest that the effects of regulatory foci on attentional scope may be mediated by differences in relative hemispheric activation. For instance, in a recent study (Friedman & Förster, 2005, Experiment 4) regulatory focus was manipulated with the cheese versus owl mazes described previously, and then
relative hemispheric activation was gauged using a variant of the Milner line bisection task (Milner, Brechmann, & Pagliarini, 1992). In this task, participants were presented with a series of centrally bisected lines and asked to indicate which segment of each line was longer (left versus right). The tendency to view the leftward segments of the centrally bisected lines as longer is posited to reflect a left visual field (LVF) bias, engendering attentional neglect of the rightward extension of the line. Theoretically speaking, this LVF bias reflects greater relative right hemispheric activation (Milner et al., 1992). After completing the line bisection task, participants were administered a creative generation task (on which performance benefits from a broadened scope of attention), followed by an analytical reasoning task (on which performance benefits from a narrowed attentional scope). Replicating previous results, promotion, relative to prevention, focus was associated with increased creativity and impaired analytical reasoning. Moreover, a promotion focus was associated with lesser relative left (i.e., greater relative right) hemispheric activation than was a prevention focus. Finally, multivariate analyses indeed suggested that the effects of regulatory focus on attentional scope were mediated to a statistically significant extent by variations in relative hemispheric activation.

**Effect of Regulatory Foci on Eating Behaviour**

As discussed earlier, approach and avoidance motor actions (i.e., arm flexion versus arm extension) are typically associated with either the motivation to attain nurturance by approaching beneficial objects (i.e., promotion focus) or the motivation to attain security by avoiding noxious stimuli (i.e., prevention focus), and have been shown to induce differential processing styles: global and local processing, respectively (Friedman & Förster, 2000, 2002). More recently, Förster (2003) took the first step to explore the intriguing possibility that behaviour, namely eating behaviour, can be influenced by the motor actions of arm flexion and arm extension as well.
In two experiments, Förster (2003) led presumably non-hungry (Experiment 1) and non-thirsty participants (Experiment 2) to enact either motor actions of arm flexion (by pressing their hand upward on a table) or arm extension (by pressing their hand downward on a table) while exposed to a luxury food or luxury/neutral drink product (Experiment 1 and 2, respectively). To prevent participants from inferring the meaning of their motor actions (i.e., pulling/pushing as wanting/not wanting), a documentary was shown throughout the manipulation and participants in Experiment 1 were told that physiological reactions of muscle activity would be recorded as an objective measure of their liking of the documentary. Similarly, participants in Experiment 2 were told that the purpose of the study was to investigate the role of hemispheric activation in memory and that the arm actions required of them constituted a standard means of activating the left hemisphere. In both experiments, the experimenter left the room after starting the documentary to rule out the possibility of interaction effects on participants’ eating behaviour, such as ‘social facilitation’ (Berry, Beatty, & Klesges, 1985; Redd & de Castro, 1992) or ‘social inhibition’ (Rozin, 1996).

In Experiment 1, participants who engaged in arm flexion consumed more of the luxury food item (i.e., chocolate cookies) than participants who engaged in arm extension, and neither the taste of the cookies, pleasantness and effort of the arm positions, or mood of the participant (as assessed post-manipulation) mediated this effect. Similarly, in Experiment 2, participants under arm flexion drank more of a delicious drink (i.e., ice cold orange juice) than a control group (asked to perform a non-specific arm position), who in turn, drank more than those who extended their arms. Once again, this effect did not appear to be mediated by taste, pleasantness or effort of the arm positions, or mood. Interestingly, arm position had no such impact on the intake of a neutral drink (i.e., lukewarm mineral water). In explaining the above results, Förster (2003) suggests that when not in a state of hunger or thirst (as was the case for his
participants), food or drink has an explorative quality, thus reflecting self-actualisation and growth rather than deficit needs or safety requirements. As such, the luxury food and drink offered to participants under promotion cues of arm flexion constituted a regulatory fit and thereby facilitated intake. In contrast, the luxury food and drink offered to participants under prevention cues of arm extension constituted a regulatory misfit (i.e., since they are not regarded as means to ensure security) and thus inhibited intake. With respect to the absence of an influence of arm position on the consumption of a neutral drink, Förster (2003) reasons that motor actions of approach and avoidance only affect the consumption of food and drinks with a valence compatible with the arm positions.
CHAPTER 4.
THE EFFECT OF ATTENTIONAL SCOPE ON HEDONIC SNACK CONSUMPTION: STUDIES 1 AND 2

Introduction and Methodological Considerations

In light of growing evidence for a link between regulatory focus and attentional scope, two initial studies were developed to examine whether global and local processing tasks affect the consumption of hedonic or luxury snack food in a similar manner to Förster’s (2003) promotion and prevention focus priming. To assess this hypothesis, participants in the present studies were invited to help themselves to a bowl of a popular snack food (i.e., Crispy M&Ms) while they engaged in a global processing, local processing, or control task for an equivalent period of time. Extending Förster (2003), the present studies also aimed to determine whether an effect of attentional scope on hedonic snack consumption is related to differences in hemispheric activation. This was achieved by having participants complete a line bisection task (Milner et al., 1992) both immediately before (i.e., a baseline measurement) and after the manipulation. A final objective was to address the yet to be answered question of whether conscious desire or craving for hedonic snack food is also affected by attentional scope, and whether attentional scope has an effect on consumption over and above an individual’s chronic regulatory focus. In nearly all respects Studies 1 and 2 were identical except that different global processing tasks were used. For both studies it was predicted that compared to the control group:

The global processing group would:

- Make more pronounced leftward bisection errors relative to baseline, thereby demonstrating a greater increase in right hemispheric activation;
- Consume more of the hedonic snack; and
- Retrospectively report a stronger urge or desire to consume the snack.

And the local processing group would:

- Make more pronounced rightward bisection errors relative to baseline, thereby demonstrating a greater increase in left hemispheric activation;
- Consume less of the hedonic snack; and
- Retrospectively report a milder urge or desire to consume the snack.

### Induction of Processing Styles

As described in the previous chapter, global and local processing have classically been induced by directing participants to attend to either large or small letters, respectively, in a Navon task ( Förster, 2009; Förster & Higgins, 2005; Förster, Liberman, & Kushel, 2008; Macrae & Lewis, 2002). These processing styles have also been induced using a map task ( Förster, 2009; Förster et al., 2008; Friedman et al., 2003), which requires participants to study either the overall shape of a city map (i.e., global processing) or its finer details (i.e., local processing). Neuropsychological studies of both healthy subjects (Fink et al., 1996, 1997; Martinez et al., 1997; Volberg & Hübner, 2004) and patients with cerebral lesions (Robertson & Delis, 1986; Robertson, Lamb, & Knight, 1988) have confirmed that global processing is associated with right hemispheric activation (RHA) and local processing is associated with left hemispheric activation (LHA). Therefore, tasks that primarily involve the right versus left hemisphere should induce global versus local processing, respectively.

Broadly speaking, the right hemisphere has been found to be specialised for visuo-spatial processing (e.g., piecing together puzzles, arranging blocks to match designs, and reading maps), recognising faces, perceiving and expressing emotions,
creativity and insight, and recognising musical tunes. The left hemisphere, on the other hand, has generally been found to be specialised for language (i.e., speaking, reading and writing), arithmetic, and other tasks requiring detail analysis or logical thought (Mildner, 2008). These specialisations are frequently summarised into several dichotomies outlined in Table 4.1. Despite having different specialisations, Mildner (2008) emphasises that the two hemispheres do not work independently of each other. Rather, they communicate back and forth across the corpus callosum.

Table 4.1.

A Summary of Right-Left Hemisphere Dichotomies Based on the Literature

<table>
<thead>
<tr>
<th>Right Hemisphere</th>
<th>Left Hemisphere</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonverbal</td>
<td>Verbal</td>
</tr>
<tr>
<td>Holistic</td>
<td>Analytic</td>
</tr>
<tr>
<td>Parallel</td>
<td>Sequential</td>
</tr>
<tr>
<td>Global</td>
<td>Local</td>
</tr>
<tr>
<td>Appositional</td>
<td>Propositional</td>
</tr>
<tr>
<td>Coordinate</td>
<td>Categorical</td>
</tr>
</tbody>
</table>

Mental rotation refers to the imagined rotation of a visual image from one orientation to another, and is thought to be performed largely by the right hemisphere (Milivojevic, Hamm, & Corballis, 2009). In a pioneering study, Shepard and Metzler (1971) presented participants with drawings of pairs of three-dimensional objects (see Figure 4.1). The second item of the pair could be a rotated version of the first item, or a rotated version of a mirror image of the first item. The participants’ task was to determine whether the items in each pair depicted two identical objects or depicted a mirror-reversed pair. Shepard and Metzler found that response time on this task was linearly related to the difference in the angle of orientation of the two depicted objects.
This suggested that participants try to mentally align the two objects before making the discrimination and, in the process, imagine the object passing through intermediate orientations. Later studies by Cooper and Shepard (1973, 1975) demonstrated that participants also mentally rotate more recognisable stimuli, such as alphanumeric characters (see Figure 4.2) and drawings of hands.

![Figure 4.1. Examples of mental rotation stimuli used by Shepard and Metzler (1971).](image)

![Figure 4.2. Rotated letter stimuli of the sort used by Cooper and Shepard (1973).](image)

Although the majority of neuro-imaging studies support right hemispheric dominance for mental rotation (Carpenter, Just, Keller, Eddy, & Thulborn, 1999; Harris et al., 2000; Yoshino, Inoue, & Suzuki, 2000; Zacks, Vettel, & Michelon, 2003), some studies have reported bilateral activation (Cohen et al., 1996; Jordan, Heinze, Lutz,
Kanowski, & Jäncke, 2001; Kosslyn, DiGiralamo, Thompson, & Alpert, 1998) and left hemispheric dominance (e.g., Alivisatos & Petrides, 1996). Corballis (1997) posits that the complexity of the stimuli used in mental rotation tasks influences hemispheric lateralisation. While the rotation of simple stimuli, such as Cooper and Shepard’s alphanumeric characters, may be accomplished in a holistic fashion (favouring the right hemisphere); the rotation of Shepard and Metzler’s more complex three-dimensional objects may induce piecemeal processing, thus increasing the involvement of the left hemisphere (Corballis, 1997). Therefore, the simpler Cooper and Shepard’s (1973) task was used to induce global processing in the present studies.

With respect to choosing a left hemisphere task, there is much evidence from visual hemisfield (D’Hondt & Leybart, 2003; Grossi, Coch, Coffey-Corina, Holcomb, & Neville, 2001; Rayman & Zaidel, 1991), neuro-imaging (Démonet, Price, Wise, & Frackowiak, 1994; Lurito, Kareken, Lowe, Chen, & Mathews, 2000), and tympanic membrane thermometry studies (Cherbuin & Brinkman, 2004) that rhyme judgment tasks are lateralised to the left hemisphere. In rhyme judgment tasks participants are presented with a written target word followed by a written test word, which are orthographically dissimilar (i.e., have different end spellings), and are required to decide whether the test word rhymes with the previously seen target word (e.g., STONE-OWN) or not (e.g., DARE-FREE).

**Choice of Control Task**

Finding a suitable control task for the present studies was difficult as it is questionable whether any task (including doing “nothing”) could occupy a participant for the duration of the food exposure period without having any effect on processing style. For example, Hunt and Carroll (2008) found that asking participants to engage in proximal imagining by considering their plans and goals for the next day elicited an analytic processing style, which exacerbated the negative impact of having described a
face on its subsequent recognition (i.e., verbal overshadowing effect). In contrast, asking participants to engage in distal imagining by thinking about their lives a year from now elicited a holistic processing style (most congruent with the demands of face recognition), which alleviated the verbal overshadowing effect. These findings suggest that the control task should be structured as leaving participants to ruminate without direction could elicit either type of processing style.

In the present studies, control participants viewed a series of landscape photographs and were required to indicate nonverbally (using specified keys on the numeric keypad) whether they liked the photograph or not. No words or faces were depicted in any of the images to reduce the use of local and global processing strategies, respectively. It was anticipated that this task would have little effect on processing style, yet would keep participants occupied (in particular their hands) to the same extent as the experimental conditions while exposed to the snack food.

*Manipulation Check of Processing Styles*

To confirm that the tasks did actually induce the intended processing styles (or lack thereof, in the case of the control task), hemispheric activation was measured using a line bisection task (Milner et al., 1992), which was described in Chapter 3. While previous studies (e.g., Förster et al., 2008; Friedman & Förster, 2005) have based their findings of hemispheric activation on just one line bisection measurement taken after the manipulation, the present studies included a pre-manipulation (or baseline) measurement for comparison. In essence, this allows a much more definitive conclusion about whether the tasks have produced a change in hemispheric activation. It was anticipated that participants who performed the global processing task would exhibit more pronounced leftward bisection errors relative to baseline than participants in the control condition, thereby demonstrating a greater increase in right (and decrease in left) hemispheric activation. In contrast, it was anticipated that participants who performed
the local processing task would exhibit more pronounced rightward errors relative to baseline (and thus a greater increase in left and decrease in right activation) than those in the control condition.

*Measuring Chronic Regulatory Focus*

Regulatory focus theory posits that there are relatively stable individual differences in chronic regulatory focus, but that certain situational variables can temporarily change a person’s focus. To determine whether the processing style manipulation had an effect on snack intake over and above participants’ chronic regulatory focus it was necessary to measure this latter variable. Individual differences in chronic regulatory focus have largely been assessed using the regulatory focus questionnaire (RFQ; Higgins et al., 2001) and the general regulatory focus measure (GRFM; Lockwood, Jordan, & Kunda, 2002).

The RFQ consists of two orthogonal scales designed to assess individuals’ subjective histories of success or failure in promotion and prevention self-regulation. The promotion pride scale consists of six items that assess individuals’ subjective history of successfully achieving aspirations, ideals, and ambitions (e.g., “How often have you accomplished things that got you ‘psyched’ to work even harder?”). The prevention pride scale consists of five items that assess individuals’ subjective history of successfully fulfilling duties, obligations, and responsibilities (e.g., “How often did you obey rules and regulations that were established by your parents?”). These items are rated on a 5-point scale (1 = Never, 5 = Very often). Cronbach’s alpha approximated .73 for the promotion pride scale and .80 for the prevention pride scale, indicating good internal consistency for both (Higgins et al., 2001).

In contrast, the GRFM is tailored for use with undergraduate students, emphasising success and failure at academic goals. Using a 9-point scale (1 = Not at all true of me, 9 = Very true of me), participants are required to indicate the extent to which
they endorse 8 items pertinent to promotion goals (e.g., “I frequently imagine how I will achieve my hopes and aspirations”; “My major goal in university right now is to achieve my academic ambitions”) and 10 items pertinent to prevention goals (e.g., “I am anxious that I will fall short of my responsibilities and obligations”; “My major goal in university right now is to avoid becoming an academic failure”). Lockwood et al. (2001) found both scales to be reliable (promotion $\alpha = .81$, prevention $\alpha = .75$).

While the RFQ and the GRFM are both widely used measures of chronic regulatory focus, Summerville and Roese (2008) recently demonstrated that participants’ responses on these two measures were largely unrelated. They suggested that the difference between the RFQ and the GRFM pivoted on affect. While the RFQ was not related to affective valence, the GRFM’s promotion scale was significantly correlated with positive affect and its prevention scale was significantly correlated with negative affect. Given that promotion and prevention foci are theorised to be independent of affective valence, Summerville and Roese recommend a cautious reading of data based on the GRFM. For this reason, the RFQ was employed as the measure of chronic regulatory focus in the present studies.

Study 1

Method

Participants

A total of 36 first-year Australian National University (ANU) psychology students were recruited for an ostensible study on “brain hemisphere specialisation” via a web-based advertisement (Appendix A). Six participants were excluded from data analysis because they were predominantly left-handed (4), dieting (1) and/or allergic to the food stimulus (1). This left 30 participants (16 males and 14 females) whose ages ranged from 17 to 31 years ($M = 20.07$, $SD = 3.06$). They were tested individually in a cognitive laboratory within the Department of Psychology and earned one hour’s course
credit for their participation. Each participant read and signed a consent form before taking part in the study and received an information sheet upon completion. See Appendix B.

Design

Study 1 was a simple global processing, local processing, or control condition between-subjects design. The dependent variables were hemispheric activation, the quantity of the hedonic snack consumed (in grams), and participants’ self-reported urge or desire to consume the snack.

Apparatus

The experimental and control tasks were performed using an Intel(R) Core(TM) Duo CPU with 3.25GB of RAM. The operating system was Microsoft XP Professional (Version 2002). The monitor was a Dell UltraSharp 2208WFP 22-inch Widescreen Flat Panel LCD, which had a refresh rate of 60 Hertz.

A pocket scale with a 0-300 gram capacity and sensitivity to differences of 0.1 grams was used to measure the quantity of the snack food consumed.

Materials

Food stimulus. The food stimulus was 160 grams of Crispy M&Ms presented in a red plastic serving bowl (14cm x 5cm). The exact weight of the food was measured before and after the experimental session.

Mental rotation (global processing) task. The stimuli for the mental rotation task (see Figure 4.3) consisted of six uppercase alphabetic (F, G, J, L, P and R) and three numeric characters (2, 4 and 5), which were presented in both a normal and mirror-reversed form at angular departures of 0, 60, 120, 180, 240, and 300° clockwise from upright. The stimuli were presented as black characters (Arial 72-point font) on a white background and remained on the screen until the participant responded. Participants were required to decide whether the characters were normal or mirror-reversed by
pressing the "1" and the "2" keys, respectively. Given Johnson, McKenzie and Hamm's (2002) finding that females were slightly left lateralised when making a dominant hand response but strongly right lateralised when making a non-dominant hand response on a mental rotation task, all participants were required to make their decisions using their non-dominant hand. Each participant received a practice session of 10 trials to familiarise them with the task, followed by 5 blocks of 70 test trials. The complete set of mental rotation stimuli can be found in Appendix C.

<table>
<thead>
<tr>
<th>Rotation</th>
<th>0°</th>
<th>60°</th>
<th>120°</th>
<th>180°</th>
<th>240°</th>
<th>300°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Mirrored</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
</tbody>
</table>

*Figure 4.3. Examples of stimuli for the mental rotation task.*

*Rhyming (local processing) task.* The stimuli for the rhyming task (see Table 4.2) consisted of 252 target/test word pairs, half of which rhymed. The target words were 3-6 letters long and the test words always three letters long. All pairs were orthogonally dissimilar. The target word was presented first for 800 ms, followed by an inter-stimulus interval of 200 ms, and then the test word was presented for 800 ms. Using the numeric keypad of the computer keyboard, participants were instructed to press the "1" key if the test word rhymed with the previously presented target word. Otherwise, they were to press the "2" key. Each participant received a practice session of 10 trials and then received 5 blocks of 65 test trials. The complete list of rhyming and non-rhyming word pairs is presented in Appendix C.
Table 4.2.

*Examples of Stimuli for the Rhyming Task*

<table>
<thead>
<tr>
<th>Rhyming word pairs</th>
<th>Non-rhyming word pairs</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLUR – FIR</td>
<td>RAID – TUG</td>
</tr>
<tr>
<td>PLEA – FEE</td>
<td>CHOMP – AID</td>
</tr>
<tr>
<td>WOE – ROW</td>
<td>LOG – RED</td>
</tr>
<tr>
<td>BRICKS – MIX</td>
<td>GRADE – TAX</td>
</tr>
<tr>
<td>DIN – INN</td>
<td>DOT – LIP</td>
</tr>
<tr>
<td>FOUL – OWL</td>
<td>COIN – MUD</td>
</tr>
</tbody>
</table>

*Control task.* The stimuli for the control task consisted of 271 colour photographs, which depicted a variety of rural, coastal, urban and industrial scenes. Participants were asked to inspect each photograph for a couple of seconds and then decide whether they liked the photograph or not. Again, using the numeric keypad, participants were required to press the “1” key if they liked the photograph or the “2” key if they did not like the photograph. Appendix C includes a sample of the control task photographs.

*Line bisection task.* Twenty-two horizontal lines of different lengths (in cm, 11.5, 9.0, 11.6, 11.5, 14.4, 10.8, 13.4, 10.5, 11.8, 13.5, 10.3, 14.4, 9.4, 12.9, 12.5, 12.4, 12.4, 11.9, 10.4, 11.9, 13.5, 13.9) were distributed across two sheets of paper. Participants were instructed to mark the centre of each line, using a sheet of cardboard with a 15 cm x 2 cm window to eliminate visual interference from the other lines.

*Health survey.* Given that a number of health and lifestyle factors (e.g., diabetes, food allergies/intolerances, and dieting) potentially impact upon the type and quantity of food individuals consume, questions regarding these factors were embedded in a health survey (see Appendix D) and issued to participants prior to starting the study.
Chronic regulatory focus. Chronic regulatory focus was assessed prior to the manipulation using the Regulatory Focus Questionnaire (RFQ; Higgins et al., 2001), which can be found in Appendix D. In the present study, internal consistency (Cronbach’s alphas) for both the promotion pride scale and the prevention pride scale was good (α = .79 and .74, respectively) and comparable to findings reported by Higgins et al. (2001). The correlation between the two scales was non-significant (r = .017, p = .93), which confirms that the two scales are orthogonal.

Handedness questionnaire. Most right-handed people (i.e., 94%) have a typical pattern of functional lateralisation with the left hemisphere being specialised for language and the right hemisphere being specialised for visuo-spatial skills. In contrast, only about 78% of left-handed individuals are typically lateralised (Springer & Deutsch, 1998). For this reason, handedness was assessed using a handedness questionnaire adapted from Provins and Cunliffe (1972), and data from participants shown to be predominantly left-handed was excluded from analysis. This questionnaire (see Appendix D) demonstrated excellent internal consistency (α = .91) in the present study.

Post-manipulation questionnaire. In a short questionnaire (see Appendix D), participants’ desire or craving for the offered snack food was assessed retrospectively using 4 items (α = .81), which were generated by the experimenter (e.g., “As I worked on the computer task I found myself thinking a lot about the food offered” from 1 = strongly disagree, to 9 = strongly agree). The questionnaire also examined the extent to which variables, other than the manipulation of processing style, might have influenced the amount of M&Ms participants consumed. Specifically, the questionnaire assessed: liking, engagement, and difficulty of the tasks (from 1 = not at all, to 9 = very much); effect of the tasks on positive mood (α = .78; e.g. “When you think about completing the computer task, how likely was it that you felt happy?” from 1 = very unlikely, to 9 = very likely) and negative mood (α = .75; e.g., “When you think about completing the
computer task, how likely was it that you felt sad?”); liking of the snack product (e.g., “Please rate how much you like M&Ms” from 1 = not at all, to 9 = very much); level of hunger prior to starting the study (rating scale from 1 = not at all hungry, to 9 = extremely hungry); and how pressured participants felt by the situation to consume or not consume the snack product (e.g., “I thought the experimenter would think badly of me if I ate all the M&Ms” from 1 = strongly disagree, to 9 = strongly agree).

Procedure

On arrival, participants completed the health survey, a line bisection task, a handedness questionnaire, and the chronic regulatory focus measure. They were then randomly allocated to work on the mental rotation (global processing) task, the rhyming (local processing) task, or the control task. Before commencing the task each participant was offered a snack (i.e., a 160 gram packet of M&Ms) as a “small gesture of appreciation for their time”. The packet was opened in full view of participants (to assure them that the product was fresh and untainted) and then taken outside the lab where its contents were poured into a bowl and covertly weighed. After placing the bowl of M&Ms in front of participants (always centred between the keyboard and the central processing unit), the experimenter instructed them to start the computer task and excused herself from the room with a cover story about needing to leave for 15 minutes in order to photocopy some material for the next part of the study. Precisely 15 minutes later, the experimenter returned, collected the bowl for weighing, and immediately re-issued the previous line bisection task (i.e., manipulation check). Finally, participants completed the questionnaire, were probed for any suspicions, debriefed, and thanked for their involvement in the study. The experimental procedure took approximately 40 minutes.
Results

Analysis of relative hemispheric activation

To reiterate, participants were issued a line bisection task prior to engaging in the processing task (i.e., global, local, or control) to attain a baseline or pre-manipulation measurement of their hemispheric activation. On ceasing the processing task, participants were immediately asked to bisect the same set of lines (i.e., post-manipulation measurement) to ascertain whether the processing task had altered their hemispheric activation in the expected direction. It was predicted that participants who performed the global processing task would exhibit more pronounced leftward bisection errors relative to baseline than participants in the control condition, thereby demonstrating a greater increase in right hemispheric activation. In contrast, it was predicted that participants who performed the local processing task would exhibit more pronounced rightward bisection errors relative to baseline compared to the control group, indicating a greater increase in left hemispheric activation. To assess these predictions, the deviations of participants’ bisection marks from the lines’ true midpoints (for both the pre- and post-manipulation measures) were calculated. The obtained values were averaged across each set of 22 lines to create two overall bisection error indices, with positive values indicating a leftward bias and negative values indicating a rightward bias.

A 3 (processing condition: global, local control) x 2 (time: pre-manipulation, post-manipulation) repeated measures analysis of variance (ANOVA) was conducted on these overall bisection error indices. The means and standard deviations are presented in Table 4.3. This analysis yielded a main effect of time, $F(1, 27) = 8.32, p = .008, \eta^2 = .236$, but no main effect of processing condition, $F(2, 27) = 1.60, p = .221, \eta^2 = .106$. The time by processing condition interaction was significant, $F(2, 27) = 7.00, p = .004, \eta^2 = .341$, indicating that the conditions differed in terms of change in hemispheric
activation across time. Follow-up analyses demonstrated that consistent with predictions, the local processing condition evidenced a significantly greater rightward shift from baseline (i.e., a greater increase in left hemispheric activation) than both the control, $t(27) = 3.67, p = .001$ and the global processing conditions, $t(27) = -2.45, p = .021$. However, as can been seen in Table 4.3, the global processing condition shifted in the opposite direction to that predicted (i.e. slightly rightward) indicating a small increase in left hemispheric activation but was not significantly different from the control condition, $t(27) = 1.22, p = .231$.

Table 4.3.

Study 1 Means (and Standard Deviations) for Hemispheric Activation as Measured by the Line Bisection Task as a Function of Processing Condition

<table>
<thead>
<tr>
<th>Time of measurement</th>
<th>Processing Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Global ($n = 10$)</td>
</tr>
<tr>
<td>Pre-task (baseline)</td>
<td>.10 (.21)</td>
</tr>
<tr>
<td>Post-task</td>
<td>.08 (.20)</td>
</tr>
</tbody>
</table>

*Note. Measured in centimetres. Higher values indicate higher right hemispheric activation.*

**Snack intake**

All participants engaged in at least some snacking during the food exposure period, with the minimum amount of M&Ms consumed being 5.20 grams. It was anticipated that relative to a control condition, engaging in a global processing task would facilitate the consumption of a hedonic snack such as M&Ms, whereas engaging in a local processing task would inhibit it. To assess these predictions, a one-way between-groups ANOVA was conducted, which compared the total number of grams of M&Ms consumed by the three processing conditions. Although this difference was marginally significant, $F(2, 27) = 3.17, p = .058, \eta^2 = .190$, Table 4.4 shows that the
pattern of consumption was not entirely consistent with predictions. Specifically, contrast analyses revealed that while the local processing condition consumed significantly less of the snack than the control condition, $t(27) = 2.40, p = .024$, there was no significant difference in consumption between the local and global processing conditions, $t(27) = -.53, p = .599$. Also against prediction, the control condition consumed more of the snack than the global processing condition, with the difference approaching but not reaching significance, $t(27) = 1.86, p = .073$.

Table 4.4.

*Study 1 Means (and Standard Deviations) for Snack Intake and Desire to Eat Ratings as a Function of Processing Condition*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Processing Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Global ($n = 10$)</td>
</tr>
<tr>
<td>Snack intake (in g.)</td>
<td>28.24 (18.67)</td>
</tr>
<tr>
<td>Desire to eat</td>
<td>5.28 (1.70)</td>
</tr>
</tbody>
</table>

*Note. Desire to eat was measured on 9-point scales. Higher values indicate greater desire to eat.*

*Desire to eat*

To examine desire to eat among the different processing conditions a one-way ANOVA was used. Contrary to prediction the ANOVA indicated no significant differences among the three conditions in terms of participants’ desire to consume the snack, $F(2, 27) = 1.92, p = .166$, $\eta^2 = .124$. Mean desire to eat scores for each of the conditions are presented in Table 4.4.

*Analysis of alternative explanations for snack intake*

Self-report measures of mood, chronic regulatory focus, liking of the task, liking of the snack, task engagement, and hunger were statistically controlled for using hierarchical multiple regression. Only one of these variables made a statistically
significant contribution to snack intake and that was hunger ($\beta = .519, p = .012$).

Controlling for these variables did eliminate the significance of processing condition on
snack intake, $F_{\text{change}} (1, 20) = 0.22, p = .647$. However, given the small sample size this
result needs to be viewed cautiously.

**Discussion**

The aim of the present study was to explore the effect of global and local
processing (linked to promotion and prevention foci, respectively) on hemispheric
activation, conscious desire or craving for a hedonic snack, as well as its actual
consumption. As predicted, the local processing (i.e., rhyming) condition showed a
greater increase in left hemispheric activation from baseline compared to the control
group and consumed relatively less of the snack. Although the local processing
condition reported (after intake) having experienced less of a desire to consume the
snack than the control group, this difference was not statistically significant. Contrary to
predictions, the global processing (i.e., mental rotation) condition did not show a greater
increase in right hemispheric activation from baseline compared to the control group
and did not consume relatively more of the snack. The global processing condition
reported less desire to consume the snack than the control condition, although once
again this difference was not statistically significant.

The absence of an anticipated boost in snack intake for the global processing
condition is most likely due to limitations of mental rotation as a right hemisphere,
global processing task. As discussed previously, participants rotated Cooper and
Shepard’s (1973) two-dimensional alphanumerical characters rather than Shepard and
Metzler’s (1971) more complex three-dimensional objects in order to encourage holistic
(right hemisphere) processing as opposed to piecemeal (left hemisphere) processing.
However, even this more pure measure of mental rotation has failed to consistently
demonstrate right hemispheric dominance (Alivisatos & Petrides, 1996; Cohen et al.,
1996; Jordan et al., 2001; Kosslyn et al., 1998). While aware of the limitations of mental rotation as a right hemisphere task, finding a task that predominantly activates the right hemisphere is notoriously difficult (Hellige, 1990) and mental rotation was chosen as the less problematic of the options available.

It could be the case in the present study that, as shown by Voyer (1995), extended practice led to a left hemispheric contribution to mental rotation. Voyer (1995) had participants complete 4 blocks of 64 trials of mental rotation and observed a shift from a right hemisphere advantage to a left hemisphere advantage across blocks of trials. This shift in laterality was interpreted as a shift from the use of a holistic mental rotation strategy at the onset of the study (when the task was novel) to the use of an analytical strategy with practice. Whilst every effort was made in the present study to limit the amount of practice participants had at mental rotation, this was constrained by the need to have participants exposed to the snack for a long enough period of time (i.e., 15 minutes) to permit variability in intake.

The results of Study 1 suggest that mental rotation may not be the most appropriate task for inducing right hemispheric activation, and that whatever task is used in Study 2, needs to be brief enough to avoid participants becoming practiced and shifting to an analytic strategy.

**Study 2**

Given the lack of right hemispheric activation for mental rotation in Study 1, it was necessary to re-examine the hypotheses using a potentially stronger manipulation of global processing; namely, insight problem-solving. In contrast to incremental or analytical problem-solving, insight problem-solving is characterised by the following features: (1) Solvers initially experience an impasse, possibly because they are misdirected by ambiguous information in the problem (Dominowski & Dallob, 1995; Smith, 1995); (2) Solvers usually cannot report the process that enabled them to
reinterpret the problem and overcome the impasse (Gick & Lockhart, 1995; Ohlsson, 1992; Schooler & Melcher, 1995); and (3) Solvers experience a distinct affective response involving suddenness and surprise (i.e., the “aha!” feeling) when a solution is reached (Schooler, Ohlsson & Brooks, 1993; Smith & Kounios, 1996). A neurological model of insight (see Bowden, Jung-Beeman, Fleck & Kounios, 2005) proposes that while the left hemisphere engages in relatively fine semantic coding, misdirecting focus towards the dominant or literal meaning of words in the problem; the right hemisphere engages in relatively coarse semantic coding, maintaining diffuse activation of alternative meanings and distant associates, which enables insight.

Jung-Beeman and colleagues (e.g., Bowden & Jung-Beeman, 1998; Bowden & Jung-Beeman, 2003; Jung-Beeman et al., 2004) have investigated this neurological model of insight using a compound remote associate (CRA) task. In a CRA word puzzle, participants are given three words, such as “tooth”, “potato”, and “heart”, and asked to think of a word that can be combined with all three – in this case “sweet” (“sweet tooth”, “sweet potato”, “sweet heart”). Solutions to these problems can be reached with or without insight, which is typically determined by asking participants to indicate whether or not a solution was accompanied by an “aha!” feeling.

Using a priming paradigm, Bowden and Jung-Beeman (1998) found that when participants were presented with potential solution words for CRA puzzles (actual solution and unrelated words), the actual solution words were read faster than the unrelated words, and this effect was larger when the words were presented in the left visual field (i.e., projected to the right hemisphere). This right hemisphere advantage occurred only when the solution was reached with insight. Consistent with these results, a functional magnetic resonance imaging (fMRI) study revealed increased activation in the right anterior superior temporal gyrus for insight relative to non-insight solving of CRA puzzles, and scalp electroencephalogram (EEG) recordings revealed a sudden
burst of high-frequency (gamma-band) neural activity in the same region about 300ms before insight (Jung-Beeman et al., 2004). Based on the above evidence, the aim of the present study was to re-run Study 1 using insight problem-solving in place of mental rotation as the global processing task. In all other respects, Study 2 was identical to Study 1.

**Method**

*Participants*

Eighty-four first-year ANU psychology students were recruited for a study on “brain hemisphere specialisation” via a web-based advertisement (Appendix A). Nine participants were excluded from data analysis because they were predominantly left-handed (5), dieting (1) and/or allergic to the food stimulus (3). This left 75 participants (18 males, 57 females) whose ages ranged from 17 to 46 years ($M = 19.47$, $SD = 3.90$). As in the previous study, participants were tested individually and received one hour’s course credit for their participation. Each participant read and signed a consent form prior to taking part in the study and received an information sheet on completion. See Appendix B.

*Design*

Study 2 was a simple global processing, local processing, or control condition between-subjects design. The dependent variables were hemispheric activation, the quantity of the hedonic snack consumed, and self-reported desire to consume the snack.

*Apparatus*

The local processing task and the control task were performed on the same computer used in Study 1. The global processing task was administered in a paper-and-pencil format. The same pocket scale was used to measure the quantity of the snack consumed.
Materials

Food stimulus. See Study 1 for details.

Insight problem-solving (global processing) task. The stimuli for the insight problem-solving task consisted of 40 CRA problems selected from a set of 144 CRA problems developed by Bowden and Jung-Beeman (2003). Each problem contained three stimulus words, each of which could form a compound word or phrase with the solution word (e.g., aid / rubber / wagon – band). See Appendix C for complete CRA set.

Rhyming (local processing) task and control task. See Study 1 for details.

Measures. The same measures from Study 1 were used to assess participants’ chronic regulatory focus (promotion focus $\alpha = .60$; prevention focus $\alpha = .78$), handedness ($\alpha = .86$), conscious desire to snack ($\alpha = .85$), and the effect of the manipulation on both positive and negative mood ($\alpha = .82$ and .65, respectively).

Procedure

The procedure for Study 2 was identical to that of Study 1, except that the task (and food exposure) duration for all conditions was reduced from 15 minutes to 10 minutes. This modification was made in order to limit practice effects (i.e., a shift in processing strategy), hypothesised to have occurred for the global processing condition in the previous study.

Results

Analysis of relative hemispheric activation

As in Study 1, participants were issued the same line bisection task before and after engaging in the processing task to attain a baseline and post-manipulation measurement of their hemispheric activation, respectively. Again, it was predicted that compared with participants in the control condition, those who performed the global processing task would exhibit more pronounced leftward bisection errors relative to baseline (i.e., a greater increase
in right hemispheric activation) and those who performed the local processing task would exhibit more pronounced rightward bisection errors relative to baseline (i.e., a greater increase in left hemispheric activation).

A 3 (processing condition: global, local control) x 2 (time: pre-manipulation, post-manipulation) repeated measures ANOVA was conducted on the bisection error indices. The means and standard deviations are presented in Table 4.5. A main effect of time was non-significant, although a trend was evident, $F(1, 72) = 2.84, p = .096, \eta^2 = .036$. There was no main effect of processing condition, $F(2, 72) = 0.41, p = .664, \eta^2 = .011$. A time by processing condition interaction demonstrated a significant difference between the conditions in terms of change in hemispheric activation across time, $F(2, 72) = 8.89, p < .001, \eta^2 = .198$. In line with predictions, the local processing condition evidenced a significantly greater rightward shift from baseline (i.e., a greater increase in left hemispheric activation) than both the control, $t(72) = 2.90, p = .005$ and the global processing conditions, $t(72) = -4.16, p < .001$. While the global processing condition shifted in the anticipated direction (i.e., leftward), indicating an increase in right hemispheric activation, it was not significantly different from the control condition, $t(72) = -1.26, p = .212$.

Table 4.5.

*Study 2 Means (and Standard Deviations) for Hemispheric Activation as Measured by the Line Bisection Task as a Function of Processing Condition*

<table>
<thead>
<tr>
<th>Time of measurement</th>
<th>Processing Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Global $(n = 25)$</td>
</tr>
<tr>
<td>Pre-task (baseline)</td>
<td>.04 (.11)</td>
</tr>
<tr>
<td>Post-task</td>
<td>.07 (.12)</td>
</tr>
</tbody>
</table>

*Note: Measured in centimetres. Higher values indicate higher right hemispheric activation.*
Snack intake

All participants engaged in at least some snacking during the food exposure period, with the minimum amount of M&Ms consumed being 1.1 grams. Once again it was predicted that compared with a control condition, engaging in a global processing task would facilitate the consumption of the snack food, whereas engaging in a local processing task would inhibit it. A one-way between-groups ANOVA comparing the total number of grams of M&Ms consumed in three processing conditions revealed a significant difference, $F(2, 72) = 5.35, p = .007, \eta^2 = .129$, and as can be seen in Table 4.6, the pattern of consumption was consistent with predictions. Contrast analyses showed that the local processing condition consumed significantly less of the snack than both the global processing condition, $t(72) = -3.21, p = .002$ and the control condition, $t(72) = 2.14, p = .036$. However, while the global processing condition consumed more of the snack than the control group, the difference was not significant, $t(72) = -1.08, p = .285$.

Table 4.6.

Study 2 Means (and Standard Deviations) for Snack Intake and Desire to Eat Ratings as a Function of Processing Condition

<table>
<thead>
<tr>
<th>Measure</th>
<th>Processing Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Global ($n = 25$)</td>
</tr>
<tr>
<td>Snack intake (in g.)</td>
<td>39.32 (27.25)</td>
</tr>
<tr>
<td>Desire to eat</td>
<td>6.24 (1.82)</td>
</tr>
</tbody>
</table>

Note. Desire to eat was measured on 9-point scales. Higher values indicate greater desire to eat.
Contrary to prediction, the difference in self-reported desire to eat among the three processing conditions approached but did not reach significance, $F(2, 72) = 2.70$, $p = .074$, $\eta^2 = .070$. Contrast analyses revealed that the local processing condition desired the snack less than the control group, $t(72) = 1.15$, $p = .027$. However, the global processing condition did not report a greater desire to eat the snack than the local processing condition, $t(72) = -1.62$, $p = .109$ or the control group, $t(72) = .63$, $p = .530$. Mean desire to eat scores for each of the processing conditions are presented in Table 4.6.

Analysis of alternative explanations for snack intake

The effect of processing task on snack intake remained significant [$F_{\text{change}} (1, 63) = 4.64$, $p = .035$] after controlling for mood, chronic regulatory focus, liking of the task, liking of the snack, task engagement, task difficulty, hunger and age using hierarchical multiple regression. None of these variables made a statistically significant contribution to snack intake ($p$'s > .05).

Discussion

The aim of Study 2 was to re-examine the effect of processing style on hedonic snack consumption and conscious desire using insight problem-solving in place of mental rotation as the global processing task. As in Study 1 (and consistent with predictions), the local processing (i.e., rhyming) condition again showed a greater increase in left hemispheric activation from baseline compared to the control group as well as consuming relatively less of the snack. While the local processing condition experienced significantly less desire to consume the snack than the control group, it was not significantly less than the global processing condition. Improving on Study 1, the global processing task showed a greater increase in right hemispheric activation from baseline compared to the control group, and as predicted, consumed relatively more of
the snack. However, these differences were not statistically significant. While consuming, on average, the greatest quantity of the snack, the global processing condition did not report experiencing a significantly stronger desire than either the local processing or control condition.

The lack of a statistically significant amount of right hemispheric activation for the global processing condition again reflects difficulties in finding a strongly right lateralised task, and a task that can engage the right hemisphere over an extended period of time (i.e., 10 minutes). While insight problem-solving appears to be more lateralised to the right hemisphere than mental rotation, it too is not devoid of input from the left hemisphere. For example, Jung-Beeman et al. (2004) demonstrated that solutions to insight problems can be reached through insight processes or through analytic non-insight processes (56% and 42% of correct solutions, respectively), and only the insight solutions bring about increased activity in the right hemisphere. While subjective experience of insight (i.e., aha! response) was not measured in the present study, it is likely that my participants alternated between insight and non-insight processes to solve the problems, resulting in the relatively weak amount of right hemispheric activation. However, right hemispheric activation was still greater than that found following the mental rotation task used in Study 1.

Consistent with Study 1, neither chronic promotion nor chronic prevention focus was predictive of snack intake. Again, this highlights the superseding effect of situational over dispositional focus, at least temporarily. Like regulatory focus, there are also individual differences in cognitive processing style. Some individuals are habitually more wholistic in the way that they retrieve, perceive and process information, while others are more analytical (Riding & Rayner, 1998). It is possible that trait measures of these styles could have moderated the present findings. Future
research should include an assessment of these styles, perhaps using Riding’s (2000) Cognitive Styles Analysis, which has a Wholistic-Analytic dimension.

The present study supports a growing body of research connecting regulatory focus to attentional scope (e.g., Förster & Higgins, 2005). Participants in the local processing condition behaved similarly to Förster’s (2003) participants who engaged in arm extension (a prevention focus manipulation); both showed an inhibition of snacking behaviour. Furthermore, participants in the global processing condition exhibited the same boost in snack intake observed for Förster’s participants who engaged in arm flexion (a promotion focus manipulation), although perhaps to a lesser extent. Like Förster’s study, the influence of the manipulation on snacking behaviour was not associated with participants’ mood, suggesting that it is the particular focus and not the emotional response produced by that focus that drives intake.

From a regulatory fit perspective, the inhibited snacking behaviour by the local processing condition reflects a regulatory misfit between the type of food offered and an indirectly induced prevention focus. For most non-hungry individuals, a hedonically pleasing luxury food such as M&Ms represents a means of satisfying nurturance rather than security needs, and is therefore at odds with a focus on safety and protection. In contrast, the increased snack consumption by the global processing condition represents a regulatory fit. For these participants, an indirectly induced focus on nurturance, ideals and gains (i.e., a promotion focus) is highly compatible with the hedonic snack offered. Regulatory fit has also been used to predict and influence consumer behaviour for non-food products, such as mp3-players. Hassenzahl, Schöbel and Trautmann (2008) found that participants induced with a promotion focus rated a primarily hedonic mp3-player (i.e., interesting and original sonique skin) as more appealing and chose it more frequently compared to individuals induced with a prevention focus. The reverse was
true for the evaluation and choice of the pragmatic player, which comprised a more controllable and simpler skin.

**General Discussion**

The first two studies attempted to manipulate regulatory focus indirectly using global and local processing tasks. While the local processing task produced strong left hemispheric activation and inhibited snack consumption in both studies, neither of the global processing tasks used produced a statistically significant increase in right hemispheric activation or snack consumption. This suggests that a more direct or traditional manipulation of regulatory focus may be necessary for influencing (or at least facilitating) snacking behaviour.

The findings of the first two studies generalise to individuals with relatively healthy eating attitudes and behaviours as none of the participants were dieting to control weight at the time. Dieting has been identified as a major risk factor for the development and maintenance of eating disorders, including bulimia nervosa and anorexia nervosa (Stice, 2002). There is a great deal of evidence, which will be discussed in the next chapter, to suggest that eating disordered individuals predominantly operate under a prevention focus, and that those who binge eat (typically on hedonic "forbidden" foods), do so in order to obtain temporary security or protection from unpleasant thoughts and emotions. Given that hedonic food appears to have a different meaning or serve a different function for eating disordered individuals, it is important to understand how regulatory focus influences their eating behaviour and how it might differ from healthy individuals. This will be explored in Studies 3 and 4, which are presented in Chapter 6.
CHAPTER 5.
KEY COGNITIVE, BEHAVIOURAL AND AFFECTIVE FEATURES OF
CLINICAL EATING DISORDERS AND SUBCLINICAL DISORDERED
EATING

Binge Eating and the Classification of Eating Disorders

Binge eating is a highly distressing symptom characteristic of anorexia nervosa (binge eating/purging type), bulimia nervosa, and the more recently recognised diagnosis of binge eating disorder (American Psychiatric Association [APA], 1994). The fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; APA, 1994) specifies that to be considered a binge, an episode of eating must be characterised by the following:

1. Eating, in a discrete period of time (e.g., within any 2-hour period), an amount of food that is definitely larger than what most people would eat during a similar period of time and under similar circumstances.

2. A sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating).

Along with these essential diagnostic features, DSM-IV suggests that binge eating usually occurs in secrecy due to embarrassment about how much one is eating, and is characterised by rapid consumption, which often continues until the individual is uncomfortably or even painfully full (APA, 1994). Although the type of food consumed during binges varies, individuals typically select high-calorie sweet and savoury snacks that are low in nutrients (APA, 1994; Allison & Timmerman, 2007).

The Eating Disorder Examination (EDE; Fairburn & Cooper, 1993) distinguishes between four forms of overeating, based on the amount of food consumed and the subjective experience of loss of control. As shown in Figure 5.1, "objective
binge episodes" are what the DSM-IV criteria term binge eating, in that the individual consumes an amount of food that is objectively large (guidelines suggest three or more times a normal portion) and a sense of loss of control over eating is reported.

"Subjective binge episodes", on the other hand, are accompanied by the belief that one has overeaten and that same sense of loss of control, but the amount consumed is not objectively large. Lastly, the terms "objective overeating" and "subjective overeating" describe parallel episodes of perceived overeating except there is no sense of loss of control.

<table>
<thead>
<tr>
<th>Amount eaten</th>
<th>Not &quot;large&quot;, but viewed by subject as excessive</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Large&quot; (EDE definition)</td>
<td></td>
</tr>
<tr>
<td>“Loss of control”</td>
<td>Objective bulimic episode</td>
</tr>
<tr>
<td>No “loss of control”</td>
<td>Objective overeating</td>
</tr>
</tbody>
</table>

*Figure 5.1. The EDE scheme for classifying episodes of overeating.*

*Binge Eating in Anorexia Nervosa*

Anorexia nervosa is a deeply perplexing illness that primarily strikes young females aged between 15 and 19 years (Lucas, Beard, O’Fallon, & Kurland, 1991). Epidemiological studies have suggested an incidence rate for anorexia nervosa of at least 8 cases per 100,000 persons per year and an average prevalence of 0.3% using strict criteria for diagnosis (Hoek & van Hoeken, 2003). The requirements for a diagnosis of anorexia nervosa according to the DSM-IV (APA, 2000) are summarised as (1) refusal to maintain body weight at or above a minimally normal weight for age and height (i.e., less than 85% of that expected), (2) intense fear of gaining weight,
despite being underweight, (3) disturbance in the way that body weight or shape is experienced, (4) shape and weight are central to the individual’s self-evaluation, and (4) amenorrhea (i.e., the absence of at least three consecutive menstrual cycles) in postmenarcheal females. The DSM-IV divides anorexia nervosa into two diagnostic subtypes: restricting type (AN-R) and binge eating/purging type (AN-B/P). AN-R is defined by rigid restriction of food intake without bingeing or purging, while AN-B/P is defined by strict attempts to limit intake, followed by episodes of binge eating and self-induced vomiting and/or laxative abuse.

Anorexia nervosa is associated with the highest mortality rate of any mental disorder; with approximately 6% of those diagnosed with anorexia nervosa dying from suicide or related medical complications, often in the form of electrolyte disturbances and cardiac arrhythmias (Herzog et al., 2000). Other medical complications associated with anorexia nervosa include gastrointestinal effects (i.e., impaired oesophageal motility and gastric emptying), endocrine abnormalities, osteopenia and osteoporosis, dermatological symptoms (i.e., loss of scalp hair, dry skin, and brittle nails), dental problems, and a variety of perturbations of the haematological and immune systems (Mehler & Krantz, 2003; Mitchell & Crow, 2006; Sidiropoulos, 2007).

Along with these serious medical issues, research has also demonstrated that anorexia nervosa has substantial Axis I psychiatric comorbidity, including a high prevalence of mood (Halmi et al., 1991; Milos, Spindler, Buddeberg, & Crameri, 2003), anxiety (Godart, Flament, Perdereau & Jeammet, 2002; Kaye et al., 2004), and substance use disorders (Root et al., 2010). Axis II psychiatric disorders are also common, with research showing elevated rates of obsessive-compulsive personality disorder among individuals diagnosed with AN-R, and elevated rates of borderline personality disorder among those with AN-B/P (Piran, Lerner, Garfinkel, Kennedy, & Brouillette, 2006; Sansone, Levitt, & Sansone, 2004). Finally, individuals with anorexia
nervosa (particularly those with the binge-purge subtype) perceive their illness to be highly disruptive to a variety of life domains, even more so than individuals with other serious medical and psychiatric conditions including heart disease and schizophrenia (Carter, Bewell, & Devins, 2008).

**Binge Eating in Bulimia Nervosa**

Bulimia Nervosa typically afflicts females during late adolescence and early adult life and is far more common than anorexia nervosa. Hoek and van Hoeken (2003) estimate an incidence rate for bulimia nervosa of at least 12 cases per 100,000 persons per year and an average prevalence of 1%. According to DSM-IV, bulimia nervosa is present when (1) episodes of binge eating occur relatively frequently (twice a week or more) for at least three months; (2) compensatory behaviours are practiced after binge eating to prevent weight gain, primarily self-induced vomiting, laxative abuse, diuretics, or abuse of emetics (80 per cent of cases), and, less commonly, severe dieting and strenuous exercise (20 per cent of cases); (3) weight is not severely lowered as in anorexia nervosa; and (4) self-worth is judged largely, or even exclusively, in terms of body weight and shape. The diagnosis of bulimia nervosa is subdivided into a purging type, for those who regularly engage in self-induced vomiting or the use of laxatives or diuretics; and a non-purging type, for those who use strict dieting, fasting, or vigorous exercise but do not engage in regular purging.

Bulimia nervosa (especially the purging type) is associated with serious and potentially life-threatening physiological consequences, such as low potassium (hypokalemia), esophageal ruptures, carthartic colon, impaired kidney function, cardiac arrythmias, and cardiac arrest (Sansone & Sansone, 1994). Even when not directly life-threatening, bulimic behaviours greatly affect the body in terms of oral problems (e.g., tooth enamel erosion and parotid gland enlargement), gastrointestinal symptoms, renal
and electrolyte abnormalities, cardiovascular complications, and negative consequences to the endocrine system (Mehler, Crews, & Weiner, 2004).

In addition to physiological problems, individuals with bulimia nervosa also frequently suffer from co-occurring Axis I (e.g., mood, anxiety, substance use) psychiatric disorders (Godart et al., 2007; Herzog, Franko, Doer, Keel, Jackson, & Manzo, 2006; Holderness, Brooks-Gunn, & Warner, 1994; Hudson, Hiripi, Pope, & Kessler, 2007; Swinbourne & Touyz, 2007) and Axis II (e.g., borderline personality, avoidant personality) psychiatric disorders (Cassin & von Ranson, 2005; Godt, 2008; Sansone, Levitt, & Sansone, 2004). Compared with non-eating disordered controls, individuals with bulimia nervosa also experience greater levels of psychosocial impairment, specifically in the areas of work, leisure, and family relationships (Herzog, Keller, Lavori, & Ott, 1987) and report a poorer quality of life (de la Rie, Noordenbos, & van Furth, 2005).

**Binge Eating in Binge Eating Disorder**

Binge eating disorder was recently introduced in the DSM-IV as a specific example of eating disorder not otherwise specified (EDNOS) and as a provisional diagnosis that is distinct from bulimia nervosa. The prevalence rate of binge eating disorder is estimated to be between 2% and 3% in the general population and between 20% and 30% among weight reduction program samples (Hudson et al., 2007; Spitzer et al., 1993; Striegel-Moore & Franko, 2003). Although binge eating disorder is somewhat more common in women than in men, prevalence rates are less skewed than in anorexia nervosa and bulimia nervosa (i.e., approximately 3:2 female-to-male ratio). Individuals who seek treatment for binge eating disorder also tend to be older, with most aged between 30 and 50 years (Grilo, 2002).

The proposed criteria for the diagnosis of binge eating disorder include: (1) recurrent episodes of binge eating (at least two days per week) which are persistent (at
least six months); (2) impaired control over, and significant distress about, the binge eating; and (3) the absence of inappropriate compensatory behaviours (i.e., purging) to avoid weight gain. Other associated features include eating much more quickly than normal, eating to the point of physical discomfort, eating despite lack of physical hunger, eating alone due to embarrassment about how much one is eating, and feeling disgust, depression, or guilt after binge eating (APA, 2000). While not currently a diagnostic criterion, individuals with binge eating disorder also appear to have similar levels of over-evaluation of shape and weight as those with bulimia nervosa and anorexia nervosa (Wilfley, Schwartz, Spurrell, & Fairburn, 2000).

Binge eating disorder is associated with overweight and obesity (Smith, Marcus, Lewis, Fitzgibbon, & Schreiner, 1998), and indeed, a number of studies (e.g., Picot & Lilenfeld, 2003) have found a positive relationship between the severity of the binge eating (in terms of its frequency and size) and the degree of overweight as measured by body mass index (BMI; kg/m²). Accordingly, individuals with binge eating disorder are more likely to suffer from a number of obesity-related medical problems, including hypertension, coronary heart disease, stroke, type 2 diabetes, osteoarthritis, obstructive sleep apnea, and a range of cancers (Brien, Brown, & Dixon, 2005).

With regards to psychopathology, most investigations have found significantly higher levels of depression, anxiety, impulsive behaviour and anger among individuals with binge eating disorder compared with weight-matched controls without binge eating disorder (Bulik, Sullivan, & Kendler, 2002; Fassino, Leombruni, Piero, Abbate-Daga, & Giacomo Rovera, 2003; Telch & Stice, 1998) but significantly lower levels compared to individuals with bulimia nervosa (Fichter, Quadflieg, & Brandl, 1993; Raymond, Mussell, Mitchell, Crosby, & de Zwaan, 1995). In addition to increased rates of psychiatric symptoms, individuals with binge eating disorder also report significantly more impairment in the psychosocial domains of work (e.g., receiving appropriate
raises), public activities (e.g., worrying about fitting into seats in public places), sexual life (e.g., sexual desire), and self-esteem than individuals without the disorder (Rieger, Wilfley, Stein, Marino, & Crow, 2005).

**Eating Disorders Continuum**

The continuum hypothesis (Nylander, 1971) asserts that eating attitudes and behaviour fall along a continuum (see Figure 5.2), with enjoyment of eating and self-acceptance of body weight and shape forming one end of this continuum, and the clinical eating disorders forming the other end. Between these two extremes lie a variety of subclinical disordered eating behaviours, ranging in severity from limiting food groups to moderately restricting energy intake to occasional binge eating and purging. While overall rates of clinical eating disorders are relatively low, up to 61% of female American university students exhibit some level of disturbed eating and body image (Mintz & Betz, 1988), and if left untreated, these subclinical disturbances can progress to clinical eating disorders or contribute to other psychological disorders (Ellam & Kimbrell, 1995). Proponents of the continuum hypothesis, such as Scarano and Kalodner-Martin (1994), recommend that attending to all levels of eating disturbances may lead to a better understanding of the aetiology, prevention, and treatment of both clinical and subclinical eating problems.
Figure 5.2. The continuum of disordered eating.

**Binge Eaters: A Chronic Prevention Focus?**

Regulatory focus theory posits that there are two distinct motivational systems—a promotion and prevention system—which can occur as chronic or situational variables. In a promotion focus, individuals are guided by the need for nurturance and growth and are motivated to realise aspirations. As a consequence they tend to use eager approach strategies (i.e., take a risk) to ensure gains and prevent missed opportunities.

In a prevention focus, by contrast, individuals are guided by the need for safety and security and are motivated to fulfil their duties. As such, they tend to use vigilant avoidance strategies (i.e., play it safe) in order to prevent mistakes and guard against losses. The term vigilance epitomises several of the safety behaviours, cognitive avoidance strategies, and attentional and information-processing biases commonly seen in people with eating disorders (including those who binge eat), suggesting that these individuals operate under a chronic prevention focus.
Safety Behaviours

People with an eating disorder (ED) typically engage in two types of safetybehaviours: dietary restraint and body checking/avoidance. Dietary restraint ischaracterised by the attempt to restrict food intake and avoid certain “forbidden” foods that are perceived as risky or fattening, such as chocolate, chips, or bread. It is feared that eating outside of these constraints will result in catastrophic outcomes, such as uncontrolled and rapid weight gain. Paradoxically, there is now considerable evidence (e.g., Agras & Telch, 1998; Steiger, Lehoux, & Gauvin, 1999; Timmerman & Gregg, 2003) to suggest that dietary restraint actually makes individuals vulnerable to binge eating as it leads to hunger and preoccupation with food. Another way in which dietary restraint is thought to promote binge eating is via the abstinence-violation effect (Marlatt & Gordon, 1985); that is, following even the slightest dietary transgression (e.g., eating a couple of Tim Tams), dieters tend to experience negative affect and think in all-or-nothing terms (e.g., “I’ve blown it now, I might as well eat the whole packet), leading them to abandon control over eating.

Body checking is another safety behaviour that is common among people with an ED. Examples of body checking include frequent weighing, scrutinising specific body parts in the mirror, using the fit of clothes to judge shape or weight change, monitoring the “spread” of thighs when sitting down, pinching flesh, seeking reassurance about shape, and comparing it to the shape of other people (Rosen, 1997). Mountford, Haase, and Waller (2006) found that body checking is driven by three key beliefs, which each relate to a focus on safety and security. Specifically, that body checking will decrease anxiety (as a form of reassurance) and help one to feel better, that a feared consequence will occur if one does not engage in body checking, and that body checking helps one to stay in control of their eating and weight. However, research indicates that regular body checking actually maintains body dissatisfaction among ED
individuals (as they tend to selectively scrutinise only those aspects of their body which they dislike) as well as an over-evaluation of body weight and shape in judging self-worth (Fairburn, Cooper, & Shafran, 2003; Shafran, Lee, Payne & Fairburn, 2007).

Many people with an ED alternate between body checking and body avoidance behaviours. Examples of body avoidance include refusing to be weighed, covering mirrors, wearing shape-disguising clothes, covering the stomach (e.g., with the arms), refusing to be photographed or look at photographs of the self, and avoiding close physical contact with others such as hugging or sex. While the aim of these behaviours is to avert feelings of distress or discomfort and feared catastrophes (e.g. rejection), they prevent individuals from disconfirming their fears, and like body checking, maintain anxiety relating to eating, shape and weight in the long term (Shafran, Fairburn, Robinson, & Lask, 2004).

Cognitive avoidance

People with an ED generally evidence deficits in coping mechanisms to deal with stress (Ball & Lee, 2000), and in some cases, the disordered eating can be conceptualised as a maladaptive avoidance-oriented coping strategy (e.g., binge eating or extreme food restriction as a way of coping with negative affect). Indeed, a substantial amount of research has identified negative affect (both naturally occurring and experimentally induced) as a major precipitant of binge episodes (Chua, Touyz, & Hill, 2004; Crosby et al., 2009; Laessle & Schulz, 2009; Telch & Agras, 1996); and binge eating has been shown to provide temporary relief, thus negatively reinforcing the behaviour (Arnow, Kenardy, & Agras, 1992; Heatherton & Baumeister, 1991; McManus & Waller, 1995). Heatherton and Baumeister’s (1991) escape theory offers an explanation for how negative affect triggers binge eating and how affect reduction subsequently occurs.
The central hypothesis of escape theory (Heatherton & Baumeister, 1991) is that binge eating arises as part of a motivated attempt to "escape" from aversive self-awareness. According to escape theory, individuals who binge eat suffer from unusually high expectations (i.e., for physical thinness and attractiveness, achievement etc), including both their own standards and their perceptions of what other people expect of them. Given the difficulty of meeting such standards, they inevitably fall short on occasion, resulting in awareness of the self as inadequate or deficient. This awareness then creates negative self-focused affect such as anxiety or depression, which the individual seeks to escape.

Escape theory posits that in order to escape from the unpleasant feelings, the individual employs a cognitive strategy of "narrowing". That is, they narrow their attention on the immediate and present stimulus environment (i.e., food) and engage in low-level or concrete thinking (i.e., focus on the mechanics of biting or chewing). In such a state, meaningful interpretations such as attributions, comparisons against standards and implications of one's actions are no longer readily accessible, and so negative emotions are temporarily avoided. A secondary effect of this shift to low-level thinking is that higher level cognitive functions such as reasoning and inhibition are lost; thereby releasing previously suppressed urges to eat.

In support of the idea that "escape" processes help trigger binge eating, Heatherton, Polivy, Herman, and Baumeister (1993) found that situations that promote low self-awareness (i.e., watching a distracting video) trigger more disinhibited eating compared with situations that promote high self-awareness (i.e., watching a video of one's performance on a problem-solving task). Furthermore, retrospective studies indicate that individuals with bulimia nervosa report low self-awareness and dissociative experiences (i.e., feeling "in a daze" or "spaced out") during binge episodes (e.g., Abraham & Beumont, 1982; Lyubomirsky, Casper, & Sousa, 2001).
A related model is expectancy theory, which proposes that binge eating is maintained through an individual’s beliefs or expectancies about the effects of binge eating (i.e., that eating will reduce negative mood or will be rewarding), which develop as a product of learning history (Hohlstein, Smith, & Atlas, 1998). Expectancy theory has been supported by a number of studies that have examined individual differences in cognitive expectancies and their association with binge eating (e.g., Bohon, Stice, & Burton, 2009; Hayaki, 2009; Smith, Simmons, Flory, Annus, & Hill, 2007).

**Attentional Bias for Threat**

Further support for ED individuals being prevention-focused relates to their attentional bias towards threatening information. Attentional bias research has typically used modifications of the Stroop colour-naming task (Stroop, 1935), which requires subjects to name the colour of the ink in which a stimulus word is printed, whilst ignoring the meaning of the word. Delayed colour-naming latencies have been used to infer attentional biases toward the stimulus (i.e., emotional interference). According to Lee and Shafran (2004), Stroop research has generally indicated that compared with healthy female controls, women with an ED are significantly slower to name the colour of food-, shape-, and size-related words (e.g., ‘fat’) than non-words (e.g., XXXX) or control words (e.g., ‘pencil’). However, it is not clear whether this reflects attention towards the troubling words (thus interfering with colour-naming) or attention away from the words. Shifting attention away from the location of potentially troubling information (e.g., cognitive avoidance) would also slow colour-naming.

Given the difficulty in interpreting increased colour-naming latencies in the emotional Stroop task, investigators have turned towards an alternative measure of attentional bias, namely the dot-probe task (MacLeod, Mathews, & Tata, 1986). In this task, two words are briefly displayed (one above the other) and are immediately followed by a visual probe in the location of one of the words. Subjects are required to
signal their detection of the probe as quickly as possible. The assumption is that subjects are faster to respond to probes that appear in the same spatial location as the stimulus to which they are paying attention.

Rieger and colleagues (1998) used a dot-probe task consisting of both positive words (e.g., denoting a thin physique) and negative words (e.g., denoting a large physique) with women with an ED and control subjects. They found that ED women demonstrated an attentional bias toward words denoting large physiques, and attention away from words denoting thin physiques. The opposite pattern was observed for the controls. This was interpreted as suggesting that women with an ED attend to information consistent with their fear of weight gain, but ignore information that counters this fear.

In addition, ED women show an attentional bias toward threatening information that is unrelated to their eating pathology. For example, McManus, Waller, and Chadwick (1996) used the Stroop methodology to investigate cognitive biases in the processing of five different forms of threat in bulimic and comparison women. They included sociotropy (e.g., lonely), autonomy (e.g., controlled), discomfort anxiety (e.g., blood), ego-others (e.g., ridiculed), and ego-self threats (e.g., failure). McManus and colleagues found that the bulimic women were significantly slower to colour-name all forms of threat, and that this interference effect was strongest for self-generated ego threats. They report that these results provide indirect support for Heatherton and Baumeister’s (1991) model, which asserts that aversive self-awareness can trigger bulimic behaviours.

*Weak Central Coherence*

Finally, researchers are now proposing that “weak central coherence” (i.e., a bias towards local or detail-oriented processing at the expense of global meaning) is an endophenotype for ED (Lopez, Tchanturia, Stahl, & Treasure, 2009). This is based on
evidence that ED women (both acutely ill and recovered) perform extremely well on tasks that benefit from enhanced detail function (e.g., Embedded Figures Test) and display weaker performance on tasks such as the Rey-Osterrieth Complex Figure and Sentence Completion Task, which require a global strategy (Lopez et al., 2008; Lopez, Tchanturia, Stahl, & Treasure, 2008; Lopez et al., 2009). As discussed in Chapter 3, local processing (superior in ED) has been linked to a prevention focus and global processing to a promotion focus (e.g., Förster & Higgins, 2005).
CHAPTER 6.
THE EFFECT OF REGULATORY FOCUS ON HEDONIC SNACK
CONSUMPTION AMONG INDIVIDUALS WITH VARYING DEGREES OF
DISORDERED EATING: STUDIES 3 AND 4

Introduction and Methodological Considerations

The literature reviewed in Chapter 5 suggests that hedonic or luxury food such as chocolate, chips and ice-cream may hold a different psychological meaning for eating disordered individuals who binge eat compared to individuals without any difficulties in this area. While non-disordered eaters typically associate hedonic food with promotion/nurturance rather than prevention/security ( Förster, 2003), eating disordered individuals appear to associate this food (through negative reinforcement) largely with the latter orientation (i.e., protection from distressing thoughts and feelings). From a regulatory fit perspective, disordered eaters should therefore show the reverse pattern of hedonic food intake in response to promotion and prevention foci, compared to non-disordered eaters. Specifically, prevention focus priming should have a facilitatory effect on the intake of disordered eaters, signifying a regulatory fit between the focus and the food; while promotion focus priming should have an inhibitory effect, signifying a regulatory misfit. This chapter presents Studies 3 and 4, which were designed to examine this hypothesis.

Female university students have been well documented as a high risk group for fully diagnosable eating disorders, such as anorexia nervosa and bulimia nervosa (Coric & Murstein, 1993; Fairburn & Beglin, 1990; Halmi, Falk, & Schwartz, 1981; Pope, Hudson, Yurgelun-Todd, & Hudson, 1984). As highlighted in Chapter 5, “subclinical” disordered eating is even more common among this population, with 61% of female American university students classified as having some intermediate form of eating
disturbance, including chronic dieting, binge eating and purging (Mintz & Betz, 1988). Conceptualising eating disorders as a continuum, Studies 3 and 4 recruited participants predominantly from a nonclinical university sample (rather than a clinically-diagnosed sample) and used a continuous assessment instrument, namely the Binge Eating Scale (BES, Gormally, Black, Daston, & Rardin, 1982), to compare the influence of regulatory foci on food intake (and desire to eat) among individuals with varying degrees of binge eating severity. Like the previous two studies reported in this thesis, Studies 3 and 4 also examined whether the impacts of the foci were related to differences in hemispheric activation, and whether the situational manipulation superseded the influence of participants’ chronic or dispositional focus.

*Inducing Regulatory Focus*

As stated earlier, regulatory focus can be measured both as a personality trait and influenced in a state-like manner by experimental manipulations. A range of experimental protocols have been developed to manipulate regulatory focus, including (1) increasing the salience of gains or losses (Crowe & Higgins, 1997; Roney et al., 1995; Shah et al., 1998), (2) priming ideals or oughts (Friedman-Wheeler, Rizzo-Busack, McIntosh, Ahrens, & Haaga, 2010; Freitas et al., 2002; Leonardelli, Lakin, & Arkin, 2007; Molden & Higgins, 2008; Vaughn, Baumann, & Klemann, 2008), (3) activating knowledge structures related to nurturance or security needs (Friedman & Förster, 2001; Friedman & Förster, 2005; Werth & Förster, 2007), and (4) activating approach or avoidance motor actions (Förster, 2003; Friedman & Förster, 2000, 2002).

In the present studies regulatory focus was manipulated using variants of Friedman and Förster’s (2001) cheese-owl mazes. As discussed in Chapter 3, this task requires participants to guide a cartoon mouse out of a maze to approach a piece of cheese or avoid a hovering owl, signalling a benign (promotion) versus dangerous (prevention) situation, respectively. Endeavouring to manipulate a prevention focus
with a dual emphasis on attaining security and avoiding a threat, the mazes created for the present studies were modelled closely on an adaptation by Werth and Förster (2007). Werth and Förster’s prevention focus maze manipulation instructs participants to imagine that they have returned to their car (parked in the centre of the maze) to discover that they are about to exceed the time limit for that parking space. Participants are told that they need to leave the parking space and reach the street, which is visually depicted at the exit of the maze, to avoid exceeding the time limit. In contrast to Friedman and Förster’s prevention focus maze, which visually emphasises the hovering owl as a source of threat to be avoided, Werth and Förster’s adaptation visually emphasises the street as a source of security to be approached, in order to avoid an undesired end-state.

*Measurement of Eating Disorder Psychopathology*

A variety of methods have been developed for measuring eating disorder psychopathology, with the two most common being clinical interviews and self-report questionnaires. While clinical interviews are necessary for making diagnostic and treatment decisions, self-report questionnaires serve as valuable screening instruments for the presence and/or severity of eating-related symptomatology and other concerns (Crowther & Sherwood, 1997). They have the advantage of being relatively brief, easily administered, and objectively scored, which is particularly important in research settings (Garner, 2002). A range of questionnaires (presented in Appendix D) were selected to assess the core behavioural and psychological aspects of eating disorders, including binge eating and compensatory behaviours, dietary restraint, over-concern with weight and shape, and eating-related cognitions. These questionnaires are well utilised in empirical studies and have demonstrated adequate validity and reliability.

*The Eating Disorder Examination Questionnaire.* The Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994, 2008), modelled on the
Eating Disorder Examination interview (EDE; Fairburn & Cooper, 1993) is one of the most widely utilised self-report measures of disordered eating. It is a popular alternative to the EDE, which requires extensive training to administer, is time-consuming, and is not appropriate for group administration (Wilfley, Schwartz, Spurrell, & Fairburn, 1997). Research studies have demonstrated good convergence between the EDE and EDE-Q in both community and clinical samples (Binford, Le Grange, & Jellar, 2005; Grilo, Masheb, & Wilson, 2001; Mond, Rodgers, Hay, Owen, & Beumont, 2004; Wilfley et al., 1997), although the EDE-Q may overestimate episodes of objective binge eating (Fairburn & Beglin, 1994).

Like the interview, the EDE-Q focuses on the past 28 days and assesses key attitudinal features of eating disorders (i.e., the excessive importance of weight and shape in determining self-worth) as well as the frequency of core eating disorder behaviours, including binge eating and compensatory behaviours. The EDE-Q yields a Global score and four subscale scores: Restraint, Eating Concern, Shape Concern, and Weight Concern. The Global score is the average of the four subscale scores. Ratings for subscale items are scored on a 7-point scale (0 – 6) with higher scores reflecting greater eating-related pathology. Scores ≥ 4 on the Global scale or any of the subscales are considered to lie in the clinical range. With respect to the psychometric properties of the EDE-Q, Luce and Crowther (1999) observed Cronbach’s alpha coefficients of 0.78 and higher for the EDE-Q subscales, as well as good two-week test-retest reliability (α = 0.81 – 0.94) in a sample of undergraduate women. Normative data are necessary for appropriate interpretation of scores on the EDE-Q and community norms are available for adolescent girls (Carter, Stewart, & Fairburn, 2001), young adult women (Mond, Hay, Rodgers, & Owen, 2006), and undergraduate women (Luce, Crowther, & Poole, 2008; Villarroel, Penelo, Portell, & Raich, 2011). The EDE-Q was employed primarily as a screening device in Study 4 to ensure the recruitment of sufficient numbers of
participants from both extremes of the disordered eating continuum, especially the clinical end.

**Binge Eating Scale.** As discussed in the previous chapter, binge eating is characterised by two dimensions: eating a large amount of food in a discrete period of time, and experiencing a sense of lack of control during the episode. The Binge Eating Scale (BES; Gormally et al., 1982) is one of the most widely used instruments for assessing binge eating. It consists of 16 multiple-choice items, 8 items assessing the behavioural manifestations of binge eating (e.g., eating fast, eating in secret) and 8 items asking about thoughts and feelings that accompany binge eating (e.g., loss of control, guilt following a binge). Each item consists of four statements reflecting a range of severity with 0 indicating no binge eating problems and 3 indicating severe binge eating problems. The BES yields a total score (ranging from 0 to 46) by adding the individual values for all 16 items. Clinical cut-off scores have been established, distinguishing three levels of severity: scores $\leq 17$ indicate the absence of binge eating, scores from 18 to 26 indicate moderate levels of binge eating, and scores $\geq 27$ reflect the presence of "severe" binge eating. The BES (Portuguese version) has demonstrated good internal consistency ($\alpha = .89$; Freitas, Lopes, Appolinaro, & Coutinho, 2006). Given the present research's focus on binge eating, total scores on the BES were used to separate participants into no/mild versus moderate (Study 3) and no/mild, moderate, and severe (Study 4) groups for comparison on the dependent variables.

**The Dutch Eating Behaviour Questionnaire.** Three types of eating behaviour have been associated with excessive snacking, weight gain, and bingeing: eating in response to negative emotions (emotional eating), eating in response to the sight or smell of food (external eating), and paradoxically, eating less than desired in order to lose or maintain body weight (restrained eating). These three eating behaviours originated from psychosomatic, externality and restraint theory, respectively, and can be
reliably and validly assessed with the Dutch Eating Behaviour Questionnaire (DEBQ; van Strien, Frijters, Bergers, & Defaures, 1986). The DEBQ is a 33-item self-report questionnaire consisting of three subscales, which refer to each of the different eating styles. The emotional eating subscale contains 13 items, such as “Do you have a desire to eat when you are depressed or discouraged?” The external eating subscale contains 10 items, such as “If you walk past the baker do you have the desire to buy something delicious?” Finally, the restrained eating subscale contains 10 items, such as “Do you try to eat less at mealtimes than you would like to eat?” Item are rated on a five-point Likert scale, ranging from “never” to “very often”. Cronbach’s alpha approximated .94, .80 and .95 for the emotional, external and restrained eating subscales, respectively, indicating good internal consistency (van Strien et al., 1986). The DEBQ was included in Study 3 as an additional measure to the BES, mainly to ensure that participants in the three regulatory focus conditions were similar in eating styles.

*Nurturance and Security Needs Scales.* To more directly examine the hypothesis that the hedonic snack served distinct functions for disordered eaters versus non-disordered eaters in the present studies, a brief self-report measure was developed. Six items assessed how much the hedonic snack represented a means of satisfying nurturance needs (e.g., “Looking back I believe I snacked on the food to treat myself” from 1 = *strongly disagree*, to 9 = *strongly agree*) and 6 items assessed how much the snack represented a means of satisfying security needs (e.g., “Looking back I believe I snacked on the food to feel settled”).

*The Eating Expectancy Inventory.* The Eating Expectancy Inventory (EEI; Hohlstein et al., 1998) is a 34-item self-report scale designed to assess cognitive expectancies for eating. It has been validated in adult women with and without eating disorders (Holstein et al., 1998) and adolescent females (Simmons, Smith, & Hill, 2002). The EEI consists of five subscales that have been validated via factor analysis:
eating helps manage negative affect; eating is pleasurable and useful as a reward; eating leads to feeling out of control; eating enhances cognitive competencies; and eating alleviates boredom. Internal consistency reliability coefficients for the subscales range between .78 and .94. This measure was included to provide a secondary assessment of psychological motivation for consumption.

Study 3

Method

Participants

A total of 94 female ANU students were recruited for a study on “brain hemisphere specialisation” via a web-based advertisement and posters displayed around campus (Appendix A). Four participants were excluded from data analysis because they declined the offer of the food. This left 90 participants whose ages ranged from 18 to 61 years ($M = 22.54, SD = 8.70$). Participants were tested individually and received either $10 or 1 hour’s course credit for their participation. Each participant read and signed a consent form prior to taking part and received an information sheet up completion of the study. See Appendix B.

Design

Study 3 was a 3 (regulatory focus: promotion, prevention, control) x 2 (binge eating severity: no/mild versus moderate) between-subjects design. The dependent variables were the quantity of the snack food consumed (in grams), conscious desire to consume the food, and hemispheric activation.

Materials

Food stimulus. The food stimulus and its presentation were identical to that of Studies 1 and 2.

Regulatory focus manipulation. The stimuli for the regulatory focus manipulation were seven easily-solvable mazes, which were randomly generated using
Discovery Education's Puzzlemaker (http://puzzlemaker.discoveryeducation.com).

Each maze was 12.7cm x 12.7cm and contained a 3.2cm x 3.2cm graphic of a female (e.g., a woman hiking) in its centre. In the promotion mazes, an image associated with nurturance (e.g., a sunset) was displayed on the right-hand side of the maze near the exit. In the prevention mazes, an image associated with security (e.g., a cabin) was displayed near the exit. Regulatory focus priming scenarios were presented directly above the mazes in Calibri (size 12) font. Table 6.1 provides examples of these scenarios. The same physical mazes were used for the control task but without the regulatory focus priming scenarios and images. See Appendix C for a sample of the regulatory focus mazes and control mazes.
Table 6.1.

*Examples of Promotion Focus and Prevention Focus Maze Instructions*

<table>
<thead>
<tr>
<th>Maze</th>
<th>Promotion</th>
<th>Instructions</th>
<th>Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imagine you are the hiker in the centre...</td>
<td>You have just read in your hiking guide that there is a look-out, out ahead which offers spectacular views at sunset. You would really like to enjoy the sunset from this look-out.</td>
<td>You have just heard on your radio that a storm is fast approaching and you haven’t packed appropriate clothing for such conditions. You have to get back to your cabin before the storm hits to avoid getting cold and wet.</td>
<td></td>
</tr>
<tr>
<td>Imagine you are the waitress in the centre...</td>
<td>You notice that a customer whom you have waited on diligently throughout the night has left behind a generous tip for you. You would really like to reach the tip before your manager or a fellow employee claims it as their own.</td>
<td>You notice that one of your new employees has dropped a tray of large drinks. You have to get to her with a caution sign to reduce the likelihood of anyone slipping and suing your establishment.</td>
<td></td>
</tr>
</tbody>
</table>

*Emotional, external and restrained eating.* The Dutch Eating Behaviour Questionnaire (DEBQ; van Strien et al., 1986) was used to assess emotional, external, and restrained eating. In the present study, the internal consistency (Cronbach’s alphas) of these subscales was observed to be very good 1 (α = .94, .79, and .91, respectively).

*Binge eating.* The Binge Eating Scale (BES; Gormally et al., 1982) was used to assess binge eating behaviours as well as cognitions and feelings associated with binge
eating. This measure has been found to discriminate effectively among individuals with no/mild, moderate, and severe binge eating problems. In the present study, Cronbach’s alpha was .87, indicating very good internal consistency.

Nurturance and security needs. The nurturance needs scale (α = .90) and security needs scale (α = .92) both showed excellent internal consistency.

Additional measures. The same measures from Studies 1 and 2 were used to assess chronic regulatory focus (promotion focus α = .57; prevention focus α = .75), handedness (α = .89), conscious desire to snack (α = .91), and the effect of the manipulation on both positive and negative mood (α = .77 and .78, respectively).

Procedure

Participants were randomly allocated to work on the set of promotion focus, prevention focus, or control mazes while exposed to a bowl of M&Ms, which was offered in the same way as Studies 1 and 2. For each maze, participants were instructed to spend about 20 seconds firstly imagining the scenario in as much detail as possible and then to trace a route from the centre of the maze to the exit. Aside from the use of a pure regulatory focus manipulation and the addition of eating disorder assessment measures, the procedure for Study 3 was identical to that of the previous study. To avoid confounding effects on snack intake, the eating disorder assessment measures were deliberately administered at the end of the study (i.e., after intake).

Results

Eating characteristics and classification of participants

Table 6.2 reports the means and standard deviations for the total sample and the three regulatory focus conditions on each of the disordered eating variables measured in the study; that is, emotional eating, external eating, and restrained eating (as measured by the DEBQ), and binge eating severity (as measured by the BES). As can be seen
from the $p$-values, no significant differences were found between the three conditions on any of the eating disorder symptoms, indicating that randomisation was successful. On the BES, 81.1% of the total sample scored $\leq 17$, indicating mild or no binge eating; 16.7% met the cut-off for moderate binge eating (scoring between 18 and 26); and 2.2% met the cut-off for severe binge eating (scoring $\geq 27$). Given the very small proportion of severe binge eaters in the present study, a sample split was performed on the BES to create two groups (45 no/mild binge eaters versus 45 moderate binge eaters) whose snack intake (and desire to eat) as a function of the regulatory focus manipulation was compared. In the final study of this thesis, a larger sample of severe binge eaters made it possible to analyse the data for the three categories of binge eating severity identified by this instrument.
Table 6.2.

Study 3 Eating Characteristics of the Total Sample and ANOVA Results for the Regulatory Focus Conditions

<table>
<thead>
<tr>
<th></th>
<th>Total Sample</th>
<th>Promotion</th>
<th>Prevention</th>
<th>Control</th>
<th>( F )</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( N = 90 )</td>
<td>( n = 30 )</td>
<td>( n = 30 )</td>
<td>( n = 30 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEBQ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional eating</td>
<td>2.87 (.89)</td>
<td>2.93 (.92)</td>
<td>2.88 (.79)</td>
<td>2.79 (.95)</td>
<td>0.19</td>
<td>.824</td>
</tr>
<tr>
<td>External eating</td>
<td>3.40 (.61)</td>
<td>3.46 (.55)</td>
<td>3.49 (.59)</td>
<td>3.24 (.67)</td>
<td>1.42</td>
<td>.247</td>
</tr>
<tr>
<td>Restrained eating</td>
<td>2.69 (.87)</td>
<td>2.82 (.87)</td>
<td>2.60 (.83)</td>
<td>2.65 (.90)</td>
<td>0.51</td>
<td>.599</td>
</tr>
<tr>
<td>BES</td>
<td>12.37 (7.01)</td>
<td>14.30 (6.92)</td>
<td>11.90 (7.91)</td>
<td>10.90 (5.83)</td>
<td>1.90</td>
<td>.155</td>
</tr>
</tbody>
</table>

Note. DEBQ = Dutch Eating Behaviour Questionnaire; BES = Binge Eating Scale
Snack intake

Overall, snack intake ranged from 0.0 to 53.7 grams ($M = 19.13$, $SD = 13.60$). While the majority of participants ate at least some of the food, 3 participants did not consume any. A 3 (regulatory focus: promotion, prevention, control) x 2 (binge eating severity: no/mild versus moderate) between-groups ANOVA was conducted on the snack intake data. The means and standard deviations are presented in Table 6.3. There was a main effect of regulatory focus, $F(2, 84) = 8.99$, $p < .001$, $\eta^2 = .176$, but no main effect of binge eating severity, $F(1, 84) = 1.87$, $p = .175$, $\eta^2 = .022$. The analysis yielded a marginally significant regulatory focus by binge eating severity interaction effect, $F(2, 84) = 3.06$, $p = .052$, $\eta^2 = .068$, indicating that the impact of regulatory focus on snack intake was different for no/mild binge eaters versus moderate binge eaters.

A follow-up one-way between-groups ANOVA comparing the intake of no/mild binge eaters across the three regulatory focus conditions revealed a significant difference, $F(2, 42) = 13.22$, $p < .001$, $\eta^2 = .386$. Contrast analyses showed that as anticipated, no/mild binge eaters in the promotion focus condition consumed significantly more of the snack than those in the both the prevention focus condition, $t(42) = -4.44$, $p < .001$ and the control condition, $t(42) = -4.54$, $p < .001$. However, contrary to prediction, no/mild binge eaters in the prevention focus condition did not consume significantly less of the snack than those in the control condition, $t(42) = -.18$, $p = .857$. 
Table 6.3.

Study 3 Means (and Standard Deviations) for Snack Intake (in Grams) as a Function of Regulatory Focus and Binge Eating Severity

<table>
<thead>
<tr>
<th>Binge Eating Severity</th>
<th>Regulatory Focus</th>
<th>M</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>No/mild</td>
<td>Promotion</td>
<td>29.59</td>
<td>13.80</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Prevention</td>
<td>11.85</td>
<td>10.58</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>11.14</td>
<td>7.84</td>
<td>16</td>
</tr>
<tr>
<td>Moderate</td>
<td>Promotion</td>
<td>24.28</td>
<td>15.77</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Prevention</td>
<td>21.44</td>
<td>13.04</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>17.47</td>
<td>10.83</td>
<td>14</td>
</tr>
</tbody>
</table>

In contrast to no/mild binge eaters, a follow-up one-way ANOVA comparing the intake of moderate binge eaters across the three regulatory focus conditions did not reveal a significant difference, $F(2, 42) = 1.00, p = .377, \hat{\eta}^2 = .045$. As can be seen in Figure 6.1, this was largely related to higher levels of intake among these participants in response to a prevention focus compared to no/mild binge eaters induced with the same focus, $r(28) = -2.22, p = .034$. There were also higher levels of intake among moderate binge eaters compared to no/mild binge eaters in the control condition, which was a marginally significant result, $r(28) = -1.84, p = .077$. Finally, Figure 6.1 shows slightly lower levels of intake for moderate binge eaters versus no/mild binge eaters in response to a promotion focus. However, this difference was not statistically significant, $t(28) = .98, p = .338$. 
Figure 6.1. Study 3 means for snack intake as a function of regulatory focus and binge eating severity.

Desire to eat

A 3 (regulatory focus) x 2 (binge eating severity) ANOVA on desire to eat ratings revealed a significant main effect of binge eating severity, $F(1, 84) = 6.05, p = .016, \eta^2 = .067$, indicating that moderate binge eaters reported a greater conscious desire to consume the snack than no/mild binge eaters. The consistently higher ratings of desire to eat in participants with moderate binge eating scores were reflected in differences in dietary restraint. Moderate binge eaters reported higher dietary restraint ($M = 2.98, SD = 0.13$) than no/mild binge eaters ($M = 2.40, SD = 0.80$), $t = -3.37, p = .001$. Thus, the higher desire to eat ratings could indicate greater avoidance of recent eating. The main effect of regulatory focus [$F(2, 84) = 2.41, p = .096, \eta^2 = .054$] and the interaction effect [$F(2, 84) = 0.14, p = .874, \eta^2 = .003$] did not reach statistical
significance. The means and standard deviations for desire to eat are presented in Table 6.4.

Table 6.4.

Study 3 Means (and Standard Deviations) for Desire to Eat Ratings as a Function of Regulatory Focus and Binge Eating Severity

<table>
<thead>
<tr>
<th>Binge Eating Severity</th>
<th>Regulatory Focus</th>
<th>M</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>No/mild</td>
<td>Promotion</td>
<td>4.61</td>
<td>2.56</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Prevention</td>
<td>4.73</td>
<td>2.68</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>3.28</td>
<td>1.80</td>
<td>16</td>
</tr>
<tr>
<td>Moderate</td>
<td>Promotion</td>
<td>5.58</td>
<td>2.34</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Prevention</td>
<td>5.80</td>
<td>1.93</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>4.83</td>
<td>2.36</td>
<td>14</td>
</tr>
</tbody>
</table>

*Note.* Desire to eat was measured on 9-point scales. Higher values indicate greater desire to eat.

**Nurturance and security needs**

The means and standard deviations for nurturance and security needs (as self-reported motives for consuming the snack during the study) are displayed in Table 6.5. Although the means for both needs mostly fell below the midpoint (i.e., 4.5) of the 9-point scales, nurturance was generally rated as being a more important motivator of snacking than security needs across the three regulatory focus conditions for both no/mild binge eaters and moderate binge eaters.

A 3 (regulatory focus) x 2 (binge eating severity) ANOVA on nurturance needs ratings revealed a marginally significant main effect of binge eating severity, $F(1, 84) = 3.41, p = .069, \eta^2 = .039$, indicating that nurturance needs were a stronger driver of snack intake for moderate binge eaters than no/mild binge eaters. There was no main
effect of regulatory focus, \( F(2, 84) = 0.95, p = .393, \eta^2 = .022 \), nor was there a
significant interaction between regulatory focus and binge eating severity, \( F(2, 84) =
0.01, p = .993, \eta^2 = .000 \). A separate 2 x 3 ANOVA on security needs ratings yielded
similar results. There was a significant main effect of binge eating severity, \( F(1, 84) =
11.50, p = .001, \eta^2 = .120 \) (reflecting higher ratings by moderate binge eaters), but no
main effect of regulatory focus, \( F(2, 84) = 0.11, p = .897, \eta^2 = .003 \) or interaction effect,
\( F(2, 84) = 0.18, p = .833, \eta^2 = .004 \).

Table 6.5.

*Study 3 Means (and Standard Deviations) for Nurturance and Security Needs Ratings as a Function of Regulatory Focus and Binge Eating Severity*

<table>
<thead>
<tr>
<th>Regulatory Focus</th>
<th>Nurturance (No/mild)</th>
<th>Security (No/mild)</th>
<th>Nurturance (Moderate)</th>
<th>Security (Moderate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promotion</td>
<td>3.65 (1.90)</td>
<td>2.44 (1.28)</td>
<td>4.54 (2.22)</td>
<td>3.74 (1.66)</td>
</tr>
<tr>
<td>Prevention</td>
<td>3.23 (2.58)</td>
<td>2.14 (1.72)</td>
<td>3.99 (1.94)</td>
<td>3.63 (2.07)</td>
</tr>
<tr>
<td>Control</td>
<td>3.93 (2.27)</td>
<td>2.53 (1.77)</td>
<td>4.78 (1.71)</td>
<td>3.49 (1.87)</td>
</tr>
</tbody>
</table>

*Note.* Nurturance and security needs were measured on 9-point scales. Higher values indicate greater need.

Of particular interest was whether security became a more important motivator
of intake for moderate binge eaters in the prevention condition. Thus a series of paired
samples \( t \)-tests were carried out to assess the relative importance of the two needs in
driving eating behaviour in this study. This series of \( t \)-tests indicated that among
no/mild binge eaters, nurturance needs were reported as a significantly stronger
motivator for eating than security needs across the promotion focus \( t(13) = 5.38, p <
.001 \), prevention focus, \( t(15) = 3.26, p = .005 \), and control conditions \( t(14) = 3.65, p =
.003 \). For moderate binge eaters, nurturance needs were also reported as a significantly
stronger motivator than security needs in the promotion focus condition \( t(15) = 2.34, p = .034 \), and the control condition \( t(14) = 2.92, p = .011 \). However, in the case of the prevention focus condition, moderate binge eaters were equally motivated by both nurturance and security needs, \( t(13) = 1.00, p = .336 \).

As can be seen in Figure 6.2, the degree to which nurturance was more important than security needs as a motivator of food intake was consistent across the three regulatory focus conditions for no/mild binge eaters, \( F < 1 \). Although this figure shows that the relative importance of nurturance was attenuated somewhat in both the promotion and prevention focus conditions among moderate binge eaters, this trend was not significant \( (p > .05) \).

![Regulatory Focus Condition](image)

**Figure 6.2.** Study 3 mean differences between nurturance and security needs ratings as a function of regulatory focus and binge eating severity.
Analysis of alternative explanations for snack intake

One-way ANCOVAs to predict snack intake using chronic regulatory focus, mood, hunger, liking of the snack, liking of the manipulation task, difficulty of the manipulation task, and engagement of the manipulation task as covariates did not change the pattern of results for either no/mild binge eaters or moderate binge eaters. Specifically, the situationally induced regulatory focus remained a significant predictor of snack intake for no/mild binge eaters, $F_{\text{change}}(2, 33) = 9.72, p < .001, \eta^2 = .371$, despite liking of the snack emerging as a marginally significant covariate, $F(1, 33) = 3.38, p = .075, \eta^2 = .093$. Similarly, after controlling for the above covariates, situational focus continued to be a non-significant predictor of snack intake among moderate binge eaters, $F_{\text{change}}(2, 33) = 0.03, p = .968, \eta^2 = .002$. For moderate binge eaters, liking of the snack emerged as a significant covariate, $F(1, 33) = 7.61, p = .009, \eta^2 = .187$, while chronic promotion focus was a marginally significant covariate, $F(1, 33) = 3.55, p = .068, \eta^2 = .097$.

Analysis of relative hemispheric activation

As in the previous two studies, participants completed the same line bisection task before and after the regulatory focus manipulation, providing a baseline and post-manipulation measurement of their relative hemispheric activation. It was predicted that participants in the promotion focus condition would exhibit more pronounced leftward bisection errors relative to baseline than participants in the control condition, indicating a greater increase in right hemispheric activation. In contrast, it was predicted that participants in the prevention focus condition would exhibit more pronounced rightward errors relative to baseline than participants in the control condition, indicating a greater increase in left hemispheric activation.

A 3 (regulatory focus: promotion, prevention, control) x 2 (time: pre-manipulation, post-manipulation) repeated measures ANOVA was conducted on the
overall bisection error indices. The means and standard deviations are presented in Table 6.6. This analysis yielded a main effect of both regulatory focus, $F(2, 87) = 3.65$, $p = .030$, $\eta^2 = .077$ and time, $F(1, 87) = 15.17$, $p < .001$, $\eta^2 = .149$. The regulatory focus by time interaction was also significant, $F(2, 87) = 7.85$, $p = .001$, $\eta^2 = .153$, indicating that the conditions differed in terms of change in hemispheric activation across time.

Consistent with predictions, the prevention focus condition exhibited a significantly greater rightward shift from baseline (i.e., a greater increase in relative left hemispheric activation) than both the control, $t(87) = 1.97$, $p = .053$ and promotion focus conditions, $t(87) = -4.05$, $p < .001$. Also consistent with predictions, the promotion focus condition exhibited a significantly greater leftward shift from baseline (i.e., a greater increase in relative right hemispheric activation) than the control condition, $t(87) = -2.08$, $p = .040$.

Table 6.6.

Study 3 Means (and Standard Deviations) for Hemispheric Activation as Measured by the Line Bisection Task as a Function of Regulatory Focus

<table>
<thead>
<tr>
<th>Regulatory Focus</th>
<th>Promotion</th>
<th>Prevention</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n = 30)</td>
<td>(n = 30)</td>
<td>(n = 30)</td>
<td></td>
</tr>
<tr>
<td>Pre-manipulation (baseline)</td>
<td>.11 (.16)</td>
<td>.11 (.15)</td>
<td>.02 (.17)</td>
</tr>
<tr>
<td>Post-manipulation</td>
<td>.12 (.17)</td>
<td>.04 (.14)</td>
<td>-.01 (.17)</td>
</tr>
</tbody>
</table>

*Note. Measured in centimetres. Higher values indicate higher right hemispheric activation.*

**Discussion**

The main objective of the present study was to compare the effect of directly induced regulatory foci on hedonic snack intake and desire to eat among no/mild binge eaters versus moderate binge eaters (based on a sample split of scores on the BES), and to determine whether these effects are related to differences in hemispheric activation.
Overall, the prevention focus priming led to a greater increase in left hemispheric activation from baseline, and the promotion focus priming led to a greater increase in right hemispheric activation from baseline, relative to the control condition. Follow up analysis did indicate that the regulatory focus priming might have activated the hemispheres of no/mild binge eaters versus moderate binge eaters slightly differently. However, small sample sizes combined with small effect sizes undermine the strength of these results, making them suggestive of differences in lateralisation only.

For no/mild binge eaters, the priming of a promotion focus encouraged consumption of the hedonic snack. As predicted, they consumed significantly more of the snack than both the prevention focus and control condition, indicating a regulatory fit between the food and the focus. Contrary to prediction, however, the prevention focus priming failed to have an inhibitory effect on snack intake compared with the control group. This absence of a significant inhibitory effect may reflect limitations of the control task rather than the prevention focus priming, as the control task produced a slight amount of left hemispheric activation and the intake results mimicked those found for the prevention focus condition. While participants in the promotion and prevention focus conditions were encouraged to take a few moments to vividly imagine the scenario before tracing a route through the maze, control participants (who were given no such scenarios) were simply asked to complete the mazes, always working from the inside of the maze to the outside. This may have created an implicit or subtle impression of escape which is being directly evoked by the prevention scenarios.

For moderate binge eaters, regulatory focus did not bring about any significant differences in snack intake. This was largely related to a higher level of intake among these participants in response to a prevention focus compared to no/mild binge eaters primed with the same focus. There was also a marginally significant higher level of intake among moderate binge eaters compared to no/mild binge eaters in the control
condition, and a slight (but non-significant) decrease in intake for moderate binge eaters versus no/mild binge eaters primed with a promotion focus. It is possible that this trend towards an increase in regulatory fit (i.e., facilitation of intake) for prevention-focused moderate binge eaters and decrease in fit (i.e., inhibition of intake) for promotion-focused moderate binge eaters would be more pronounced with a sample of higher severity binge eaters. Given recruitment was aimed at a general university population, participants had generally low levels of binge eating. Thus, while the study compared the snack intake of 45 relatively high scorers with 45 relatively low scorers (sample split) on the BES, the level of clinically recognisable binge eating among the high scorers was limited to only 2 severe cases and 15 moderate cases, with the majority (28 out of 45) scoring below the clinical cut-off level.

As in the previous studies, participants’ conscious desire or craving for the food was not significantly affected by the regulatory focus priming (despite intake being affected), and this was true for both no/mild binge eaters and moderate binge eaters. While this may just reflect participants’ inability to recall and quantify a subjective experience after it has taken place, it might alternatively suggest that regulatory foci, like attentional scope, influences eating an automatic or unconscious level. Also consistent with the previous studies and Förster (2003) was the finding that it was the specific focus and not an emotional response produced by the focus that influenced intake.

Consistent across the three regulatory focus conditions, no/mild binge eaters identified nurturance needs (i.e., to treat oneself) as a more important motivator of their snack intake than security needs (i.e., to feel settled). Interestingly, nurturance needs were also identified as more important by most moderate binge eaters, except in the prevention focus condition where they seemed to be equally motivated by both needs.
The results of Study 3 suggest that a broader sample and better control task is needed to assess the hypotheses. It would also be interesting to see how long the mazes exert their influences for.

**Study 4**

The main purpose of Study 4 was to reassess the hypotheses using a sample of females comprising a larger proportion (relative to the previous study) reporting higher levels of disordered eating. Specifically, the present study aimed to determine whether the trend observed in Study 3 (i.e., a reduction in snack intake by promotion-focused HDEs and an increase in intake by prevention-focused HDEs) might reach significance for those whose eating psychopathology lies in the clinical range. Study 4 was also designed to examine the possibility that regulatory foci might exert an influence on snack intake beyond the cessation of its priming; in other words, have a carry-over effect. As such, a second opportunity to snack was included.

**Method**

*Participants*

Ninety females aged 18 to 34 ($M = 20.07, SD = 2.94$) were recruited through flyers displayed around the university campus, medical centres and gyms, and an advertisement in a local newspaper calling for either healthy volunteers or volunteers who felt like their eating was “out of control” to participate in a “Taste Perception Study”. See Appendix A. The flyers stated that the purpose of the study was to investigate how various distractions affect taste perception among women with different eating patterns. A link was provided to an online survey (Appendix D), which they could complete as a way of registering their interest. Embedded among questions about taste perception and distraction was the Eating Disorder Examination Questionnaire (EDE-Q version 6.0; Fairburn & Beglin, 2008), which ensured that equal numbers of LDEs and HDEs were allocated to each of the conditions. Eligible participants were
invited to attend an experimental session at the Department of Psychology, where they were tested individually and received either course credit or $10 in exchange for their time. Each participant read and signed a consent form prior to taking part and received an information sheet upon completion of the study. See Appendix B.

**Design**

Study 4 was a 3 (regulatory focus: promotion focus, prevention focus, or no focus control condition) x 3 (binge eating severity: no/mild, moderate, severe) x 2 (taste test: time 1, time 2) between-subjects design. The dependent variables were the quantity of the snack food consumed, conscious desire to consume the food, and hemispheric activation at time 1 and time 2.

**Materials**

*Food stimuli.* The food stimulus for taste test one was always 160 grams of Crispy M&Ms and the food stimulus for taste test two was always 120 grams of Arnott’s Shapes. Both foods were presented in red plastic serving bowls (14cm x 5cm) and the exact weights of the foods were measured before and after the experimental session.

*Taste perception rating sheet.* After each taste test participants were instructed to rate the food on various appearance, flavour and texture properties (e.g., bright, salty, crispy) using 5-point scales, ranging from “not at all” to “very”. These ratings were requested primarily to be consistent with the cover story of the study. The perception rating sheet can be found in Appendix D.

*Taste test 1: Regulatory focus mazes and control mazes.* The regulatory focus mazes were identical to those used in Study 3. The control mazes, however, were altered so that every second maze required the participant to trace a route to the centre rather than exit (i.e., entering versus leaving). See Appendix C.
**Taste test 2: Neutral task.** The neutral task was the same photo-evaluation control task used in Studies 1 and 2, which produced negligible hemispheric activation both times.

**Eating Disorder Examination Questionnaire.** The Eating Disorder Examination Questionnaire (EDE-Q version 6.0; Fairburn & Beglin, 2008) was used to assess specific psychopathology of eating disorders over the previous 28 days. In the present study, Cronbach’s alphas were .84, .86, .93, and .91 for the restraint, eating concern, shape concern and weight concern subscales, respectively.

**The Eating Expectancy Inventory.** The Eating Expectancy Inventory (EEI; Holstein et al., 1998) was used to assess cognitive expectations regarding the benefit of eating, including eating helps manage negative affect (α = .94), eating is pleasurable and useful as a reward (α = .69), eating leads to feeling out of control (α = .93), eating enhances cognitive competency (α = 76), and eating alleviates boredom (α = .82). These Cronbach’s alphas are comparable to those reported by Holstein et al. (1998).

**Additional measures.** The same measures from the previous three studies were used to assess chronic promotion focus (α = .73), chronic prevention focus (α = .73), handedness (α = .88) and binge eating (α = .92). The same measures were also used to assess the effect of the regulatory focus manipulation on conscious desire to snack (α = .86, .84); positive mood (α = .85, .85); negative mood (α = .85, .82); nurturance needs (α = .89, .90); and security needs (α = .88, .89) at time 1 and time 2, respectively.

**Procedure**

On arrival participants completed the same line bisection task, handedness questionnaire, and chronic regulatory focus measure used in the previous studies. Under the guise of a taste test, participants were then presented with a pre-weighed bowl of M&Ms and asked to taste the food as they worked on the randomly allocated promotion focus mazes, prevention focus mazes or control mazes. They were led to believe that the
researcher was interested in how being distracted by this particular task would affect how they later rated various properties of the snack. To ensure that participants engaged in at least some eating, they were told that they could eat as little or as much of the snack as they liked, as long as they tasted it so that they could later rate it. As in the previous studies the researcher left the room during the 10 minute tasting period to reduce self-consciousness around eating. On return the researcher collected the bowl for weighing and issued the post-manipulation line bisection task and the taste perception rating sheet, which took approximately 5 minutes to complete. For the second taste test participants were presented with a pre-weighed bowl of Arnott's Shapes to taste while they were left alone to work on the photo-evaluation filler task. Again, they were led to believe that the researcher was interested in how this task might impact their taste perception rather than their intake. After a 10 minute tasting period the researcher returned to the room, collected the bowl for weighing and issued the post-experimental questionnaire. The experimental procedure took approximately 60 minutes.

**Results**

*Eating characteristics and classification of participants*

Table 6.7 presents the means and standard deviations for the total sample and the three regulatory focus conditions on the EDE-Q, the BES, and the EEI. The $p$-values reported in the table demonstrate that the three conditions were equivalent on these measures.

Prior EDE-Q studies have utilised a cut-off score $\geq 4$ as a marker of clinical significance. Based on this cut-off, 11.1% of the total sample scored in the clinical range on the Restraint subscale, 3.6% on the Eating Concern subscale, 25.7% on the Shape Concern subscale, 28.9% on the Weight Concern subscale, and 19.9% on the Global scale. Across all four subscales and the Global Scale, percentages in the clinical range were higher in the present sample than those reported in other female community
samples (e.g., Luce et al., 2008; Mond et al., 2004). In terms of the frequency of core
eating disorder behaviours, 18.9% and 20.0% of the present sample met the DSM-IV
criteria for regular (i.e., $\geq 2$/week) objective and subjective binge episodes, respectively.
Furthermore, the regular use of self-induced vomiting, laxative misuse and excessive
exercise to control weight and shape was reported by 2.2%, 0.0% and 17.8% of
participants, respectively. Excluding laxative misuse, these percentages were also higher
than those reported by Mond et al. (2004) and Luce et al. (2008).

As in the previous study, participants were assessed for binge eating severity
using the BES. On this measure, 50% ($N = 45$) of the total sample reported no binge
eating or mild binge eating, 33.3% ($N = 30$) met the cut-off for moderate binge eating,
and 6.7% ($N = 15$) met the cut-off for severe binge eating. Given sufficient numbers of
severe binge eaters in the present study, snack intake as a function of regulatory focus
was compared across these three established groups. A one-way ANOVA confirmed
that the three binge eating groups differed significantly in EDE-Q Global scale scores,
$F(2, 83) = 59.54, p < .001$. As expected, severe binge eaters scored higher on the EDE-
Q Global scale than moderate binge eaters, $t(87) = 2.80, p < .05$ and no/mild binge
eaters, $t(87) = 9.44, p < .001$. In turn, moderate binge eaters scored higher on the EDE-
Q Global scale than no/mild binge eaters, $t(87) = 8.18, p < .001$. 
### Table 6.7.

**Study 4 Eating Characteristics of the Total Sample and ANOVA Results for the Regulatory Focus Conditions**

<table>
<thead>
<tr>
<th></th>
<th>Total Sample (N = 90)</th>
<th>Promotion (n = 30)</th>
<th>Prevention (n = 30)</th>
<th>Control (n = 30)</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EDE-Q Restraint</strong></td>
<td>1.89 (1.59)</td>
<td>1.97 (1.67)</td>
<td>1.97 (1.62)</td>
<td>1.74 (1.53)</td>
<td>0.21</td>
<td>.811</td>
</tr>
<tr>
<td><strong>EDE-Q Eating concern</strong></td>
<td>1.75 (1.54)</td>
<td>1.62 (1.57)</td>
<td>1.94 (1.68)</td>
<td>1.70 (1.41)</td>
<td>0.35</td>
<td>.707</td>
</tr>
<tr>
<td><strong>EDE-Q Shape concern</strong></td>
<td>2.91 (1.80)</td>
<td>2.82 (1.91)</td>
<td>3.01 (1.91)</td>
<td>2.89 (1.63)</td>
<td>0.08</td>
<td>.921</td>
</tr>
<tr>
<td><strong>EDE-Q Weight concern</strong></td>
<td>2.49 (1.89)</td>
<td>2.46 (1.92)</td>
<td>2.41 (2.09)</td>
<td>2.59 (1.68)</td>
<td>0.68</td>
<td>.934</td>
</tr>
<tr>
<td><strong>Global EDE-Q</strong></td>
<td>2.25 (1.59)</td>
<td>2.23 (1.66)</td>
<td>2.32 (1.73)</td>
<td>2.21 (1.43)</td>
<td>0.04</td>
<td>.961</td>
</tr>
<tr>
<td><strong>BES</strong></td>
<td>17.36 (8.99)</td>
<td>17.10 (9.64)</td>
<td>18.17 (9.51)</td>
<td>16.80 (7.98)</td>
<td>0.19</td>
<td>.829</td>
</tr>
<tr>
<td><strong>EEI Manage negative affect</strong></td>
<td>3.58 (1.34)</td>
<td>3.53 (1.39)</td>
<td>3.56 (1.38)</td>
<td>3.66 (1.27)</td>
<td>0.07</td>
<td>.933</td>
</tr>
<tr>
<td><strong>EEI Alleviate boredom</strong></td>
<td>4.62 (2.43)</td>
<td>4.54 (1.63)</td>
<td>4.72 (1.46)</td>
<td>4.59 (1.20)</td>
<td>0.12</td>
<td>.889</td>
</tr>
<tr>
<td><strong>EEI Out of control</strong></td>
<td>3.54 (1.74)</td>
<td>3.43 (1.79)</td>
<td>3.58 (1.86)</td>
<td>3.63 (1.61)</td>
<td>0.11</td>
<td>.898</td>
</tr>
</tbody>
</table>

*Note. EDE-Q = Eating Disorder Examination Questionnaire; BES = Binge Eating Scale; EEI = Eating Expectancy Inventory*
All participants engaged in at least some snacking during the first food exposure period, with the minimum amount of M&Ms consumed being 1.2 grams. A 3 (regulatory focus: promotion, prevention, control) x 3 (binge eating severity: no/mild, moderate, severe) between-groups ANOVA was conducted on the consumption of the M&Ms. The means and standard deviations are presented in Table 6.8. While there was a marginally significant main effect of binge eating severity, $F(2, 81) = 2.97, p = .057$, $\eta^2 = .068$, neither the main effect of regulatory focus [$F(2, 81) = 1.62, p = .204$, $\eta^2 = .038$] or the interaction effect [$F(4, 81) = 0.92, p = .455$, $\eta^2 = .044$] reached statistical significance. Despite the absence of a significant interaction effect, the findings of the previous study and the present study’s hypotheses make follow-up analyses worth exploring, especially given the limited and unequal sample sizes.

A one-way ANOVA comparing M&M intake by no/mild-binge eaters across the three regulatory focus conditions revealed a significant difference, $F(2, 42) = 4.57, p = .016$, $\eta^2 = .179$. As predicted, no/mild-binge eaters in the promotion focus condition consumed significantly more of the snack than no/mild-binge eaters in the prevention focus condition, $r(42) = 2.86, p = .007$ and the control condition, $r(42) = -2.27, p = .030$. Also as predicted, no/mild-binge eaters in the prevention focus condition consumed less of the snack than those in the control condition, however this difference was not statistically significant $r(42) = -.59, p = .560$. In contrast to no/mild-binge eaters, ANOVA results revealed that the effect of regulatory focus on intake was not significant for moderate binge eaters, $F(2, 27) = 0.53, p = .593$, $\eta^2 = .038$ or severe binge eaters, $F(2, 12) = 0.36, p = .707$, $\eta^2 = .059$. This is consistent with the findings of the previous study.
Table 6.8.

Study 4 Means (and Standard Deviations) for Snack Intake (in Grams) as a Function of Regulatory Focus and Binge Eating Severity at Time 1

<table>
<thead>
<tr>
<th>Binge Eating Severity</th>
<th>Regulatory Focus</th>
<th>M</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>No/mild</td>
<td>Promotion</td>
<td>23.08</td>
<td>15.35</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Prevention</td>
<td>11.75</td>
<td>9.27</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>14.08</td>
<td>5.59</td>
<td>15</td>
</tr>
<tr>
<td>Moderate</td>
<td>Promotion</td>
<td>21.55</td>
<td>15.68</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Prevention</td>
<td>18.30</td>
<td>10.47</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>16.02</td>
<td>8.93</td>
<td>10</td>
</tr>
<tr>
<td>Severe</td>
<td>Promotion</td>
<td>24.80</td>
<td>17.80</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Prevention</td>
<td>28.90</td>
<td>13.62</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>21.10</td>
<td>11.78</td>
<td>5</td>
</tr>
</tbody>
</table>

As in the previous study, the absence of a statistically significant effect of regulatory focus on snack intake for participants with greater levels of binge eating severity was related to an increase in intake in response to a prevention focus. Figure 6.3 demonstrates that under a prevention focus, severe binge eaters consumed significantly more of the snack than no/mild-binge eaters, $t(27) = 3.19, p = .004$ and moderate binge eaters, $t(27) = 1.86, p = .074$ primed with the same focus. Severe binge eaters in the control condition also consumed more than no/mild-binge eaters in the control condition, however the difference was only marginally significant, $t(27) = 1.71, p = .099$. 
Figure 6.3. Study 4 snack intake as a function of regulatory focus and binge eating severity at Time 1.

Analysis of alternative explanations for time 1 snack intake

One-way ANCOVAs to predict snack intake using chronic regulatory focus, mood, hunger, liking of the snack, liking of the manipulation task, difficulty of the manipulation task, and engagement of the manipulation task as covariates did not change the pattern of results. Specifically, the situationally induced regulatory focus remained a significant predictor of snack intake for no/mild-binge eaters $F_{\text{change}} (2, 34) = 4.93, p = .013, \eta^2 = .225$, despite positive mood [$F(1, 34) = 5.06, p = .031, \eta^2 = .129$] and difficulty of the manipulation task [$F(1, 34) = 5.02, p = .032, \eta^2 = .129$] emerging as significant covariates. Furthermore, regulatory focus remained a non-significant predictor of snack intake for moderate binge eaters, $F_{\text{change}} (2, 19) = 0.35, p = .708, \eta^2 = .036$ and severe binge eaters, $F_{\text{change}} (2, 4) = 3.57, p = .129, \eta^2 = .641$ after controlling for the potential covariates, none of which were significant, $p$'s > .05.
Time 1 desire to eat

A 3 (regulatory focus) x 3 (binge eating severity) ANOVA on desire to eat ratings revealed no significant main effects of regulatory focus, $F(2, 81) = 0.03, p = .969, \eta^2 = .001$ or level of binge eating severity, $F(2, 81) = 2.21, p = .116, \eta^2 = .052$. Nor did the analysis reveal a significant interaction effect, $F(4, 81) = 0.82, p = .516, \eta^2 = .039$. The means and standard deviations for desire to eat are presented in Table 6.9.

Table 6.9.

Study 4 Means (and Standard Deviations) for Desire to Eat Ratings as a Function of Regulatory Focus and Binge Eating Severity at Time 1

<table>
<thead>
<tr>
<th>Binge Eating Severity</th>
<th>Regulatory Focus</th>
<th>M</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>No/mild</td>
<td>Promotion</td>
<td>5.14</td>
<td>2.21</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Prevention</td>
<td>5.97</td>
<td>1.87</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>5.06</td>
<td>1.35</td>
<td>15</td>
</tr>
<tr>
<td>Moderate</td>
<td>Promotion</td>
<td>5.36</td>
<td>2.49</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Prevention</td>
<td>5.65</td>
<td>1.90</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>6.38</td>
<td>2.47</td>
<td>10</td>
</tr>
<tr>
<td>Severe</td>
<td>Promotion</td>
<td>7.10</td>
<td>1.21</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Prevention</td>
<td>6.20</td>
<td>2.16</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>6.60</td>
<td>1.66</td>
<td>5</td>
</tr>
</tbody>
</table>

*Note.* Desire to eat was measured on 9-point scales. Higher values indicate greater desire to eat.

Nurturance and security needs

As in the previous study participants were asked to recall to what extent they consumed the snack to satisfy nurturance and security needs. Mean ratings and standard deviations are presented in Table 6.10. A 3 (regulatory focus) x 3 (binge eating severity)
ANOVA on the nurturance needs ratings revealed no significant main effects of regulatory focus, $F(2, 81) = 0.35, p = .708, \hat{\eta}^2 = .008$, binge eating severity, $F(2, 81) = 0.36, p = .698, \hat{\eta}^2 = .009$ or interaction effect, $F(4, 81) = 0.40, p = .805, \hat{\eta}^2 = .020$. A separate 2 x 3 ANOVA on the security needs ratings revealed a marginally significant main effect of binge eating severity, $F(2, 81) = 2.50, p = .089, \hat{\eta}^2 = .058$ (reflecting higher ratings by severe binge eaters), but no main effect of regulatory focus, $F(2, 81) = 0.04, p = .961, \hat{\eta}^2 = .001$ or interaction effect, $F(4, 81) = 0.24, p = .912, \hat{\eta}^2 = .012$. Consistent with the paired samples $t$-test results from Study 3, no/mild-binge eaters reported that nurturance needs were a significantly stronger motivator for snacking than security needs across the promotion focus, $t(14) = 4.13, p = .001$, prevention focus, $t(14) = 5.18, p < .001$ and control conditions, $t(14) = 5.50, p < .001$. For moderate binge eaters, nurturance needs were also reported as a significantly stronger motivator than security needs in the promotion focus condition, $t(9) = 2.69, p = .025$ and the control condition, $t(9) = 3.58, p = .006$. However, in the case of the prevention focus condition, the difference between nurturance and security needs was only marginally significant, $t(9) = 2.06, p = .069$. For severe binge eaters, security needs became an equally strong driver of intake for the promotion focus, $t(4) = 1.28, p = .270$ and prevention focus conditions, $t(4) = .86, p = .440$, while nurturance needs were only a marginally stronger motivator for severe binge eaters in the control condition, $t(4) = 2.42, p = .073$. 


Table 6.10.

*Study 4 Means (and Standard Deviations) for Nurturance and Security Needs Ratings as a Function of Regulatory Focus and Binge Eating Severity*

<table>
<thead>
<tr>
<th>Regulatory Focus</th>
<th>No/Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nurturance</td>
<td>Security</td>
<td>Nurturance</td>
</tr>
<tr>
<td>Promotion</td>
<td>4.26 (2.50)</td>
<td>3.04 (1.90)</td>
<td>4.55 (2.73)</td>
</tr>
<tr>
<td>Prevention</td>
<td>5.36 (2.06)</td>
<td>3.44 (1.91)</td>
<td>4.75 (1.54)</td>
</tr>
<tr>
<td>Control</td>
<td>4.57 (1.72)</td>
<td>2.85 (1.22)</td>
<td>5.04 (2.25)</td>
</tr>
</tbody>
</table>
Time 2 snack intake

All participants engaged in at least some snacking during the follow-up food exposure period, with the minimum amount of Arnott’s Shapes consumed being 1.8 grams. A 3 (regulatory focus: promotion, prevention, control) x 3 (binge eating severity) between-groups ANOVA was conducted on the consumption of the Shapes. The means and standard deviations are presented in Table 6.11. No main effects were observed for regulatory focus, $F(2, 81) = 1.63, p = .202, \eta^2 = .039$ or binge eating severity, $F(2, 81) = 0.62, p = .542, \eta^2 = .015$. Nor was there a significant interaction effect, $F(4, 81) = 0.50, p = .733, \eta^2 = .024$. As with the Time 1 snack intake data, follow-up analyses were performed for each binge eating severity group.

A one-way ANOVA comparing intake by no/mild-binge eaters across the three regulatory focus conditions revealed a significant difference, $F(2, 42) = 4.36, p = .019, \eta^2 = .172$. Specifically, no/mild-binge eaters in the promotion focus condition continued at Time 2 to consume significantly more of the snack than no/mild-binge eaters in the prevention focus condition, $t(42) = 2.89, p = .006$, but no longer consumed more than those in the control condition, $t(42) = -.92, p = .365$. Furthermore, no/mild-binge eaters in the prevention condition again trended to consume less than no/mild-binge eaters in the control condition, with the difference more closely approaching statistical significance, $t(42) = -1.97, p = .055$. ANOVAs also revealed that snack intake by moderate binge eaters [$F(2, 27) = 0.38, p = .690, \eta^2 = .027$] and severe binge eaters [$F(2, 12) = 0.32, p = .735, \eta^2 = .050$] continued not to differ as a function of regulatory focus at Time 2.
Table 6.11.

Study 4 Means (and Standard Deviations) for Snack Intake (in Grams) as a Function of Regulatory Focus and Binge Eating Severity at Time 2

<table>
<thead>
<tr>
<th>Binge Eating Severity</th>
<th>Regulatory Focus</th>
<th>M</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>No/mild</td>
<td>Promotion</td>
<td>21.87</td>
<td>8.18</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Prevention</td>
<td>12.35</td>
<td>8.43</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>18.85</td>
<td>10.32</td>
<td>15</td>
</tr>
<tr>
<td>Moderate</td>
<td>Promotion</td>
<td>20.84</td>
<td>20.34</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Prevention</td>
<td>16.11</td>
<td>10.17</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>15.78</td>
<td>11.07</td>
<td>10</td>
</tr>
<tr>
<td>Severe</td>
<td>Promotion</td>
<td>24.36</td>
<td>15.60</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Prevention</td>
<td>21.88</td>
<td>15.37</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>17.80</td>
<td>6.37</td>
<td>5</td>
</tr>
</tbody>
</table>

Analysis of alternative explanations for time 2 snack intake

A one-way ANCOVA including Time 1 snack intake as a covariate eliminated the effect of regulatory focus on Time 2 snack intake for no/mild-binge eaters, $F_{\text{change}}(2, 33) = 1.66, p = .205, \eta^2 = .091$. Time 1 snack intake [$F(1, 33) = 17.01, p > .001$] emerged from this analysis as a significant covariate, while hunger [$F(1, 33) = 3.98, p = .054$] was a marginally significant covariate, explaining 34% and 11% of the variance, respectively. ANCOVAs on Time 2 intake by moderate and severe binge eaters did not change the pattern of results for these groups, with the effect of regulatory focus remaining non-significant. Time 1 snack intake emerged as a significant covariate for moderate binge eaters, $F(1, 18) = 8.84, p = .008$, explaining nearly 30% of the variance.
**Time 2 desire to eat**

A 3 (regulatory focus) x 3 (binge eating severity) ANOVA on desire to eat ratings revealed no significant main effects of regulatory focus, $F(2, 81) = 0.81, p = .449, \hat{\eta}^2 = .020$, binge eating severity, $F(2, 81) = 1.11, p = .336, \hat{\eta}^2 = .027$ or interaction effect, $F(4, 81) = 0.19, p = .941, \hat{\eta}^2 = .009$. The means and standard deviations for desire to eat are presented in Table 6.12.

**Table 6.12.**

**Study 4 Means (and Standard Deviations) for Desire to Eat Ratings as a Function of Regulatory Focus and Binge Eating Severity at Time 2**

<table>
<thead>
<tr>
<th>Binge Eating Severity</th>
<th>Regulatory Focus</th>
<th>M</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>No/mild</td>
<td>Promotion</td>
<td>5.22</td>
<td>1.40</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Prevention</td>
<td>5.40</td>
<td>1.48</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>4.73</td>
<td>2.15</td>
<td>15</td>
</tr>
<tr>
<td>Moderate</td>
<td>Promotion</td>
<td>6.10</td>
<td>1.80</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Prevention</td>
<td>5.28</td>
<td>2.35</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>5.13</td>
<td>2.35</td>
<td>10</td>
</tr>
<tr>
<td>Severe</td>
<td>Promotion</td>
<td>6.30</td>
<td>2.12</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Prevention</td>
<td>6.00</td>
<td>2.50</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>5.60</td>
<td>2.53</td>
<td>5</td>
</tr>
</tbody>
</table>

*Note. Desire to eat was measured on 9-point scales. Higher values indicate greater desire to eat.*
Analysis of relative hemispheric activation

As in the previous studies participants completed the same line bisection task before and after the regulatory focus manipulation, providing a baseline and an initial post-manipulation measurement of their hemispheric activation. It was predicted that participants in the promotion focus condition would exhibit more pronounced leftward bisection errors relative to baseline than participants in the control condition, indicating a greater increase in right hemispheric activation. In contrast, it was predicted that participants in the prevention focus condition would exhibit more pronounced rightward errors relative to baseline than participants in the control condition, indicating a greater increase in left hemispheric activation. To assess the durability of the manipulation’s effect on hemispheric activation, participants in the present study completed the same line bisection task for a third time, following the neutral photo-evaluation filler task.

A 3 (regulatory focus: promotion, prevention control) x 3 (time: pre-manipulation, post-manipulation 1, post-manipulation 2) repeated measures ANOVA was conducted on the overall bisection error indices. The means and standard deviations are presented in Table 6.13. There was a main effect of time, \( F(1, 87) = 12.57, p = .001, \eta^2 = .126 \) but no main effect of regulatory focus, \( F(2, 87) = 1.96, p = .147, \eta^2 = .043 \). The time by regulatory focus interaction was significant, \( F(2, 87) = 4.90, p = .010, \eta^2 = .101 \), indicating that the conditions differed in terms of change in hemispheric activation across the three measurement points. Analysis of the differences between the baseline and 1st post-manipulation measures showed that as predicted the prevention focus condition exhibited a significantly greater rightward shift from baseline (i.e., a greater increase in left hemispheric activation) than both the control, \( t(87) = -4.57, p < .001 \) and promotion focus conditions, \( t(87) = 5.15, p < .001 \).
Table 6.13.

**Study 4 Means (and Standard Deviations) for Hemispheric Activation as Measured by the Line Bisection Task as a Function of Regulatory Focus**

<table>
<thead>
<tr>
<th>Time of measurement</th>
<th>Promotion (n = 30)</th>
<th>Prevention (n = 30)</th>
<th>Control (n = 30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-manipulation (baseline)</td>
<td>.05 (.19)</td>
<td>.05 (.19)</td>
<td>.07 (.15)</td>
</tr>
<tr>
<td>Post-manipulation 1</td>
<td>.06 (.21)</td>
<td>-.06 (.20)</td>
<td>.07 (.15)</td>
</tr>
<tr>
<td>Post-manipulation 2</td>
<td>.03 (.20)</td>
<td>-.04 (.20)</td>
<td>.06 (.15)</td>
</tr>
</tbody>
</table>

*Note.* Measured in centimetres. Higher values indicate higher right hemispheric activation.

However, contrary to prediction, the promotion focus condition did not show a greater leftward shift from baseline (i.e., a greater increase in right hemispheric activation) compared to the control condition, $t(87) = .58, p = .573$. Analysis of the differences between the baseline and 2nd post-manipulation measures revealed that the prevention focus condition continued to show a greater increase in left hemispheric activation than both the control, $t(87) = -2.99, p = .004$ and promotion focus conditions, $t(87) = 2.45, p = .016$; and the promotion focus condition continued to show no significant difference to the control condition, $t(87) = .54, p = .591$.

**Discussion**

Study 4 sought to extend the results of the previous study by examining the effect of regulatory focus on hedonic snack intake in a sample comprising a greater number of participants with clinical levels of disordered eating. Again this study was interested in whether these differences were related to hemispheric activation. Study 4 was also designed to include two independent food exposure or “tasting” periods (separated by approximately
5 minutes) to determine whether regulatory focus can influence snack intake beyond the cessation of its priming. Participants were led to believe that the experimenter was interested in their “taste perception” of various properties of the food (rather than their actual intake) to minimise potential self-consciousness and moderation of their eating behaviour. Despite using a different cover story to explain the snack food (i.e., a “taste test” versus a “thank you” gesture), the average overall intake during the regulatory focus priming was equivalent to intake in the previous study ($M = 18.01$ grams; $SD = 12.38$ and $M = 19.13$ grams; $SD = 13.61$, respectively).

Replicating the previous study’s finding of a regulatory fit between the food and a situationally induced promotion focus, no/mild-binge eaters in Study 4 consumed significantly more of the snack when they underwent promotion focus priming compared to when they underwent no priming (i.e., control condition) or prevention focus priming. While promotion focus priming encouraged consumption of the snack among no/mild-binge eaters, the prevention focus priming again failed to significantly inhibit intake (relative to the control condition), despite trending in that direction. One suggested explanation for this non-significant effect in the previous study was that the control mazes were not sufficiently neutral, and as such, changes were made to the mazes used in the current study. However, the same pattern of results emerged, suggesting that the problem lies more with the prevention focus stimuli evoking only a weak prevention focus.

Based on intake trends for the group of “high disordered eaters” in the previous study, it was predicted that for those participants with more severe levels of eating psychopathology a prevention focus would significantly facilitate snack consumption (signifying a regulatory fit), whereas a promotion focus would significantly inhibit consumption (signifying a misfit). While there was a clear trend for severe binge eaters primed with a prevention focus to consume more of the snack than severe binge eaters in
the control group, this difference was not statistically significant, which is most likely due to the small number of severe binge eaters that participated in this study. Contrary to prediction, there was a slight (albeit non-significant) trend for severe binge eaters to consume more, rather than less of the snack, when primed with a promotion focus versus no-focus. This absence of inhibition suggests that hedonic snack food and a promotion focus do not constitute a regulatory misfit for individuals with high levels of disordered eating, contrary to prediction.

As in the previous study, participants in the current study were asked to rate to what extent their snack intake was motivated by nurturance needs and security needs, and again, no/mild-binge eaters identified nurturance as the more influential of the two needs regardless of which regulatory focus condition they were in. For severe binge eaters, in contrast, security needs were reported as equally influential as nurturance needs in motivating intake, but only when they were primed with either a prevention or promotion focus. Nurturance needs remained a more influential driver of intake than security needs among severe binge eaters in the control condition. The current findings suggest that individuals with disordered eating seek nurturance as well as security from hedonically pleasing foods, which may explain why their intake wasn’t inhibited under promotion focus priming.

Consistent with the previous studies, participants’ conscious desire to eat remained unaffected by the regulatory focus priming (despite intake being affected), and this was the case for all three categories of disordered eating. Again, this suggests that the effects are operating at an automatic or unconscious level. Also consistent with the previous studies was the finding that it was the specific focus and not an emotional response produced by that focus that influenced intake. This is perhaps most interesting for the severe binge eaters who showed an increase in their snack intake under a prevention focus relative to severe
binge eaters in the control group, despite showing no concomitant increase in negative mood. While there is a great deal of empirical evidence (e.g., Telch & Agras, 1996) that negative mood is a trigger for binge eating behaviour, in this study negative mood was not found to mediate the relationship between focus and intake.

A major contribution of Study 4 relates to the transiency of regulatory focus manipulations. Although regulatory focus had a significant effect on snack intake (among no/mild-binge eaters) at the first tasting period when the focus was being actively primed, the effect was no longer significant at the second tasting period which took place approximately 5 minutes after the priming had ended. Instead, the most significant predictor of snack consumption at the second tasting period was the amount consumed during the first taste test, and the nature of this relationship was positive. In other words, the more (or less) participants ate at taste test one, the more (or less) they ate at taste test two, and this was the case regardless of level of disordered eating. This in itself is interesting as one might have expected no/mild-binge eaters to consume less at the second taste test due to satiation, and severe binge eaters (particularly those with high scores on the Restraint subscale of the EDE-Q) to eat more in response to having broken their intended pattern of food restriction (i.e., preload induced disinhibition). However, it is likely that mean intake at taste test one (16.30 grams and 24.9 grams out of a possible 160 grams) by no/mild-binge eaters and severe binge eaters, respectively, was not large enough to produce satiation, nor a perception of having overeaten.

With respect to hemispheric activation, the prevention focus priming successfully activated the left hemisphere relative to a control task, replicating the findings of the previous study. The promotion focus priming, in contrast, failed to produce a significant amount of right hemispheric activation relative to the control condition. Study 4 explored
an important question relating to the durability of hemispheric activation, and showed that the activation patterns continued for at least 5 minutes past the focus priming.

**General Discussion**

Extending on the initial two studies reported in this thesis, Studies 3 and 4 exchanged global and local processing for a more direct manipulation of regulatory focus (i.e., variants of Friedman and Förster’s 2001 cheese-owl mazes) and assessed participants on various eating, shape and weight-related attitudes and behaviours. In both studies, participants with low levels of disordered eating symptomatology consumed significantly more of the hedonic food under a promotion focus, signifying a regulatory fit between the food and the focus. This facilitatory effect of promotion focus priming was not mediated by the right hemisphere, which was only weakly activated in both studies.

Despite consistently activating the left hemisphere, the prevention focus priming failed to significantly inhibit the snack intake of low disordered eaters in either study, which may reflect subtle differences between my mazes and the original maze manipulation developed by Friedman and Förster (2001). As described in Chapter 3, Friedman and Förster’s promotion focus maze depicted a piece of cheese awaiting a cartoon mouse if it could locate the exit of the maze, and their prevention focus maze depicted a hovering owl preparing to swoop down and capture the mouse if it could not find its way to the exit. In other words, these mazes were designed to signal benign versus unsafe situations and activate approach versus avoidance behaviours, respectively. Like Friedman and Förster, the current prevention focus mazes also asked participants to imagine a threatening scenario, such as being caught in a storm while hiking, but the focus was on moving towards a source of security (i.e., shelter) to alleviate the threat, rather than purely avoiding the threat by exiting the maze.
Studies 3 and 4 also produced some interesting findings for participants with higher levels of disordered eating symptomatology, which may inform treatment interventions for clinical binge eating. While regulatory focus was not a significant predictor of snack intake for high disordered eaters in either study, there was a clear trend for increased consumption under both a prevention and promotion focus relative to a control task. Furthermore, responses on the nurturance/security needs scales, suggest that hedonically pleasing snack food such as chocolate represents a source of both nurturance and security for high disordered eaters, whereas low disordered eaters perceive the food primarily as a source of nurturance. Other valuable findings of Studies 3 and 4 were that for low and high disordered eaters, regulatory focus exerted its influence on snack intake without impacting participants’ mood or their conscious desire to eat, and the influence on intake is a transient one. In other words, the focus only appears to effect intake in the period that it is being actively primed.
CHAPTER 7.
SUMMARY AND CONCLUSIONS

Summary of the Literature and Research Questions

Drawing on regulatory focus theory (Higgins, 1997, 1998) and the phenomenon of "value from fit" (Higgins, 2000, 2002) this thesis is focused on enhancing our understanding of the psychological/motivational processes that unfold when individuals are exposed to hedonically appealing food in the absence of physical hunger, and how these processes may vary for individuals with disordered eating cognitions and behaviours. Regulatory focus theory proposes that individuals can adopt one of two distinct motivational states or regulatory foci: a promotion focus (on advancement and growth) and a prevention focus (on safety and security), characterised by eager approach and vigilant avoidance strategic means, respectively. Chapter 3 reviewed a range of evidence linking a promotion focus to global processing and a broadening of perceptual and conceptual attention, and a prevention focus to local processing and a narrowing of perceptual and conceptual attention (e.g., Förster & Higgins, 2005; Förster et al., 2006). Chapter 3 also reviewed evidence suggesting that these relationships are accompanied by variations in relative hemispheric activation (e.g., Friedman & Förster, 2005).

In addition to influencing processing style and breadth of attention, regulatory focus has been shown to influence a wide range of human behaviour, including eating behaviour. The inspiration for using regulatory focus theory as a framework for better understanding hedonic eating originated from Förster's (2003) intriguing finding that non-hungry/non-thirsty participants consumed greater quantities of chocolate cookies and ice-cold orange juice (i.e., luxury items) when performing subtle motor actions associated with a promotion focus, and lesser quantities when performing actions associated with a prevention focus.
Fürster interpreted this facilitation and inhibition of consumption in terms of regulatory fit. Specifically, he suggested that the cookies and juice were perceived as a source of nurturance and exploration (and not a source of security or safety), leading to a compatibility or "fit" with the promotion focus and an incompatibility or "misfit" with the prevention focus. While Fürster's findings shed light on the impact of regulatory foci on snack intake by individuals with non-problematic eating attitudes and behaviours, it remains unclear how these manipulations impact disordered-eaters (especially binge eaters) for whom there is suggestion that security or safety is sought through the consumption of these types of high-calorie, low-nutrient foods.

Chapter 5 reviewed research and theory relating to a range of behavioural, cognitive/affective and attentional features of disordered eating, drawing parallels to a prevention focus. In summary, disordered eaters tend to engage in safety behaviours, similar to the vigilant avoidance strategies posited by regulatory focus theory, including attempts to restrict food intake and avoidance of certain "forbidden" foods, body checking (e.g., frequent weighing) and body avoidance (e.g., refusing to be weighed). While these safety behaviours are aimed at averting feared outcomes (such as weight gain) and feelings of distress or discomfort, they actually maintain the eating disorder because the non-occurrence of the feared outcome is attributed to the use of the safety behaviour rather than the improbability of the feared event (Pallister & Waller, 2008). A substantial body of literature has evaluated the function of binge eating in reducing negative cognitions and associated negative affect. Heatherton and Baumeister's (1991) escape theory, for instance, proposes that binge eating reduces negative affect by narrowing cognitive attention from higher level abstract thinking (particularly with regard to personal failures to meet high standards) to the more immediate environment. According to Hohlstein et al. (1998), individuals develop "cognitive expectancies" about binge eating (i.e., that it will alleviate
negative emotions) based on their learning history, which maintains the behaviour. In addition to safety behaviours and cognitive/affective avoidance, eating disordered individuals show an attentional bias towards threatening information (including information unrelated to their eating pathology) and a bias towards local or detail-oriented processing, both characteristic of a prevention focus. As outlined in Chapter 1, an integrative review of the literature on regulatory focus, attentional scope and eating disorders, lead to the development of six main research questions:

1. Does global and local processing affect snack consumption in a similar manner to Förster's promotion and prevention focus priming? (Studies 1 and 2)

2. Do disordered eaters show a different pattern of snack consumption in response to promotion and prevention focus priming? (Studies 3 and 4)

3. Does the priming influence participants’ conscious desire to eat the snack? (Studies 1-4)

4. Are the effects of the priming related to changes in relative hemispheric activation from baseline? (Studies 1-4)

5. Is priming apparent after controlling for chronic regulatory focus and mood? (Studies 1-4)

6. Does regulatory focus continue have an influence beyond the cessation of its priming? (Study 4)

**Summary of the Main Findings**

In Study 1, local and global processing were manipulated using tasks shown to be predominantly lateralised to the left and right hemisphere, respectively; namely, a
computer-based rhyming task and mental rotation task. While the local processing rhyming
task engendered left hemispheric activation (from baseline) and significantly inhibited
snack consumption relative to the control group (indicative of a regulatory misfit between
the luxury food and the focus), the global processing mental rotation task failed to activate
the right hemisphere or facilitate snack consumption. Based on findings of Voyer (1995), it
was suggested that despite being a predominantly right-lateralised task, the extended
practice of mental rotation in the present study (which was required to permit variability in
snack intake) caused participants to shift from a holistic/global strategy to an analytic/local
strategy, leading to contributions from the left hemisphere. Due to the limitations of mental
rotation as a global processing task, Study 2 was conducted using a different manipulation,
namely insight problem-solving. Again, the local processing task engendered left
hemispheric activation and inhibited snack consumption relative to the control group,
reflecting a regulatory misfit between the food and the focus. However, this time the global
processing task showed a trend (although non-significant) towards right hemispheric
activation and greater snack consumption relative to the control condition, suggestive of a
regulatory fit.

In Study 3, global and local processing tasks were exchanged for a more direct
manipulation of promotion and prevention foci (i.e., variants of Friedman and Förster’s
2001 cheese-owl mazes). This study compared the effect of these foci on snack
consumption for no/mild binge eaters versus moderate eaters, who were classified based on
a sample split of scores on the BES. Among no/mild binge eaters, the promotion focus
mazes significantly facilitated snack intake relative to the control mazes (despite eliciting
only a weak amount of right hemispheric activation), while the prevention focus mazes
failed to have an inhibitory effect (despite eliciting strong left hemispheric activation). As
hypothesised, moderate binge eaters exhibited a very different pattern of snack
consumption. Specifically, moderate binge eaters who completed either the promotion focus mazes or the prevention focus mazes completed greater amounts (although not statistically significant) of the snack than moderate binge eaters who completed the control mazes. Most notably, moderate binge eaters consumed significantly more of the snack in response to the prevention focus mazes than low disordered eaters who completed the same mazes. While no/mild binge eaters identified nurturance needs as the most important driver of their snack intake, moderate binge eaters reported that their consumption was motivated by both nurturance and security needs.

These findings were replicated by Study 4, which pre-screened prospective participants to ensure greater proportions of clinically significant cases of disordered eating. The trend for the prevention focus priming to facilitate snack intake strengthened with increasing levels of binge eating severity. Using a “taste test” cover story, Study 4 also extended Study 3 by adding a follow-up “tasting” period in order to examine the longevity of the foci’s effects on snack intake. The results demonstrated that the effects are transient. Regardless of level of disordered eating, the best predictor of snack intake at the second tasting period was not the situationally induced regulatory focus, but the amount of the snack consumed at the first tasting period.

Consistent across all four studies, conscious desire or craving for the snack remained unaffected by the priming despite significant impacts on snack consumption. Furthermore, statistical analyses consistently confirmed that it was the actual priming and not the individual’s chronic regulatory focus or mood that was explaining the results.

**Theoretical Implications**

The findings of this thesis support a growing body of research characterising eating as an automatic behaviour that can, at least temporarily, be influenced by aspects of the food environment and the deliberate priming of motivational states (Cohen & Farley, 2008;
Fürster, 2003). It makes sense that a behaviour so central to human survival can be initiated and maintained with little cognitive direction or effort. About half a century ago, researchers started to try to quantify the processing capacity of consciousness and unconsciousness (e.g., Miller, 1956). While the processing capacity of the entire human system (consciousness and unconsciousness combined) is estimated to be an immense 11 million bits per second, consciousness can only process 40-60 bits per second — equivalent to a short sentence (Dijksterhuis, 2004). Stated differently, “if the unconscious is a modern computer, consciousness is nothing more than an old abacus” (Dijksterhuis, 2004, p. 587). Therefore, motivational orientations such as promotion and prevention foci may be thought of as “short-cuts” that enable us to bypass cognitive deliberation, a process that we have limited capacity for, and perform actions that are necessary for survival.

Previous research by Fürster (2003), which was reviewed in Chapter 3, concluded that motor actions associated with a promotion focus automatically facilitate hedonic snack consumption, while motor actions associated with a prevention focus inhibit it. The current thesis extends this perspective demonstrating that it is the interaction between the primed focus and the psychological meaning/s (i.e., nurturance versus security) that the individuals holds for the food stimulus, presumably through a lifetime of learned associations, which predicts the eating response. In Studies 3 and 4, there was a consistent trend (although non-significant) for the prevention focus priming to facilitate (rather than inhibit) hedonic snack consumption among participants with greater levels of disordered eating symptomatology, which was related to self-reported expectancies about the snack food’s capacity for satisfying security or safety needs, in addition to nurturance needs. Hence, while eating is impacted by external or situational cues, within-person differences in food meanings, associations and expectancies, appear to have a critical role in determining the nature and extent of this impact.
The trend for the prevention focus priming in this research to facilitate snack consumption among the more disordered eaters, without eliciting conscious changes in mood, also has theoretical implications for our understanding of the precursors of binge eating episodes. As reviewed in Chapter 5, functional analysis studies have identified caloric deprivation, negative affect (e.g., depression, anger, emptiness, and worry), aversive social experiences, and negative self-perceptions as the predominant proximal antecedents to binge episodes. Most, if not all, of these previously researched factors tend to be cognitive or conscious processes and as such lend themselves to being captured by retrospective self-report. This thesis has shown that while most eating behaviour is motivated by conscious choices, binge eating behaviour may also be susceptible to unconscious cues signalling threat/danger. However, the exact nature of this relationship is still unknown and further investigation is needed to tease this apart. Future research could also explore the impact of regulatory focus on binge drinking as this behaviour has several important features in common with binge eating, specifically personality correlates and affective characteristics (Ferriter & Ray, 2011).

**Implications for Public Health and Obesity**

A kilogram of body fat is roughly equivalent to 7700 calories. Eating just 5 Crispy M&Ms a day (25 calories) on top of one’s recommended dietary intake would lead to a consumption of an additional 9125 calories over the year – more than a kilogram of weight gain. Combining the four studies reported in this thesis, the average quantity of M&Ms consumed during the 10 minute snack exposure period was 24 grams (24 pieces), equivalent to 118 calories. If this occurred on a daily basis over the course of a year, participants could find themselves over 5.5 kilograms heavier. In a real-world context, where people are exposed to a wide variety of calorie-rich foods for virtually unlimited periods of time, opportunities for the motivational mechanisms identified in this thesis to
operate could lead to even greater intake and subsequent weight gain. This is significant as research indicates that men and women with even modest weight gain of 5-10 kg (at any level of BMI) during early and middle adulthood are at an increased risk of coronary heart disease, type 2 diabetes and hypertension, as compared with individuals who maintain their weight within 2 kg of their weight at 18-20 years of age (Willett, Dietz & Colditz, 1999). The good news is that most health consequences of weight gain can be ameliorated or even reversed by effective weight management (Lean, 2010).

Public health interventions have tended to direct efforts towards educating people to regulate their food intake through such means as publicising general guidelines on nutrition (e.g. NHMRC Dietary Guidelines for Australian Adults), promoting tailored diets (e.g. CSIRO Total Wellbeing Diet), and labelling foods with nutritional information (e.g. Heart Foundation Tick). More recently, the Commonwealth Government has launched its “Swap it don’t stop it” campaign, which encourages Australians to swap big for small (portion control), swap often for sometimes (occasional treats), swap fried for fresh (nutritional quality), and swap sitting for moving and watching for playing (physical activity). The continued growth of overweight/obesity despite the employment of these methods raises important questions about the assumptions underlying them. The fundamental assumption is that, given the right information and motivation, people can successfully reduce their food intake to match their caloric expenditure over the long term. This assumption in turn implies that eating is largely a conscious act. However, the findings presented in this thesis suggest that this is not always the case. Therefore, interventions need to also focus on making people aware of the non-conscious ways in which they unwittingly increase their intake.
Clinical Implications

Cognitive behavioural therapy (CBT) is widely acknowledged as the leading treatment for bulimia nervosa and binge eating disorder (National Institute for Clinical Excellence, 2004). An early task of CBT is for patients to formulate a personalised list of pleasurable, simple and distracting activities that they can engage in to manage the urge to graze or binge eat between their planned meals and snacks. Ideally, activities are chosen that address the specific emotional state underlying the urge (e.g., if the patient is feeling lonely, she or he might phone or chat online with a friend). Other alternative activities include reading a book or magazine, listening to music, playing a computer game, surfing the internet, doing craftwork or a puzzle, writing letters, gardening, taking a bath, playing with a pet, or going for a walk. These activities are considered healthier and more adaptive ways of satisfying emotional needs (i.e., affect regulation) than binge eating, and successful use of these new activities can challenge the patient’s belief that their mood and eating is outside of their control. Later on, when urges to eat between planned meals and snacks are intermittent and less overwhelming, CBT teaches patients the skill of “riding out” or “sitting with” urges and emotions until they naturally dissipate, rather than trying to eliminate them using alternative activities (Fairburn & Beglin, 2008).

The findings of this thesis have major implications for the types of alternative activities patients are initially encouraged to use to distract from their eating urges. Snack intake results for high disordered eaters in Studies 3 and 4 raise a concern that some activities with a strong emphasis on avoidance and the prevention of losses may be inadvertently facilitating some patients’ eating (via a regulatory fit) rather than inhibiting it. One activity that potentially stimulates a prevention focus, and is favoured by patients because of its convenience, is the playing of smartphone games such as “Cover Orange” and “Plants vs. Zombies”. In both games players are motivated to avoid an undesired
outcome (i.e., failing the level) by using vigilant defensive strategies. In “Cover Orange” the strategy is to construct a roof or cover to protect smiley-faced oranges from incoming acid rain, and in “Plant vs. Zombies” players position different types of plants and fungi around a house in order to stop a horde of zombies from devouring the brains of the residents. Such games clearly signal a threatening environment, which may make some patients even more vulnerable to unplanned eating due to learnt associations (and hence a regulatory fit) between snack food consumption and safety/security needs.

Snack intake results for high disordered eaters in Studies 3 and 4 suggest that activities with a strong emphasis on approaching gains and positive outcomes are also unsuitable for resisting binge eating urges. While the promotion focus priming in the present studies did not stimulate snacking by high disordered eaters to the same extent as the prevention focus priming, it did not curb the behaviour either. The task that consistently led to the least amount of snacking by high disordered eaters was the control mazes, indicating that patients may benefit most from engaging in alternative activities that cultivate a relatively neutral motivational state, emphasising neither promotion or prevention goals. One activity that involves no attachment to achieving any goal at all, and is increasingly being incorporated into interventions for eating and other clinical disorders, is the practice of mindfulness (Baer, Fischer, & Huss, 2006; Baer, 2003). Mindfulness is typically defined as a deliberate “way of paying attention” to one’s moment-to-moment experiences, including bodily sensations, perceptions (e.g., sights, sounds), thoughts and emotions, with an attitude of openness, curiosity and flexibility (Harris, 2009). It involves going beyond the usual goal focus, by shifting from a “doing” mode to a non-striving “being” mode. Rather than striving for pleasant experiences (i.e., promotion) or pushing away painful or unpleasant experiences (i.e., prevention), mindfulness encourages a non-judgmental acceptance of all aspects of one’s inner experience (Shapiro, Carlson, Astin, &
Freedman, 2006). The mindfulness literature describes numerous meditation exercises that can be practiced while sitting or lying down in a relaxed posture, or while engaged in routine activities such as walking, taking a shower and doing domestic chores. Thus, based on the findings of this thesis, mindfulness exercises may offer the best treatment option for high disordered eaters as a means of enabling them to reduce or control their binge eating episodes.

**Limitations and Directions for Future Research**

Although this thesis provides valuable insights into the psychological and motivational processes underlying hedonic snack consumption, it is not without its limitations. The first notable limitation concerns the priming of attentional scope (specifically global processing) in the initial two studies. As discussed previously, global processing was at most, only weakly induced in the second study via an insight problem-solving task, as indicated by non-significant increases in right hemispheric activation and snack consumption. It was hypothesised that participants may have resorted to analytic, non-insight processes to solve some of the problems, eliciting a contribution from the left hemisphere. In addition to this weak priming effect, the tasks used to manipulate the two processing styles were also different on a number of dimensions (e.g., computer-based versus paper-and-pencil, dichotomous versus open-ended response), implying a number of potential confounds. While questions were asked to check for differences in liking, engagement and difficulty of the tasks, it is possible that other elements such as depth of processing and task novelty could have confounded the results. Future studies attempting to prime attentional scope would be best to continue with the standard methodologies described in Chapter 4 such as the Navon task or map task (e.g., Förster, 2009), which require participants to focus on either the gestalt or the details of the one structure.
The regulatory focus manipulation employed in Studies 3 and 4 resolved the limitations of the attentional scope priming by keeping the underlying structure of the tasks the same across the three conditions (i.e., paper-and-pencil mazes). However, the results of these studies raise some concern about the depth or strength of the prevention focus priming, which is also worth discussing. While the promotion focus mazes consistently engendered the predicted boost in snack intake among low disordered eaters, the prevention focus mazes failed in both studies to show the predicted inhibition of intake by these participants. It was hypothesised that the act of moving towards a visual image associated with ‘security’ to alleviate a verbally implied (but unseen) threat may not be as effective in priming a prevention focus as the act of moving away from a visual image associated with ‘threat’ – like the hovering owl in Friedman and Förster’s (2001) original prevention focus maze. Therefore, future research should re-examine the current research questions using a new set of regulatory focus mazes, designed with a greater emphasis on approach and avoidance, rather than nurturance and security. Another cue that is related to approach/avoidance, which would be worthwhile examining as a predictor of hedonic snack consumption, is colour. A recent study by Mehta and Zhu (2009) showed that the colour blue is related to approach behaviour and broadens both perceptual and conceptual attention. The colour red, on the other hand, has been linked to avoidance behaviour (such as leaning away from a test cover) and the narrowing of attention (Elliot, Maier, Moller, Friedman, & Meinhardt, 2007; Maier, Elliot, & Lichtenfeld, 2008). Notably, there was no evidence that colour influenced mood in any of these studies.

A major strength of this thesis is that each study employed a manipulation check, contrary to the majority of regulatory focus research which has simply assumed that their manipulations have worked as intended. Success of the manipulations in the current studies was determined using a behavioural measure of relative hemispheric activation (i.e., a line
bisection task), based on evidence that global processing and promotion motivation are associated with right hemispheric activation, and local processing and prevention motivation are associated with left hemispheric activation. While the line bisection task has the advantage of being inexpensive, non-invasive and quick to administer, it is limited in the sense that it only permits assessment of differences in 'relative' hemispheric activation. In other words, it does not allow determination of whether any differences obtained are due to increased activation of one hemisphere, diminished activation of the other, or both (Friedman & Förster, 2010). It is recommended that more sensitive instruments such as EEG are used in the future to examine absolute patterns of hemispheric activation, including whether there is a shifting of activation to different loci within each hemisphere (e.g., anterior versus posterior). In addition to hemispheric activation, future research could also check that regulatory focus manipulations have worked by directly asking participants questions about their motivation. Gino and Margolis (2011), for instance, asked participants to describe their goals when taking the perspective of the mouse (in Friedman & Förster’s cheese-owl mazes), which were later coded by two judges as indicating a promotion or prevention focus.

Finally, as with all laboratory-based studies, questions remain about the ecological validity of the present findings. While every effort was made to minimise social desirability effects (i.e., the experimenter leaving the room), the setting in which the eating took place was still an artificial one. It is possible that within the participant’s natural environment (where they are likely to have more privacy, comforts, time, and access to the specific foods and drinks they like), the impact of the situational regulatory foci on intake might have been more pronounced. This would be worthwhile investigating in future research using ecological momentary assessment (EMA; Stone & Shiffman, 1994). EMA involves signalling participants within their natural environment several times throughout each day.
to report on eating, external events, and subjective responses such as affective states. Devices such as programmable wristwatches, pagers or hand-held computers typically control the signals. Regarding the current research, participants could be prompted to complete the regulatory focus mazes at various points throughout the week and to report back at certain intervals about their eating response. This of course would rely on honest and accurate self-reporting, which is always the trade-off.

**Conclusion**

On the surface, the solution to the obesity epidemic seems simple: people need to eat less and/or exercise more. However, as this thesis has shown, people’s reflective or deliberative regulation of their eating can be overridden by situational cues that stimulate consumption without their awareness. Specifically, this thesis has demonstrated that depending on where people fall along the disordered eating continuum, the priming of processing styles and regulatory foci can influence their eating behaviour. As such, where the priming complements the psychological meaning attached to certain foods, there is a tendency for people to eat greater amounts than those in an unprimed condition. Conversely, where the priming conflicts with the food meaning, there is a tendency for people to eat less than those in an unprimed condition. Given the automatic nature of eating, understanding this process may represent our best hope at controlling the obesity epidemic.
REFERENCES


environment. *Behavioral Research and Therapy, 47*, 181-188.


doi:10.1016/0031-9384(94)90286-0


doi:10.1007/s11136-005-0585-0


Levitsky, D. A., & Young, T. (2004). The more food young adults are served, the more they overeat. *Journal of Nutrition, 134*, 2546-2549.


Disorders, 7, 589-599. doi:10.1002/1098-108X(198809)7:5<589::AID-EAT2260070502>3.0.CO;2-H


Appendix A:
Web-based Advertisements
Are you a 1st year psychology student interested in earning 1 hour’s research credit?

Then how about participating in a psychology study on Brain Hemisphere Specialisation which hopes to tell us more about how the two hemispheres of the brain process information differently?

If you are interested in signing up please contact Catherine Hunt at Catherine.Hunt@anu.edu.au or call (02) 6125 4379 to arrange a time

Thank you!
Are you a right-handed female aged between 18 and 65 years?

...And interested in earning 1 hr's research credit OR $10 for your time?

Then how about participating in a psychology study on *Brain Hemisphere Specialisation* which hopes to tell us more about how the two hemispheres of the brain process information differently?

If you are interested in signing up please contact Catherine Hunt at Catherine.Hunt@anu.edu.au or call (02) 6125 4379 to arrange a time

Thank you!
CALL FOR RESEARCH PARTICIPANTS

Do you ever feel that your eating is OUT OF CONTROL?

IF YES... Perhaps you would like to participate in a study aimed at investigating how various distractions affect taste perception among women with different eating patterns. This study is being conducted as part of an ongoing clinical PhD project and may inform future treatment for eating problems.

Who can participate?
- Females who feel that at times their eating is out of control
- Aged between 18 and 45 years
- English-speaking

What does the study involve?
The study involves completing a short online survey, and if eligible, attending one 60 minute session at the ANU Department of Psychology. At this session you will be asked to taste two different kinds of food while working on distractor tasks and then complete a questionnaire. In exchange for your time you will receive $10.

How do I participate?
If you are interested in participating in this study please complete the short online survey at the following address: http://tiny.cc/3nsj1
Appendix B:
Information Sheets, Consent Forms and Debriefing Sheets
Study I

Brain Hemisphere Specialisation Study

Information Sheet

Thank you for agreeing to participate in this study on the relative contribution of the left and right hemisphere of the brain in the performance of certain cognitive functions, which forms part of a series of experiments for a PhD project. If you are enrolled in Psychology 1003, you will receive 1 hour’s research credit for participating in this study.

In this study, which should take approximately 45 minutes, you will be asked to work on a computer-based mental rotation task, rhyming task, or photograph evaluation task. You will also be asked to complete a line bisection task and a short questionnaire.

There are no risks associated with this study. This is not any kind of intelligence test. The data generated by your participation will remain strictly anonymous and the questions themselves are not personally probing. All information will be identified by an identification code, not your name, and shall be securely stored at ANU and not disclosed. The information obtained will be analysed statistically and used in the researcher’s PhD thesis. This data may be used in future published journal articles. However, your name or other identifying information will not be associated with any research.

I am very grateful for your participation in this study, and information concerning its outcome will be made available to you through the psychology noticeboard when all data has been collected. Participation in this study is entirely voluntary and you have the right to withdraw your consent and discontinue at any time, for any reason, without penalty. If you decide to withdraw from this study, you will still receive any credit for participation that was promised you. You can withdraw by simply leaving the room or by telling me that you wish to withdraw. You do not have to answer any questions you do not wish to answer.

This research project has been approved by the Human Ethics Committee of the Australian National University (contact Secretary, Human Research Ethics Committee, Ph (02) 6125-3427, the Research Office, Chancery 10B, ANU, ACT 0200). Any other questions concerning this research should be directed to Prof Marie Carroll (email: marie.carroll@anu.edu.au, Ph 6125 4806). This research is being conducted by Catherine Hunt (email: catherine.hunt@anu.edu.au, Ph 6125 4379, Room 146, Building 39, ANU).
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Consent Statement

I have read the above statement, understand the nature of my participation in the research, and I freely agree to participate. I recognise my right to withdraw from the experiment at any time without penalty, and recognise that my activities and data generated by my participation will remain strictly anonymous.

Signed: ........................................ Date: ......................
(by participant)

Print name: ..................................................
Signed on behalf of researchers

Signed: ..............................................          Date: ..........................

Print name: ........................................... 

This research project has been approved by the Human Ethics Committee of the Australian National University (contact Secretary, Human Research Ethics Committee, Ph (02) 6125-3427, the Research Office, Chancelry 10B, ANU, ACT 0200). Any other questions concerning this research should be directed to Prof Marie Carroll (email: marie.carroll@anu.edu.au, Ph 6125 4806). This research is being conducted by Catherine Hunt (email: catherine.hunt@anu.edu.au, Ph 6125 4379, Room 146, Building 39, ANU).
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There are no risks associated with this study. This is not any kind of intelligence test. The data generated by your participation will remain strictly anonymous and the questions themselves are not personally probing. All information will be identified by an identification code, not your name, and shall be securely stored at ANU and not disclosed. The information obtained will be analysed statistically and used in the researcher's PhD thesis. This data may be used in future published journal articles. However, your name or other identifying information will not be associated with any research.

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Consent Statement

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Study 3

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In this study, which should take approximately 60 minutes, you will be asked to work on a series of paper-and-pencil cartoon mazes, a line bisection task, and some brief questionnaires.

The data generated by your participation will remain strictly anonymous. All information will be identified by an identification code, not your name, and shall be securely stored at ANU and not disclosed. The information obtained will be analysed statistically at an aggregate level and used in the researcher’s PhD thesis. This data may be used in future published journal articles. However, your name or other identifying information will not be associated with any research.

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Consent Statement

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Signed: ........................................... Date: ..........................
(by participant)
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Study 4

Taste Perception under Distraction Study

Information Sheet

Thank you for agreeing to participate in this study on the impact of various distractions upon taste perception and preference, which forms part of a series of experiments for a PhD project. If you are enrolled in Psychology 1004, you will have the option of receiving 1 hour’s research credit or $10 for participating in this study. Alternatively, you will receive $10 in exchange for your time.

In this study, which should take approximately one hour, you will be asked to taste two different kinds of food while working on distractor tasks. You will then be asked to complete a questionnaire.

The data generated by your participation will remain strictly confidential. All information will be identified by an identification code, not your name, and shall be securely stored at ANU and not disclosed. The information obtained will be analysed statistically at an aggregate level and used in the researcher’s PhD thesis. This data may be used in future published journal articles. However, your name or other identifying information will not be associated with any research.

I am very grateful for your participation in this study, and information concerning its outcome will be made available to you through the psychology noticeboard when all data has been collected. Participation in this study is entirely voluntary and you have the right to withdraw your consent and discontinue at any time, for any reason, without penalty. If you decide to withdraw from this study, you will still receive any credit for participation that was promised you. You can withdraw by simply leaving the room or by telling me that you wish to withdraw. You do not have to answer any questions you do not wish to answer.

If you have any questions or concerns about the study, please do not hesitate to discuss these with the primary investigator Cath Hunt in the Department of Psychology at the Australian National University (email: Catherine.Hunt@anu.edu.au, Ph 6125 4379) or her supervisor Prof Marie Carroll (email: marie.carroll@sydney.edu.au, Ph +61 2 9351 7790). If you have any concerns about the way the study is conducted please contact the Secretary, Human Research Ethics Committee, Research Office, Chancellery 10B, ANU, ACT 0200; Tel: +61 2 6125 4807 or email: human.ethics.officer@anu.edu.au
Taste Perception under Distraction Study

Consent Form

Thank you for agreeing to participate in this study on the impact of various distractions upon taste perception, which forms part of a series of experiments for a PhD project. If you are enrolled in Psychology 1004, you will have the option of receiving 1 hour’s research credit or $10 for participating in this study. Alternatively, you will receive $10 in exchange for your time.

In this study, which should take approximately one hour, you will be asked to taste two different kinds of food while working on distractor tasks. You will then be asked to complete a questionnaire.

The data generated by your participation will remain strictly confidential. All information will be identified by an identification code, not your name, and shall be securely stored at ANU and not disclosed. The information obtained will be analysed statistically at an aggregate level and used in the researcher’s PhD thesis. This data may be used in future published journal articles. However, your name or other identifying information will not be associated with any research.

I am very grateful for your participation in this study, and information concerning its outcome will be made available to you through the psychology noticeboard when all data has been collected. Participation in this study is entirely voluntary and you have the right to withdraw your consent and discontinue at any time, for any reason, without penalty. If you decide to withdraw from this study, you will still receive any credit for participation that was promised you. You can withdraw by simply leaving the room or by telling me that you wish to withdraw. You do not have to answer any questions you do not wish to answer.

Consent Statement

I have read the above statement, understand the nature of my participation in the research, and I freely agree to participate. I recognise my right to withdraw from the experiment at any time without penalty, and recognise that my activities and data generated by my participation will remain strictly confidential.

Signed: .......................................................... Date: ..........................
(by participant)

Print name: ........................................................................
Signed on behalf of researchers

Signed: ........................................ Date: ..........................

Print name: .............................................................

If you have any questions or concerns about the study, please do not hesitate to discuss these with the primary investigator Cath Hunt in the Department of Psychology at the Australian National University (email: Catherine.Hunt@anu.edu.au, Ph 6125 4379) or her supervisor Prof Marie Carroll (email: marie.carroll@sydney.edu.au, Ph +61 2 9351 7790). If you have any concerns about the way the study is conducted please contact the Secretary, Human Research Ethics Committee, Research Office, Chancery 10B, ANU, ACT 0200; Tel: +61 2 6125 4807 or email: human.ethics.officer@anu.edu.au
Taste Perception under Distraction Study

Debriefing Sheet

Thank you for participating in this study! The primary aim of this study was to compare how a focus on gains or opportunities affects how much of a pleasurable food (such as chocolate) people eat compared to a focus on losses or mistakes. It is hypothesised that people who experience little in the way of difficulties with their eating eat more when they are focused on gains/opportunities and less when they are focused on losses/mistakes. In contrast, for people who struggle with their eating, it is hypothesised that a focus on gains/opportunities leads to a reduction in eating and a focus on losses/mistakes leads to an increase in eating.

Up until this point you were led to believe that the researcher was interested in taste perception rather than eating behaviour. This was necessary because it has been shown that disclosing the true nature of these kinds of studies can change the way people respond and this affects our ability to draw valid conclusions from the results. Now that you know the true purpose of this study you are more than welcome to withdraw your information. However, don’t feel like you have to make the decision right now. If after thinking about your participation for a while you can email or phone me (see contact details below) to have your data removed and securely destroyed. You do not have to provide any explanation for your withdrawal from the study and will retain the course credit or money that you received for your participation.

Your contribution to this study is very valuable and much appreciated. It is hoped that this research will help us to better understand eating behaviour and may also help to inform methods for treating individuals with eating disorders. Thank you again for participating in this study. Please do not show this debriefing sheet to or discuss any aspect of the study with other potential participants. In order for this study to work, it is important that future participants do not have this information. Thank you!

If you would like more information, or have any further questions about any aspect of this study, then please feel free to contact Cath Hunt (email: Catherine.Hunt@anu.edu.au; ph: 6125 4379). If participants wish to discuss the impact this research has had on them, it is recommended that they talk to a qualified counsellor, either through private or public psychological services. Participants are also encouraged to contact Lifeline (Australian telephone: 13 11 14 or visit http://lifeline-international.org/looking_for_help). The researcher has contact details for other qualified support services that you can access.
Appendix C:

Priming Tasks and Control Tasks
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<td>NAIL - FAR</td>
<td>MAIL - WIT</td>
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<tr>
<td>MALE - DIP</td>
<td>NAIL - FAR</td>
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<tr>
<td>JAIL - MAP</td>
<td>MALE - DIP</td>
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<tr>
<td>KNEE - MOP</td>
<td>JAIL - MAP</td>
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<tr>
<td>KNOW - JET</td>
<td>KNEE - MOP</td>
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<tr>
<td>LINE - RAN</td>
<td>CLAW - NOW</td>
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<td>NULL - HUT</td>
<td>TAKE - PLY</td>
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<tr>
<td>RUG - INK</td>
<td>ASH - ZIG</td>
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<tr>
<td>POST - LAW</td>
<td>CALL - WIG</td>
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<tr>
<td>SHELF - WIN</td>
<td>PUTT - WAG</td>
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<tr>
<td>Compound Remote</td>
<td>Solution</td>
<td>Compound Remote</td>
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<tr>
<td>Associate Problems</td>
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<td>Associate Problems</td>
</tr>
<tr>
<td>cream/skate/water</td>
<td>ice</td>
<td>stick/maker/point</td>
</tr>
<tr>
<td>loser/throat/spot</td>
<td>sore</td>
<td>sleeping/bean/garbage</td>
</tr>
<tr>
<td>night/wrist/stop</td>
<td>watch</td>
<td>right/cat/carbon</td>
</tr>
<tr>
<td>rocking/wheel/high</td>
<td>chair</td>
<td>cross/rain/tie</td>
</tr>
<tr>
<td>dew/comb/bee</td>
<td>honey</td>
<td>boot/summer/ground</td>
</tr>
<tr>
<td>aid/rubber/wagon</td>
<td>band</td>
<td>main/sweeper/light</td>
</tr>
<tr>
<td>cracker/fly/fighter</td>
<td>fire</td>
<td>pike/coat/signal</td>
</tr>
<tr>
<td>safety/cushion/point</td>
<td>pin</td>
<td>tank/hill/secret</td>
</tr>
<tr>
<td>cane/daddy/plum</td>
<td>sugar</td>
<td>dress/dial/flower</td>
</tr>
<tr>
<td>dream/break/light</td>
<td>day</td>
<td>house/thumb/pepper</td>
</tr>
<tr>
<td>fish/mine/rush</td>
<td>gold</td>
<td>carpet/alert/ink</td>
</tr>
<tr>
<td>political/surprise/line</td>
<td>party</td>
<td>knife/light/pal</td>
</tr>
<tr>
<td>sense/courtesy/place</td>
<td>common</td>
<td>foul/ground/mate</td>
</tr>
<tr>
<td>worm/shelf/end</td>
<td>book</td>
<td>change/circuit/bread</td>
</tr>
<tr>
<td>flower/friend/scout</td>
<td>girl</td>
<td>way/board/sleep</td>
</tr>
<tr>
<td>print/berry/bird</td>
<td>blue</td>
<td>blank/list/mate</td>
</tr>
<tr>
<td>cadet/capsule/ship</td>
<td>space</td>
<td>man/glue/star</td>
</tr>
<tr>
<td>fur/rack/tail</td>
<td>coat</td>
<td>teeth/arrest/start</td>
</tr>
<tr>
<td>wet/law/business</td>
<td>suit</td>
<td>wise/work/tower</td>
</tr>
<tr>
<td>hold/print/stool</td>
<td>foot</td>
<td>horse/human/drag</td>
</tr>
</tbody>
</table>
Studies 1, 2 and 4: Control Condition
Imagine you are the driver of the car in the centre and are desperately looking for a parking space. You discover that there is a free space conveniently located close to the entrance of the shopping mall and you would really like to reach it. Please use the pencil provided to trace the route from your car to the available parking space.
Studies 3 and 4: Promotion Focus Condition

Imagine you are the hiker in the centre. You have read in your hiking guide that there is a look-out ahead which offers spectacular views at sunset. You would really like to enjoy the sunset from this look-out. Please use the pencil provided to trace the route from the walking track to the look-out.
Imagine you are the cocktail waitress in the centre. You notice that a customer whom you have waited on diligently throughout the night has left behind a generous tip for you. You would really like to reach the tip before your manager or a fellow employee claims it as their own. Please use the pencil provided to trace the route from behind the bar to the tip.
Imagine you are the driver of the car in the centre. At around midday you return to your car and discover that you have parked in a space strictly reserved for residents after midday. You have to leave the parking lot and reach the street to avoid exceeding the time limit and a heavy fine. Please use the pencil provided to trace the route from your parking space to the street.
Studies 3 and 4: Prevention Focus Condition

Imagine you are the hiker in the centre. You have just heard on your radio that a storm is fast approaching and you haven’t packed appropriate clothing for such conditions. You have to get back to your cabin before the storm hits to avoid getting cold and wet.

Please use the pencil provided to trace the route from the walking track to the cabin.
Imagine you are the cocktail waitress in the centre. You notice that one of your new employees has dropped a large tray of drinks. You have to get to her with a caution sign to reduce the likelihood of anyone slipping and suing your establishment. Please use the pencil provided to trace the route from behind the bar to the caution sign.
Study 3: Control Condition

Starting in the centre of the maze, please trace the route to the exit.
Study 4: Control Condition

Starting at the entry of the maze, please trace the route to the centre.
Appendix D:
Questionnaires
Health Survey

Before we begin the experiment, it is very important that we check for a number of health and lifestyle factors which have been shown in previous research to influence aspects of peoples' brain function or which may affect your ability to fully engage with the experimental task. Please answer the following questions as truthfully as you can.

Age:

Gender:

Please circle Male/ female

Do you smoke?

Please circle Not at all/ occasionally/ regularly

Are you currently restricting your daily food intake to lose weight?

Please circle Yes/ no

Do you drink coffee or caffeinated soft drinks (Pepsi, Red Bull etc)?

Please circle Not at all/ occasionally/ regularly

Do you drink alcohol?

Please circle Not at all/ occasionally/ regularly

Do you suffer from any of the following? If so please circle which one/s:

- Diabetes
- Epilepsy
- Food allergies/intolerance
- Hand-eye coordination deficits
- Impaired hearing
- Impaired vision
- Migraines
- Stress
### Regulatory Focus Questionnaire

This set of questions asks you HOW FREQUENTLY specific events actually occur or have occurred in your life. Please indicate your answer to each question by circling the appropriate number below it.

1. Compared to most people, are you typically unable to get what you want out of life?
   - 1: Never
   - 2: Sometimes
   - 3: Often
   - 4: Very often

2. Growing up, would you ever “cross the line” by doing things that your parents would not tolerate?
   - 1: Never
   - 2: Sometimes
   - 3: Often
   - 4: Very often

3. How often have you accomplished things that got you “psyched” to work even harder?
   - 1: Never
   - 2: Sometimes
   - 3: Often
   - 4: Very often

4. Did you get on your parents’ nerves often when you were growing up?
   - 1: Never
   - 2: Sometimes
   - 3: Often
   - 4: Very often

5. How often did you obey rules and regulations that were established by your parents?
   - 1: Never
   - 2: Sometimes
   - 3: Often
   - 4: Very often

6. Growing up, did you ever act in ways that your parents thought were objectionable?
   - 1: Never
   - 2: Sometimes
   - 3: Often
   - 4: Very often

7. Do you often do well at different things that you try?
   - 1: Never
   - 2: Sometimes
   - 3: Often
   - 4: Very often

8. Not being careful enough has gotten me into trouble at times.
   - 1: Never
   - 2: Sometimes
   - 3: Often
   - 4: Very often

9. When it comes to achieving things that are important to me, I find that I don’t perform as well as I ideally would like to do.
   - 1: Never
   - 2: Sometimes
   - 3: Often
   - 4: Very often

10. I feel like I have made progress toward being successful in my life.
    - 1: Never
    - 2: Sometimes
    - 3: Often
    - 4: Very often

11. I have found very few hobbies or activities in my life that capture my interest or motivate me to put effort into them.
    - 1: Never
    - 2: Sometimes
    - 3: Often
    - 4: Very often
Handedness Questionnaire

A. The following questions assess to what degree you are right or left handed. Using the scale below, please write the appropriate number in the blank beside each item.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left mostly</td>
<td>Left more often</td>
<td>Either</td>
<td>Right more often</td>
<td>Right mostly</td>
<td></td>
</tr>
</tbody>
</table>

1. ___ With which hand do you write?
2. ___ In which hand do you prefer to use a spoon when eating?
3. ___ With which hand do you throw a ball?
4. ___ In which hand do you prefer to hold the toothbrush when you are cleaning your teeth?
5. ___ In which hand do you prefer to hold a tennis or squash racquet?
6. ___ If both hands were free, which hand would you use to put a key in a key hole?
7. ___ In which hand do you hold the box when striking a match?
8. ___ When cutting paper, in which hand do you hold the scissors?
9. ___ With which hand would you prefer to use a knife to sharpen a pencil?
10. ___ In which hand do you prefer to hold the pack when dealing cards?
11. ___ In which hand do you prefer to hold the eraser to rub out a pencil mark?
12. ___ Which hand do you use to 'pilot' a computer mouse?
13. ___ When pinning a notice on a notice board, which hand presses in the drawing pin?
14. ___ With which hand do you prefer to turn on a tap?
15. ___ When washing dishes, in which hand do you prefer to hold the dish?
16. ___ When pouring tea, in which hand do you prefer to hold the pot?
17. ___ With which hand do you use a comb?
18. ___ With which hand do you adjust a window blind?
19. ___ When buttering bread, which hand holds the bread?
20. ___ With which hand do you hold the thread when threading a needle?
21. ___ In which hand do you prefer to carry a suitcase?
22. ___ In which hand do you prefer to hold a jar when unscrewing the lid?
23. ___ With which hand do you put a plug into a power-point?
24. ___ With which hand do you hold a hammer?
25. ___ In which hand would you carry a full glass of water?
26. In which hand would you hold an apple while peeling it?
27. Which hand do you prefer to remove an object from a high shelf?
28. Which hand do you use to draw?
29. If catching a ball with one hand, which hand would you use?
30. With which hand do you hold the bowl/plank steady when using a hand rotary mixer or drill?
31. When feeling material to determine the texture or thickness which hand would you use?

B. The following questions assess your eye preference. Using the scale below, please write the appropriate number in the blank beside each item.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left mostly</td>
<td>Left more often</td>
<td>Either</td>
<td>Right more often</td>
<td>Right mostly</td>
</tr>
</tbody>
</table>

1. With which eye do you (or would you) look into a microscope?
2. With which eye do you (or would you) use to look through a small hole?
3. With which eye do you (or would you) look into a telescope?
4. With which eye do you (or would you) keep open when threading a needle?
5. With which eye do you (or would you) use to aim a camera?

C. The following questions assess your foot preference. Using the scale below, please write the appropriate number in the blank beside each item.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left mostly</td>
<td>Left more often</td>
<td>Either</td>
<td>Right more often</td>
<td>Right mostly</td>
</tr>
</tbody>
</table>

1. With which foot do you (or would you) hop?
2. With which foot do you (or would you) kick a ball?
3. With which foot do you (or would you) put a shoe on first?
4. With which foot do you (or would you) step on a bug?
5. On which foot do you (or would you) stand the longest?
Post-Task Questionnaire

Please read the following statements and indicate your response by circling the appropriate number on the scales provided.

1. As I worked on the task I wanted to taste the food offered
   Strongly disagree 1 2 3 4 5 6 7 8 9 strongly agree

2. As I worked on the task I felt like snacking on the food offered
   Strongly disagree 1 2 3 4 5 6 7 8 9 strongly agree

3. As I worked on the task I found myself thinking a lot about the food offered
   Strongly disagree 1 2 3 4 5 6 7 8 9 strongly agree

4. As I worked on the task my desire to have some of the food offered seemed overwhelming
   Strongly disagree 1 2 3 4 5 6 7 8 9 strongly agree

5. Please rate how hungry you felt before starting the experiment
   Not at all hungry 1 2 3 4 5 6 7 8 9 extremely hungry

6. Please rate how much you liked the snack product offered
   Not at all 1 2 3 4 5 6 7 8 9 very much

7. Please rate how much you liked the task
   Not at all 1 2 3 4 5 6 7 8 9 very much

8. Please rate how engaging you found the task
   Not at all 1 2 3 4 5 6 7 8 9 very much

9. Please rate how difficult you found the task
   Not at all 1 2 3 4 5 6 7 8 9 very much

10. Before the experiment started the last meal I ate was (please circle):
    dinner/breakfast/lunch

11. This meal was eaten (please circle):
    20 mins before/ 40 mins before/ 1 hr before/ more than 2 hrs before
Please read the following situation and indicate your feelings by circling the appropriate number on the scales provided. If unsure about a particular feeling tick the box marked “I don’t know”.

When you think about completing the task, how likely was it that you felt:

- **Annoyed** very unlikely 1 2 3 4 5 6 7 8 9 very likely I don’t know □
- **Proud** very unlikely 1 2 3 4 5 6 7 8 9 very likely I don’t know □
- **Happy** very unlikely 1 2 3 4 5 6 7 8 9 very likely I don’t know □
- **Frustrated** very unlikely 1 2 3 4 5 6 7 8 9 very likely I don’t know □
- **Calm** very unlikely 1 2 3 4 5 6 7 8 9 very likely I don’t know □
- **Ashamed** very unlikely 1 2 3 4 5 6 7 8 9 very likely I don’t know □
- **Cheerful** very unlikely 1 2 3 4 5 6 7 8 9 very likely I don’t know □
- **Heartened** very unlikely 1 2 3 4 5 6 7 8 9 very likely I don’t know □
- **Nervous** very unlikely 1 2 3 4 5 6 7 8 9 very likely I don’t know □
- **Pleased** very unlikely 1 2 3 4 5 6 7 8 9 very likely I don’t know □
- **Sad** very unlikely 1 2 3 4 5 6 7 8 9 very likely I don’t know □
- **Disappointed** very unlikely 1 2 3 4 5 6 7 8 9 very likely I don’t know □
- **Excited** very unlikely 1 2 3 4 5 6 7 8 9 very likely I don’t know □
- **Stressed** very unlikely 1 2 3 4 5 6 7 8 9 very likely I don’t know □
- **Uncertain** very unlikely 1 2 3 4 5 6 7 8 9 very likely I don’t know □
- **Bored** very unlikely 1 2 3 4 5 6 7 8 9 very likely I don’t know □
- **Confident** very unlikely 1 2 3 4 5 6 7 8 9 very likely I don’t know □
- **Relaxed** very unlikely 1 2 3 4 5 6 7 8 9 very likely I don’t know □
Please read the following statements and indicate your level of agreement by circling the appropriate number on the scales provided.

1. I felt pressured by the experimenter to eat the food
   strongly disagree  1  2  3  4  5  6  7  8  9  strongly agree

2. I was unconcerned about how much of the food I ate
   strongly disagree  1  2  3  4  5  6  7  8  9  strongly agree

3. People like me think that eating snack food is not good for you
   strongly disagree  1  2  3  4  5  6  7  8  9  strongly agree

4. I thought the experimenter would think badly of me if I ate all the food
   strongly disagree  1  2  3  4  5  6  7  8  9  strongly agree

5. People like me believe that eating snack food is a good thing
   strongly disagree  1  2  3  4  5  6  7  8  9  strongly agree

6. I was worried that if I ate all the food the next participant would miss out
   strongly disagree  1  2  3  4  5  6  7  8  9  strongly agree

7. I felt the experimenter did not want me to eat the food
   strongly disagree  1  2  3  4  5  6  7  8  9  strongly agree

8. People like me believe it is important to eat snack food in moderation
   strongly disagree  1  2  3  4  5  6  7  8  9  strongly agree

9. I felt the experimenter would have enough food regardless of how much I ate
   strongly disagree  1  2  3  4  5  6  7  8  9  strongly agree
**Study 3**

**Dutch Eating Behaviour Questionnaire**

Please indicate how frequently you engage in the following eating habits by marking the appropriate circle on the right.

<table>
<thead>
<tr>
<th>Question</th>
<th>Never</th>
<th>Seldom</th>
<th>Some times</th>
<th>Often</th>
<th>Very often</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. When you have put on weight, do you eat less than you usually do?</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2. Do you try to eat less at mealtimes than you would like to eat?</td>
<td></td>
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<tr>
<td>3. How often do you refuse food or drink offered because you are concerned about your weight?</td>
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<td>4. Do you watch exactly what you eat?</td>
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<tr>
<td>5. Do you deliberately eat foods that are slimming?</td>
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<tr>
<td>6. When you have eaten too much, do you eat less than usual the following day?</td>
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<tr>
<td>7. Do you deliberately eat less in order not to become heavier?</td>
<td></td>
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<tr>
<td>8. How often do you try not to eat between meals because you are watching your weight?</td>
<td></td>
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<tr>
<td>9. How often in the evenings do you try not to eat because you are watching your weight?</td>
<td></td>
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<tr>
<td>10. Do you take into account your weight with what you eat?</td>
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<tr>
<td>11. Do you have the desire to eat when you are irritated?</td>
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<tr>
<td>12. Do you have a desire to eat when you have nothing to do?</td>
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<tr>
<td><strong>13.</strong> Do you have a desire to eat when you are depressed or discouraged?</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td><strong>14.</strong> Do you have a desire to eat when you are feeling lonely?</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td><strong>15.</strong> Do you have a desire to eat when someone lets you down?</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td><strong>16.</strong> Do you have a desire to eat when you are cross?</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td><strong>17.</strong> Do you have a desire to eat when you are expecting something unpleasant to happen?</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td><strong>18.</strong> Do you get the desire to eat when you are anxious, worried or tense?</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td><strong>19.</strong> Do you have a desire to eat when things are going against you or when things have gone wrong?</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td><strong>20.</strong> Do you have a desire to eat when you are frightened?</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td><strong>21.</strong> Do you have a desire to eat when you are disappointed?</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td><strong>22.</strong> Do you have a desire to eat when you are emotionally upset?</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td><strong>23.</strong> Do you have a desire to eat when you are bored or restless?</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td><strong>24.</strong> If food tastes good to you, do you eat more than usual?</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td><strong>25.</strong> If food smells and looks good, do you eat more than usual?</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td><strong>26.</strong> If you see or smell something delicious, do you have a desire to eat it?</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td><strong>27.</strong> If you have something delicious to eat, do you eat it straight away?</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td><strong>28.</strong> If you walk past the baker do you have the desire to buy something delicious?</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Question</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>29. If you walk past a snack bar or café, do you have the desire to buy something delicious?</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>30. If you see others eating, do you also have the desire to eat?</td>
<td></td>
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<tr>
<td>31. Can you resist eating delicious foods?</td>
<td></td>
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<tr>
<td>32. Do you eat more than usual, when you see other eating?</td>
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<tr>
<td>33. When preparing a meal are you inclined to eat something?</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
**Studies 3 and 4**

**Binge Eating Scale**

For each of the 16 items, please circle the letter corresponding to the statement that best describes the way you feel about your eating habits.

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 urges 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, I 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 mealtimes or at snacks.
d  I eat so much food that I regularly feel quite uncomfortable after eating and sometimes a bit nauseas.

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 my 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 feel uncomfortably 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 else 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 three meals a day, but I also normally snack between meals. |
| c | When I am snacking heavily, I get into 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.
Studies 3 and 4

*Items Used for Nurturance Needs (numbers reflect the order in which they appeared in questionnaire)*

5. Looking back I believe I snacked on the food to nurture myself
   Strongly disagree 1 2 3 4 5 6 7 8 9 strongly agree

7. Looking back I believe I snacked on the food to be kind to myself
   Strongly disagree 1 2 3 4 5 6 7 8 9 strongly agree

9. Looking back I believe I snacked on the food to feel nourished
   Strongly disagree 1 2 3 4 5 6 7 8 9 strongly agree

11. Looking back I believe I snacked on the food to treat myself
    Strongly disagree 1 2 3 4 5 6 7 8 9 strongly agree

13. Looking back I believed I snacked on the food to feel fulfilled
    Strongly disagree 1 2 3 4 5 6 7 8 9 strongly agree

15. Looking back I believe I snacked on the food to feel happy
    Strongly disagree 1 2 3 4 5 6 7 8 9 strongly agree

*Items Used for Security Needs (numbers reflect the order in which they appeared in questionnaire)*

6. Looking back I believe I snacked on the food to feel secure
   Strongly disagree 1 2 3 4 5 6 7 8 9 strongly agree

8. Looking back I believe I snacked on the food to protect myself
   Strongly disagree 1 2 3 4 5 6 7 8 9 strongly agree

10. Looking back I believe I snacked on the food to feel safe
    Strongly disagree 1 2 3 4 5 6 7 8 9 strongly agree

12. Looking back I believe I snacked on the food to feel settled
    Strongly disagree 1 2 3 4 5 6 7 8 9 strongly agree

14. Looking back I believe I snacked on the food to defend myself
    Strongly disagree 1 2 3 4 5 6 7 8 9 strongly agree

16. Looking back I believe I snacked on the food to feel relaxed
    Strongly disagree 1 2 3 4 5 6 7 8 9 strongly agree
Study 4

Thank you for registering your interest in the Taste Perception under Distraction Study. The first step is to complete this online survey which should take about 15 minutes. At the end of the survey you will be provided with contact details for the researcher who you can contact to arrange a time to participate in the study.

First, please enter your personal research code in the space provided below (First two letters of your mother’s first name, your birth date excluding the year, e.g. mine is HE2254).

<table>
<thead>
<tr>
<th>Please click on the appropriate answer.</th>
<th>Never</th>
<th>Sometimes</th>
<th>Most of the time</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How often do you eat meals (breakfast, lunch or dinner) while watching television?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. How often do you eat meals in front of the computer?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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</tr>
<tr>
<td>3. How often do you have music playing while eating a meal?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. How often do you eat meals ‘on the go’ (while tying up, preparing meals for others, driving etc.)?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. How often do you eat meals while talking on the phone?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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</tr>
<tr>
<td>6. How often do you read (newspaper, magazine, novel etc.) while eating a meal?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Please click on the appropriate number. ON HOW MANY OF THE PAST 28 DAYS...

<table>
<thead>
<tr>
<th>No days</th>
<th>1-5 days</th>
<th>6-12 days</th>
<th>13-15 days</th>
<th>16-22 days</th>
<th>23-27 days</th>
<th>Everyday</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Have you been deliberately trying to limit the amount you eat to influence your shape or weight (whether or not you have succeeded)?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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</tr>
<tr>
<td>2. Have you gone for long periods of time (8 waking hours or more) without eating anything at all in order to influence your shape or weight?</td>
<td>☐</td>
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</tr>
<tr>
<td>3. Have you tried to exclude from your diet any foods that you like in order to influence your shape or weight (whether or not you have succeeded)?</td>
<td>☐</td>
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</tr>
<tr>
<td>4. Have your tried to follow definite rules regarding your eating (for example, a calorie limit) in order to influence your shape or weight (whether or not you have succeeded)?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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</tr>
<tr>
<td>5. Have you had a definite desire to have an empty stomach with the aim of influencing your shape or weight?</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>6. Have you had a definite desire to have a totally flat stomach?</td>
<td>☐</td>
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<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7. Has thinking about food, eating or calories made it very difficult to concentrate on things you are interested in (for example, working, following a conversation, or reading)?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>8. Has thinking about shape or weight made it very difficult to concentrate on things you are interested in (for example, working, following a conversation, or reading)?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>9. Have you had a definite fear of losing control over eating?</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>10. Have you had a definite fear that you might gain weight?</td>
<td>☐</td>
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<tr>
<td>11. Have you felt fat?</td>
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<tr>
<td>12. Have you had a strong desire to lose weight?</td>
<td>☐</td>
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</tbody>
</table>

Please type the appropriate number in the space provided. OVER THE PAST 28 DAYS...

13. Over the past 28 days, how many times have you eaten what other people would regard as an unusually large amount of food (given the circumstances)?

14. On how many of these times did you have a sense of having lost control over your eating (at the time that you were eating)?

[Blank space for answers]
15. Over the past 28 days, on how many days have such episodes of overeating occurred (i.e., you have eaten an unusually large amount of food and have had a sense of loss of control at the time)?

16. Over the past 28 days, how many times have you made yourself sick (vomited) as a means of controlling your shape or weight?

17. Over the past 28 days, how many times have you taken laxatives as a means of controlling your shape or weight?

18. Over the past 28 days, how many times have you exercised in a "driven" or "compulsive" way as a means of controlling your weight, shape or amount of fat, or to burn off calories?

Please click on the appropriate number. Note that for these questions the term "binge eating" means eating what others of your age and gender would regard as an unusually large amount of food for the circumstances, accompanied by a sense of having lost control over eating.

19. Over the past 28 days, on how many days have you eaten in secret (i.e., furtively)? Ignore episodes of binge eating

<table>
<thead>
<tr>
<th>Number of Days</th>
<th>No days</th>
<th>1-5 days</th>
<th>6-12 days</th>
<th>13-15 days</th>
<th>16-22 days</th>
<th>23-27 days</th>
<th>Everyday</th>
</tr>
</thead>
<tbody>
<tr>
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<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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</tr>
</tbody>
</table>

20. On what proportion of the times that you have eaten have you felt guilty (felt that you've done wrong) because of its effect on your shape or weight? Ignore episodes of binge eating

<table>
<thead>
<tr>
<th>None of the time</th>
<th>A few of the times</th>
<th>Less than half</th>
<th>Half of the time</th>
<th>More than half</th>
<th>Most of the time</th>
<th>Every time</th>
</tr>
</thead>
<tbody>
<tr>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

21. Over the past 28 days, how concerned have you been about other people seeing you eat? Ignore episodes of binge eating

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Slightly</th>
<th>Moderately</th>
<th>Markedly</th>
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</thead>
<tbody>
<tr>
<td>○</td>
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</tbody>
</table>

Please click on the appropriate answer. Remember that the questions only refer to the past 4 weeks (28 days). OVER THE PAST 28 DAYS...

22. Has your weight (number on the scale) influenced how you think about (judge) yourself as a person?

23. Has your shape influenced how you think about (judge) yourself as a person?

24. How much would it affect you if you were asked to weigh yourself once a week (no more, or less, often) for the next 4 weeks?

25. How dissatisfied have you been with your weight (number on the scale)?

26. How dissatisfied have you been with your shape?

27. How uncomfortable have you felt seeing your body (for example, seeing your shape in the mirror, in a ship window reflection, while undressing or taking a bath or shower)?

28. How uncomfortable have you felt about others seeing your body (for example, in communal changing rooms, when swimming, or wearing tight clothes)?

Please click on the appropriate answer.

<table>
<thead>
<tr>
<th>Never</th>
<th>Sometimes</th>
<th>Most of the time</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

1. When you eat, do you notice the subtle flavours of the food (sweet, salty etc.)?

2. When you eat, are you aware of the general appearance (shape, size and colour etc.) of the food?

3. When you eat, do you notice the texture of the food (fatty, sticky etc.)?

4. When you eat, are you aware of the aroma or smell of the food?

5. When you eat, do you notice the various sensations in your mouth (hot, smooth etc.)?
Study 4

Taste Sensitivity and Preference Questionnaire

1. Please rate the food you tasted on the following appearance dimensions from 1=not at all to 5=very
   - Bright 1 2 3 4 5
   - Glossy 1 2 3 4 5
   - Symmetrical 1 2 3 4 5
   - Cracked 1 2 3 4 5

2. Please rate the food you tasted on the following flavour dimensions from 1=not at all to 5=very
   - Sweet 1 2 3 4 5
   - Salty 1 2 3 4 5
   - Sour 1 2 3 4 5
   - Nutty 1 2 3 4 5

3. Please rate the food you tasted on the following texture dimensions from 1=not at all to 5=very
   - Chewy 1 2 3 4 5
   - Crispy 1 2 3 4 5
   - Creamy 1 2 3 4 5
   - Grainy 1 2 3 4 5

4. Please rate how much you liked the look or appearance of the food
   Not at all 1 2 3 4 5 Very much

5. Please rate how much you liked the smell of the food
   Not at all 1 2 3 4 5 Very much

6. Please rate how much you liked the taste of the food
   Not at all 1 2 3 4 5 Very much

7. Would you try this food again? Please circle: YES / NO

8. Would you recommend this food to a friend to try? Please circle: YES / NO
**Study 4**

**Eating Expectancy Inventory**

Read each statement and circle the number of the response which most closely matches your level of agreement. Please respond to the items in terms of what the word “eating” means to you. There are no right or wrong answers. Choose only one response for each item. Do not leave any items blank.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completely Disagree</td>
<td>Mostly Disagree</td>
<td>Slightly Disagree</td>
<td>Neither Agree or Disagree</td>
<td>Slightly Agree</td>
<td>Mostly Agree</td>
<td>Completely Agree</td>
<td></td>
</tr>
</tbody>
</table>

1. Eating makes me feel loved.  
   1 2 3 4 5 6 7

2. When I am feeling depressed or upset, eating can help me take my mind off problems.  
   1 2 3 4 5 6 7

3. Eating makes me feel out of control.  
   1 2 3 4 5 6 7

4. Eating fills some emotional need.  
   1 2 3 4 5 6 7

5. When I am feeling anxious or tense, eating helps me relax.  
   1 2 3 4 5 6 7

6. I don’t see eating as a pleasurable event.  
   1 2 3 4 5 6 7

7. Eating helps me deal with feelings of inadequacy about myself.  
   1 2 3 4 5 6 7

8. Eating doesn’t help me deal with boredom.  
   1 2 3 4 5 6 7

9. When I have nothing to do, eating helps relieve the boredom.  
   1 2 3 4 5 6 7

10. When I eat, I often feel like I am not in charge of my life.  
    1 2 3 4 5 6 7
<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.</td>
<td>When I am feeling anxious, eating does not make me feel calmer.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>11.</td>
<td>Eating serves as an emotional release.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>12.</td>
<td>Eating seems to decrease my level of anxiety if I am feeling tense or stressed.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>13.</td>
<td>Eating is a good way to celebrate.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>14.</td>
<td>When I do something good, eating is a way to reward myself.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>15.</td>
<td>Eating isn’t useful as a reward for me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>16.</td>
<td>I don’t get a sense of security or safety from eating.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>17.</td>
<td>If I have nothing planned to do during the day, eating isn’t something that would help me fill the time.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>18.</td>
<td>Eating helps me think and study better.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>19.</td>
<td>Eating is fun and enjoyable.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>20.</td>
<td>My eating behaviour often results in a feeling that I am not in control.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>21.</td>
<td>When I work hard or accomplish something, eating doesn’t serve as a good reward.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>22.</td>
<td>Eating is something to do when you feel bored.</td>
<td>1</td>
<td>2</td>
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</tr>
<tr>
<td>1</td>
<td>Completely Disagree</td>
<td>Mostly Disagree</td>
<td>Slightly Disagree</td>
<td>Neither Agree or Disagree</td>
<td>Slightly Agree</td>
<td>Mostly Agree</td>
<td>Completely Agree</td>
</tr>
<tr>
<td>23.</td>
<td>Eating is a way to vent my anger.</td>
<td>1</td>
<td>2</td>
<td>3</td>
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</tr>
<tr>
<td>24.</td>
<td>Eating helps me avoid uncomfortable social situations.</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>5</td>
<td>6</td>
</tr>
<tr>
<td>25.</td>
<td>When I am angry at my parents, partner or friends, eating helps me get back at them.</td>
<td>1</td>
<td>2</td>
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<td>6</td>
</tr>
<tr>
<td>26.</td>
<td>When I am faced with difficult tasks, eating can help me avoid doing them.</td>
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<td>2</td>
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</tr>
<tr>
<td>27.</td>
<td>Eating helps me forget or block out negative feelings, like depression, loneliness or fear.</td>
<td>1</td>
<td>2</td>
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</tr>
<tr>
<td>28.</td>
<td>Eating calms me when I am feeling stressed, anxious or tense.</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>6</td>
</tr>
<tr>
<td>29.</td>
<td>Eating can help me bury my emotions when I don’t want to feel them.</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>30.</td>
<td>Eating helps me work better.</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>31.</td>
<td>Eating helps me cope with negative emotions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>32.</td>
<td>Eating does not make me feel out of control.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>33.</td>
<td>Eating helps me deal with sadness or emotional pain.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
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