

# **EATING PSYCHOPATHOLOGY AND COGNITIVE FUNCTIONING**

by

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degree of

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## Abstract

*The nature and scope of the current thesis is to cross-culturally explore whether non-eating disordered females with a restrained eating style exhibit deficits in executive functioning. A mediating role of potential mechanisms has been further investigated within this thesis. In contrast to the previous studies, this research is the first investigation which employs a well-established self-report measure of executive functions grounded in the everyday environment, rather than laboratory measures based on Baddeley's model of working memory. The findings have clearly provided evidence for cultural- and dietary restraint-related differences on the domain of executive functions (EF). Overall, English females have reported poorer performance on components of a self-reported EFs, except on Emotional Control than Greeks. Restrained eaters have found to perform worst on all components of EFs than unrestrained eaters. More specifically, this research has revealed that nationality has an overall impact on EFs; and in particular on i) emotional control, namely on the way people modulate their emotional responses in everyday life, ii) self-monitor, specifically the extent to which people observe their own attitudes and behaviours and the negative effects of these on others, iii) working memory, specifically adults ability to hold information in mind for the purpose of completing a task, and iv) task-monitor, namely the degree to which people keep track of their own problem-solving success or failure. With the exception of emotional control, these nationality-related differences on self- and task-monitor, as well as WM are at least partially mediated by or co-vary with BMI, preoccupying thoughts about food, diet, and body shape, depressive symptoms, and fluid intelligence. Regarding restrained eating, the current*

*research has provided evidence for its negative role on i) shift, ii) initiate and ii) working memory. These findings suggest that females with a restrained eating style face difficulties in their flexibility related to shifting problem-solving set, to begin a task or activity, and to independently generate ideas, responses, or problem-solving strategies, as well as difficulties on their working memory performance. When the variance attributable to BMI, preoccupying cognitions, depression, and fluid intelligence, the observed differences within the restrained eating group on shift, initiate, and working memory have been reduced. To conclude, the findings presented in this thesis point to potentially fruitful directions which future research in the domain of eating psychopathology and cognitive functioning within non-clinical populations cross-culturally might follow.*

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*Last but not least, I would like to thank my family and friends for their emotionally support all this time.*

## **Abbreviations**

<b>ADHD</b>	Attention/Deficit Hyperactive Disorder
<b>AN</b>	Anorexia Nervosa
<b>ANT</b>	Attention Network Test
<b>BED</b>	Binge Eating Disorder
<b>BM</b>	Boundary Model
<b>BMI</b>	Body Mass Index
<b>BN</b>	Bulimia Nervosa
<b>BP</b>	Brain Pathology
<b>BRI</b>	Behavioural Regulation Index
<b>BRIEF-A</b>	Behavioural Rating Inventory Executive Function- Adult version
<b>CD</b>	Cognitive Deficit
<b>CES</b>	Central Executive System
<b>CES-D</b>	Centre for Epidemiologic Studies-Depression scale
<b>CLT</b>	Cognitive Load Theory
<b>CNS</b>	Central Nervous System
<b>CT</b>	Cognitive Theory
<b>DCCS</b>	Dimensional Change Card Sorting
<b>DEBQ</b>	Dutch Eating Behaviour Questionnaire

<b>DEBQ-R</b>	DEBQ-Restraint sub-scale
<b>DR</b>	Dietary Restraint
<b>DV</b>	Dependent Variable
<b>ECR</b>	Executive Control Recourse
<b>ED</b>	Eating Disorder
<b>EDNOS</b>	Eating Disorder Not Otherwise Specified
<b>EF</b>	Executive Functions
<b>EFD</b>	Executive Function Deficit
<b>EI</b>	Eating Inventory
<b>EP</b>	Eating Psychopathology
<b>ES</b>	Effect Size
<b>FC</b>	Flexible Control
<b>GEC</b>	Global Executive Composite
<b>HPA</b>	Hypothalamus Pituitary Adrenal
<b>IGT</b>	Iowa Gambling Task
<b>IV</b>	Independent Variable
<b>LTM</b>	Long-Term Memory
<b>MI</b>	Metacognition Index
<b>PFC</b>	Prefrontal Cortex
<b>PMS</b>	Person Mean Substitution
<b>RC</b>	Rigid Control

<b>RNG</b>	Random Number Generation
<b>RS</b>	Restraint Scale
<b>RS-R</b>	Restraint Scale –Restraint sub-scale
<b>RT</b>	Restrained Theory
<b>SAM</b>	Sympathetic-Adrenomedullary System
<b>SD</b>	Standard Deviation
<b>SEM</b>	Structural Equation Modelling
<b>SPSS</b>	Statistical Package for Social Sciences
<b>STM</b>	Short-Term Memory
<b>TFEQ</b>	Three Factor Eating Questionnaire
<b>TMT-B</b>	Trail Making Test-B
<b>TOH</b>	Tower Of Hanoi
<b>TOL</b>	Tower Of London
<b>UCLan</b>	University of Central Lancashire
<b>UK</b>	United Kingdom
<b>VMH</b>	Ventromedial hypothalamus
<b>WAIS</b>	Wechsler Adult Intelligence Scale
<b>WCST</b>	Wisconsin Card Sorting Task
<b>WM</b>	Working Memory



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# **Chapter 1: “Eating Psychopathology and Cognitive Functioning: An Overview”**

## **1.1: Introduction**

Within the health-related research area of eating disorders, there is a substantial focus on the negative consequences of severe dieting. Although most of the individuals who are diagnosed with a clinical eating disorder, such as Bulimia Nervosa, are under treatment, the increasing emergence and maintenance of eating disorders within general population, especially among women and young girls is a cause for concern (Stice & Shaw, 2004 for a review).

The severe dieting, within non-eating disordered individuals, in order to attain the ideal slim body shape as frequently portrayed in the media, has become increasingly common in Western culture and is now considered to be normal by many. Research has estimated that approximately 30% of women and 25% of men have reported that they have previously dieted to maintain their weight, while about 24% of women and 8% of men are currently dieting to lose weight (Hill, 2002). The National Task Force on the Prevention and Treatment of Obesity defines dieting as *“the intentional and sustained restriction of caloric intake for the purpose of reducing body weight or changing body shape, resulting in a significant negative energy balance between intake and expenditure”* (National Task Force on the Prevention and Treatment of Obesity, 2000, p.2582).

However, there are major differences in the behaviours characterising the concepts of dieting and dietary restraint. Herman and Polivy (1980) have defined dietary restraint as the cognitively mediated attempts of an individual to restrict food intake which are frequently undermined by overeating behaviour. On the one hand, dieters consciously restrict food intake to lose weight, while restrained eaters, on the other hand, are characterised by an '*anomalous*' eating pattern, whereby they predominantly exhibit cognitive control over their urge to eat. Thus, restrained eaters consciously restrict food intake to lose or maintain weight. When they feel that they have violated their dieting program, they commonly show binge-eating episodes, often, also, seen in people with Bulimia Nervosa (Lowe, 1995, Herman & Polivy, 1980; Herman & Mack, 1975), utilising post hoc rationalisations such as: '*I broke my diet, so I will eat as much as I want today, and I will eat less calories tomorrow*'

These behaviours and attitudes seen in restrained eaters are consistent with the *Continuum Model of Eating Psychopathology* which suggests that, within the general population, there is a very thin line between restrained eating and Bulimic Symptomatology. Characteristic behaviours exist with different degrees of severity with vulnerable individuals progressing along the continuum from non-clinical to clinical cases (Herman & Polivy, 1975; Bruch, 1973). Therefore, this model provides a rationale for studying non-eating disordered individuals in eating-related research.

Support for the continuum has been offered from studies that have employed various information-processing methodologies. Restrained eaters have been found to show important information-processing biases, related to attention and memory,

especially in relation to food-related stimuli. Studies have revealed that restrained eaters exert cognitive control in order to restrict their responsiveness to appetitive stimuli. This is achieved by attenuating primarily to food-related stimuli, rather than focusing rigidly on the task at hand. In other research it has been established that restrained eaters remember more forbidden food-related words, which may reflect an increased salience towards food that is deemed highly palatable. Therefore maladaptive schemata, which are commonly observed in eating disordered individuals, probably underpin the desire to restrict food intake from the one hand, but paradoxically this increases food craving in non-clinical restrained eaters on the other hand (Veenstra & de Jong, 2012 for a review).

These information-processing biases have often been associated with central executive processes, including planning, decision making, abstract thinking, cognitive flexibility, and inhibition of inappropriate actions. A variety of studies have indicated that executive processes play a key role in the regulation of a wide array of behaviours and impairments in these functions have been associated with various mental/psychiatric disorders (Austing, Mitchell, & Goodwing, 2001).

Recently, researchers have attempted to explore the role of executive functions in self-regulation (Hofmann, Schmeichel, & Baddeley, 2012), more specifically in relation to dieting and restrained eating within healthy females (Ball, Singer, Kemps, & Tiggemann, 2010). Additionally, they are particularly interested to investigate executive functioning cross-culturally; as it is documented that mainly the meta-cognitive components of executive functions, such as working memory, are dependent on culture, and language is a central key for exploring deficits on central executive cross-culturally (Ardila, 2008).

Consequently, dietary restraint (restrained eating) and executive functions have been explored within this thesis. Additionally, this thesis aims to explore cross-cultural differences on central executive.

## 1.2: Plan of Thesis

The aim of the current thesis is to cross-culturally investigate whether non-eating disordered females with a restrained eating style exhibit deficits on those aspects of executive functions that are particularly relevant to people's everyday life activities and which play a central role in their day-to-day functioning. A cross-cultural comparison between English and Greek females will allow an assessment of the influence of a broader range of cultural and social factors on eating attitudes and behaviours, as well as their impact on executive functioning to be evaluated. Additionally, this thesis aims to further examine potential mechanisms, such as age, BMI, alcohol consumption, depression, preoccupying thoughts about food, diet, and body shape, as well as fluid intelligence, which may co-vary with central executive impairments in restrained eaters. This last aspect is important as previous investigations (Kemps, Tiggemann, & Marshall, 2005; Vreugdenbur, Bryan, & Kemps, 2003) have documented that dietary restraint-related central executive dysfunction is at least partly attributable to those mediators.

Chapter 2 sets the stage by reviewing the literature based on the development of Restraint Theory. Important consideration has been given on the role of overeating in restrained eaters. This (over)-eating displayed as a consequence of the disinhibition of dietary restraint that has been likened to the bingeing episodes,

commonly seen in individuals with a clinical diagnosis of Bulimia Nervosa. More specifically, the Escape Model and Cognitive Load Theory have been put forward to explain the reasons why restrained eaters overeat.

Chapter 3 focuses on the increasing prevalence of eating psychopathology within non-eating disordered individuals, with gender- and cultural-related differences specifically considered. The evolutionary Continuum Model of Eating Psychopathology has been discussed. In order to shed light on restrained eaters' apparent preoccupation with food, information-processing perspectives, related to attentional and memory biases in the processing of food-related stimuli are described.

Chapter 4 outlines the Central Executive System, with a particular focus on the role of executive functions in everyday life. A review of the theoretical models of executive functions has been provided, with an emphasis on Baddeley's model of working memory and Miyake et al.'s conceptualisation of executive functions. Chapter 4 ends with a discussion regarding cross-cultural research on executive functions as well as the measurements of executive functions.

Chapter 5 provides a detailed discussion regarding the role of executive functioning in people with severe eating problems, with a particular focus on dietary restraint. A summary of studies investigating the impact of restrained eating or dieting on executive functions has been reviewed. The partial role of age, BMI, alcohol consumption, depression, preoccupying cognitions, and fluid intelligence on executive functions has been evaluated. Finally, methodological issues in the existing field of research have been outlined.

Chapter 6 offers details regarding the methodology employed within this thesis; and Chapter 7 outlines all the appropriate procedures conducted before the main analysis.

Chapter 8 is the empirical Chapter of the current thesis. Within this Chapter the impact of nationality and restrained eating on executive functions will be assessed employing a well-established self-report measure of executive functions, the Behavioural Regulation Index of Executive Function-Adult version (BRIEF-A).

Finally, Chapter 9 critically discusses the results obtained within the context of previous research findings. Consideration will be given to the limitations identified in the thesis and possible directions for future research will be identified.



## **Chapter 2: “The Development of Restraint Theory”**

### **Overview**

*Chapter 2 charts the evolution of Restraint Theory. This theory incorporates elements of early theories of obesity (Psychosomatic and Internal/External theory), and the Set-Point theory of body-weight regulation. Restrained eaters are characterised by an ‘anomalous’ eating pattern, whereby they predominantly exhibit cognitive control over their urge to eat. However, this stringent cognitive control over food intake is relinquished when restrained eaters are confronted with the triggers of disinhibition, such as psychological stress that contains an ego-threatening element. The (over)-eating is displayed as a consequence of this disinhibition of Dietary Restraint has been likened to a bingeing episode, commonly seen in individuals with a clinical diagnosis of Bulimia Nervosa. The Escape Model and the Cognitive Load Theory have been put forward to explain why restrained eaters overeat. Finally, in addition to dietary restraint that has been characterised as an individual difference variable moderating the relationship between psychological stress and binge-eating, the measurement of it as well as the flexible vs. rigid attitude to dieting are also important factors that further moderate this relationship.*

## **2.1: Introduction**

In the 1960s, researchers proposed that the differences between obese and normal-weight individuals lay in variations in the eating patterns of the two groups. The basic explanation for these differences proposed by the early psychosomatic theorists (Bruch, 1961; Kaplan & Kaplan, 1957) is that obese individuals are more likely to overeat as a response to the experience of negative emotions. This comfort eating serves as a coping strategy to reduce feelings of anxiety, and may have been developed in early childhood as a result of inappropriate feeding experiences (Kaplan & Kaplan, 1957). It is said to be a causal factor in the development of obesity. Bruch (1961) has suggested that overeating in response to negative emotional affect is derived from a failure to discriminate between the physiological states associated with anxiety and hunger. Therefore, the physiological feelings of anxiety are misinterpreted as physiological cues for hunger, and eating occurs. Inspection to Figure 2.1 suggests that, compared to a non-stressed state, obese individuals overeat in response to stress, while normal-weight individuals eat the same amount of food when are stressed.

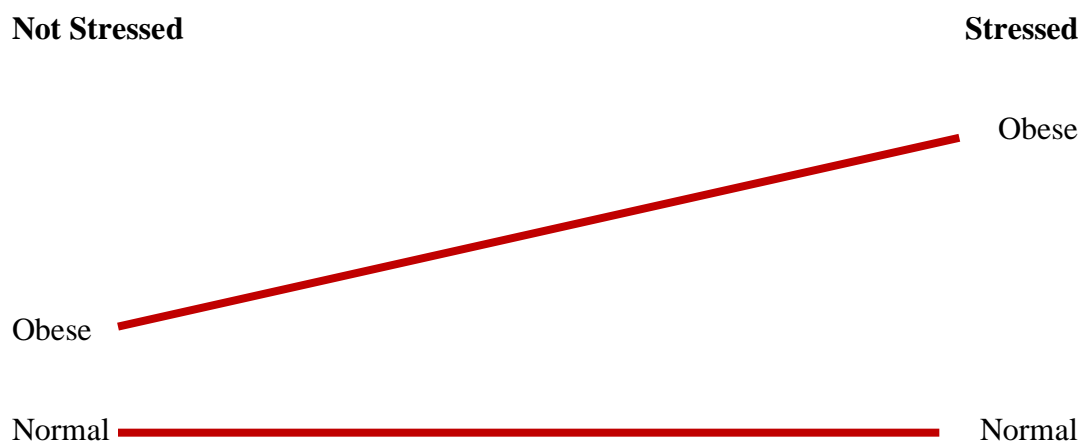


Figure 2.1: The Psychosomatic Theory (Adapted from Greeno & Wing, 1994)

Another explanation for the differences in eating patterns between obese and normal-weight individuals has been introduced by Schachter and colleagues (1971; 1968). Schachter has advanced his Internal/External Theory of obesity including two broad sets of controlling stimuli: i) Internal, which suggests physiological components such as gastric contractions and circulatory and hypothalamic influences and ii) External, which is to say, aspects of the environment that are processed cognitively and perceptually. Schachter's main suggestion is that whereas normal-weight people eat in response to internal cues obese individuals are cued to eat primarily in response to immediate external stimuli, such as the sight and smell, or food or the time of day. Given that the known physiological response to stress (the fight-flight response) is associated with the inhibition of gastric motility (e.g., Cannon, 1915), it has been predicted that normal-weight individuals would eat less under a stress condition, whereas obese (who are much

less aware of their internal hunger and satiety cues) would eat the same amount when are stressed as when are not stressed. Figure 2.2 depicts the predictions made by this theory.

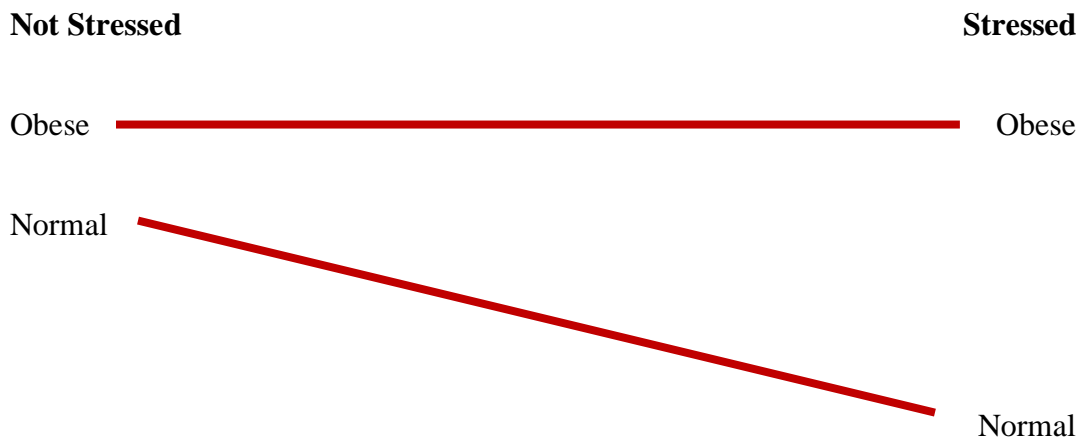


Figure 2.2: The Schachter's Model (Adapted by Greeno & Wing, 1994)

Although a substantial amount of research has been carried out in the 1970s testing Schachter's theory, the results of these studies remained equivocal (e.g., Robin, 1981; Spitzer & Robin, 1981; Schachter & Robin, 1974; Wooley, 1972). For instance, it has been found that the degree to which a person is overweight is not well correlated with the degree of responsiveness to external cues (Rodin, 1981), and people of normal-weight have been reported to show a high level of responsiveness to external food cues (Rodin & Slochower, 1976 for a review). Moreover, it is known that people of all weights have great difficulty in estimating

how much food they are consuming, based on their monitoring of gastric hunger contractions (Gilbert, 1986 for a review).

Consequently, the Set-Point Theory proposed by Nisbett (1972) attempted to explain the reasons why external responsiveness among individuals might occur. It has been suggested that i) each individual<sup>1</sup> has a biologically-based set-point that controls long-term body weight and/or fat regulation and ii) weight is homeostatically synchronised via bodily signals of hunger and satiety.

Several researchers have further examined Nisbett's theory, but the findings have offered different conclusions. In support of this theory, Harris (1990) has observed that the body weight of adults over several years tends to fluctuate by only a few pounds around a mean weight. Pinel, Assanand, and Lehman (2000) have indicated that people who live in environments with food-replete (over)-eat because of the expectation of pleasure and not real hunger. Woods, Schwartz, Baskin, and Seeley (2000) have, also, suggested that food intake and body weight are homeostatically regulated as well as that neural and hormonal signals control the individual's urge to eat and body fat. However, a recent study by Lowe and Butryn (2007) has argued that a difference exists between homeostatic and hedonic<sup>2</sup> hunger, suggesting that people have problems with their weight balance because their eating is influenced by hedonic and not homeostatic hunger.

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<sup>1</sup> For overweight/obese individuals, their set-point is comparatively high, consequent them to consume large amounts of food to reach their biologically predetermined weight. In contrast, for normal-weight individuals, their set-point is set much lower, and therefore they eat smaller amounts naturally.

<sup>2</sup> Hedonic hunger may powerfully stimulate overeating in an environment where highly palatable foods are omnipresent, and contribute to the surge in obesity (Lowe & Butryn, 2007).

Therefore, overweight and obese individuals have problems achieving a normal weight; as the determination of a maintained body weight is due to a range of body weight that depends on external (e.g., environmental) cues and not due to the biological-based set-point function. (Nisbett, 1972). However, critiques of the Set-Point theory maintain that there is little empirical support for some of the central assumptions of this theory (Stroebe, 2008; Pinel et al., 2000 for reviews).

A key study in the domain of individual difference research in eating patterns has been undertaken by Baucom and Aiken (1981). These researchers have reported that, compared to a non-stressed state, stressed dieters have shown an increase in food intake, whereas stressed non-dieters have shown a decrease in food intake. This has given a rise to the suggestion that it may be dieting status, rather than weight category, that is the best predictor of stress-induced feeding, and that the existent differences in food intake between stressed obese and normal-weight individuals may be a consequence of the fact that many obese individuals frequently restrict their food intake in an attempt to lose weight. Baucom and Aiken's (1981) study has provided the impetus for the development of Restraint Theory.

## 2.2: Restraint Theory

Restraint Theory (RT; Herman & Polivy, 1980) incorporates elements of the early theories of Obesity (Psychosomatic & Internal/External) as well as Nisbett's (1972) Set-Point Theory<sup>3</sup> of body weight regulation. Herman and Mack (1975) have indicated that dietary restraint (DR) and not obesity *per se*, is responsible for the over-responsiveness to food-relevant external cues. Subsequent research has provided further evidence of overeating responses to violations to DR as well as to negative emotional arousal (Wallis & Hetherington, 2009; Mills & Palandra, 2007). Therefore, Herman and Polivy (1980) have developed a theory of DR, called RT, which is characterised by cognitively mediated attempts by the individual to restrict food intake, which are frequently undermined by overeating behaviour; and the Disinhibition Hypothesis has been introduced in order to explain the reason why overeating occurs in people with restrained eating.

### 2.2.1: Disinhibition Hypothesis

The disinhibition hypothesis suggests that restrained eaters are characterised by an 'anomalous' eating pattern, whereby they predominantly exhibit cognitive control over their physiological urge to eat; and when the diet is broken, then overeating is likely to occur (Herman & Polivy, 1980). In order to explain the reason why

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<sup>3</sup> Set-Point theory has been incorporated into RT, as an explanation of why restrained eaters regain all of the weight, and sometimes more, that they have lost during their food restrictions periods.

restrained eaters overeat, researchers have focused on the role of dietary disinhibitors, which are associated with cognitive (Macht & Simons, 2000) and emotional (Macht, 1999) natures. Specifically, when the cognitive nature of disinhibitors, which may involve thoughts, is present, then an automatic thought to eat all or nothing happens (Macht & Simons, 2000). When the emotional nature of disinhibitors, which may involve the alterations in the pattern of food's consumption behaviour, is present, then the greater level of food's calories may be viewed as the distraction of one's senses to achieve the regulation of the emotional status, particularly in the case of negative emotional state (Macht, 1999). Heatherton, Polivy, and Herman (1990) have argued that the key to disinhibition is the awareness of whether the diet has been broken or not. Researchers have, therefore, proposed the triggers of disinhibition.

### 2.2.2: Triggers of Disinhibition

With regards to dietary disinhibition, there are three main triggers of disinhibition. Particularly, overeating is observed in restrained eaters when the alcohol intoxication is present (Polivy & Herman, 1976), when forced to consume a diet-exceeding pre-load<sup>4</sup> (Herman & Mack, 1975); or what restrained eaters think is a diet exceeding pre-load (Polivy, 1976) and when they expose to a stress condition (McFarlane, Polivy, & Herman, 1998; Heatherton & Baumeister, 1991). In all these cases, including multiple replications, unrestrained eaters, on the other hand,

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<sup>4</sup> Herman and Mack (1975) have been interested to examine if dieters would be tend to eat more after a preload than without a preload. In order to assess it they have provided a milkshake. They have found that restrained eaters have *increased*, and unrestrained eaters have *decreased*, their ice-cream consumption after drinking a high-calorie milkshake. The restrained eater's response has been labelled '*counter-regulatory eating*'.



respond to manipulations with either an important decrease in eating, or the manipulations have had no any particular effect (Herman & Polivy, 1980).

In an attempt to explain why restrained eaters overeat in response to pre-loading, several models have been formulated. The Causal Model of overeating suggests that DR and bingeing are causally related (Herman & Polivy, 1988; 1980; Polivy & Herman, 1985; Herman & Mack, 1975), whereby the overeating seen by restrained eaters occurs, paradoxically, as a consequence of their attempts to restrict food intake (Wardle & Beales, 1988).

Another explanation of why dieting can cause overeating is offered by the Boundary Model (BM; Herman & Polivy, 1984). The BM suggests that biological pressures operate to maintain food intake within an optimal range. Aversive controls operate, at the one hand to maintain consumption above the minimum level (hunger), and at the other hand below to a maximum level (satiety). Between hunger and satiety lies the zone of biological indifference in which overeating is most likely to be influenced by psychological (i.e., emotional arousal), social (i.e., celebratory eating), and environmental factors (i.e., time of day). Non-dieters and unrestrained eaters are assumed to regulate their eating via biological feedback between hunger and satiety, thus they eat when they feel hungry and stop eating when they are full. In contrast, dieters and restrained eaters impose a cognitive diet boundary in their zone that sits between hunger and satiety. If they consume a forbidden food (e.g., ice-cream), the diet boundary is crossed. As a consequence, food intake occurs and continues until a state of satiety is reached. Because the

satiety boundary is further than that of a person with normal hunger regulation, a restrained eater consumes not only substantially more than he/she would normally, but also more than would a non-dieter or unrestrained eater (Herman & Polivy, 1984).

The BM has received a considerable amount of support from the research on counter-regulation (Mills & Palandra, 2007; Kahan, Polivy, & Herman, 2003). The high calorie pre-load causes dieters to transgress their self-imposed diet boundary. The dieter experiences a '*what the hell*' effect and eating continues until the pressures of satiety inhibit consumption (Herman & Polivy, 1984), and as a deliberate decision to overeat (Ogden & Wardle, 1991). However, there is a limited support for the existence of the '*what the hell*' cognitions which are supposedly activated in response to a violation in DR (Boon, Stroebe, Schut, & Jansen, 1998; French, 1992 for reviews).

Although the BM provides some explanations regarding overeating behaviour, it fails to accommodate the full range of this phenomenon that is associated with DR. It fails to explain *why* some dieters and restrained eaters are able to maintain their eating within the self-imposed diet boundary, whereas others are not able.

Therefore, Macht's (2008) five-way model has been introduced and suggests that i) dieters and restrained eaters might eat in order to regulate their negative emotions and ii) eating may be caused by the stress-induced disruption of individuals' cognitive self-regulation (Macht, 2008). Elegant studies have

extensively investigated these two theoretical paths in restrained eaters indicating that people with restrained eating style have been linked to obesity, Bulimia Nervosa (BN), and BED due to psychological stress (Habhab, Sheldon, & Loed, 2009; Delinsky & Wilson, 2008; Gluck, 2006).

### **2.3: Why do Restrained Eaters overeat in response to Psychological Stress?**

A substantial body of research has demonstrated the disinhibition phenomenon in restrained eaters when compared to a non-stressed state, and when compared to stressed unrestrained eaters, in response to psychological stress, particularly when the stressful event involves ego-threat (Lowe & Kral, 2006; Greeno & Wing, 1994 for reviews). The Escape Model (Heatherton & Baumeister, 1991) and the Cognitive Load Theory (CLT; Sweller, van Merriënboer, & Paas, 1998) have been developed in order to explain why restrained eaters overeat in response to psychological stress.

### 2.3.1: Escape Model

In 1991, Heatherton and Baumeister put forward the Escape Model of binge-eating, which aims to explain why restrained eaters overeat. They have argued that binge-eating behaviour can be conceptualised as an effect that is adopted by individuals in order to escape their distress. Individuals with perfectionistic self-standards may experience an aversive self-awareness and a negative affect that cause the desire to eat; and this desire to eat has found to be associated with binge-eating episodes. This binge-eating has found to be characterised by one's shifting awareness and the mechanism that is involved in introducing a binge is an escape to consequential thought, which is achieved by narrowing one's attentional focus to the instantaneous stimulus environment, such as low level thinking (Heatherton & Baumeister, 1991).

Baumeister (1991) has defined this process with the term cognitive narrowing. Although bulimic behaviour is continued, the behaviour for binge-eating is strengthened. This difference in behaviour exists because i) individuals reject thoughts about the implications that they have in terms of one's individuality and because ii) it productively serves to decrease negative affect that are associated to one's self, such as the aversive self-awareness. Thus, a binge-eating episode is a result of the escape from negative affect through cognitive narrowing, rather than a cause of that narrowing.

Blackburn, Johnston, Blampied, et al. (2006) have examined the applicability of this model to non-clinical females. The findings from Structural Equation Modelling (SEM) have revealed a good-fit to the data, suggesting that the model

can provide a framework for better understanding the casual processes leading to binge-eating; and explaining the function binge-eating serves for an individual. The analysis has supported the relationship between the predicted variables in the model, indicating that stronger perfectionist ideals are associated with greater levels of aversive self-awareness, which in turn lead to greater levels of negative affect. Higher negative affect in turn leads to greater cognitive narrowing, which is consistent with the individual attempting to escape unpleasant feelings and negative affect. Cognitive narrowing has predicted levels of binge-eating, supporting their relationship. However, this relationship has been revealed as a negative, suggesting that higher levels of binge-eating can predict lower levels of cognitive narrowing. Figure 2.3 describes the model.

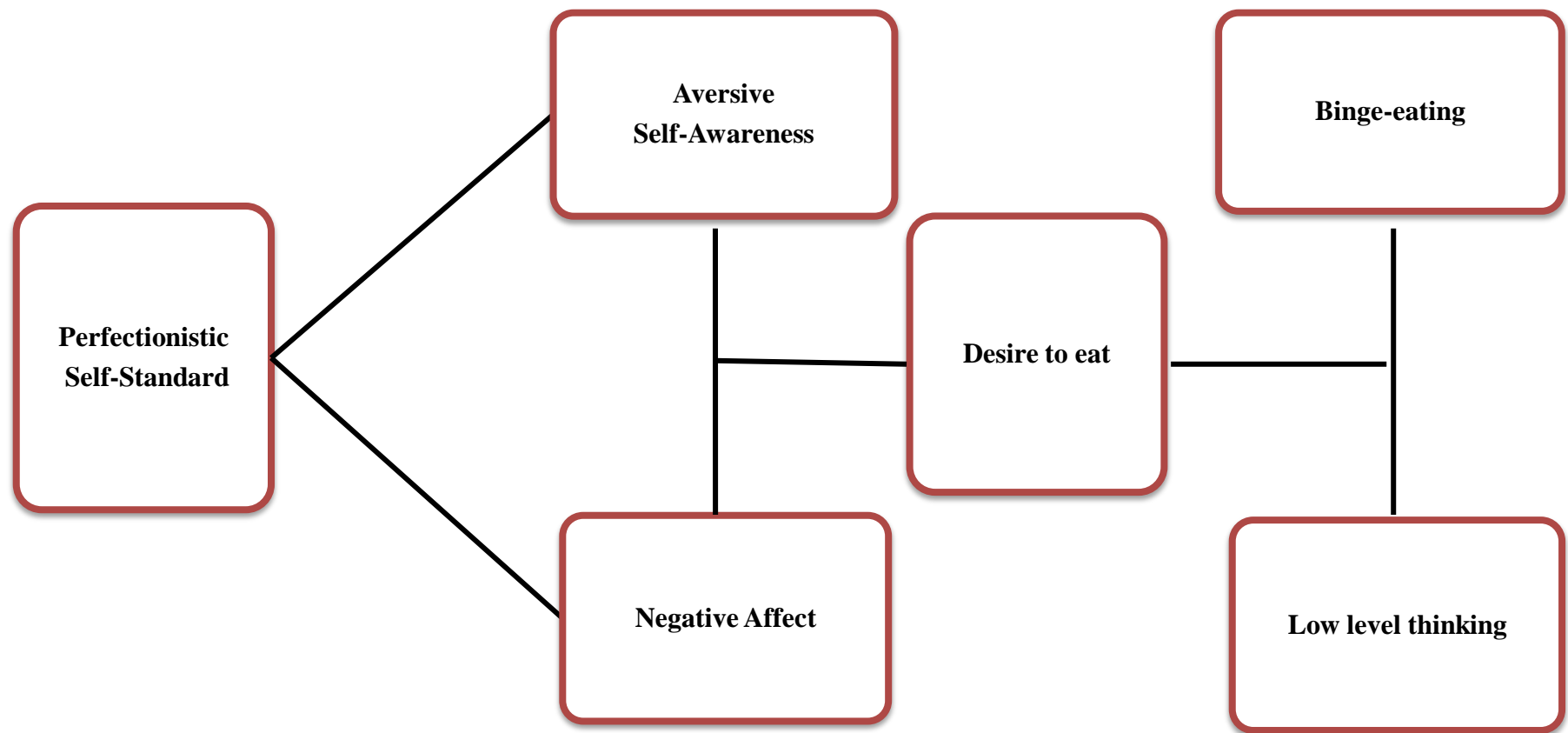


Figure 2.3: The Escape Model

### 2.3.2: Cognitive Load Theory

In eating-related literature, the fundamental nature of cognitive processing resources has found to be related to DR (Green & Rogers, 1998). Therefore, disinhibition could be *“merely the general effect of a limited cognitive capacity-due to any factor-that compromises restrained eaters’ diets”* (Boon et al., 2000, p.2). Previous study investigating disinhibited eating under cognitive load (CL) has argued that the characteristic of the stressor (i.e., degree of difficulty taken to complete a task) and not stress *per se*, interferes with restrained eaters’ monitoring of their food intake (Ward & Mann, 2000). From this point of view, it is suggested that the cognitive loading of the stress task occupies so much of the restrained eater’s limited mental processing capacity that they no longer have sufficient cognitive processing power to allocate to the monitoring of their eating behaviour (Habhab et al., 2009). Therefore, any task that is sufficiently high in terms of cognitive loading might cause disinhibition in restrained eaters, leading to bingeing behaviour, and several studies have provided support to this theory (Stroebe, 2008; Lowe & Kral, 2006; Boon, Stroebe, Schut, & Ijtema, 2002; Boon, Stroebe, Schut, & Jansen, 1997). For instance, Boon et al. (2002) have found that when non-stressed restrained eaters have been under cognitive distraction they have eaten more ice-cream than non-stressed unrestrained eaters.

### 2.3.3: The Emotional Stroop Task

A modified version of the classic colour-naming Stroop task (Stroop, 1935), that incorporates salient stimuli (e.g., stimuli relating to food, weight and body shape) or ego-threatening stimuli has often been utilized within the laboratory to induce disinhibited eating in restrained eaters. Using the emotional Stroop task, researchers that have recorded reaction times (i.e., target words versus matched neutral words or a comparison of restrained versus unrestrained eaters in respect of reaction times to target words) have found that restrained eaters evidence similar concerns to females who have significant bulimic tendencies or a current diagnosis of bulimia (i.e., concerns over food, body weight and shape) (Wilson & Wallis, 2012; Lattimore & Maxwell, 2004; Wallis & Hetherington, 2004; Vreugdenburg, Bryan, & Kemps, 2003; Boon et al., 2002; Lattimore, 2001; Tanofsky-Kraff et al., 2000; Ward & Mann, 2000; Waller, Watkins, Shuck, & McManus, 1996).

This has been taken as evidence to support the *Continuum Model of Eating Psychopathology*, which suggests that restrained eaters who persistently encounter triggers of dietary disinhibition, leading to failed dieting attempts, may begin to use more drastic compensatory behaviours that are commonly employed by bulimics (e.g., the use self-induced vomiting, laxatives and diuretics) in order to control their weight. If this persists, the restrained eaters may ultimately themselves receive a clinical diagnosis of BN (refer to Chapter 3).



Therefore, DR is an individual difference variable that has been found to moderate the relationship between psychological stress and binge-eating. However, other variables, such as the measurement of DR and a rigid versus flexible attitude to dieting, have been found to further moderate the experimental outcome of this relationship.

## **2.4: Moderating Variables**

### **2.4.1: The Measurement of Dietary Restraint**

Well validated self-report measures have been recommended in order to measure restraint levels and to classify individuals as restrained eaters (dieters) or unrestrained eaters (non-dieters). The most commonly applied measures of DR are the Three Factor Eating Questionnaire (TFEQ; Stunkard & Messick, 1985) renamed as Eating Inventory (EI; Stunkard & Messick, 1988), the Restraint Scale (RS; Herman & Mack, 1975) and the updated version RS-R by Herman & Polivy, 1980; and the Dutch Eating Behaviour Questionnaire (DEBQ; van Strien, Frijters, Van Staveran, 1986) (Williamson, Martin, York-Crowe, 2007 for a review).

Each of these questionnaires, except the RS, purports to measure '*pure*' restraint (Williamson et al., 2007; Stice, Ozer, & Kees, 1997). The Restraint sub-scale of RS (RS-R) fails to measure pure restraint because is most likely to predict overeating behaviours and attitudes (Heatherton, Herman, Polivy, et al., 1988) and it incorporates items which are particularly related to disinhibited eating (Stice et

al., 1997). Furthermore, participants who are classified with low DR and who do not regularly weight themselves regularly are having difficulties to complete the RS and RS-R, as some of the questions included within the questionnaire are related to the amount of weight gained or lost (Wardle, 1986).

Although the Restraint sub-scale of TFEQ (TFEQ-R) and RS-R questionnaires have been extensively used in DR-related research providing well validated results (Kavazidou, Proios, Liolios, et al., 2012; Mak & Lai, 2012; Angle, Engblom, Eriksson, et al., 2009; Stice, Cooper, Schoeller, et al., 2007; van Strien, Herman, Engels, et al., 2007), in the current thesis the Restraint sub-scale of DEBQ (DEBQ-R) will be used. DEBQ-R has been employed in the current thesis due to its strong validity and reliability as has been demonstrated in DR-related research within non-clinical population, and especially females (e.g., Ahern, Fielda, Yokumb, et al., 2010; Hollitt, Kemps, Tiggemann, et al., 2010; Veenstraa & de Jonga, 2010; Pothos, Tapper, & Calitri, 2009; Tapper, Pothos, Fadardi, & Ziori, 2008; Lattimore & Caswell, 2004; Green, Jones, Smith, et al., 2003; Alison, Kalinsky, & Gorman, 1992; van Strien et al., 1986).

The main goal of DEBQ-R (refer to Chapter 6; 6.3.2 for details) is to investigate the theoretical constructs for the contributors of the development and maintenance of human's obesity. Its items measure degrees of restraint eating, corresponding to RT. DEBQ-R appears to incorporate two important aspects of caloric restriction that is intending to diet. From the ten questions, the three questions ask '*try*' (e.g., "*Do you try to eat less at mealtimes than you would like to eat?*") and the other seven ask about the '*actual*' behaviour (e.g., "*Do you deliberately eat less in*

*order not to become heavier?*”). This differentiation implicitly suggests that restraint is a combination of dieting attempts that may or may not succeed and actual successful restriction. A high level on DEBQ-R suggests that people intend to limit their food intake, but often indulge in exactly the foods they want to avoid. A median split classifies the sample as restrained eaters and unrestrained eaters (Van Strien et al, 1986).

#### 2.4.2: Rigid Vs. Flexible attitude to dieting

Westenhoefer (1991; 1990) has argued that the construct of DR could be divided into two dieting strategies, the rigid control (RC) that is characterised by dichotomous ‘*all or nothing*’ approach of eating, weight, and dieting, and flexible control (FC) that is characterised by a more graduated approach to eating, weight, and dieting. These two dieting strategies have important differences. RC is associated with higher levels of BMI, more frequent and severe binge-eating or overeating, and greater scores of disinhibition. FC is associated with lower BMI, less frequent and severe binge-eating or overeating, and greater probability of successful weight loss during a one-year dieting.

Several studies have supported the differences between RC and FC. For instance, Westenhoefer, Stunkard, and Pudel (1999) have found that individuals with high levels of RC and greater vulnerability to overeating consume more after a pre-load than those individuals with high FC levels and low susceptibility to overeating. Studies have suggested that although FC can be a useful predictor in weight-loss

programs (Westenhoefer, von Falck, Stellfeldt, & Fintelman, 2004; Provencher, Drapeau, Tremblay, et al., 2003; Pudel & Westenhoefer, 1992), RC does not seem to be associated to outcomes in weight-loss studies (Westenhoefer, et al., 2004). The conclusion is, therefore, that there is a little and growing body of evidence indicating that the conceptualisation of DR as a combination of RC and FC may be helpful in understanding the role of restraint.

### **Summary**

The current chapter provides a detailed discussion regarding the development of RT, which suggests that an individual cognitively mediates specific attempts to restrict food intake, which are frequently undermined by overrating behaviour (Herman & Polivy, 1980). This theory incorporates elements of the Psychosomatic (Bruch, 1961; Kaplan & Kaplan, 1957) and Internal/External (Schacter et al., 1971; 1968) early Theories of Obesity (overeating in response to psychological stress is the key feature of these theories); as well as elements of Set-Point Theory of body-weight regulation (important differences between over- and normal-weight individuals in their external responsiveness) (Nisbett, 1972).

The reasons why restrained eaters overeat have been reviewed from the evaluations in disinhibition hypothesis (Herman & Polivy, 1980), which suggests that people may be influenced by dietary disinhibitors that are either associated with cognitive thoughts processing to eat all or nothing (Macht & Simons, 2000)

or emotional natures, especially when a negative affect is involved (Macht, 1999). Researchers have concluded that this behaviour should be due to triggers of disinhibition, like the force to consume a diet-exceeding pre-load (Herman & Mack, 1975) or the exposition of psychological stress (McFarlane et al., 1998).

In an attempt to explain why restrained eaters overeat to pre-loading, several models have been formulated. One such model is the BM suggesting that biological pressures operate to maintain food intake within an optimal range by two aversive controls: i) the hunger and ii) the satiety. Restrained eaters impose a cognitive diet boundary between hunger and satiety, and it is crossed if they consume a forbidden food. As a consequence, restrained eaters consume substantially more amount of food that they would normally do, leading to the '*what the hell*' effect (Herman & Polivy, 1984). However, BM fails to explain the actual reason why some individuals are able to maintain their eating within the self-imposed diet boundary, whereas others are not.

Macht's (2008) model suggests that disinhibited eating may be caused by the stress-induced disruption of individuals' cognitive self-regulation. Elegant studies have supported this assumption indicating that restrained eaters have been tied to obesity, BN, and BED due to psychological stress (e.g., Habhab et al., 2009), particularly when the stressful event involves ego-threat (e.g., Greeno & Wing, 1994).

Regarding the statement that restrained eaters overeat due to psychological distress, the Escape Model (Heatherton & Baumeister, 1991) and CLT (Sweller et

al., 1998) has been introduced. The Escape Model suggests that a binge-eating episode is a result of the escape from negative affect through cognitive narrowing, rather than a cause of that narrowing. The CLT argues that the characteristic of the stressor (i.e., degrees of difficulty taken to complete a task) rather than the stress per se interferes with restrained eaters' monitoring of their food intake (Ward & Mann, 2000). For instance, using the emotional Stroop task, researchers that have recorded reaction times have found that restrained eaters evidence similar concerns to females who have significantly bulimic tendencies or a current diagnosis of bulimia (e.g., Lattimore & Maxwell, 2004).

Therefore, DR is an individual difference variable moderating the relationship between psychological stress and binge-eating. However, other factors, such as the measurement of DR, the DEBQ-R, as well as the RC and FC have been found to moderate this relationship.

Taking into consideration the review provided within Chapter 2, is it well understood that overeating behaviour has been linked to binge-eating due to cognitive distractions. This behaviour is also commonly observed in individuals with BN, leading to the development of the *Continuum Model of Eating Psychopathology*, which incorporates the construct of DR. Therefore, Chapter 3 offers a detailed discussion regarding the development and maintenance of Eating Psychopathology within general (non-clinical) populations who vary in terms of pathological eating, with a particular interest on the role of information-processing (related to attention and memory biases) in non-eating disordered individuals.

## Chapter 3: “Eating Psychopathology”

### Overview

*Chapter 3 provides a review regarding Eating Psychopathology. It is documented that females are more at risk of developing an abnormal/maladaptive eating behaviour than males; and the Dual-Pathway Model of overeating addresses cultural differences for the development and maintenance of Bulimia. The Continuum Model of Eating Psychopathology is considered, as this model indicates the rationale for utilizing non-clinical populations who vary in terms of pathological eating. Support for this model has been provided by studies employing various Information-Processing methodologies originating from Cognitive Psychology. Beck’s model is reviewed as it has heavily influenced the design and development of cognitive models. When confronted with food-related stimuli, information-processing biases relating to attention and memory have been reported in restrained eaters, suggesting that maladaptive schemata probably underpin the desire to restrict food intake. However, paradoxically, this serves to increase food craving in non-clinical restrained eaters, as is commonly seen in BN.*

### 3.1: Eating Psychopathology

Eating psychopathology (EP), including threshold and sub-threshold AN<sup>5</sup>, BN<sup>6</sup>, and BED<sup>7</sup> is one of the most prevalent psychiatric problems at the present time. Chronicity and relapse are the key features describing the eating behaviours and attitudes of an individual with EP (Stice & Shaw, 2004 for a review). Due to its maintenance and development, there is a growing body of research exploring the binge-eating aspect of pathological eating behaviours (e.g., vomiting and purging) within non-eating disordered individuals (e.g., Goldschmidt, Wall, Loth, et al., 2012; Tangney, Baumeister, & Boone, 2004; Halmi, Falk, & Schwartz, 1981). This population commonly presents severe eating attitudes (e.g., concerns over

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<sup>5</sup>AN is defined as a psychiatric disorder that is associated with long term effects and medical morbidity. ‘Severe’ is a term that is commonly used in order to describe AN. A combination of biological, psychological, and social factors characterize the concept of AN, and the treatment for this disorder is to focus on these factors (Maguire, Grange, Surgenor, et al., 2008; APA, 2007).

<sup>6</sup> BN is a psychiatric condition that is characterised by an adult’s binge-eating episodes at least twice a week for three months. ‘Extreme’ could be used to describe this ED, as individuals consume large amounts of food with no control during a bulimic episode; and after the episode they use extreme ways of removing the food from their body (purging behaviours such as the excessive use of laxatives and diuretics). Both AN and BN involve distortion of body image and caloric restriction (dieting) (APA, 2007; Rushing, Jones, & Carney, 2003).

<sup>7</sup>BED is the most common form of abnormal eating which usually leads to obesity, while it can occur in normal-weight population. (APA, 2007). People with BED do not typically meet all the diagnostic criteria of ED, but can be classified as having the Eating Disorder Not Otherwise Specified (EDNOS). EDNOS is the most common ED diagnosis nowadays, as it is frequently used to classify people who do not quite meet all of the diagnostic criteria of AN and BN (Thomas, Vartanian, & Brownell, 2009; APA, 2007).



weight and shape) and behaviours (e.g., binge-eating and purging) relating to an ED, particularly BN (APA, 2007).

Gender- and cultural-related differences have been observed in EP. Females are much more at risk than males (e.g., Cornier, Salzeberg, Endly, et al., 2010); and cultural factors seem to play an important role for the development and maintenance of EP according to the Dual-Pathway model (Stice, 1994).

### 3.1.1: Eating Psychopathology & Gender

The role of gender within the area of EP is well investigated, with women to be more likely to develop an EP or food cravings compared to men (Cornier et al., 2010; Braet, Claus, Goossens, et al., 2008; Burton, Smit, & Lightwler, 2007; Polivy, Coleman, & Herman, 2005; Lafay, Thomas, Mennen, et al., 2001; Weingarten & Elston, 1990 for reviews); and that is the reason why this thesis has mainly focused on female population. Studies have documented that the existence of sex-based differences is due to biological regulation (Blashill, 2011; Cornier et al., 2010; Shi & Clegg, 2009; Hepp, Spindler, & Milos, 2005; Meyer, Blissett, & Oldfield, 2001; Lakkis, Ricciardelli, & Williams, 1999 for reviews) or social, environmental and cultural factors (Cornier et al., 2010; Westerberg-Jacobson, Edlund, & Ghaderi, 2010; King, 2008; Aruguete, DeBord, Yates, & Edman, 2005; Beardsworth, Bryman, Keil, et al., 2002; Miller & Punariega, 2001; Stice, 1994; Rolls, Fedoroff, & Guthrie, 1991 for reviews) that differentially influence females and males.

The biologically-based account of EP differences focuses on the role of gender-related hormonal changes (Cornier et al., 2010; Edelsbrunner, Herzog, & Holzer, 2009; Shi & Clegg, 2009; Hepp et al., 2005; Woods, Gotoh, & Clegg, 2003; Meyer et al., 2001). Two major hypotheses, the femininity hypothesis (Lakkis et al., 1999) and masculinity hypothesis (Blashill, 2011), have been proposed to account for differences in the development of EP in women and men. Regarding non-clinical individuals, studies have provided evidence for a positive association between femininity and disturbed eating behaviour but only for homosexual males and not for heterosexual males (Meyer et al., 2001). Therefore, the elemental difference here is not only the role of hormones, but also the way in which homosexual men process the information relating to food intake.

In addition to hormonal changes, neuro-imaging studies have indicated a brain response to hunger, satiation, and food stimulation. Findings have supported this neuronal basis for the development of pathological eating and revealed that women have greater sensitivity to hunger and satiety than men. This sensitivity is likely to affect the ability of an individual to better maintain energy balance during an ad libitum diet (Cornier et al., 2010).

Regarding the social, environmental, and cultural factors giving rise to gender differences in the development of EP, a plethora of studies have suggested that females are more likely to be affected by these influences than males (e.g., Westerberg-Jacobson et al., 2010). One possible explanation is provided by the

Dual-Pathway Model of overeating (Stice, 1994). To the best of the reader's knowledge a brief discussion in relation to the prevalence of EP among European countries is provided before the assessment of the Dual-Pathway Model; specific consideration has been given to UK and Greece.

### 3.1.2: Eating Psychopathology among Europe

A review by Hoek and van Hoeken (2003) based on the incidence of EDs in general, and EP in particular, has demonstrated that since 1930s there is a clear upward trend in the incidence of severe eating in UK, Sweden, Scotland, Wales, Switzerland, and Netherlands (Hoek & van Hoeken, 2003).

An additional report by the World Health Association (2004) suggests that UK has the highest rate of severe eating in Europe; and data reports indicate that 1 in 100 women has a clinically diagnosed ED (approximately 269 thousand females in England and Wales alone); and over half a serious issue with food that wouldn't be clinically diagnosed but causes them significant trouble. An important observation has been mentioned within the report suggesting that between 11 and 13 million people, especially females, in UK have psychological issues or problems connected with food that often leaves them in effect of a permanent diet. Trends of statistics indicated that ¼ of adults admit that they feel guilty after eating and ¼ of adults have also reported that they think they would be happier if they were thinner, when in fact there are not overweight; and 6/10

women have reported that they cannot stand the way they look and only 1 in 25 is totally happy with her body image. Lastly, it has been reported that 1 in 6 women and 1 in 10 men regularly skip meals in an attempt to control their weight.

Although there have been some attempts to record the incidence and prevalence of severe eating in Greece, however, are mainly derived from unpublished reports conducted within clinical settings while the Epidemiological Research Protocols necessary for reliable findings are, at the moment, absent from the literature. However, studies comparing Greek adolescents living abroad with Greek adolescents living in Greece found that the Greek females who leave abroad have showed a higher prevalence of AN (approximately 0.4% vs. 1.1%) (Fichter, Quadflieg, Georgopoulou, et al., 2005; Fichter, Elton, Sourdi, et al., 2004; Fichter, Xepapadakis, Quadflieg, et al., 2004).

### 3.1.3: Eating Psychopathology & Culture: The Dual-Pathway Model

Socio-cultural pressure based on norms of physical appearance has been suggested as the main aetiology for the development and maintenance of pathological eating among young women (Westerberg-Jacobson et al., 2010; King, 2008; Enjel-Maddox, 2005; Polivy & Herman, 2004; Miller & Punariega, 2001; Stice, 1994; Striegel-Moore, Silberstein, & Robin, 1986; Garner, Garfinkel, Dschwartz, & Thompson, 1980). The decrease in the weight of the ideal female

body as has been portrayed in the media (Wiseman, Gray, Mosimann, & Ahrens, 1992), and other factors associated with bulimia including the ideal-body internalisation, body dissatisfaction, negative affect, and restrained eating (Ouwens, Strien, Leeuwe, & Staak, 2009; Strien, Engels, Leeuwe, & Snoek, 2005; Stice, 2001; Shepherd & Ricciardelli, 1998) have assumed a prominent role in theoretical accounts of the development of BN. The Dual-Pathway Model (Stice, 1994) has been introduced in order to explain the process by which bulimic symptoms appear within non-clinical populations.

Key components of the Dual-Pathway Model are negative affect and restrained eating which serve as the final predictors of Bulimic Symptomatology. The model proposes that when individuals perceive socio-cultural pressures, emphasising the desirability of having a thin body, they internalise the thin-as-ideal body concept thereby giving rise to body dissatisfaction which through both restrained eating and negative affect create bulimic behaviours. Additionally, Body Mass Index (BMI) is recommended to be a factor that influences perceived socio-cultural pressures and body dissatisfaction (Stice, 1994). In a longitudinal study of this model, each of the theoretical components have shown an indirect or direct relation to bulimic behaviour and the model has been found to account for 33% of the variance in future Bulimic Symptomatology (Stice, Shaw, & Nemeroff, 1998). Figure 3.1 presents the components and describes the interrelationships embodied in the model.

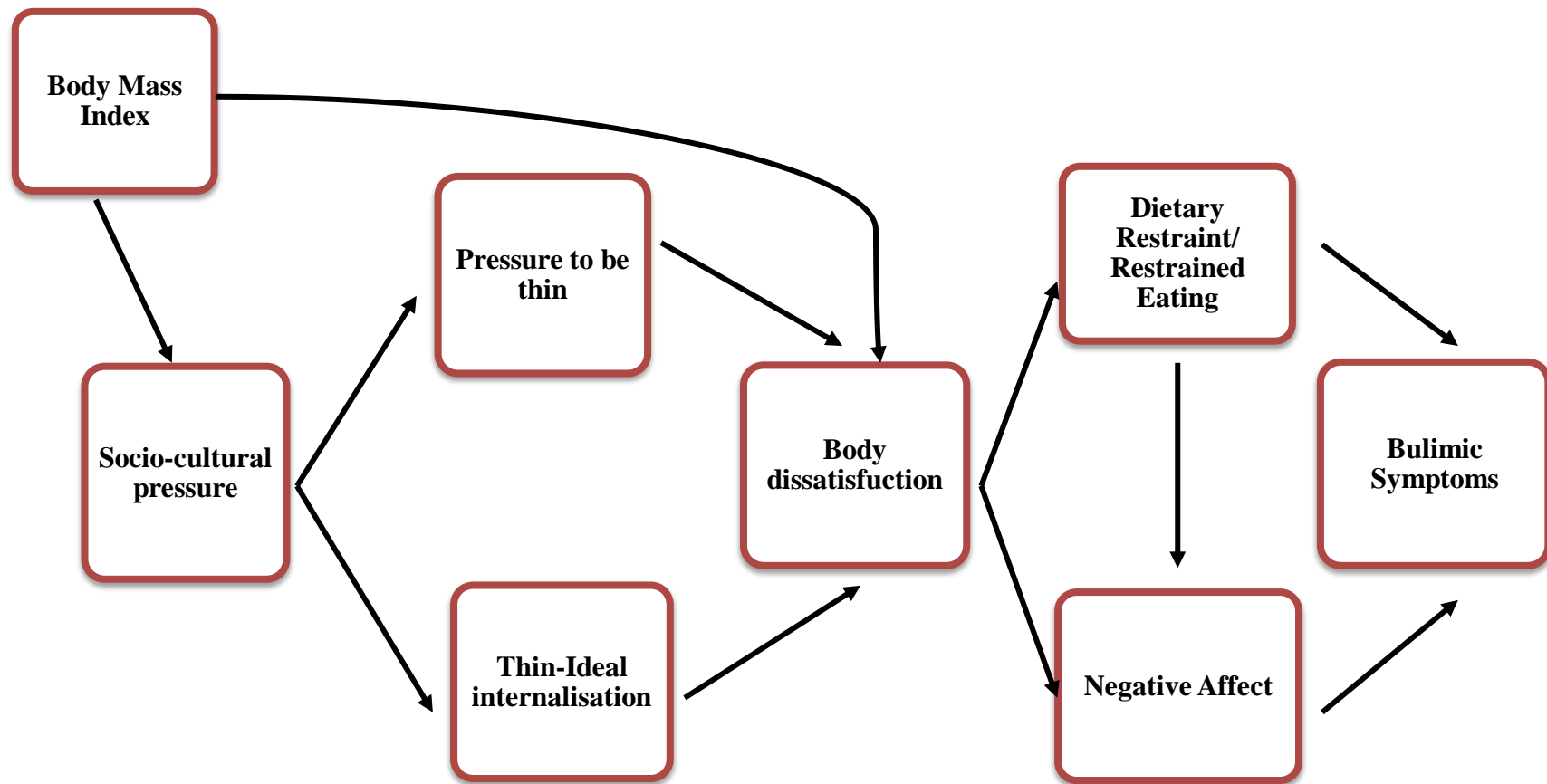


Figure 3.1: The Theoretical Components of the Dual-Pathway Model

It is, therefore, understood that EP exists cross-culturally within non-eating disordered women; and this thesis has aimed to explore cross-cultural differences between English and Greek healthy females. With regards to the maintenance and development of EP within non-clinical individuals, the *Continuum of Eating Psychopathology* has been introduced.

### **3.2: The Continuum of Eating Psychopathology**

Due to the maintenance and development of EP in general populations, the Continuum Models<sup>8</sup> of Eating Psychopathology have been introduced and proved to be particularly reliable for investigating the similarities and differences among the nature of EDs, especially for those disorders that binge-eating is involved (Gleaves, Brown & Warren, 2004). Two of such as models are the Continuity Model (Herman & Polivy, 1975) and the Discontinuity Model (Bruch, 1973). These models have been proposed in order to specify the relationship between dieting and the development of BN.

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<sup>8</sup> Russell and Ryder (2001) have postulated a continuum model that focuses on the relationship between disordered eating behaviour and body image. Scarano and Kalodner-Martin (1994) have published a continuum model that is specifically depict the process of normal eating to bulimic symptoms in patterns of eating-related behaviours, body image-related cognitions and self-esteem. Fairburn and Garner (1986), Bruch (1978), and Boskind-Lodahl and Sirlin (1977) have recommended separate continuum models for describing different pathways for the development of AN and BN.

### 3.2.1: Continuity & Discontinuity Models

The Continuity Model claims that there is a very thin line between restrained eaters and individuals with BN in terms of bulimic risk factors and symptoms (Hsu, 1990; Herman & Polivy, 1975; Polivy & Herman, 1987; 1985). Herman and Polivy (1975) have argued that the continuity hypothesis points the fundamental role of dieting for the development and maintenance of BN, mentioning that non-clinical vulnerable individuals can present similar eating-related behaviours and attitudes (e.g., starvation or binge cycle, vomiting) with those having BN (e.g., Lowe, Gleaves, DiSimone-Weiss, et al., 1996). The Discontinuity Model establishes not only the causal role that dieting should commonly play in the development of bulimia, but it suggests, also, that dieting is likely to develop into bulimia only among those individuals who have other predisposing characteristics, such as depression, impulse control problems, and so on (Bruch, 1973).

Unrestrained eaters, restrained eaters, and bulimic individuals are the three groups that feature within these models. Features of Bulimic Psychopathology (e.g., intense concern with weight, body shape, and eating attitudes) have, also, been present in a group with restrained eating behaviours (Heatherton, Herman, Polivy, et al., 1988). Here it must be mentioned that while bulimics and restrained eaters have similar characteristics, bulimics demonstrate greater scores on DR scales (Lindhold & Wilson, 1988).



On the one hand, the continuity perspective can be supported when risk factors associated with bulimic behaviour increase as one moves from unrestrained to restrained eaters to those with bulimia. The discontinuity perspective can be supported, on the other hand, when an individual with restrained eating behaviour is comparable to an unrestrained eater, but both of these types differ in terms of their behaviours from those with Bulimic Symptomatology (Lowe et al., 1996). Figures 3.2a and 3.2b describe the models.

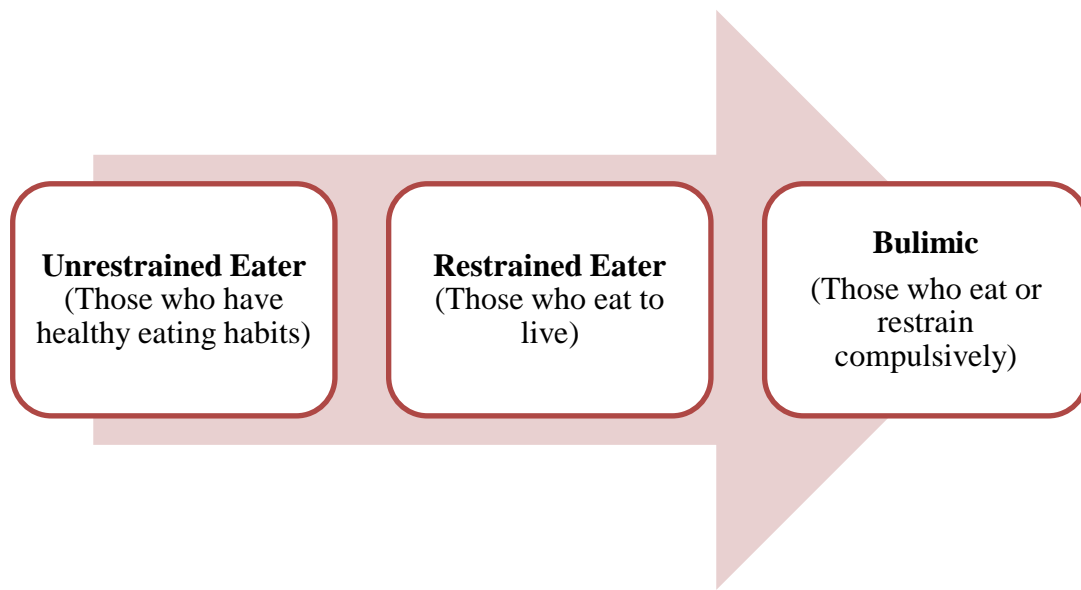


Figure 3.2a: Continuity Model of Eating Psychopathology

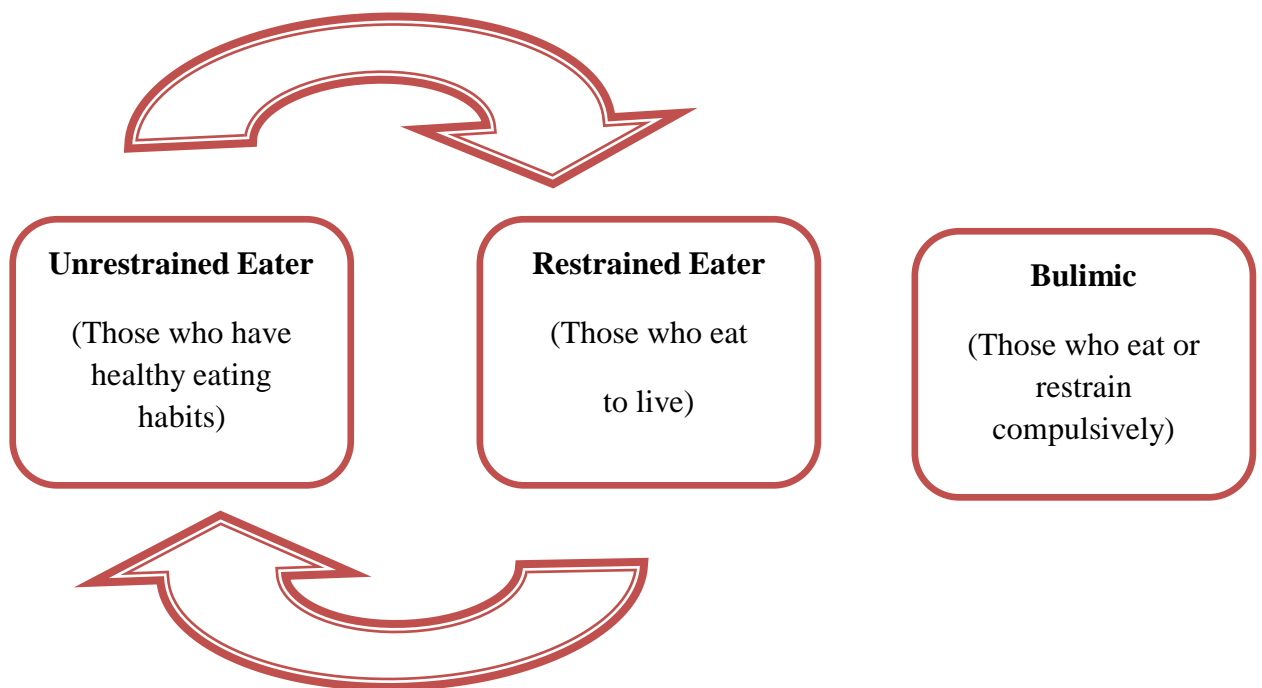


Figure 3.2b: Discontinuity Model of Eating Psychopathology

To summarise, the Continuum of EP exists within general populations, with different degrees of severity across vulnerable individuals who according to continuity perspective progress along the continuum from a non-clinical to a clinical classification, particularly BN (e.g., Keogh, 2007; Stice, Killen, Hayward, & Taylor, 1998; Lowe et al., 1996; Scanaro & Kalodner-Martin, 1994). It has been suggested that dieting and experiences of negative emotional affect are the strongest factors influencing the development of this abnormal/maladaptive eating behaviour (Robert-McComb, 2001; Fairburn, Marcus, & Wilso, 1993; Hsu, 1990). Therefore, this thesis has mainly adopted the continuity model, rather than the discontinuity, as it provides a rationale for employing non-clinical populations in eating-related research. Support for the Continuum of EP is derived from studies that have employed various Information-Processing methodologies originating from Cognitive Psychology in order to assess the aetiology and maintenance of this pathological eating behaviour.

### **3.3: Support for the Continuum of Eating Psychopathology**

According to the information-processing approach, people perceive and process reality that is the main reason influencing people's thoughts and behaviours. There are thoughts, called automatic thoughts, at the fringe of awareness that occur suddenly in order to give an immediate interpretation to a situation. Underpinning these automatic thoughts are deeper and sometimes dysfunctional

thoughts, called schemas or core beliefs. This cognitive schema can be positive or negative, adaptive or maladaptive. It can be formed in early childhood or later in life and it plays a key role in explaining and evaluating one's life experience, even in situations where when it may no longer be applicable (Knapp & Beck, 2008). Therefore, an eating-disordered individual is more likely to selectively process and has enhanced recall for schema-congruent information (i.e., fat stimuli) and resist schema-incongruent information (i.e., thin stimuli), resulting in the persistence of ED Symptomatology (Vitousek & Hollon, 1990).

Information-processing of food/body-related stimuli (related to attention and memory) have been found in both eating-disordered individuals (Van den Eynde, Guillaume, Broadbent, et al., 2011; Dobson & Dozios, 2004; Faunce, 2002 for reviews) and non eating-disordered individuals, especially restrained eaters (Hotham, Sharma, & Hamilton-West, 2012; Jiang & Vartanian, 2012; Veenstra & de Jong, 2012; Hollitt, Kemps, Tiggemann, et al., 2010; Veenstra, de Jong, Koster, & Roefs, 2010; Johansson, Ghaderi, & Andersson, 2005; Dobson & Dozios, 2004; Lee & Shafran, 2004 for reviews). The existence of information-processing biases in restrained eaters has been supported by outcomes on tasks, such as the emotional Stroop task. Research in this area has been heavily influenced by Aaron Beck's (1985) model. Therefore, it is important to provide a brief discussion of Beck's model, before moving on to information-processing biases in restrained eating.

### 3.3.1: Beck's Model

Beck, Emery, and Greenberg's (1985) cognitive model has been developed in order to explain the psychological processes of anxiety. Beck et al. (1985) have argued that the aetiology, maintenance, and treatment of anxiety should be explained by the type of emotional information and the manner in which it is processed. Additionally, their schema-based model proposes cognitive distortions as the main feature of anxiety disorders. Besides this, there is also an assumption suggesting that anxious individuals underestimate their personal coping resources, as well as the safety and rescue characteristics of the environment. Therefore, the difference between pathological and normal anxiety is due to the degree of how people estimate their anxiety and not the kind of anxiety.

### 3.3.2: Information-Processing in Restrained Eaters

Studies have revealed that restrained eaters show impaired cognitive performance, particularly on tasks involving concentration (Williams et al., 2004) and speed of responding (Green, Rogers, & Elliman, 2000), as well as a preoccupation with food and eating (Polivy & Herman, 2002; Cogan & Ernsberger, 1999). This exists because restrained eaters are more likely to focus on food-related stimuli and their attempt to avoid these stimuli in order to control their body weight (Green, Elliman, & Rogers, 1997; Green & Rogers, 1993). This food preoccupation affects, therefore, the way in which restrained eaters process information regarding food.

A variety of experimental paradigms, such as the emotional Stroop (Stroop, 1935) and Dot-Probe tasks (Macleod et al., 1986), investigating information-processing in people with restrained eating style (and people with EDs) have revealed biases in relation to attention and memory in this cohort (Brooks, Prince, Stahl, et al., 2012 for a review). Within the information-processing literature, attention bias describes a situation in which people who are preoccupied with their food (or body weight/shape) are more likely to give attention to such stimuli (Williams et al., 2004); and memory bias is concerned with the proposition that information related to preoccupying thoughts about food (or diet, or body-shape/weight) will be encoded more readily in an individual's memory and will be easier to recall (Stoetens & Braet, 2007; Sebastian, Williamson, & Blouin, 1996).

Studies investigating information-processing biases in relation to attention and memory in restrained and unrestrained eaters have provided an inconsistent picture. Inspection of Table 3.1 reveals on the one hand that attention and memory biases in response to food-related stimuli are greater for restrained eaters than unrestrained eaters. Therefore, restrained eaters: i) cognitively control themselves to restrict the appetitive response in the brain, reducing the strength of food-related stimuli in order to focus rigidly on their task (attention bias); and ii) remember more forbidden food-related words, which may reflect increased salience towards food deemed highly palatable (memory bias). On the other hand, studies have failed to provide any particular difference on attentional or memory biases between restrained and unrestrained eaters. The conclusion is, therefore, that maladaptive schemata *probably* underpin the desire to restrict food intake, but

paradoxically this increases food craving in non-clinical restrained eaters. Also, the findings that demonstrated no evidence for DR-related differences on information-processing biases might be due to an approach-avoidance conflict to food cues in which heightened appetitive responses to food are inhibited by food-related anxiety.

Table 3.1: Attention and Memory bias of Food-related stimuli in Restrained vs. Unrestrained eaters

<b>Key: DEBQ-R</b> (Dutch Eating Behavior Questionnaire-Restraint); <b>N.R</b> (Not reported); <b>RS-R</b> (Restraint Scale-Restraint)						
<b>Author(s)</b>	<b>Aim(s)</b>	<b>Participants</b>	<b>Mean age</b>	<b>BMI</b>	<b>Neuro-cognitive Measure(s)</b>	<b>Conclusion(s)</b>
<i>Hotham et al. (2012)</i>	Investigated the attentional control of restrained eaters when exposed to food.	55 Restrained eaters vs. 56 Unrestrained eaters	21.76(5.9) (overall)	N.R	Stroop task  Food image (High Fat &Non-Food)	In restrained eaters adaptation effects did not differ as a function of image. In contrast, adaptation effects in unrestrained eaters were not observed with high-fat food.
<i>Ahern et al. (2010)</i>	Tested the hypotheses that DR scores are associated with greater reward sensitivity and cognitive bias for food-related cues, which might result in chronic overeating and efforts to curb this tendency through dietary restriction.	N=63 females (total)  Classified as high vs. low DEBQ-R (Restrained eaters vs. Unrestrained eaters)	20.2(.3) (overall)	22.8(.4) (overall)	Visual Probe Attention Task  Stimuli Response Compatibility Task  Food Reinforcement Task  Taste	Participants with high versus low scores on the DEBQ-R did not differ on attentional bias for pictorial food-related cues on a visual probe task, or approach tendencies elicited by food cues, as assessed with a stimulus–response compatibility task. Restraint was also unrelated to performance on an operant task that assessed how hard participants would work for snacks, or responding during a



					Habituation Task	taste habituation paradigm. DR scores were correlated with self-reported appetitive response to food, sensitivity to reward, and sensitivity to punishment.
<b><i>Blechert et al. (2010)</i></b>	Investigated whether restrained eating pattern of chronic dietary restriction that is increased with episodes of disinhibited overeating is related to altered electrocortical processing of appetitive food stimuli in two different motivational contexts.	19 Restrained eaters vs. 21 Unrestrained eaters	22.6(3.27)  23.6(5.03)	24.1(3.8)  20.1(2.25)	International Affective Picture System: Food pictures (pleasant, neutral, unpleasant/arousal-valence) Non-food pictures	Restrained and unrestrained eaters passively viewed high-caloric food pictures, along with normative emotional pictures in a first block. In a second block, food availability was manipulated: participants were told that half of the food items should later be eaten (available food items), whereas the other half of food items was said to be unavailable. While no group differences were obtained during the first block, restrained eaters' event-related potentials (ERPs) were significantly modulated by the availability manipulation: ERPs for available food cues were significantly less positive than ERPs to unavailable food cues.

Table 3.1 continue

Author(s)	Aim(s)	Participants	Mean age	BMI	Neuro-cognitive Measure(s)	Conclusion(s)
<b>Hollitt et al. (2010)</b>	Investigated attentional bias for food cues among restrained eaters. In particular, the roles of speeded detection (enhanced orientation of attention toward food stimuli) and slowed disengagement (trouble disengaging attention from food stimuli) were examined.	38 Restrained eaters vs. 40 Unrestrained eaters	19.63(1.7)  19.33(1.42)	22.84(3.08)  23.11(4.11)	Odd-one-visual search task  Stimuli assessed by a matrix of 19 distracter words	Restrained eaters were disproportionately faster than unrestrained eaters to detect a food word within a neutral matrix compared to a neutral word within a neutral distracter matrix. Restrained eaters were also faster, rather than slower, than unrestrained eaters to detect a neutral word within a food matrix compared to a neutral word within a neutral distracter matrix. Thus restrained eaters show a heightened vigilance for food cues, but no slower disengagement from such cues.
<b>Papies et al. (2008)</b>	Examined the impact of food cues on restrained eaters' attention for food.	Study 1: N=104 (25 males	N.R	N.R	Experiment 1&2: Visual probe	The results of two studies revealed that restrained eaters, but not unrestrained eaters, displayed an

	Two studies conducted.	vs. 79 females) Study 2: N=158 (40 males vs. 98 females) All participants classified as Restrained eaters vs. Unrestrained eaters using the RS-R	N.R	N.R	task	attentional bias for hedonically rated food items when they had been pre-exposed to food cues. However, this attentional bias did not occur when restrained eaters were primed with the concept of dieting, thereby rendering the regulation of eating behaviour more successful.
<b><i>Tapper et al. (2008)</i></b>	Examined associations between restraint, disinhibition, and food- related processing bias (FPB) in university students in UK, Greece, and Iran.	N=216 (total)	21.7(3.91) (total)	22(3.57) (total)	Emotional Stroop task	Results showed that high restraint was associated with higher FPB. However, high restraint current dieters showed lower FPB than high restraint non-dieters. There was no significant difference in FPB for those showing high vs. low disinhibition.
<b><i>Israeli &amp; Stewart (2001)</i></b>	Investigated whether highly restrained women show a later stage memory bias for forbidden food words.	N=67 (total) Classified as high vs. low restraint group using the RS- R (29 high restraint	22.2(4.5) (overall)	25.9(4.9) 22.1(3.3)	Incidental memory task (Forbidden foods)	High-restraint women did not remember more forbidden food words than low-restraint women. High-restraint women did, remember fewer animal control

		group vs. 38 low restraint group)				words than low-restraint women, suggesting a deficit in memory for material outside of the food-schema domain in restrained eaters relative to non-restrained eaters. Finally, only women in the high-restraint group remembered more forbidden food than animal control words, indicating a relative memory bias for forbidden food words only among restrained eaters.
<b>Boon et al. (2000)</b>	Examined whether the frequently found prolonged colour naming of food words in Stroop tasks in people who restrain their food intake is due to hyperattention to or avoidance of these food words.	N=59 (total) Classified as restrained and unrestrained eaters using the RS-R (29 restrained eaters vs. 30 unrestrained eaters)	N.R	N.R	Visual Attention Task Recognition Task	The visual attention task revealed neither attention nor avoidance of food and weight/shape stimuli. In the recognition task restrained subjects were found to need less time for recognizing food words than neutral words. For unrestrained eaters, the response times for food and neutral words were the same.
<b>Francis et al. (1997)</b>	Examined whether restrained eaters relative to non-restrained eaters show greater	14 restrained eaters vs. 14 non-restrained	N.R	22.43(2.94) (overall)	Stroop task (forbidden & non-forbidden	DR was associated with the selective processing of both forbidden and non forbidden food words. Stroop interference for both

	preoccupation with forbidden foods than non forbidden foods using a modified Stroop colour-naming task.	eaters			food)	types of food words was greater for restrained eaters than non-restrained eaters. Restrained eaters did not demonstrate greater interference when colour naming forbidden versus non forbidden food words. However, restrained eaters rated only forbidden foods as more highly forbidden than non-restrained eaters.
<i>Stewart &amp; Samoluk (1997)</i>	Selective processing of appetitive cues was investigated among food-deprived subjects and restrained eaters using the modified Stroop task.	N=33 (7 males vs. 25 females)  Classified as high, medium, low restraint group using the RS-R (11 high restraint; 10 medium restraint; 11 low restraint)	21.8(1.9) (overall)	N.R	Stroop task (food deprivation )	Food deprivation failed to produce longer latencies for food or alcohol words relative to control words. However, high restraint status was associated with significantly longer latencies for both food and alcohol, relative to control, words. Thus, chronic DR but not short-term food deprivation was associated with selective processing of appetitive cues.
<i>Overduin et al. (1995)</i>	Investigated whether it is possible to instantaneously induce an attentional bias in	26 Restrained eaters  vs.	22.6(1.9)	22.3(2.7)	Stroop task (appetiser & no-appetiser food)	The results showed that in unrestrained eaters Stroop interference for food words was found only in the appetizer

	<p>subjects by providing them with an appetizer, that is, a small amount of food that tastes "moreishly."</p> <p>Also, the relation between Stroop interference and subsequent ad libitum food intake was assessed.</p>	25 Unrestrained eaters	23.3(2.4)			<p>condition. Restrained eaters, however, showed a permanent interference for food words. A significant correlation of .58 between Stroop food-word interference and ice cream intake was found only in unrestrained subjects. In restrained eaters the correlation was near 0. No effect of condition or restraint was found on Stroop body shape-word interference.</p>
			20.7(1.3)			
<b><i>Green &amp; Rogers (1993)</i></b>	Investigated the presence of an attentional bias towards the processing of body shape and food-related material amongst non-eating disordered women.	<p>27 Low to Medium restraint eaters</p> <p>15 High restraint eaters</p> <p>13 Current dieters</p>	18 to 40 years old (overall)	N.R	Stroop task	Significant colour-naming disruptions of both food and body shape-related material were found for highly restrained eaters, irrespective of whether they were currently dieting. There were no reliable differences in colour-naming times found for low to medium restrained eaters.

## Summary

There is a substantial body of interest in and research on the binge-eating aspect of pathological eating behaviours within non-clinical individuals (Goldshmidt et al., 2012). Existing literatures suggest that females are more in risk of developing an EP than males (Cornier et al., 2010). Additionally, the Dual-Pathway Model of overeating indicates cultural differences regarding the development and maintenance of BN within non-clinical individuals (Stice, 1994).

The Continuum Model of EP provides an explanation of how non eating-disordered (non-clinical) individuals adopt behaviours and attitudes similar to eating-disordered (clinical) individuals, especially to those with BN and therefore provides the rationale for employing non-clinical population within eating-related research. Dieting and experiences of negative emotional affect have been proposed as the strongest features influencing this disordered eating behaviour (Lowe et al., 1996). Support for this is derived from studies that have employed various information-processing methodologies originating from Cognitive Psychology.

Information-processing related to attention and memory biases have been found within non eating-disordered individuals according to their level of EP (Veenstra & de Jong, 2012). Studies have indicated that restrained eaters show impaired cognitive performance, particularly on tasks involving concentration (Williams et al., 2004) and speed of responding (Green et al., 2000); as well as a preoccupation with food and eating (Polivy & Herman, 2002), as restrained eaters are more likely to focus on food-related cues in the environment and attempt to avoid these

cues in order to control their body weight (Green et al., 1997). This preoccupation with food affects the way in which restrained eaters process information regarding food.

These cognitive biases are often attributed to the central executive, frequently referring to executive functions (EF), including planning, decision making, abstract thinking, cognitive flexibility, and the inhibition of inappropriate actions. Baddeley and his colleagues (1996) have proposed temporary activation of long-term memory (LTM) and shifting between tasks as additions to EF. Baddeley et al (1998) have, also, included the selective attention and inhibition. In addition to Baddeley's assumption, Miyake et al. (2000) have introduced an individual difference model of EFs which proposes the separation of EFs into three categories: Inhibition, Shifting, and Updating. Taking the existing literature into consideration, Chapter 4 aims to provide a detailed discussion regarding the central executive system, with a particular interest on executive functioning, in order to evaluate in depth the processes of these cognitive functions.



## Chapter 4: “Central Executive System”

### Overview

*Chapter 4 outlines the central executive system, with a particular interest in executive functions. The executive system is an ‘umbrella’ term covering those general-purpose control processes and sub-processes which monitor and seek to optimise one’s thoughts and behaviours. Several theoretical models have been reviewed to assess the impact of executive function deficits in the everyday environment. Although executive (dys)-functions are commonly used in relation to frontal lobe (dys)-functions, invoking the holistic notion of dysexecutive syndrome, some researchers have claimed that executive processes are in fact separable and fractionated. In this regard, Baddeley’s model of Working Memory and Miyake et al.’s model of executive functions have been discussed in order to determine the actual role of executive functions in complex cognition and to judge if executive functions could most usefully be conceptualised as unitary or non-unitary. Besides these, cross-cultural research on executive functioning has been reviewed. Finally, in addition to laboratory based conceptualisations of executive processes, Chapter 4 intends to discuss measures of executive functioning, such as the BRIEF-A, that are grounded in the individual’s everyday experiences and objectives.*

#### **4.1: Central Executive**

Baddeley's (1990) notion of the central executive is based on Norman and Shallice's (1986) concept of the supervisory attentional system which, it is claimed, is responsible for allocating limited attentional resources among potentially competing cognitive tasks. Norman and Shallice (1986) have argued that the central executive plays a vital role in regulating those cognitive activities which support the individual's planning and decision making in their everyday life. When the level of difficulty or novelty in some ongoing cognitive activity is increased, then a neural network located in the anterior cingulate gyrus and the frontal lobes is recruited, and activity in this network increases with task demands (Whitman, 2011). At this point, it is important to define the term of executive function (EF) and to discuss in depth the theoretical models underpinning the construct.

#### **4.2: Approaches to Define Executive Functions**

The term executive function (EF) is typically identified as an '*umbrella*' term that describes the processes and sub-processes of different multifaceted cognitive tasks (Elliot, 2003), and it has been often found to play a crucial role in neuropsychological theories of behaviour (Stuss & Knight, 2002; Luria, 1973). It comprises a wide range of cognitive processes and behavioural competencies which include verbal reasoning, problem-solving, planning, sequencing, the ability to sustain attention, resistance to interference, utilisation of feedback,

multitasking, cognitive flexibility, working memory (WM), and the ability to deal with novelty. EFs are often linked to the prefrontal cortex (PFC) of the brain, an area that regulates the dynamics of human cognition and action (Miyake & Friedman, 2012; Janssen, De Mey, Egger, & Witteman, 2010; McCabe, Roediger III, McDaniel, et al., 2010; Banich, 2009; Alvarez & Emory, 2006; Carlson, 2005; Elliott, 2003; Gazzaniga, Ivry, & Mangun, 2002; Stuss & Knight, 2002; Funahashi, 2001; Burgess, Veitch, de la Costello, & Shallish, 2000; Gioia, Isquith, Guy, & Kenworthy, 2000; Grafman & Litvan, 1999; Miller & Cummings, 1999; Damasio, 1995; Struss, Shallice, Alexander, & Picton, 1995; Shallice, 1988; Struss & Benson, 1986).

EFs are categorised either as cold or hot. The cold component of EFs, like the ability to sustain attention, corresponds to those cognitive processes and sub-processes which do not involve much emotional arousal and are relatively mechanistic or logically based. The hot component of EFs is concerned more with emotional behaviours, beliefs, or desires, as in the regulation of one's own social behaviour, decision making processes involving emotional and personal interpretation, or one's experience of reward and punishment (Grafman & Litvan, 1999 for a review). Studies have argued that impairments in either the cold or hot component of EFs may have broad and important implications for everyday life, like self-regulation (Hofmann, et al., 2012; Mischel, Ayduk, Berman, et al., 2011; Moffitt, Arseneault, Belsky, et al., 2011 for reviews).

#### 4.2.1: Are Executive Functions linked to the Prefrontal Cortex?

Existing literature argues that EFs are supported by the PFC<sup>9</sup> of the brain. Recently, the frontal pole, which contains anterior portions of the dorsolateral and ventral PFC, has been found to be involved in higher level behaviours concerned with morality and empathy, and with the higher order integration of EFs (Suchy, 2009; Barbas, 2000; Krasnegof, Lyon, & Goldman-Rakic, 1997; Cummings, 1995). Therefore, executive processes appear to rely on the frontal regions of the brain, particularly with the frontal lobe.

It is evident that patients with damage to the PFC often show impairments in organisation, planning, decision-making (Stuss & Benson, 1984), behavioural disinhibition, and impairments in their intellectual abilities (Luria, 2002). Thus, there is an intimate link between EFs and frontal cortical and sub-cortical processes (Elliott, 2003) giving rise to the conclusion that executive function deficits (EFDs) can result from damage to the frontal lobes (Stuss & Knight, 2002; Miller & Cummings, 1999).

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<sup>9</sup> PFC contains all portions of the frontal lobe, which are located in anterior to motor and pre-motor cortices, and in supplementary motor area. PFC can be divided into three major convexities including the i) Dorsolateral PFC which has been described as the substrate of WM, ii) Superomedial PFC including, also, the anterior cingulated gyrus, which has been described as the substrate for sustained attention, response selection, and motivation, and iii) Ventral or Inferior PFC, which is divided into Orbitofrontal and Ventromedial, that has been described as the substrated for inhibition, social appropriateness, and sensitivity to rewards and punishments (Whitman, 2011).

Additionally, neuropsychological studies have documented that frontal systems can be vulnerable to EFDs in people with trauma to their prefrontal regions of the brain (McDonald, Flashman, & Saykin, 2002; McAllister, Sparling, Flashman, & Sayking, 2001; Levine, Dawson, Boutet, et al, 2000). Patients with Attention-Deficit Hyperactive Disorder (ADHD) (Roth & Saykin, 2004; Murphy, Barkley, & Bush, 2001), substance use disorders (Fein, Di Sclafani, & Meyerhoff, 2002; Sullivan, Fama, Rosenbloom, & Pfefferbaum, 2002), neurodegenerative disorders (Lewis, Dove, Robbins, Barker, & Owen, 2003; Ready, Ott, Grace, & Cahn-Weiner, 2003), mild cognitive impairments (Saykin, Wishart, Rabin, et al., 2004), and various mental/psychiatric disorders, including depression (Austing, Mitchell, & Goodwin, 2001; Mega & Cummings, 1994) have been characterised by a wide range of EFDs.

However, previous studies based on patients with frontal lobe damage have presented evidence for the fractionation of EFs (Roberts, Robbins, & Weiskrantz, 1998; Pennigton & Ozonoff, 1996 for reviews). Using cognitive tasks, like the Wisconsin Card Sorting Test (WCST; Heaton, Chelune, Talley, et al., 1993), Tower of Hanoi (TOH; Poole, 1994), and the Tower of London (TOL; Shallice, 1982), studies have revealed that some patients with frontal lobe damage perform normally on frontal lobe tasks (Shallice & Burgess, 1991), while some patients with lesions outside the frontal lobes do exhibit impairments on them (e.g., Reitan & Wolfson, 1994). Consequently, the term of EF cannot always be synonymously used with the term of frontal lobe functions. Regarding this evidence, several

theoretical models of EFs have been introduced in order to conceptualise EFs and to provide a better understanding for the crucial as well as natural role of EFs.

### **4.3: Theoretical Models of Executive Functions: A Historical Background**

Several theoretical models have been introduced over the years in order to better understand whether EFs are dependent on the frontal lobe, and whether EFs should be measured as unitary (i.e., single component; multiple interrelated sub-processes) or non-unitary (i.e., collection of dissociable or independent processes).

Luria's (1966) model suggests the interconnection of frontal lobe, EFs, and problem-solving, as this model provides evidence of self-regulation impairments in patients with frontal lobe damage. Problem-solving behaviour is, therefore, associated with EFs that are dependent of the frontal lobes. Stuss and Benson's (1984) model of EFs concludes that the lower or basic processes of attention, memory, perception, or language, and the higher meta-cognitive processes conceptualise the executive functioning. An important aspect of Lezak's (1995) model is that, on the one hand, people with EFDs are able to describe a problem and/or find the solution to it, but on the other hand, are not able to successfully implement the solution. Table 4.1 presents a summary of the primary components of these theories.

**Table 4.1: Theories of Executive Functions and their Components**

Theories	Components
<i>Luria, 1966</i>	Anticipation
	Planning
	Execution
	Self-Monitoring
<i>Stuss &amp; Benson, 1986</i>	Initiation
	Planning
	Sequencing
	Organization
	Regulation
<i>Lezak, 1995</i>	Volition
	Planning
	Purposive action
	Effective performance

These theoretical models of EFs, have not been consistently accepted and it has been argued that they confuse rather than elucidate the actual nature of EFs (Miyake & Friedman, 2012; Miyake, Friedman, Emerson, et al., 2000). Therefore, new theoretical models have been introduced to address these shortcomings. These new approaches have emerged from Baddeley's Model of WM which is described first before moving on Miyake et al.'s model of EFs.

### 4.3.1: Baddeley's Model of Working Memory

The relationship between EFs, memory, and attention has been discussed at length over the years (Baddeley, 2003; Baddeley & Wilson, 2002; Baddeley & Hitch, 1974). Baddeley and Hitch (1974) proposed one of the most influential models of WM which incorporates the central executive construct. This model consists of two slave storage systems: the phonological loop which is responsible for the temporary storage of verbal (articulatory control system) and speech-based (phonological store) phonological information, and the visuospatial sketchpad which is responsible for the momentary storage of spatial and visual information. In addition to these two slave storage systems, an attentional control system, called central executive system (CES), is included within the model. The CES is the key component of this model, as it is responsible for controlling and regulating cognitive processes in WM, like EFs, and is said to be linked with frontal lobe functions (Whitman, 2011).

As it can be seen from Figure 4.1, the CES acts as supervisory system that manipulates the distribution of information to and from the two slave storage systems. The phonological loop controls the memory span that has limited capacity, due to the rates of verbal rehearsal and decay of items without the rehearsal. The visuo-spatial sketch pad acts like the inner eye supporting the temporary storage of nonverbal spatial and visual information.



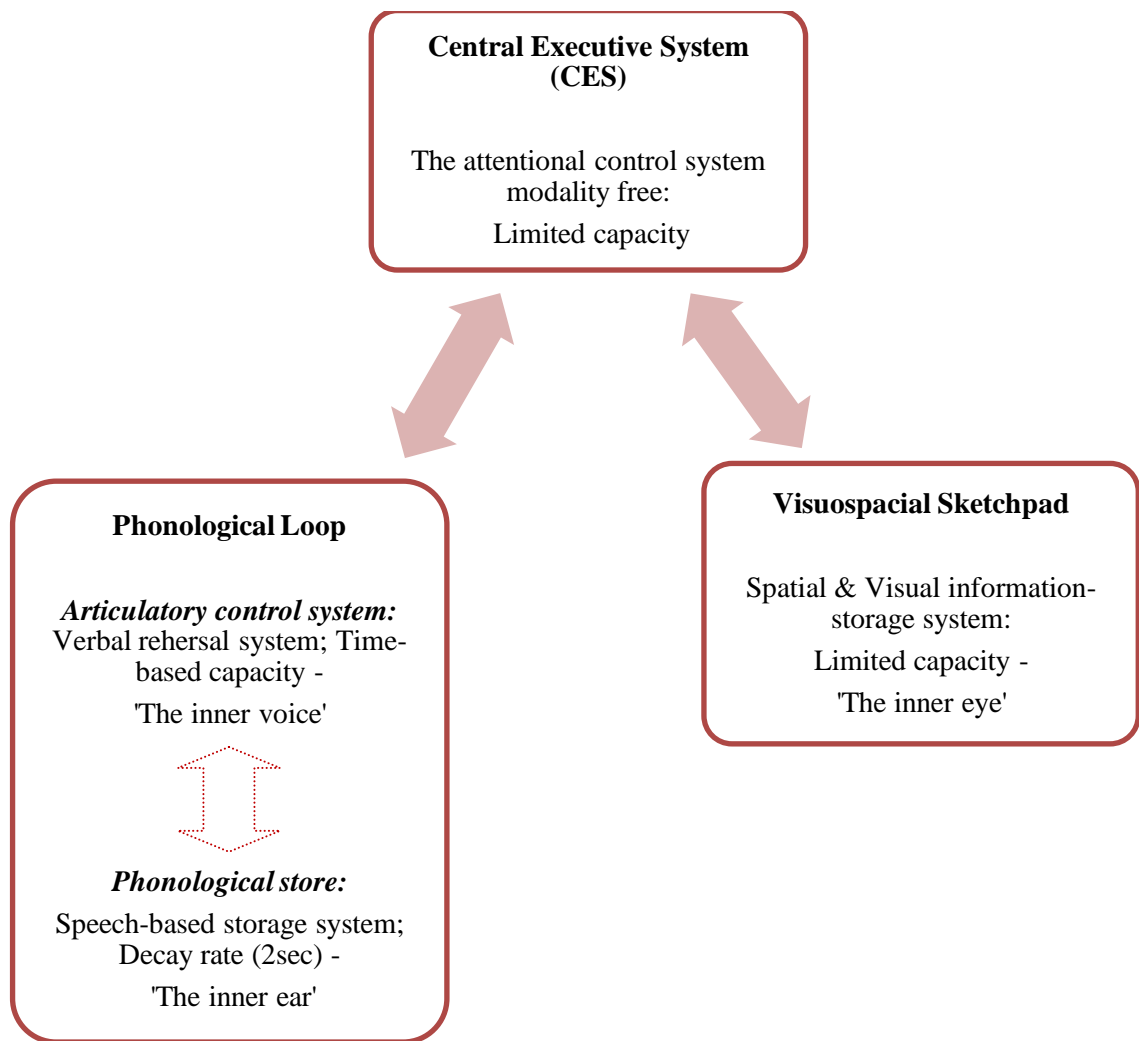


Figure 4.1: Baddeley & Hitch's (1974) Model of Working Memory

Although Baddeley and Hitch's (1974) Model of WM has been influential in clinical and neuropsychological contexts, it has been subject to periodic revision (Luck & Vogel, 1997; Logie, Zucco, & Baddeley, 1990). Early on, Baddeley further elaborated his three-component model of WM by proposing the supervisory attentional system which was developed by Norman and Shallice

(1986) as a model for the CES. Later on the WM model was further revised following the introduction of a fourth component, called the episodic buffer.

Now, the model includes three unshared storage systems (phonological loop, episodic buffer, & visuo-spatial sketch pad) representing fluid systems and shared areas (language/semantic memory, episodic long-term memory, & visual semantics) that correspond to crystallised systems. The episodic buffer is responsible for binding or integrating multimodal information in memory; and facilitates the integration of information from the other slave systems allowing the temporary storage of complex representations. The buffer is also responsible for the transfer of information to and from long-term memory (LTM) (Baddeley, 2003). Figure 4.2 outlines the new model.

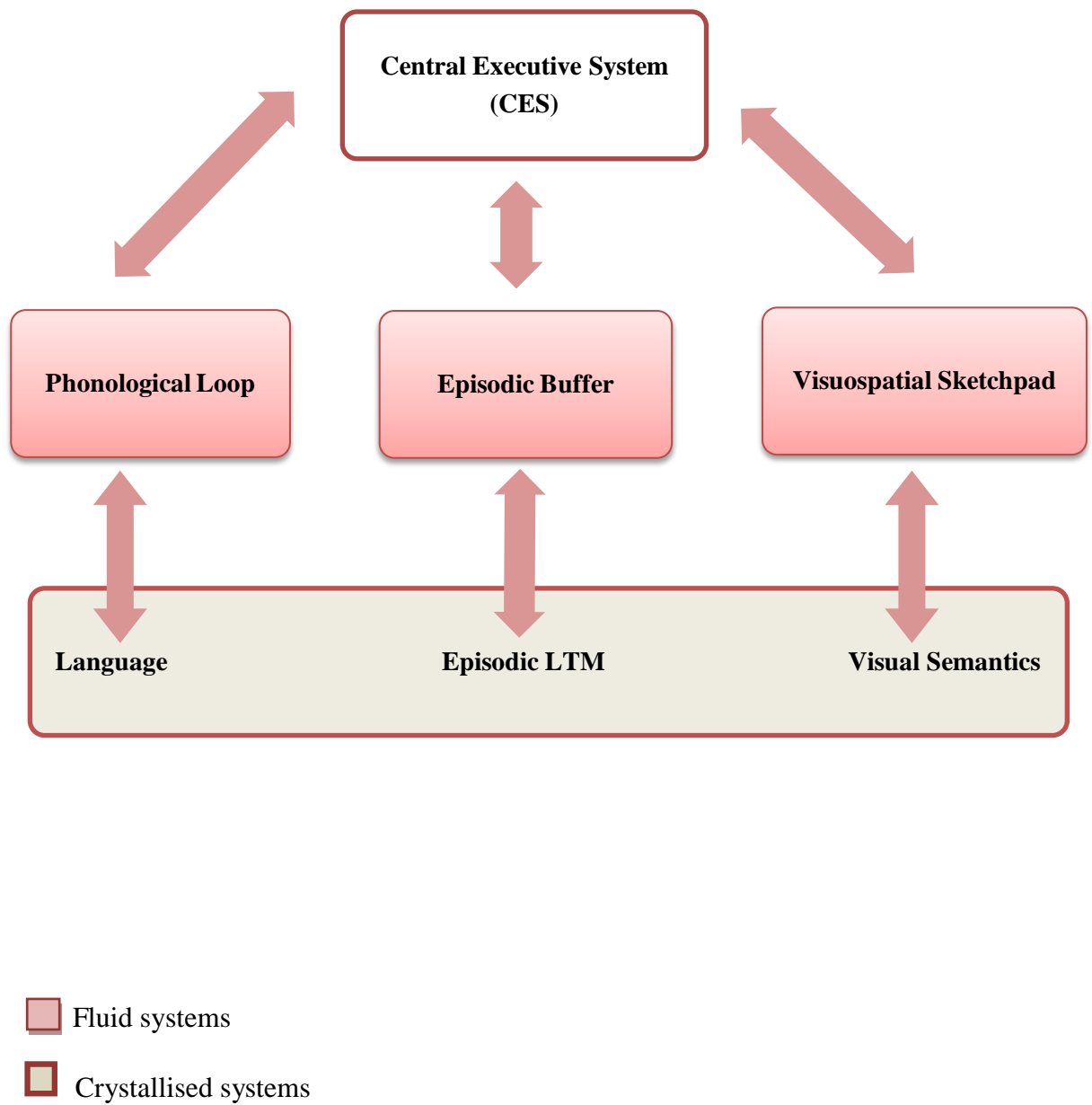


Figure 4.2: Baddeley's revised Model of Working Memory

Taking into consideration the models of WM, it is clearly understood that the original model of WM indicates short-term memory (STM) as a system that controls limited storage and processing capacity (Baddeley & Hitch, 1974), while the revised model indicates WM as an executive supervisory control system (Baddeley, 2003). Although Baddeley's model of WM is considered to be one of the most validated and reliable models offering a rationale theoretical framework of executive processes, it fails, however, to specify *whether* the functions of the CES are performed in a unitary or non-unitary manner. Consequently, a new revision to the model has been suggested by Miyake et al. (2000), in order to capture the fractionalisation of the central executive.

#### 4.3.2: Miyake et al.'s Model of Executive Functions

Miyake et al. (2000) have specified some issues regarding the utility of EFs which researchers must take into serious consideration when they are reviewing the EF-related literature. They have, also, mentioned the need of further investigation regarding the nature and organisation of individual differences in EFs. Miyake et al. (2000) have, therefore, proposed a model in order to specify the actual role of EFs, in complex cognitions (i.e., relative contributions of complex tasks assessing executive functioning); and how EFs are organised (i.e., unitary or non-unitary?). Their model proposes that the central executive is fractionated with three basic components of EFs (Shifting, Updating, & Inhibition) performing separate tasks

with varying degrees of competence and are associated with each other (refer to Figure 4.3).

Specifically, shifting is, also, referred to as task-switching, involves moving backwards and forwards between multiple tasks, mental sets, or operations. Updating requires monitoring and coding of incoming information and revising the items held in WM by replacing no longer relevant information with new, more relevant information; and inhibition refers to the ability to deliberately inhibit dominant, automatic, or pre-potent responses. They have focused on these three components of EFs noting that they are differentially implicated in the performance of more complex cognitive tasks, like the WCST; and emphasising their critical role in characterising and defining the nature of individual differences in EFs.

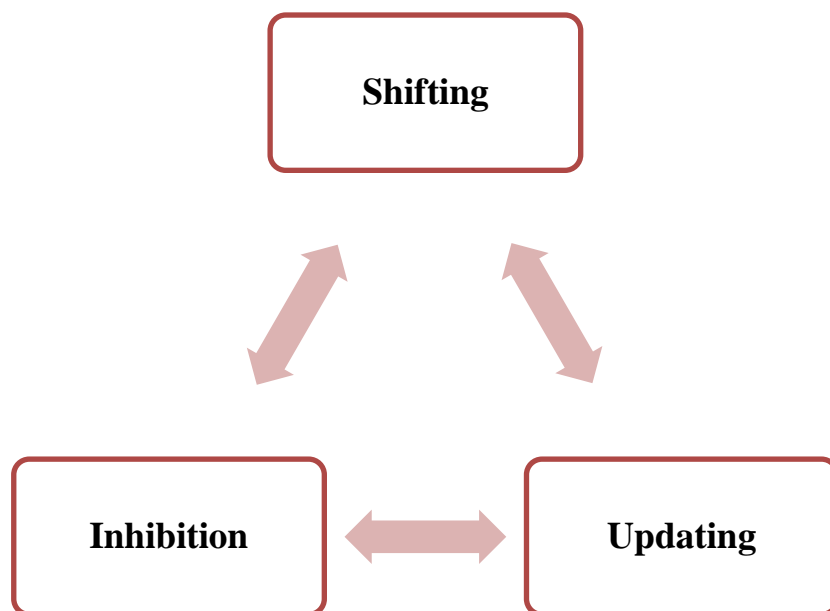


Figure 4.3: Miyake et al.' (2000) Model of Executive Functions

Miyake et al. (2000) have included shifting in their model due to its importance in understanding individual differences in shifting ability that may be influenced by people's ability to carry out a new operation in the light of proactive interference or negative priming, and not a simplistic reflection of the ability to adapt or not appropriate task sets *per se*. They have, also, suggested that parietal lobes and mid-brain may be responsible for managing shifting ability in visual attention, and the frontal lobes, including the anterior cingulate, to be responsible for controlling more domain general executive-oriented shifts. Additionally, they have included updating reflecting the processes involved in actively manipulating and replacing information in WM, as opposed to simply acting as a passive store for incoming information. Inhibition is included because it is associated with the long established behavioural inhibition function linked to the frontal lobes, and due to its role in purposely inhibiting dominant, automatic pre-potent responses when necessary.

Exploration of individual differences in EFs among young college students without any neuropsychological disorder, has demonstrated that each of the three components of EFs exist at the level of latent rather than manifest variables, and these latent constructs contribute differentially to the performance of higher level executive tasks that require complex cognition, such as the WCST and the TOH. While they appear to be separable in terms of their impact they have been found to be moderately correlated with one another consistent with at least some unitary function or aspect. Specifically, Miyake et al. (2000) have reported that the performance on the WCST is largely determined by the shifting ability. Inhibitory

ability selectively contributes to performance on TOH, and Random Number Generation (RNG; Peters, Giesbecht, Jellic, & Merckelbach, 2007) tasks. The updating process was implicated in the performance of the operation span task which requires the concurrent processing and serial storage of verbal information and is considered to measure verbal WM capacity. Among the higher level cognitive tasks assessed by Miyake et al, only RNG was associated with individual differences on more than one of the latent constructs and even here the separable nature of the processes were evident in that one of the two randomness output measures was related to updating while the other was found to be related to inhibition. Therefore, it is distinguishable that EFs are not only fractionated (unitary & non-unitary organised) but they are over-lapping to a moderate degree. Additionally, EFs are supported by different neural pathways, which have been found to underpin separable cognitive sub-processes (Miyake et al., 2000).

In order to, further, evaluate individual differences in EFs, Miyake and Friedman (2012) have provided four general conclusions. They have developed a new theoretical framework (unity/diversity framework) and concluded that individual differences in EFs indicate: i) both unity and diversity, ii) reflect considerable genetic contributions, iii) are associated with a variety of clinically and societally important phenomena, like successful dieting, and iv) show some developmental stability, like self-regulation.

As researchers have begun to focus on the assessment of EFs, the role of culture has been under consideration. Additionally, measures of EFs have been proposed in order to assess EFDs utilising laboratory-based and self-reported methodologies.

#### **4.4: Assessment of Executive Functions**

##### **4.4.1: Culture**

As has been mentioned previously, EF is a set of general-purpose control mechanisms that regulate and control the dynamic of human cognition and action; and has found to be often linked to the PFC (Miyake & Friedman, 2012). Therefore, EF is an important cognitive skill that controls and regulates a variety of abilities, like one's ability to make adaptive changes in one's complex physical and social environment. EF enables individuals to plan, execute, and monitor appropriate and relevant actions, and to inhibit irrelevant and inappropriate actions, for the achievement of a specific goal (Dempster, 1992; Welsh, Pennington, & Groisser, 1991).

From a neuropsychological perspective, cognitive biases are related to brain pathology (BP). Investigations based on cognitive abilities or performances have revealed that the disturbances in cases of BP are either partial or culturally biased (Fletcher-Janzen, Strickland, & Reynolds, 2000 for a review). A review of studies indicates that true biological differences in brain organisation between different



countries could account for discrepancies in their test performance. Also, race and ethnicity are correlates of other factors that affect brain functioning that accounts for between group differences (Brickman, Cabo, & Manly, 2006 for a review).

A growing body of research in behavioural studies (Kim et al., 2010), cognitive studies (Masuda et al., 2008; Chua, Boland, & Nisbett, 2005; Nisbett & Miyamoto, 2005; Nisbett & Masuda, 2003; Masuda & Nisbett, 2001; Nisbett et al., 2001), and neural studies (Han & Northoff, 2008; Hedden et al., 2008) have focused on cross-cultural differences in children and adults; because researchers are particularly interested to understand the role of culture in cognition as well as the developmental process in general (Moriguchi, Evans, Hiraki, et al., 2012; Kuwabara, Son, & Smith, 2011; Richland, Chan, Morrison, & Au, 2010 for reviews).

Although a variety of studies since the 1990s have explored potential cross-cultural differences in preschoolers, as it is well-documented that the PFC, which is involved in various higher cognitive functions such as planning, reasoning, and language comprehension, and these cognitive abilities change dramatically as a function of age throughout childhood and adolescence (Moriguchi et al., 2012; Lan, Legare, Ponitz, Li, & Morrison, 2011; Moriguchi, & Hiraki, 2009; Carlson & Meltzoff, 2008; Oh & Lewis, 2008; Sabbagh, Xu, Carlson, et al., 2006; Diamond, 2002; Zelazo & Muller, 2002), the impact of cultural-related differences on EFs among adults, especially to those without any neuropsychological disorder, remains elusive (Horton, 2008 for a review).

Regarding cultural-related differences among children, a recent study by Moriguchi et al. (2012) has investigated whether the performance of Canadian children would be comparable to that of Japanese children on cognitive shifting ability. Using the Dimensional Change Card Sorting (DCCS) they have indicated no cultural-related differences on DCCS task and the scores on the task have demonstrated that children from Canada and Japan perform similarly on shift.

Additionally, a study by Lan et al. (2011) has investigated the links between the sub-components of EFs (inhibition, shift, and WM) and academic achievement between Chinese and American preschoolers. The findings have revealed differences between Chinese and American preschoolers on shift, which shift has been assessed as an attentional control, and inhibition, with Chinese children to outperform in both than American children. The performance on WM was, however, comparable in both countries.

Regarding the origins of cultural differences in cognition in general and in EFs in particular among healthy adults, cultural psychologists have found that individuals from different countries differ on patterns of thinking and perception; with some cultures adopting a more analytic pattern, which is characterised by taxonomic and rule-based categorisation of objects, a narrow focus in visual attention, the use of formal logic in reasoning, and dispositional in causal attribution, and others a more holistic pattern that is characterised by thematic and family-resemblance based categorisation of objects, a focus on contextual information and relationships in visual attention, dialecticism, and an emphasis on situational causes in attribution (Nisbett et al., 2001).

An additional explanation for cross-cultural differences among healthy individuals has been proposed by Greenfield (1997). Greenfield (1997) has defined the role of culture in EFs as a polemic matter. His use of this terminology reflects the fact that culture is unquestionably related to the values and meanings, and modes of knowing that each culture adopts. For instance, some people may consider that in the Raven's Progressive Matrices test (Raven et al., 1998), the better response should be the one that follows a visual principle (i.e., the figure that looks better in that position) rather than a conceptual principle (i.e., the figure that continues the sequence).

Attempts to take due account of social and ethnic factors have informed the construction of a number of so-called culture-free tasks (Perez-Arce, 1999). In cross-cultural research, Armengol (2000) has found that EFs affect attentional processes recommending the need of further investigation in this field employing socio-cultural measures concerning biological process, such as activation and speed; and previous investigations have revealed poorer performance among ethnic minorities. For instance, researchers have found that people who are considered as ethnic minority have worse performance on tasks of visual confrontation (Carlson, Brandt, Carson, & Kawas, 1998; Ross, Lichtenberg, & Christenesn, 1995) and on tasks measuring non-verbal abilities (Miller, Bing, Selnes et al., 1993) than those people who are not considered as a minority.

Furthermore, a recent review based on the evolutionary origins of EFs by Ardila (2008) suggests that meta-cognitive EFs, including problem-solving, abstracting, planning, strategy development and implementation, as well as WM are mainly

dependent on culture and cultural instruments, usually known as conceptualisation instruments. Ardila has, also, argued that language, as well as written language as an extension of verbal language, may be the most important factors for exploring EFs cross-culturally. As for the behavioural components of EFs, which are mostly responsible for co-ordinating cognition and emotion, these are probably the result of a biological evolution shared by other primates (Ardila, 2008 for a review). Therefore, researchers must take into serious consideration the role of language in order to explore EFs among healthy adults cross-culturally.

#### 4.4.1a: The role of Language

According to Vygotsky (1934/1978), language is related to human's internal representation of thinking (Vygotsky, 1934/1978); and the most critical element of human language is the use of grammar that has been developed from action internalisation that allows individuals to use EFs (Ardila, 2006). It is documented that written language represents an extension of oral language; and the level of education has found to be one of the most important keys for the performance in psychometric EF tests (Ardila & Rosselli, 2007b; Ardila et al., 2000; Ostrosky et al., 1998; Reis & Castro-Caldas, 1997; Roselli et al., 1990; Ardila et al., 1989). For example, a study by Gomez-Perez and Ostrosky-Solis (2006) has revealed that although memory tests are sensitive to age norms, the tests measuring EFs have found to be associated with the level of education. Therefore, it can be

argued that the level of education, including the level from both oral and verbal language, is an important element for exploring EFs cross-culturally.

Regarding this conclusion, the current thesis aims to explore cross-cultural differences in EFs between English and Greek university students. Although there are extensive lists of EFs that could be under investigation for their elusive nature (Jurado & Rosselli, 2007 for a review), the current thesis has limited the discussion into the three major components of EFs (updating, shifting, and inhibition) included within Miyake's (2000) influential model for two main reasons. Firstly, because recent studies suggest that EF is not unitary (Garon, Bryson, & Smith, 2008; Miyake et al., 2000); and secondly because the BRIEF-A that is used within this thesis for the investigation of EFs conceptualises some of Miyake et al. EFs, such as inhibition and shifting in a real word context and in terms of everyday behaviours. To the best of the researcher's knowledge, there is only one study that has investigated the association between culture and cognitive processing in this cohort; the results have failed to demonstrate any relationship (Tapper et al., 2008). Consequently, the following discussion seeks to provide an account of the way in which these three specific components of EFs might be viewed cross-culturally within university students.

#### 4.4.1b: Updating

According to Miyake et al. (2000) updating requires monitoring and coding of incoming information and revising the items held in WM by replacing no longer relevant information with new more relevant information; and updating has found to be closely connected with the construct of WM (Miyake et al., 2000). WM is an important aspect as it allows people to actively hold information in mind for an appropriate period of time (Baddeley, 2002); and deficits in this aspect can have broad implications in people lives, affecting their ability to carry out complex activities (Roth et al., 2005).

From a cultural perspective, different theories based on how culture affects cognitive development suggest that culture is a factor that influences memory processes, including WM performance (Leong, 1996; Shore, 1996; Cacioppo & Berntson, 1992; Ratner, 1991; Resnick, 1991; Vigotsky, 1978); and deficits on WM could be due to the level of education, including the level of oral and verbal language, between the countries (Gomez-Perez & Ostrosky-Solis, 2006).

#### 4.4.1c: Shifting

Shifting refers to task-switching that involves moving backwards and forwards between multiple tasks, mental sets, or operations (Miyake et al., 2000). A variety of studies have differentiated two types of shifting: attention shifting and response shifting. The reason why there is this differentiation is because researchers are

keen to explore whether shifting involves selecting aspects of a stimulus or requires motor responses (Rushworth Passingham, & Nobre, 2002). Additionally, Roth et al. (2005) have defined shifting as behavioural shifting, which refers to an adult's ability to adapt their behavioural set in response to environmental or situational change; and as cognitive shifting, which is a key ability in terms of supporting flexibility in problem-solving behaviour. Therefore, deficits in this aspect can affect the person's ability to make transitions, switch or alternate attention, change focus from one mindset or topic to another, playing a vital role in problem-solving flexibility (Roth et al., 2005).

Deficits in shifting ability could be cross-culturally explained by the way individuals from different countries adopt an analytic or holistic pattern of thinking and perception. There is a growing body of research suggesting cultural-related differences on these dimensions between East Europeans and Americans. Findings of such studies have shown that Russian adults are more holistic in terms of attention and reasoning about change than Americans (Grossmann, 2009). In the same line of reasoning, Croats are more likely to show a holistic pattern of cognition in terms of attention (Varnum, Grossmann, Katunar, et al., 2009). Furthermore, it is clear that these differences exist within Europe. For instance, a study by Medzheritskaya (2008) has compared Russian and German adults and found that Russians are more likely to present deficits on attention than Germans.

#### 4.4.1d: Inhibition

Inhibition refers to the ability to deliberately inhibit dominant, automatic, or pre-potent responses (Miyake et al., 2000) and is often referred to inhibitory control (Roth et al., 2005). People who are impaired in inhibitory control have been found to show behaviours and attitudes related to impulsivity and compulsivity that are associated with a host of personal and social problems, such as obesity (Yucel, Fornito, Youssed, et al., 2012).

One main reason in studying inhibition cross-culturally is the extent to which WM is involved in carrying out inhibitory behaviours. It is documented that when WM demands for a given task and a given developmental level are high, the efforts to inhibit a pre-potent response are more likely to fail (Roberts & Pennington, 1996). An additional reason is the existing evidence that inhibition is associated with age-related deficits in language production (Burke, 1997); and as it has been mentioned previously, language is an important variable for exploring EFs cross-culturally (Ardila 2008).



## 4.4.2: Measurements of Executive Functions

### 4.4.2a: Laboratory Tasks

As has been mentioned earlier, the initial conceptualisation of EFs has found to be related with the manifestations of the frontal lobe syndrome. In this regard, laboratory-based instruments have been developed aiming to identify the impairments in components and sub-components of EFs. Table 4.2 provides a review of the most extensively used and well validated laboratory tasks of EFs.

Table 4.2: Review of Laboratory Tasks of Executive Functions

Laboratory-based Tasks	<u>Executive Functioning Processes</u>						
	Working Memory	Shift	Inhibit	Update	Planning	Initiate	Response Selection
<b>WCST</b>	*	*	*			*	
<b>TMT-B</b>	*	*					
<b>TOH</b>	*				*		
<b>Go/NoGo</b>			*				
<b>Reversal learning</b>	*	*					*
<b>Stroop</b>			*				*
<b>ANT</b>							*
<b>N-Back</b>	*						
<b>Keep Track</b>				*			
<b>Tone Monitoring</b>				*			
<b>Letter memory</b>				*			
<b>IGT</b>	*		*				*

Regarding Table 4.2, the WCST is a well-established laboratory task measuring WM, shifting ability, inhibitory control, and initiate. The Trail Making Test-Part B (TMT-B; Reitan, 1958) is the instrument to better predict WM and shifting ability. Both WCST and TMT-B have been widely validated in part due to their sensitivity to frontal-lobe lesions (Demakis & Harrison, 1997). The TOH has been found to be a well validated laboratory measure for the assessment of WM and planning ability. The Go/NoGo (Ratcliff, 1978) and the Stroop task (Stroop, 1935) are dependent on inhibition and have found to be extensively used in order to measure cognitive control. The usefulness of these measures is the selection of one's several possible answers to a given stimulus, as this usually involves the inhibition of response that is pre-potent. This pre-potent response is either due to the existence of a pre-existing well learned stimulus-response association (i.e., on the Stroop task the pre-potent response is the colour name while the required response is in the colour in which that name is printed) or due to being primed as part of the experiment (i.e., participants on switching task generates their specific answer on one trial, but the given answer is incorrect on the subsequent trial) (Suchy, 2009 for a review).

In terms of updating tasks, the N-Back paradigm has been designed to capture participant's ability holding and replace information in WM (Owen, McMillan, Laird, & Bullmore, 2005). As for the Keep Track, Tone Monitoring, and the Letter memory tasks involve the ability to successfully monitor and update WM representations (Miyake et al., 2000; Morris & Jones, 1990). Finally, the emotional decision tasks, like the Iowa Gambling Task (IGT) has been found to assess

impairments in WM functions such as response selection, and inhibition (Schneider, Wagner, Denburg, & Parente, 2007).

Over the years the extensive use of laboratory-based tasks has had its advantages. Laboratory instruments have been designed and refined in order to maximise sensitivity and specificity for separating the components of EFs. They can provide normally distributed scores, and are found to be especially resistant to previously learned abilities. Furthermore, they can provide strong internal validity, control over extraneous variables, and examine individual components of EF independently (Suchy, 2009).

However, laboratory-based tasks have several disadvantages in terms of their ecological validity and their prognostic value in assessing the role of EF in everyday functioning in non-routine situations (Gioia, Isquith, & Kenealy, 2008). Gioia and Isquith (2004) have pointed out the important role of EF's in directing and controlling real world behaviour. Consistent with this view, Goldberg and Podell (2000) have posited that laboratory tasks fail to measure the multidimensional decision making that is commonly demanded in real word situations.

With the intention of evaluating the bountaries of laboratory measures , self-report measures have been designed in order to capture individuals' EFs in the everyday enviroment. They can provide an ecologically and internally valid measure which assesses a broader range of EF's that laboratory tasks fail to fully reflect in a single assessment. Specifically, the Behaviour Rating Inventory of Executive Function for Adults (BRIEF-A; Roth, Isquith, & Gioia, 2005) self-report measure has been

developed to evaluate the behavioural manifestations of EFDs and capture the multiple interrelated domains of executive functioning as they occur within the daily environment (Bodnar, Prahme, Cutting, et al., 2007).

#### 4.4.2b: The BRIEF-A

BRIEF-A (Roth et al., 2005) is increasingly used as a self-report measure of EFs. It has been designed in order to provide a better understanding of an adult's self-control and problem-solving skills by measuring nine clinical aspects of EFs: Inhibit, Shift, Emotional Control, Self-Monitor, Initiate, WM, Plan & Organise, Task Monitor, and Organisation of Materials; with these nine aspects reflecting different abilities. Very briefly, as detailed discussion regarding BRIEF-A is provided within Chapter 6, the current questionnaire has been designed to capture adult's ability to cognitively manage attention and problem-solving; as well as to represent adult's ability to maintain appropriate regulatory controls of his/her behaviour and emotional responses.

The BRIEF-A has been extensively applied in research that focuses on ADHD (Toplak, Bucciarelli, Jain, & Tannock, 2009; Gioia, Isquith, Kenworthy, & Barton, 2002), bipolar disorders (Shear, del Bello, Rosenberg, & Strakowski, 2002), autism spectrum disorder (Gilotty, Kenworthy, Sirian, et al., 2002; Gioia et al., 2002), childhood epilepsy (Sherman, Slick, & Eyrl, 2006), traumatic brain injury (Gioia & Isquith, 2004; Gioia et al., 2002), and frontal lobe damage (Malloy & Grace, 2005). These studies demonstrate the utility of the BRIEF-A in

delineating how the behavioural manifestations of executive functioning in everyday life are affected by this broad range of clinical conditions.

While the BRIEF-A offers clear advantages over laboratory based tasks the relationship between the two classes of measure is yet to be fully understood. Several researchers have questioned if there is any association between the BRIEF-A and the laboratory tasks. On the one hand, existing evidence suggest that the BRIEF-A measures are not directly associated with specific laboratory-based tests of executive processes (Conklin, Salorio, & Slomine 2008; Rabin, Roth, Isquith, et al., 2006; Vriezen & Pigott, 2002). On the other hand, a number of studies have documented associations between the aspects of BRIEF-A and the laboratory tasks of EFs (Chang, Davies, & Gavin, 2009; Feifer & Ratton, 2007; Mares, McLuckie, Schwartz, Saini, 2007; Anderson, Anderson, Northam, et al., 2002). While the association with specific laboratory based tasks has yet to be fully investigated it is clear that the BRIEF-A is a reliable self-report measure capturing behavioural manifestations of executive functioning in the everyday environment, which laboratory-based tasks may not fully reflect.

## Summary

The CES and EFs have been the focus of Chapter 4. EFs have been described as an umbrella term reflecting a general-purpose system controlling a wide range of cognitive and behavioural processes and sub-processes, often linked to the PFC of the brain, that regulate the dynamics of human cognition and (Miyake & Friedman, 2012). Several theoretical models have been introduced over the years in order to better understand whether EFs are dependent on the frontal lobe, and whether EFs should be viewed as unitary or non-unitary. Baddeley's influential model of WM has been outlined and it is argued that it provides a useful theoretical framework for discussing the nature of executive processes. However, it fails to specify whether the functions of the CES are supported by unitary or non-unitary processes. Consequently, a new model has been introduced by Miyake et al. (2000), in order to capture the fractionated nature of central executive processes. Referring to Miyake et al's (2000) model, it is evident that while EFs are fractionated, they do over-lap to a moderate degree. Additionally, EFs appear to be supported by different neural pathways, which have been found to underpin separable cognitive sub-processes.

Neuropsychological assessments have documented cultural-related differences in EFs, particularly on cold components of EFs like WM (Ardila, 2008). Additionally, laboratory tasks have been recommended for CES-related research as they provide numerous of advantages, such as to maximise sensitivity and specificity for separating the components of EFs (Suchy, 2009). However, Goldberg and Podell (2000) have argued that laboratory measures fail to measure

the individual's multidimensional decision making that is commonly demanded in real world situations. Therefore, a very prominent self-report measure, the BRIEF-A (Roth et al., 2005), has been introduced in order to evaluate the behavioural and meta-cognitive manifestations of EFDs, and the multiple interrelated domains of executive functioning or self-regulation within daily environment.

EFs play a key role in the regulation of a wide array of behaviours, like AN and BN (Gillberg, Rastam, Wentz, & Gillberg, 2007; Duchesne, Mattos, Fontenelle, et al., 2004), obesity (Marcus & Wildes, 2009), and BED (Duchesne, Mattos, Appolinario, et al., 2010; Svaldi, Brand, & Tuschen-Caffier, 2010), as well as being associated with a variety of clinically and societally important phenomena, such as the successful implementation of dieting behaviour, and more generally self-regulation (Miyake & Friedman, 2012). This being the case, a fruitful area of investigation would be to evaluate the integrity of executive functioning in relation to dysfunctional eating behaviours (e.g., Kemps & Tiggemann, 2009), especially restrained eating (e.g., Ball, Singer, Kemps, & Tiggemann, 2010).

Therefore, Chapter 5 aims to provide a detailed account of executive functioning in non-eating disordered individuals who vary in terms of severity of eating, with a particular interest in restrained eating. Moreover, the mediating role of wide range variables, such as age, depression, alcohol, BMI, fluent intelligence, and preoccupying cognitions will also be considered.



## **Chapter 5: “Eating Psychopathology and Cognitive Functioning”**

### **Overview**

*Chapter 5 reviews the literature based on the role of executive functioning in people with severe eating. Green and colleagues have introduced a psychological explanation for impaired cognitive performance in which thoughts about dieting, body shape, food, and eating may place demands on the individual’s limited cognitive resources, such as WM, leaving fewer available for the performance of cognitive tasks. Studies have indicated that high self-reported levels of DR or reporting being on a diet are related with executive dysfunctions. Finally, age, BMI, alcohol, depression, preoccupying cognitions, and IQ have been found to partially mediate these impairments.*

### **5.1: Introduction**

Previous studies have documented that dieters and restrained eaters have lower cognitive capacity than controls (Higgs, 2007; Green, Elliman, & Kretsch, 2005; Kemps & Tiggemann, 2005; Shaw & Tiggemann, 2004; Bryan & Tiggemann, 2001; Green & Rogers, 1998; 1995; Green et al., 1997; Green, Rogers, Elliman, & Gatenby, 1994; Rogers & Green, 1993). One possible explanation for this

cognitive deficit (CD) concerns the impact of food restriction on the central nervous system (CNS), which reduces the concentration of glucose in the brain (Benton & Sargent, 1992). Inconsistent findings have been, however, reported by researchers. There are some studies supporting the relationship between blood glucose levels and cognitive performance (Benton & Sargent, 1992; Jones, Duncan, Brouwers, & Mirsky, 1991; Laessle, Bossert, Hank, et al., 1990) and other studies not (Green et al., 1997; Green, Elliman, & Rogers, 1995).

Consequently, Green and colleagues have proposed a psychological, rather than physiological, explanation for impaired cognitive performance in which thoughts about dieting, body shape, food, and eating may place demands on the limited cognitive resources, such as WM, leaving fewer available for the performance of cognitive tasks (Green et al., 2007; 2005; 2003; 2000; 1995). The conclusion is, therefore, that people differ greatly in their abilities to self-regulate eating-related thoughts and behaviours, as some individuals can resist the temptation to eat a forbidden food, mainly ice-cream, and other cannot, even when they are on a diet. A possible explanation can be the role of EFs that regulates the dynamics of human's cognition and action (Hofmann et al., 2012; 2007 for reviews).

## **5.2: Executive Functions and Dietary Restraint**

A growing body of literature has, recently, focused on the impact of dieting and DR that appears to influence the functioning of the CES. Specifically, it has been suggested that high self-reported levels of DR or reporting being on a diet are related to lower CES performance (Kemps & Tiggemann, 2005; Kemps, Tiggemann, & Marshal, 2005; Green et al., 2003; Vreugdenburg et al., 2003; Geen et al., 2000; Green & Rogers, 1998). Researchers have documented the association between severe eating and EFDs, particularly in relation to the phonological loop (Shaw & Tiggemann, 2004; Green et al., 2003; Green & Rogers, 1998) and central executive components of WM (Kemps & Tiggemann, 2009; Kemps et al., 2005; Green & Rogers, 1998). Additionally, previous investigations have observed that current dieters and restrained eaters, especially females, have been shown to display poorer sustained attention (Green et al., 1995), instantaneous free-recall (Green et al., 1994), as well as impairments related to switching (Higgs, 2007; Kemps et al., 2005) and inhibition (Hall, 2012; Nederkoon, Eijls, & Jansen, 2004). The basis of these cognitive impairments is thought to be due to the psychological mechanisms underlying the processes of being on a diet, and not to physiological consequences of weight loss (Kemps & Tiggemann, 2005; Kemps et al., 2005; Kretsch, Green, Fong, et al., 1997; Green et al., 1995). Therefore, EFs are important to study in DR-related research, because they are a core component of self-control and/or self-regulation ability, which has been shown to have broad and major implications for everyday lives.

Although there are extensive lists of EFs that could be under investigation for their elusive nature (Jurado & Rosselli, 2007), the current thesis has limited the discussion into the three major components of EFs (updating, shifting, and inhibition) included within Miyake's (2000) influential model for four main propositions. First of all, there is an assumption suggesting that these three components are associated with valuable mechanisms, such as active representation or self-regulatory goals and standards (updating), or flexible switching between different means sub-serving the same goal (shifting), or active inhibition of pre-potent impulsive (inhibition) when an individual is self-regulate his/her urge to eat in order to lose or maintain weight. Secondly, the cold components of EFs, such as updating that is closely connected with the construct of WM, may be related to the regulations of hot processes, such as food desires and cravings, as well as undesirable emotional experiences (Hofmann et al., 2012). Thirdly, recent studies suggest that EF is not unitary (Garon et al., 2008; Miyake et al., 2000); and finally, the BRIEF-A, which is used within this thesis, contextualises some of Miyake et al.'s (2000) EF, such as inhibition and shifting, in a real world context and in terms of everyday behaviours that may be more relevant to the investigation of these functions in the context of EDs in general and severe eating in particular. Therefore, the following sections summarise studies based on the broad role of updating, shifting, and inhibition within non-eating disordered individuals, with a particular interest in dieters and restrained eaters.

### 5.2.1: Updating

According to Miyake et al. (2000) updating requires monitoring and coding of incoming information and revising the items held in WM by replacing no longer relevant information with new more relevant information. This component is frequently measured by WCST, TMT-B, TOH, N-Back, IGT, or reversal learning tasks (Suchy, 2009). A substantial body of research, commonly adopted Baddeley's model of WM, identifies that dieters and restrained eaters are often impaired on WM referring to the updating component of EFs (Meule, Skirde, Freund, et al., 2012; Ball et al., 2010; Tiggemann, Kemps, & Parnell, 2010; Kemps, Tiggemann, & Grigg, 2008; Kemps & Tiggemann, 2005; Kemps et al., 2005; Shaw & Tiggemann, 2004; Green et al., 2003; Vreugdenbur et al., 2003; Jones & Rogers, 2003; Green & Rogers, 1998; Green et al., 1997; Kretsch et al., 1997; Green et al., 1995; 1994).

For instance, Kemps et al. (2005) based on Baddeley's model have investigated the relationship between weight-loss dieting and the functions of the central executive of WM. They have revealed that dieters performed poorer than non-dieters on all measures of central executive of WM, except on random generation task. Additionally, Kemps and Tiggemann (2005) have provided evidence that dieting to lose weight has an impact on components of WM, without to affect the storage capacity of the phonological loop and the visuo-spatial sketch pad. The findings from Vreugdenbur et al.'s (2003) study have indicated that females who currently dieting have worst performance on tasks that rely on WM and

individuals who are self-initiated weight loss diets may think about the process of dieting to the detriment of efficient WM processing.

Furthermore, Green et al. (1997) have tested the fundamental nature of the cognitive processing deficit associated with the spontaneous dieting behaviour between dieters and non-dieters with high and low-medium restrained eating style. They have demonstrated that although dieters showed comparatively smaller WM spans, they were better on attentional focus than highly restrained non-dieters; and this effect has found to be related to participants' self-rated desire to eat a forbidden food.

### 5.2.2: Shifting

Shifting refers to task-switching that involves moving backwards and forwards between multiple tasks, mental sets, or operations (Miyake et al., 2000), and is frequently measured by paradigms that allow inferring the time it takes participants to mentally switch between two or more simple task sets (Suchy, 2009). Roth et al. (2005) have defined shifting as behavioural shifting, which refers to an adults' ability to adapt their behavioural set of actions in response to environmental or situational change; and as cognitive shifting that is the ability to problem-solving in a flexible manner.

In DR-related research, studies have indicated that dieters and restrained eaters have deficits in their shifting abilities (Kemps & Tiggemann, 2009; Higg, 2007; Kemps et al., 2005; Green et al., 1995; 1994). However, the findings of such

investigations have provided an inconsistent picture. On the one hand, studies have revealed that individuals with severe eating are not impaired in their shifting abilities when compared to control subjects (Kemps & Tiggemann, 2009; Green et al., 1995). For instance, a study by Kemps and Tiggemann (2009) has examined attentional biases of chocolate cues in habitual (trait) chocolate cravers and the effect of experimentally induced (state) chocolate craving on such processing. The findings have indicated an attentional bias for chocolate cues; and the observed attentional bias has stemmed from difficulty in disengaging attention from chocolate cues rather than from a shift of attention toward such cues.

On the other hand, studies have found that DR has a deleterious effect on cognitive performance, and in shifting ability in particular (Higg, 2007; Kemps et al., 2005). For example, Kemps et al. (2005) have investigated the impact of weight-loss dieting on central executive components of WM, including task switching for measuring shifting ability between dieters and non-dieters. They have found that dieters perform worse than non-dieters on task switching, indicating that females who currently dieting to lose weight are impaired on their shifting abilities.

In addition to the above, a study by Green et al. (1994) has revealed that dieters have better performance on shift than non-dieters. Specifically, Green et al. (1994) have investigated if impairments of cognitive performance are associated with dieting. The findings have demonstrated that dieters have performed better on an undemanding finger tapping task than dieters with high restraint or low-medium restraint. This result indicates that females who currently dieting are not slower in

their motor responses or lack in motivation to carry out tasks, namely dieting is not associated with deficits on shifting.

### 5.2.3: Inhibition

As has been mentioned in Chapter 4 inhibition refers to the ability to deliberately inhibit dominant, automatic, or pre-potent responses (Miyake et al., 2000) and it is typically assessed with versions of Stroop, stop-signal, Go/NoGo tasks, or by WCST (Suchy, 2009). In DR-related literature there is an assumption suggesting that people, especially restrained eaters are frequently tempted by their impulses to indulge in taste, high calorie food, even though this behaviour is inconsistent with their weight control goals (Hofmann, Friese, & Roefs, 2009); and deficits on inhibition have found to play a key role (Nederkoorn et al., 2004).

Specifically, previous investigations have indicated that individuals with weaker inhibitory control are more likely to eat more high calorie and palatable food (Guerrieri, Nederkoorn, Schrooten, et al., 2009; Guerrieri et al., 2007), are more often described as unsuccessful dieters (Jansen et al., 2009), or overweight or obese (Nederkoorn, Guerrieri, Havermans, et al., 2009; Guerrieri, Nederkoon, & Jansen, 2008; Nederkoorn, Jansen, Mulken, & Jansen, 2007; Nederkoorn, Braet, van Eijs, et al., 2006) than individuals with more effective inhibitory control. More specifically, restrained eaters have found to overeat when their inhibitor control is low (Jansen et al., 2009) and when inhibitory control abilities are weak then food intake in restrained eaters is more strongly related to automatic impulses and less



strongly guided by DR standards (Hall, 2012; Janinska, Yasuda, Burant, et al., 2012; Nederkoorn, Houben, Hofmann, et al., 2010; Hofmann et al., 2009; Frieze, Hofmann, & Wanke, 2008; Hall et al., 2008; Hofmann & Frieze, 2008; Hofmann, Rauch, & Gaworonski, 2007).

For instance, a recent study by Hall (2012) using the Stroop and Go/NoGo tasks has examined the association between executive control resources (ECRs) and consumption of fatty foods among young, middle-aged, and older healthy adults in order to evaluate inhibitory control. The findings have revealed evidence for a positive relationship between ECRs strength and avoidance of fatty foods; and this behaviour has not been found to be related to age norms. Therefore, when ECRs, and inhibition in particular is not impaired, then individuals are less likely to consume fatty foods.

Additionally, a study by Jansen et al. (2009) has examined whether successful and unsuccessful restrained eaters differ in the way to inhibit motor responses (or impulsivity) via the stop-signal task. They have revealed a positive association between restraint and impulsivity as the findings have indicated that high-restrained eaters only overeat if they are also high impulsive.

Finally, Nederkoorn et al. (2004) have tested if restrained eaters act impulsive. Specifically, they have investigated if restrained eaters are characterised by a decreased ability to inhibit ongoing responses, and this decreased ability could explain the unsuccessful dieting of restrained eaters. Indeed, restrained eaters have performed worse on the stop-signal reaction task, suggesting that restrained eaters

have a specific impairment in response inhibition. Also, they have tested the assumption that food exposure increases the impulsivity of restrained eaters. The finding has, however, demonstrated no support for this assumption as the food exposure could not influence the ability to inhibit responses of the restrained eaters nor of the unrestrained eaters.

Taking into serious consideration the findings of previous investigations based on EFs and DR, it is understood that EFs are a set of general-purpose that controls the cognitive and behavioural processes and sub-processes of people with severe eating behaviours and attitudes, such as restrained eating. Therefore, deficits in updating (including WM), shifting, and inhibition affect people with DR to successfully and effectively manage their routine life activities, such as the successful dieting. However, previous studies investigating if impairments on EFs are associated with DR have found that this association is at least partially mediated by other behaviours and attitudes, such as age, BMI, alcohol, depression, preoccupying cognitions, and fluid intelligence.

## **5.3: Mediating Variables**

### **5.3.1: Age**

Age-related studies have indicated the impact of age differences regarding EFDs, for at least two reasons. First, the term of EFs has been often used synonymously with the frontal lobes. Executive functioning is, consequently, relevant to the frontal hypothesis of aging, in which a variety of age-related cognitive deficits (CD) have found to be related with an atrophy of the frontal lobes. Secondly, the term of EFs has been encompassed with concepts like WM (updating), inhibition, and attentional capacity. These concepts have been found to play an important role in theories of cognitive aging (e.g., Andres & van der Linden, 2001; Crawford, Bryan, Luszcz, Obonsawin, & Stewart, 2000; Souchay, Isingrini, & Espagnet, 2000; Parkin & Java, 1999; Phillips & Della Sala, 1998).

Previous investigations using neuropsychological tasks have reported that older adults without any medical condition perform worse than younger adults on many classic neuropsychological tasks of EF, including the WCST (Head, Kennedy, Rodrigue, & Raz, 2009; Rhodes, 2004), the Stroop task (Ludwing, Borella, Tettamanti, & de Ribaupierre, 2010; Davidson, Zacks, & Williams, 2003), verbal fluency tests (Salthouse, Atkinson, & Berish, 2003; Hughes & Bryan, 2002), and several tower tasks, such as TOH and TOL (Ronnlund, Lovden, & Nilsson, 2001; Andres & van der Linden, 2001).

Additionally, age-related differences have been indicated in a selection of studies employing cognitive tasks<sup>10</sup>. Again, older adults have shown poorer cognitive performance than younger adults on a variety of tasks measuring WM (Sander, Lindenberger, & Werkle-Bergner, 2012; Rowe, Hasher, & Turcotte, 2008; Rypma, Prabhakaran Desmond, & Gabrieli, 2001; Salthouse, 1992), inhibition (Jennings, Mendelso, Redfern, & Nebes, 2011; Mund, Bell, & Buchner, 2010; Earles, Connor, Frieske, et al., 1997), and switching attentional abilities (Eppinger, Kray, Mecklinger, & John, 2007; Monsell, 2003; Kray & Lindenberger, 2000).

In contrast to the above, existing reports have documented that age *does not* always play a crucial role in area of EFs for at least two important reasons. The first reason is the measuring component of EFs, as it has been reported that inhibition is not always related with an elderly population; thus older people are not impaired on all EF sub-processes. The second reason is the version of instrument using for the measurement of EFs. For instance, WCST is an instrument on which most of older adults perform well (Latzman & Markon, 2010; Hull, Martin, Beier, et al., 2008; Bryan & Luszcz, 2000; Miyake et al., 2000).

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<sup>10</sup> The main principle of cognitive tasks is to measure executive-control processes referring to WM (e.g., span tasks, N-Back), inhibition of pre-potent responses (e.g., Stroop, Negative priming), and switch of attention (e.g., Switching-tasks paradigms).

### 5.3.2: BMI

There is a substantial body of research suggesting a relationship between elevated BMI and EFDs. Evidence suggests that obese children without any apparent neuropsychological disorder show more impulsivity, lack cognitive control, exhibit mental inflexibility, and lack perseverance (Gunstad, Spitznager, Paul, et al., 2008; Braet, Claus, Verbeken, & van Vlierberghe, 2007; Cserjesi, Luminet, Molnar, & Lenard, 2007).

In healthy adults, especially females, it has been documented that high levels of BMI are associated with poor cognitive performance, independently from age and endocrinology (i.e., hypertension and diabetes) (Walther et al., 2010; Cournot, Marquie, Ansiau, et al., 2006; Elias, Elias, Sullivan, et al., 2003). Specifically, it has been documented that overweight and obese adults exhibit poorer performance in the areas of EFs (Cserjesi, Luminet, Poncelet, & Lenard, 2009; Volkow, Wang, Telang, et al., 2009; Boeka & Lokken, 2008; Gunstad, Paul, Cohen, et al., 2007), attention and memory (e.g., Cournot et al., 2006).

In contrast, there are studies suggesting no effect of BMI in EFs (Sweat, Starr, Bruehl, et al., 2008; Kemps et al., 2005; Ward, Carlsson, Trivedi, et al., 2005; Green et al., 2003) or even a positive relationship between BMI and EFDs, namely elevated BMI to be associated with better cognitive performance (Kuo, Jones, Milberg, et al., 2006). For instance, Wolf, Beiser, Elias, et al. (2007) have observed that overweight and obese middle-aged individuals have better learning and memory abilities, as well as EFs than normal-weight individuals.

### 5.3.3: Alcohol

It is documented that chronic heavy alcohol users show poor neuro-cognitive performance on tasks designed to measure EFs, including WM, switching, and inhibitory control (Montgomery, Fisk, Murphy, et al., 2012 for a review). Specifically, a recent paper by Montgomery, et al. (2012) provides a systematic in depth review of previous studies into the effects of alcohol consumption on EFs in social drinkers (Study 1). In addition, the paper included a laboratory-based investigation of the relationship between alcohol consumption and EFs (as defined in Miyake et al.'s 2000 model) in a sample of non-clinical heavy social alcohol users (Study 2). While the findings from Study 1 failed to provide evidence for EFDs in social drinkers, Study 2 revealed that, relative to light alcohol users, non-clinical heavy social drinkers showed poorer EF performance, specifically on word fluency, inhibitory control, and switching. However, Nederkoorn, Baltus, Guerrieri, and Wiers (2009) found that light social alcohol users do not differ from chronic heavy drinkers in terms of inhibitory control. The conclusion is, therefore, that alcohol can partially influence individual's performance on EFs.

### 5.3.4: Depression

There is a considerable body of research investigating the relationship between depressive episodes and EFDs, specifically deficits in updating, shifting, and cognitive inhibition (Gohier, Ferracci, Surguladze, et al., 2009; Micco, Henin, Biederman, et al., 2009; Clark, Sama, & Goodwin, 2005; Harvey, Le Bastard,

Pochon, et al., 2004). Although it has been thought that depression-related EFD is dependent on age, namely more EFDs in older depressed individuals (Lockwood, Alexopoulos, & van Gorp, 2002), research by Channon & Green (1999) and Channon (1996), using the Beck Depression Inventory, suggests that EFDs are, also, present within young patients with dysphoria aged between 20 to 40 years old; as well as those with less severe depression. Moreover, while Smoller, Wadden, and Stunkard (1987) found that depression can influence dieting-related differences in EFs other research has contradicted this (Kemps et al., 2005; Green et al., 2003; Green & Rogers, 1998). Despite the ambiguity in the results it seems reasonable to assume that depression is potentially an independent factor that may affect the individuals' performance in tasks tapping EFs.

### 5.3.5: Preoccupying Cognitions

Dieting has been found to be associated with an increased preoccupation with thought about food, eating, weight, and body shape (Jones & Rogers, 2003; Rogers & Green, 1993). Specifically, Green and Rogers (1995) have suggested that these preoccupations give rise to intrusive thoughts which consume cognitive resources, leaving fewer of these to cope with additional cognitive demands. Therefore, cognitive tasks, particularly those dependent on WM capacity should be affected as preoccupying cognitions are thought to compromise the functioning articulatory loop and central executive aspects of WM system (Baddeley, 1997). This possibility has been supported by Green and Rogers (1998) who found that current

dieters performed worse than non-dieters on STM for letter sequences, (phonological loop) and planning times on TOL task (central executive), although not on a mental rotation task (visuospatial sketchpad). Additionally, a positive association between concern over body shape and planning times on the TOL has been revealed.

Therefore, preoccupation with thoughts regarding food, eating, weight, and body shape is a potential negative consequence of DR (Polivy & Herman, 2002; Cogan & Ernsberger, 1999; Green & Rogers, 1998; 1995) which may at least in part underpin impairments in the central executive components of WM (King, 2012; Hollit et al., 2010; Tapper & Pothos, 2010; Green, Elliman, & Kretsch, 2005; Kemps & Tiggemann, 2005; Kepms, et al., 2005; Shaw & Tiggemann, 2004; Green, Jones, Smith, et al., 2003; Jones & Rogers, 2003; Vreugdenburg et al., 2003; Bryan & Tiggemann, 2001; Green & Rogers, 1998; Warren & Cooper, 1998; Green, Elliman, & Rogers, 1997; Green & Rogers, 1995; Rogers & Green, 1993).

### 5.3.6: Fluid Intelligence

Previous studies based on intelligent behaviour and EFs have documented a mediating and moderating relationship between them (Roca, Manes, Chade, et al., 2012 for a review). For instance, Damasio & Anderson (1993) and Milner (1982) have investigated this relationship, but the findings have revealed that frontal lesions do not necessarily impair IQ. Additionally, in adults-related studies have



indicated that IQ is not considerably associated with EFs measures (Johnstone, Holland, & Larimore, 2000; Donders & Kirsch, 1991).

It may be that some types of EFs are related to IQ more than others. Specifically, it is documented that neuropsychological measures evaluating concepts such as problem-solving ability, mental efficiency, and language-related skills appear to be more strongly associated with IQ performance, while simple motor, constructional, and perceptual tasks are less so (Seidenberg, Giordani, Berent, & Boll, 1983 for a review).

A study by Friedman, Miyake, Corley, et al. (2006) has revealed that updating tasks, namely those tasks that require adding and deleting information in WM, are highly correlated with IQ (as measured by the WAIS Full-Scale IQ and selected subtests, and Ravens Progressive Matrices). Regarding inhibiting tasks (i.e., tasks that requiring suppressing automatic responses), or shifting tasks (i.e., tasks requiring shifting between subtasks), Friedman et al. (2006) have revealed that these are not strongly related to intelligence. The researchers have concluded that WM and updating ability requires an individual to maintain his/her attention in order to process relevant information and ignore irrelevant details. This manner corresponds to Binet's definition of intelligence<sup>11</sup>.

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<sup>11</sup> Binet's definition of intelligence suggests that individuals first perceive their world, then they log on perception in memory, and lastly they rework them (Becker, 2003).

#### **5.4: Methodological Issues in the existing field of research**

Although the existing literature has provided fruitful findings for the impact and/or role of dieting and/or restrained eating on central executive performance, there are some methodological issues that future research must take into serious consideration. One of the most important methodological issues highlighted within this area of research is the increasing adoption of Baddeley's Model of WM. As it has been discussed in Chapter 4, this model does not directly address whether the functions of the CES are performed in a unitary or non-unitary manner, while Miyake et al.'s Model of EF directly addresses this aspect. Additionally, Miyake et al.'s Model is needed to be further evaluated within the area of DR, as the three broad components of EFs included within this model (updating, inhibiting, and shifting) support important mechanisms in an individual's self-regulatory goal pursuits. Such as mechanisms can be the (down)-regulation of unwanted affect, desires, and cravings (WM operation), active inhibition of pre-potent impulses and habitual (behavioural inhibition), as well as the flexibility switching between different means subserving the same goal (task-switching) (Hofmann et al., 2012).

Another methodological issue is the extensive use of laboratory tasks. It is documented that laboratory-based investigations do not measure the individual's multidimensional decision making processes which play a key role in real world situations. Self-reported measures like the BRIEF-A (refer to Chapter 4 for details), can address this omission.

Finally an additional issue observed within this area of investigation is that most of the previous studies have classified their participants as dieters or non-dieters with a question asking “*Are you currently on a diet to lose weight?*” and with an answer Yes or No; as well as with the scores assessed by the RS-R (Ball et al., 2010; Tiggemann et al., 2010; Walther et al., 2010; Kemps et al., 2008; Steel et al., 2006; Green et al., 2005; Kemps & Tiggemann, 2005; Kemps et al., 2005; 2005; 2004; Shaw & Tiggemann, 2004; Healy et al., 2003; Vreugdeburg et al., 2003; Jones & Rogers, 2003; Green et al., 1995). Although the findings of such investigations appear promising, this can be considered as a methodological issue because these studies do not measure pure restraint, as an alternative measure like the DEBQ-R does; and therefore they cannot really claim any impact of restrained eating on components of the central executive.

## **Summary**

As EFs are a core component of self-regulation ability having broad and important implications for everyday lives, Chapter 5 has reviewed the literature based on the role of EFs in people with DR. An evolving perspective from Green and colleagues suggests that impaired cognitive performance arises when thoughts about dieting, body shape, food, and eating place demands on the limited cognitive resources, such as WM, leaving fewer available for the performance of cognitive tasks.

A variety of studies have established an association between high self-reported levels of DR and lower performance on the CES, particularly in relation to the phonological loop and central executive components of WM. Current dieters and restrained eaters, especially females, have been found to display deficits in WM, inhibition, and set-shifting ability; as well as poorer sustained attention and instantaneous free-recall. Therefore, EFDs and DR may interact affecting the ability of dieters and restrained eaters to successfully and effectively regulate their routine daily activities. In addition, studies have provided evidence for the partial role of age, BMI, alcohol consumption, depression, preoccupying cognitions, and fluid intelligence mediating the relationship between lower EF performance and DR.

Based on the evidence provided within Chapter 5 and in the previous chapters, the current thesis aims to further explore whether non-clinical females with a self-reported restrained eating style exhibit deficits in self-reported components of EFs and if so whether the extent of any deficits vary cross-culturally. Additionally, the potential mechanisms underlying central executive impairments are taken into consideration (refer to Chapter 8).

## **Chapter 6: “Methodology”**

### **Overview**

*Chapter 6 outlines the methodology employed within the present research. Therefore, information regarding the design, participant selection, materials used, and the general procedure adopted in the current study has been set out; and ethical considerations are reviewed. Finally, internal reliability of the scales is reported.*

### **6.1: Empirical Study-Design**

A quantitative methodology has been adopted for the present study, with nationality (English vs. Greek) and DEBQ-R (restrained eaters vs. unrestrained eaters) groups as between-subjects factors (Independent variables; IVs), and scores of BRIEF-A (nine-clinical sub-scales) as multiple dependent variables (DVs). Background measures including age, BMI, alcohol consumption, depression, preoccupying cognitions, and fluid intelligence have been included as covariates in order to evaluate their role in determining the relationship between the IVs (nationality & DEBQ-R) and DVs (BRIEF-A).

## **6.2: Study Population**

Participants were eligible to take part if they were University students (English who live in the UK and Greek who live in Greece). The final sample was determined according to those who met the specific criteria set out below.

### **6.2.1: Specific Criteria**

Due to gender- and cultural-related differences in DR and EFs, only females were included in the sample. Those who were i) currently or previously diagnosed with an ED, ii) presently diagnosed with any neuro-psychological disorder, and iii) currently using medication (e.g., antidepressants) were excluded from the sample.

## **6.3: Data Collection Instruments**

Six questionnaires are administered, in the following order:

### **6.3.1: Demographic Questionnaire**

Demographic questionnaires were used to collect participants' characteristics in relation to nationality, age, years of education, height and weight (used to calculate BMI), as well as alcohol consumption (units p/w). Questions regarding current medical problems and use of medication, as well as a question "*Are you currently on a diet to lose or maintain your weight?*", have been, also, included (Appendix 6.1).

### 6.3.2: Dutch Eating Behaviour Questionnaire-Restraint (DEBQ-R; van Strien et al., 1986)

The main goal of the DEBQ-R (Appendix 6.2) is to investigate degrees of restrained eating (e.g., “*Do you try to eat less at mealtimes than you would like to eat?*”). It is comprised of 10 non-reversed items, scored from 1 (never) to 5 (very often). A high level on this scale indicates that people intend to limit their food intake, but often indulge in exactly those foods they want to avoid. The DEBQ-R has been found to be a reliable instrument among the general population (Ahern, Field, Yokum, et al., 2010; Larsen, van Strein, Eisinga, et al., 2007; Alison, Kalinsky, & Gorman, 1992; van Strein et al., 1986). In the present study Cronbach’s  $\alpha$  is .95 (English), .89 (Greek), and .91 (Total). A median split of the total score is used in order to classify participants as restrained or unrestrained eaters. For the current data Median is reported at 27 (restrained eaters  $\geq 27$ ; unrestrained eaters  $< 27$ ).

#### 6.3.2a: Median Split

Use of median split has its advantages in research as it allows the researcher to compare groups of individuals who score relatively high or low on the measure, as well as it allows for the more effective treatment of multiple DVs. The median is also unaffected by extreme scores. Many experimenters find this characteristic to be useful in studies in which extreme scores occasionally occur. Also, the

calculation of the Median does not require any assumptions about the interval properties of the scale (Howell, 2010).

The original experiment of counter-regulatory eating (Herman & Mack, 1975) has used Median splits of the restraint scores in order to allocate the sample to high (restrained eaters) and low (unrestrained eaters) restraint groups. Many subsequent studies have continued this dichotomization though a median split based on whether subject's score above or below to the median on DEBQ-R [e.g., Ahern et al., 2010 (Median  $\geq 25$ ); Ball et al., 2010 (Median  $\geq 25$ ); Hollitt et al., 2010 (Median  $\geq 28$ ); Tiggemann et al., 2010 (Median  $\geq 23$ ); Veenstraa & de Jonga, 2010 (Median  $\geq 30$ ); Kemps et al., 2005 (Median  $\geq 26$ )]. Here it should be mention that the median split for each data depends on the size and the characteristics of the data.

### 6.3.3: Behavior Rating Inventory of Executive Function-Adult Version (BRIEF-A; Roth et al., 2005)

The BRIEF-A (Appendix 6.3) is a self-report measure of EFs. It has been designed to be completed by adults between the ages of 18 and 90 years with a minimum fifth-grade reading level. Analysis of the normative data indicates that the BRIEF-A is unbiased with respect to race/ethnicity and that there are no differences based on gender. Additionally, the BRIEF-A has been developed to provide a better understanding of an adult's self-control and problem-solving skills. It consists 75-items, scored from 1 (never) to 3 (often), which are allocated to nine sub-scales



measuring different aspects of EFs: Inhibit, Shift, Emotional Control, Self-Monitor, Initiate, Working Memory, Plan & Organise, Task Monitor, and Organisation of Materials.

### 6.3.3a: Clinical sub-scales

**Inhibit** is the sub-scale measuring the adult's inhibitory control, namely the ability to inhibit, impulses, or resist, as well as the ability to stop one's behaviour at the appropriate time (8-items; e.g., *"I am impulsive"*). Adults with poor performance on this sub-scale may have the tendency to interrupt and disrupt group activities, and a general failure to *"look before leaping"*.

The **Shift** sub-scale generally examines the adult's flexibility in order to make transitions, tolerate change, problem-solving, and to move without any difficulty from one focus or topic to another (6-items; e.g., *"I have trouble changing from one activity to another"*). This sub-scale incorporates items referring to behavioural and cognitive shifting. Behavioural shifting ability is defined in terms of the respondent's ability to adapt their behavioural set or actions in response to environmental or situational change. Cognitive shifting is defined as the ability to problem-solve in a flexible manner. Routine changes can result in heightened anxiety and anger responses, which may be reflected in the Emotional Control, whereas adults with difficulties in cognitive shifting may be described as stubborn, rigid, or inflexible in their thinking and as having difficulty generating ideas for problem-solving.

**Emotional Control** is the ability that modulates the expression and regulation of one's emotion (10-items; e.g., "*I have angry outbursts*"). Individuals with poor emotional control may be viewed as having emotional instability or emotional explosiveness.

The **Self-Monitor** sub-scale measures one's ability to keep track of the effect of a particular behaviour on others and more generally to attend to one's own behaviour in social contexts (6-items; e.g., "*I say things without thinking*"). Problems with self-monitoring ability are described in terms of failing to appreciate or have an awareness of one's own social behaviour and the effect this might have on others.

**Initiate** refers to the ability to begin a task/activity, and to independently generate ideas, responses, or problem-solving strategies (8-items; e.g., "*I lie around the house a lot*"). People with such problems typically want to succeed at a task, but they cannot get started. Also, impairments on Initiate might be a secondary consequence from individuals who experienced other types of EFDs. For instance, individuals who are very poorly organised can become overwhelmed with large tasks, affecting them to begin the task.

The **WM** sub-scale describes the capacity of holding information in mind in order to complete a specific task. It is the ability to encode and store information or generate goals (8-items; e.g., "*I forget instructions easily*"). Individuals, who score high on this sub-scale, usually have problems remembering things even for a few minutes, lose track of what they are doing as they work, or forget what they

are supposed to do. Therefore, they have difficulties that involve problems “*sticking to*” an activity for an appropriate amount of time. Additionally, individuals who self-reported higher scores on WM sub-scale might be impaired on sustained attention (e.g., “*I forgot what I am doing in the middle of things*”).

**Plan & Organise** are the abilities relating to components of problem-solving (10-items). Specifically, planning is the ability to set a goal and to determine the best way in which to achieve it (e.g., “*I don’t plan ahead for task*”). Organise refers to the ability either orally or in writing to order information effectively and to appreciate the relevance of salient ideas and key concepts (e.g., “*I get overwhelmed by large tasks*”). Individuals with poor performance on this sub-scale might face difficulties in respect of managing current and future-oriented task demands within the situational context.

The **Task Monitor** subscale involves the ability to check ongoing work activities and to assess the adequacy of performance during and after completing the work in order to confirm that the task has been completed in a satisfactory manner (6-items; e.g., “*I make careless mistakes*”). Adults with high scores on this sub-scale fail to appreciate or are unaware of their own performance errors during such activities as problem-solving.

The **Organisation of Materials** is the ability to keep places or materials in an orderly and accessible state (8-items; e.g., “*I am disorganized*”). Individuals with troubles in this area cannot function efficiently at work or at home because they

often misplace needed objects or do not have their belongings readily available for their use.

### 6.3.3b: Indexes & Global Executive Composite

These nine-clinical sub-scales are combined within two broader indexes, the Behavioural Regulation Index (BRI) and the Metacognition Index (MI); as well as an overall summary score, the Global Executive Composite (GEC) which summarises the 75-items. Specifically, the BRI incorporates the Inhibit, Shift, Emotional Control, and Self-Monitor sub-scales. It represents an adult's ability to maintain appropriate regulatory control of his/her behaviour and emotional responses. For instance, it includes the inhibition of thoughts and actions, flexibility in shifting problem-solving sets, modulation of emotional responses, and monitoring of one's actions. The MI includes the Initiate, WM, Plan & Organise, Task Monitor, and Organisation of Materials sub-scales. It represents an adult's ability to systematically solve problems through planning and organisation, while sustaining these task-completion efforts in active WM. It refers directly to the ability to problem solve actively in a variety of contexts, namely the ability to cognitively manage attention and problem-solving. Finally, the GEC is a summary unitary measure of EFs.

### 6.3.3c: Assessing Reliability

As an ecologically valid instrument for the assessment of EFDs, evidence for the reliability, validity, and clinical utility of the BRIEF-A has been accumulating. Internal consistency is important for the reliability of the BRIEF-A. It reflects the degree to which items on a single scale are measuring the same underlying construct. For self-report form normative sample,  $\alpha$  coefficient ranged from .73 to .90 for the nine-clinical sub-scales. The reliability and validity of BRIEF-measuring EFs in everyday life, is also supported by a numerous studies (e.g., Slick, Lautzenhiser, Sherman, & Eyrl, 2006). Table 6.1 provides the  $\alpha$  coefficient for the current data.

Table 6.1: Alpha Coefficient

Alpha Coefficient			
	English	Greek	Total
<b>BRIEF-A Subscales</b>	<b>(N=52)</b>	<b>(N=152)</b>	<b>(N=204)</b>
Inhibit	.75	.67	.96
Shift	.75	.74	.74
Emotional Control	.94	.88	.9
Self-Monitor	.79	.74	.76
Initiate	.85	.76	.8
Working Memory	.88	.69	.78
Plan & Organise	.87	.78	.82
Task Monitor	.85	.68	.76
Organisation of Materials	.94	.84	.89

### 6.3.3d: Assessing Validity

The BRIEF-A contains, also, three validity scales: Negativity, Infrequency, and Inconsistency. The Negativity scale measures the extent to which the participant responds in an unusually negative manner (i.e. 3). A total score of  $\geq 6$  is problematic. The Infrequency scale measures the extent to which adults endorse items in an atypical fashion, and includes items that are likely to be endorsed only

in one direction by most people. For instance, the endorsement of Item 10 (*“I forget my name”*) is highly unusual, even for adults with severe cognitive impairment. Scores on this scale range from 0-5, with a score of  $\geq 3$  considered to be problematic. The Inconsistency scale reveals the extent to which the respondent answers similar BRIEF-A items in an inconsistent manner, relative to respondents in the combined normative and mixed clinical/healthy adult data. For instance, Item 2 (*“I make careless errors when completing tasks”*) versus Item 41 (*“I make careless mistakes”*). Inconsistency scores can range from 0-20, with scores of  $\geq 8$  considered to be problematic.

### 6.3.3e: Missing Responses

Regarding the BRIEF-A, the protocol should be deemed invalid if there are unanswered items  $>14$  for any given individual. If more than one item on the Shift, Self-Monitor, or Task Monitor sub-scales is missing, then a raw score should not be calculated. If more than two items on the Inhibit, Emotional Control, Initiate, WM, Plan/Organise, and Organisation of Materials sub-scales are missing, then a raw score should not be calculated for the specific sub-scale. If a score can be calculated, a score of 1 should be assigned to the unanswered item before a total for the sub-scale is calculated (1=*never*, 2=*sometimes*, 3=*often*).

#### 6.3.4: Preoccupying Cognitions (Vreugdenburg et al., 2003)

The Preoccupying cognitions questionnaire (Appendix 6.4) is a self-report measure evaluating adult's experiences/thoughts about food (4-items; e.g., *"I spend most of the day thinking about food"*), diet (2-items; e.g., *"I am aware of the sugar and fat content in foods"*), and body shape (14-items; e.g., *"I am scared about being over-weight"*) over the past month. This 20-items measure ranges from 1 (never) to 6 (always), and a total score of preoccupying cognitions is obtained by summing these items. Researchers are allowed to use either the total score of preoccupying cognitions which ranged from 20 to 120; or the three sub-scales: i) diet preoccupation, ranged between 2 to 12, ii) food preoccupation, ranged between 4 to 24, and iii) body shape preoccupation, ranged between 14 to 84. High scores indicate higher levels of preoccupation.

This questionnaire has excellent internal reliability. According to Vreugdenburg et al. (2003) the reliability for the total measure has been reported at .96, and for each sub-scale the reliability has been reported at .94 (Food), .7 (Diet), and .97 (Shape). The present research has employed only the overall score of the questionnaire. Internal reliability for the present data reported at .97 (English), .97 (Greek), and .97 (Total).



### 6.3.5: Centre for Epidemiologic Studies-Depression (CES-D; Radloff, 1977)

The CES-D (Appendix 6.5) is a self-report measure assessing depressive feelings and behaviours over the past month. This 20-item measure assesses the prevalence of depressive symptoms *“During the past week”* on a four point scale from 0 (rarely or none of the time; less than 1 day) to 3 (most or all of the time; 5-7 days). The measure captures six major dimensions of depression: i) Depressed mood (e.g., *“I felt depressed”*), ii) Feelings of guilt and worthlessness (e.g., *“I felt that people dislike me”*), iii) Feelings of helplessness and hopelessness (e.g., *“I felt hopeful about the future”*), iv) Psychomotor retardation (e.g., *“I could not get going”*), v) Loss of appetite (e.g., *“I did not feel like eating; my appetite was poor”*), and vi) Sleep disturbance (e.g., *“My sleep was restless”*). Besides the six dimensions of depressive symptoms, the questionnaire includes 4-items in the positive direction to break tendencies toward response set and to determine positive affect or its absence (e.g., *“I was happy”*).

The total score for the CES-D is obtained by summing all questions, with a possible score ranging from 0 to 60. Questions 4, 8, 12, and 16 are reverse scored. A high score indicates higher levels of depressive symptoms. In particular, a score lower than 15 indicates that the participant does not appear to be experiencing high levels of depressive symptoms at this time. A positive score between 15 and 21 suggests that participants might appear to be experiencing some symptoms of mild to moderate depression; and a score higher than 21 indicates that participant might

appear to be experiencing a high level of depressive symptoms associated with major depression. It must be mentioned here that for the present research the continuous values have been used for the analysis, rather than classifying the sample into categories.

The CES-D has very strong internal reliability according to Radloff (1977), ranging between .84 and .9. Internal reliability for the present sample has been reported at .94 (English), .91 (Greek), and .92 (Total).

#### 6.3.6: Raven's Advance Progressive Matrices-SET I (Raven et al., 1998)

SET I (Appendix 6.6) has been employed in order to assess fluid intelligence. It includes 12-three by three matrix arrangements of complex geometric figures with one element missing; and is a non-verbal multiple choice measure of reasoning. For each of the 12-items, the participant is asked to identify the missing element that completes a pattern, with the potential to score  $12/12$ . Figures are presented in black ink on a white background, and become increasingly difficult as progress is made through each set. A higher score indicates a responder's ability to perceive and think clearly, make meaning out of confusion, and formulate new concepts when he/she faced with novel information.

## **6.4: Data Collection Procedure**

The present study has been advertised in UK via participation tool (SONA) and posters which have been posted around the School of Psychology (UCLan); and in Greece via oral presentations and posters around the School of Psychology of the Aristoteleion University. Volunteers have completed either the paper-based version or a computer-based version that was created using SurveyGizmo in individual lab rooms located at the Universities. Year 1 and 2 undergraduate students attending at UCLan have been awarded with four participation credits though SONA. The data have been collected over a period of five months (October 2011-February 2012). Briefing (Appendix 6.7a) and debriefing (Appendix 6.7b) have been given to all participants by the researcher.

### **6.4.1: Ethical Consideration**

Written permission to conduct the current study has been obtained from the Ethics Committees of UCLan and the Aristoteleion University of Thessaloniki. Participants provided informed verbal consent prior to completing the questionnaires. They were informed of their right to decline to participate, and to withdraw from the study if they wished to do so. However, it was made clear to participants that due to the anonymity of the responses withdrawal was only possible before the submission of the online survey or before the printed answer booklet had been placed in the sealed container.

Anonymity and confidentiality have been maintained throughout this study. Anonymity has been ensured by not obtaining participant's name or other related information, such as home address, contact number, etc. Confidentiality has been maintained by keeping the data confidential and not revealing volunteers' identities when reporting or publishing the study. Furthermore, no directly identifying information has been entered onto the answer booklet. Lastly, participants were fully debriefed and the researcher's and the Director of Studies' contact details were provided.

## **Summary**

Chapter 6 describes the research's methodology, including the design, sample, data collection instruments and procedure, as well as strategies used to ensure the ethical standards of the current research. The reliability of the scales used within this thesis has been reported; all of the measures meet Nunnally (1978) criteria in the present sample (Appendix 6.8). The following chapter, Chapter 7, provides all the appropriate information regarding data preparation and preliminary analysis.

## **Chapter 7: “Data Preparation & Preliminary Analysis”**

### **Overview**

*Chapter 7 outlines the appropriate procedures conducted before the main analysis. Thus, details for data preparation as well as a preliminary analysis are provided.*

### **7.1: Data Preparation**

After the collection of the data, data have been inputted into SPSS (version 17.0).

#### **7.1.1: Screening & Cleaning the Data**

A total number of 253 University students have taken part in the current study. Following the application of the exclusion criteria (refer to Chapter 6; 6.2.1), the data for 207 females were retained (52 English & 155 Greek), with an overall age range from 18 to 52 years old ( $M=22.41$ ;  $SD=5.14$ ) (Appendix 7.1).

### 7.1.2: Missing Values Analysis

Missing data analysis has been performed to determine if data are missing at random or not. Three cases were deleted, as they were missing not at random. No other variables with 5% or more are missing at random (Appendix 7.2). Therefore, the final data are consisted of 204 females (52 English & 152 Greek).

### 7.1.3: PMS Procedure

Missing data have been replaced by using Person Mean Substitution (PMS; Roth, 1994) x sub-scale (where applicable) for all variables, with the exception of the BRIEF-A sub-scales. For BRIEF-A, no participant had >14 missing responses, namely more than one item on the Shift, Self-Monitor, or Task Monitor sub-scales, or more than two items on the remaining sub-scales (Inhibit, Emotional Control, Initiate, WM, Plan/Organise and Organisation of Materials). As recommended, a score of 1 has been assigned to any unanswered item before a total for the sub-scale is calculated (Roth et al., 2005).

## 7.2: Preliminary Analysis

Data screening has been conducted to explore the data for Multivariate and Univariate outliers, as well as to assess normality. Based on Mahalanobis distance (MAH\_1) it was determined that data were free from Multivariate outliers (Appendix 7.3). Inspection of Boxplots have revealed Univariate outliers on Inhibit, Self-Monitor, Initiate, WM, and Plan/Organise of BRIEF-A. The researcher has made the appropriate amendments and the amended Inhibit sub-scale is free from outliers. No further adjustments to the data were necessary (Appendix 7.4). There were no extreme outliers (*as indicated by  $z$  scores  $\pm 3.0$* ) (Tabachnick & Fidell, 2007).

Inspection of the '*Test of Normality*' has demonstrated that data are non-normally distributed (*Shapiro-Wilks test; all  $p < .001$* ) indicating the violation of the assumption of normality. In relation to Skewness and Kurtosis, the  $z$  scores associated with the statistics are greater than 3.29 ( $p < .001$ ) in Self-Monitor, Initiate, WM, Plan/Organise, Task Monitor, and Organisation of Materials, but not in Inhibit, Shift, and Emotional Control ( $z < 3.29$ ;  $p > .001$ ) (Tabachnick & Fidell, 2007).

## Summary

Chapter 7 provides information regarding the data preparation before the main analysis. The final data are comprised of 204 non-clinical females (52 English & 152 Greek); and no variables with 5% or more are missing at random. PMS procedure has been applied on missing responses of DEBQ-R, CES-D, and Preoccupying cognitions questionnaires. For BRIEF-A, no participant had >14 missing responses, thus a score of 1 has been assigned to any missing item. Preliminary analysis has indicated the violation of the assumption of normality, but this is not uncommon in large samples where *“because the standard errors for both skewness and kurtosis increase with larger N the null hypothesis is likely to be rejected with large samples when there are only minor deviations from normality”* (Tabachnick & Fidell, 2007, p. 80). In this situation it is recommended that the actual shape of the distribution be inspected visually and absolute magnitude of the relevant statistics be considered before any decision is made regarding the need for data transformation (Tabachnick & Fidell, 2007). On this basis the decision was made not to make any transformations to the data.



## **Chapter 8: “Self-Reported Executive Functions in Restrained Eaters: A Cross-Cultural Comparison”**

### **Overview**

*This study has investigated, cross-culturally, whether non-clinical females with a restrained eating style exhibit deficits in components of EFs. Participants were 52 English (32 restrained & 20 unrestrained eaters) and 152 Greek (80 restrained & 72 unrestrained eaters) females who completed a well-established self-report measure, the BRIEF-A, designed to tap the separate components of EFs. Participants, also, completed a series of self-report measures evaluating depressed affect, preoccupying cognitions, and IQ. With the exception of Emotional Control, English females performed worse on the remaining sub-scales of the BRIEF-A compared to the Greek females. Restrained eaters have poorer performance on all components of EFs than unrestrained eaters. Findings have revealed statistically significant nationality differences on Emotional Control, Self-Monitor, WM, and Task Monitor; as well as DEBQ-R differences on Shift, Initiate, and WM performance. No interaction effect has been revealed. These differences were at least partially mediated by the covariates, except the performance of nationality group on the Emotional Control. It is concluded that nationality and restrained eating have an impact on EFs performance. This research has provided a possible direction for future investigations, with a particular emphasis on cross-cultural differences in EFs performance within healthy individuals.*

## 7.1: Introduction

There is a growing body of research investigating the role, nature, and organisation of individual differences in EFs (Miyake & Friedman, 2012), reflecting the fact that EFs are the key feature underpinning self-control and self-regulatory ability with broad and important implications for people's everyday lives (Mischel et al., 2011). Recently, researchers have demonstrated a considerable interest in investigating the impact of DR on cognitive performance in non-eating disordered individuals (Ball et al., 2010; Kemps & Tiggemann, 2009; Green et al., 2007; 2005; 2004; 2003; 2000); employing Baddely's model for exploring the specific components of WM affected by DR (Green et al., 2007; 2005; 2003; 2000; Kemps et al., 2005; Shaw & Tiggemann, 2004; Vreugdenburg et al., 2003; Green & Rogers, 1998; 1995).

Studies have shown that high self-reported levels of DR or reporting being on a diet are associated with lower performance on CES. Green and colleagues (Green et al., 2007; 2005; 2003; 2000; 1995) have proposed a psychological explanation for impaired cognitive performance in which thoughts about dieting, body shape, food, and eating may place demands on the limited cognitive resources (WM) leaving fewer available for the performance of cognitive tasks (CLT). In support of this assumption, several studies have reported that people with severe eating styles, such as restrained eating, show impairments on their WM capacity and its components (central executive, phonological loop, and visuospatial sketchpad) (Kemps & Tiggemann, 2005; Kemps et al., 2005; Green et al., 2004; 2000; Vreugdenburn et al., 2003; Green & Rogers, 1998). Dieters and restrained eaters

have poorer performance on WM's laboratory tasks than non-dieters and unrestrained eaters (Kemps et al., 2005; Green et al., 2003).

Additionally, it is found that restrained eaters are impaired in inhibitory control, as they are unable to control their eating (Racine et al., 2009). Using a laboratory task, Kemps and colleagues (2005) have revealed that dieters with restrained eating have problems with their shifting ability, compared to non-dieters. Researchers have, also, argued that high DR is related to lower performance on self-monitoring ability (Johnson et al., 2012). It has been documented that females who score high in terms of DR and low in social desirability demonstrate less accurate reporting of dietary intake (Schoch & Raynor, 2012), and binge-eating in these individuals is commonly triggered by interpersonal conflict that occurs as a consequence of poor problem-solving abilities (Svaldi et al., 2010).

The assessment of EFs has been largely dependent on the employment of laboratory-based tasks, like the TOL and WSCT. A limitation of existing studies of EFs in the domain of food include the fact that they have predominantly employed laboratory measures in order to assess cognitive and executive functioning (Boon et al., 2010). Goldberg and Podell (2000) have posited that laboratory tasks of EFs fail to measure the individual's multidimensional decision making that is commonly demanded in real word situations. With the intention of evaluating the limitations of laboratory measures, self-report measures have been designed in order to capture the individual's EFs within the everyday environment. Specifically, the BRIEF-A (Roth et al., 2005) self-reported measure has been developed to evaluate the behavioural and cognitive manifestations of EFDs and

multiple interrelated domains of executive functioning or self-regulation within the daily environment.

The central executive plays a key role in specialised and cognitively demanding endeavours, such as academic study and performing everyday tasks (Baddeley, 1997). Gender-related differences have been observed in DR (Turrell, 1997). Results from neuro-imaging studies have shown that women have a greater cognitive processing (prefrontal response) related to food stimuli than men (Cornier et al., 2010); and several studies show clear sex-based differences in the homeostatic regulation of energy balance and body weight and signals for hunger and satiety, which may be due to biological regulation (Blashill, 2011) or due to social, cultural and environmental forces that differentially affect men and women (King, 2008).

Recently, researchers have shown a particular interest in cross-cultural comparisons of EFs. It has been suggested that culture is an important factor that is associated with differences on components of EFs, especially on meta-cognitive components of EFs (Ardila, 2008). The Western media idealizes a thin body shape for women, which has, in part become the cultural norm. As a consequence, females, in particular, are under pressure to constantly self-regulate their food consumption, not only for healthy reasons, but also to comply with the socio-cultural ideal of beauty (Westerberg-Jacobson et al., 2010).

Therefore, the first aim of the current research is to address cross-culturally *whether* non-clinical females with restrained eating exhibit deficits in self-reported components of EFs. Hence, restrained eating has been addressed by the DEBQ-R (Van Strein et al., 1986) in order to classify the participants as restrained or unrestrained eaters according to their Median score. EF performance has been addressed by the BRIEF-A, which has been designed to selectively tap each specific aspects of EFs in everyday environment including: Inhibit, Shift, Emotional Control, Initiate, WM, Plan & Organise, Self-Monitor, Task Monitor, and Organisation of Materials. It is expected that restrained eaters would have poorer performance on the nine-clinical sub-scales of BRIEF-A, especially on sub-scales measuring WM, inhibition, and shifting ability (Hall, 2012; Higg, 2007; Kemps et al., 2005; Green et al., 2003). A cross-cultural comparison between English and Greek females would allow an assessment of the influence of a broader range of cultural and social factors on eating attitudes and behaviours, as well as their impact on executive functioning to be evaluated.

The second aim of this study is to further examine potential mechanisms underlying central executive impairment in restrained eaters. Specifically, the influential role of age, BMI, alcohol consumption, depression, preoccupying cognitions about food, diet, and body-shape, and fluent intelligence (IQ) has been assessed. Previous studies have documented that DR-related central executive dysfunction is at least partly attributable to these mediators (refer to Chapter 5; 5.3).

## 7.2: Methodology<sup>12</sup>

### 7.2.1: Design

EFs performance has been analysed by a two-way MANOVA with nationality (English vs. Greek) and restrained eating (restrained eaters vs. unrestrained eaters) as between-subjects factors, and scores of the nine-clinical sub-scales of BRIEF-A as multiple dependent variables. Background and demographic measures of age, BMI, alcohol consumption, depression, preoccupying cognitions, and fluid intelligence have been examined as potential covariates.

### 7.2.2: Participants

The total number of 204 females who met the specific criteria (refer to Chapter 6; 6.2) have been admitted into this study. From those 52 are English students attending at UCLan and 152 are Greek who attend at Aristoteleion University of Thessaloniki. According to a median split of the DEBQ-R scores (Median=27), 112 females have been classified as restrained eaters (English=32; Greek=80) and 92 as unrestrained eaters (English=20; Greek=72). Overall age ranged from 18 to 52 years ( $M=22.36$ ;  $SD=5.13$ ). Table 8.1 demonstrates participants' demographics for age and BMI (Appendix 8.1).

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<sup>12</sup> Please refer to Chapter 6 for details.

Table 8.1: Participants Demographic characteristics

	<b>Groups</b>							
	English (N=52)				Greek (N=152)			
	Restrained eater		Unrestrained eater		Restrained eater		Unrestrained eater	
	M( <i>SD</i> )	N	M( <i>SD</i> )	N	M( <i>SD</i> )	N	M( <i>SD</i> )	N
<b>Demographic variables</b>								
Age (years)	23.34(7.18)	32	24.5(6.79)	20	22.01(4.95)	80	21.72(3.3)	72
BMI	25.92(8.55)	32	25.24(6.36)	20	22.42(2.84)	80	20.64(3.41)	72

### 7.2.3: Instruments

#### 7.2.3a: Demographic & Background

A questionnaire has been used to gather information regarding participants' nationality, age, and level of education. Weight and height measures have been included to assess BMI. Questions referring to any medical issue, use of medication, and diet at the present, as well as alcohol consumption (units p/w) were, also, included on the questionnaire. The Restraint sub-scale of DEBQ (DEBQ-R; Van Strein et al., 1986) has been employed to measure DR. Scores

ranged from 10 to 50, where a high level on this scale suggests that people intend to limit their food intake, but often indulge in exactly the foods they want to avoid. A median split classifies participants as restrained or unrestrained eaters. Internal consistency for the current data is very good ( $\alpha=.91$ ). Depressive symptoms have been assessed by CES-D (Radloff, 1977). Scores ranged from 0 to 60, with higher scores indicating higher frequency of depressive symptoms. Internal consistency is high for this sample ( $\alpha=.92$ ). Preoccupying thought about food, diet, and body-shape has been addressed by the Preoccupying cognitions questionnaire (Vreugdenburg et al., 2003). A total score of this questionnaire ranged from 20 to 120, where higher scores indicate higher levels of preoccupying cognitions. Internal reliability for the present sample is high ( $\alpha=.97$ ). Finally, fluid intelligence (IQ) has been measured via the Raven's Advanced Progressive Matrices (Set I; Raven et al., 1998). For each of the 12 test items, the participant is asked to identify the missing element that completes a pattern, with the potential to score  $12/12$ .

### 7.2.3b: Executive Functions

EFs have been assessed using the BRIEF-A (Roth et al., 2005). Scores ranged from 1 to 3 measuring 75-items. No reverse items exist; higher scores on BRIEF-A indicate greater levels of executive dysfunctions, namely worst performance. Internal reliability for the sub-scales is ranged between .74 to .96 for the current sample.



#### 7.2.4: Procedure

All volunteers have completed a questionnaire pack. Briefing and debriefing information have been given to all by the researcher. Ethical considerations have been fully addressed for this study.

### 7.3: Data Preparation

All the appropriate procedures have been conducted before the main analysis. Preliminary analysis has indicated the violation of the assumption of normality, but this is not uncommon in large samples where *“because the standard errors for both skewness and kurtosis increase with larger N the null hypothesis is likely to be rejected with large samples when there are only minor deviations from normality”* (Tabachnick & Fidell, 2007, p. 80). No other major issues have been observed (refer to Chapter 7).

## 7.4: Results

### 7.4.1: Participants Characteristics

Univariate ANOVA(s) (Appendix 8.2) have been conducted to assess group differences between Greek and English, Restrained and Unrestrained eaters on age, BMI, alcohol consumption (units p/w), depression, preoccupying cognitions, and fluid intelligence (IQ). Descriptive statistics for background variables are presented in Table 8.2.

Inspection of Table 8.2 indicates significant main effects of nationality on age, with small effect size (ES) (partial  $\eta^2 = .029$ ); BMI, with moderate ES (partial  $\eta^2 = .119$ ); preoccupying cognitions, with moderate ES (partial  $\eta^2 = .065$ ); and IQ with small ES (partial  $\eta^2 = .024$ ). Mean differences have revealed that English females demonstrate greater mean scores on age, BMI, and preoccupying cognitions, but lower levels on IQ than Greeks. Significant main effects have been, also, reported between the DEBQ-R groups on depression, with small ES (partial  $\eta^2 = .033$ ); and preoccupying cognitions, with large ES (partial  $\eta^2 = .283$ ). Higher mean values are reported in restrained eaters when compared to unrestrained eaters on both depression and preoccupying cognitions. There are no differences between the groups on alcohol, neither any significant interaction (Nationality x DEBQ-R) on all background variables.

Table 8.2: Background characteristics for English and Greek, Restrained and Unrestrained eaters.

	Groups												<i>F</i> (1,200)		
	English (N=52)				Greek (N=152)				Total (N=204)						
	Restrained eater		Unrestrained eater		Restrained eater		Unrestrained eater		Restrained eater		Unrestrained eater		Main effect		Interaction effect
	M( <i>SD</i> )	N	M( <i>SD</i> )	N	M( <i>SD</i> )	N	M( <i>SD</i> )	N	M( <i>SD</i> )	N	M( <i>SD</i> )	N	Nationality	DEBQ-R	
<b>Background variables</b>															
Age (years)	23.34 (7.18)	32	24.50 (6.79)	20	22.01 (4.95)	80	21.72 (3.30)	72	22.39 (5.68)	112	22.33 (4.41)	92	6.07*	ns	ns
Total	23.79(6.99)				21.87(4.24)										
BMI	25.92 (8.55)	32	25.24 (6.36)	20	22.42 (2.84)	80	20.64 (3.41)	72	23.42 (5.35)	112	21.64 (4.60)	92	27.14***	ns	ns
Total	25.66(7.72)				21.58(3.23)										
Alcohol (units p/w)	1.20 (.58)	25	1.07 (.27)	14	1.04 (.21)	45	1.13 (.42)	32	1.10 (.39)	70	1.11 (.38)	46	ns	ns	ns
Total	1.53(.49)				1.08(.31)										
Depression	19.57 (13.86)	32	14.43 (10.41)	20	16.37 (10.71)	80	13.49 (11.14)	72	17.29 (11.72)	112	13.7 (10.94)	92	ns	4.62*	ns
Total	17.59(12.78)				15.01(10.97)										
Preoccupying Cognitions	80.97 (23.90)	32	46.85 (17.08)	20	63.52 (20.84)	80	40.18 (16.80)	72	68.51 (23.05)	112	41.63 (16.99)	92	13.93***	79.06***	ns
Total	67.84(27.14)				52.46(22.29)										
IQ	8.94 (2.02)	32	9.45 (2.44)	20	9.74 (1.99)	80	10.07 (1.75)	72	9.51 (2.02)	112	9.93 (1.92)	92	4.88*	ns	ns
Total	9.13(2.18)				9.89(1.88)										

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

### 7.4.2: Executive Functions

A Multivariate Analysis of Variance (Appendix 8.3) is performed to investigate nationality and DEBQ-R differences on EFs. Nine DVs have been used (BRIEF-A sub-scales). The IVs are nationality (English vs. Greek) and DEBQ-R (restrained eaters vs. unrestrained eaters). Preliminary assumption testing homogeneity of variance-covariance matrices has revealed no violation of this assumption; Box's  $M$ ,  $p=.06$ .  $F_{max}$  calculated for each sub-scale of BRIEF-A (refer to Table 8.3);  $F_{max}$  critical indicates that group values are not homogeneous (Tabachnick & Fidell, 2007, p. 86). Given the conservative nature of full Bonferroni correction and the consequent increase in the Type 2 error rate (especially where the outcome measures are intercorrelated) the B-Y method is adopted to determine significance for the BRIEF-A sub-scales in Univariate  $F$  tests; thus,  $p<.018$  (Narum, 2006, p.787).

Inspection of Mean differences (Table 8.3) has revealed important differences in nationality and DEBQ-R groups. With the exception of Emotional Control, English females have performed worse than Greek in the remaining eight components of EFs, including Inhibit, Shift, Self-Monitor, Initiate, WM, Plan/Organise, Task Monitor, and Organisation of Material. Restrained eaters have shown poorer performance on all EFs sub-scales compared to unrestrained eaters.

Table 8.3: Fmax & Executive Functions Performance for English and Greek, Restrained and Unrestrained eaters.

		Groups				Total (N=204)			
		English (N=52)		Greek (N=152)					
		Restrained eater (N=32)	Unrestrained eater (N=20)	Restrained eater (N=80)	Unrestrained eaters (N=72)	English (N=52)	Greek (N=152)	Restrained eaters (N=112)	Unrestrained eaters (N=92)
Fmax		M( <i>SD</i> )	M( <i>SD</i> )	M( <i>SD</i> )	M( <i>SD</i> )	M( <i>SD</i> )	M( <i>SD</i> )	M( <i>SD</i> )	M( <i>SD</i> )
Executive Functions									
Inhibit	2.55	13.94(3.32)	13.25(3.09)	13.08(2.08)	12.57(2.92)	13.67(3.22)	12.84(2.90)	13.32(3.02)	12.72(2.96)
Shift	1.54	10.63(2.78)	9.30(2.49)	10.18(2.57)	9.46(2.24)	10.12(2.73)	9.84(2.44)	10.30(2.63)	9.42(2.28)
Emotional Control	1.98	18.94(5.98)	16.40(6.48)	19.91(4.61)	19.64(5.25)	17.96(6.24)	19.78(4.90)	19.63(5.03)	18.93(5.67)
Self-Monitor	2.29	9.72(3.10)	8.55(2.44)	8.28(2.32)	7.99(2.05)	9.27(2.90)	8.14(2.19)	8.69(2.64)	8.11(2.14)
Initiate	2.46	14.66(4.67)	12.4(3.27)	12.99(3.25)	12.56(2.98)	13.79(4.30)	12.78(3.12)	13.46(3.77)	12.52(3.03)
Working Memory	3.33	14.34(4.78)	11.75(3.19)	11.85(2.80)	11.51(2.62)	13.35(4.40)	11.69(2.71)	12.56(3.64)	11.57(2.73)
Plan & Organise	2.20	16.50(5.04)	14.65(3.96)	14.83(3.40)	14.21(3.53)	15.79(4.69)	14.53(3.47)	15.3(3.99)	14.3(3.60)
Task Monitor	3.03	10.59(3.34)	9.60(2.87)	9.20(2.26)	8.51(1.92)	10.21(3.18)	8.88(2.13)	9.60(2.68)	8.75(2.19)
Organisation of Materials	2.50	14.84(5.33)	12.2(4.97)	12.35(3.66)	12.4(3.37)	13.83(5.31)	12.38(3.51)	13.06(4.33)	12.36(3.75)

A Multivariate analysis has revealed statistically significant group effects on combined DVs for nationality,  $F(9, 192)=3.93$ ,  $p<.001$ ,  $\Lambda=.845$ , partial  $\eta^2=.155$ ; but not for DEBQ-R,  $F(9, 192)=1.20$ ,  $p>.05$ , partial  $\eta^2=.053$  and Nationality x DEBQ-R,  $F(9, 192)=1.70$ ,  $p>.05$ , partial  $\eta^2=.074$ .

When the results for all BRIEF-A sub-scales have been considered separately, Univariate analysis has revealed statistically significant differences of nationality on Emotional Control, Self-Monitor, WM, and Task Monitor. Regarding DEBQ-R, the findings have indicated significant differences on Shift, Initiate, and WM. No interaction effect between Nationality x DEBQ-R has been reported. Please refer to Table 8.4.

Table 8.4: Executive Function Performance for Nationality, DEBQ-R, and Nationality x DEBQ-R

Executive Functions	<i>F(1,200)</i>					
	Nationality		DEBQ-R		Nationality x DEBQ-R	
	F	$\eta^2$	F	$\eta^2$	F	$\eta^2$
Inhibit	2.48		1.49		.04	
Shift	.12		6.26*	.030	.56	
Emotional Control	5.95*	.029	2.65		1.72	
Self-Monitor	6.60*	.032	3.48		1.27	
Initiate	1.82		5.73*	.028	2.64	
Working Memory	6.90**	.033	7.95**	.038	4.72	
Plan & Organise	2.89		3.93		.98	
Task Monitor	9.77**	.047	4.48		.15	
Organisation of Materials	3.04		3.88		4.21	

\* $p < .018$ ; \*\* $p < .01$

### 7.4.3: Mediating Effect

Since the groups differed significantly in age, BMI, depression, preoccupied cognitions, and IQ (refer to Table 8.2), correlational analysis (Appendix 8.4) has been conducted to examine the relationship between them and the BRIEF-A's sub-scales (Tabachnick & Fidell, 2007). Age has failed to correlate with any of the BRIEF-A sub-scales. In contrast, BMI is positively correlated with Inhibit,  $r=.18$ ,  $p<.05$ ; Self-Monitor,  $r=.144$ ,  $p<.05$ ; Initiate,  $r=.219$ ,  $p<.01$ ; WM,  $r=.139$ ,  $p<.05$ ; Plan & Organise,  $r=.183$ ,  $p<.01$ ; Task Monitor,  $r=.199$ ,  $p<.01$ ; and Organisation of Materials,  $r=.244$ ,  $p<.01$ . Preoccupying cognitions significantly correlated ( $p's<.01$ ) with Inhibit,  $r=.29$ ; Shift,  $r=.304$ ; Emotional Control,  $r=.181$ ; Self-Monitor,  $r=.237$ ; Initiate,  $r=.441$ ; WM,  $r=.36$ ; Plan & Organise,  $r=.364$ ; Task Monitor,  $r=.348$ ; and Organisation of Materials,  $r=.263$ . Depression is positively correlated ( $p's<.01$ ) with Inhibit,  $r=.36$ ; Shift,  $r=.418$ ; Emotional Control,  $r=.443$ ; Self-Monitor,  $r=.233$ ; Initiate,  $r=.527$ ; WM,  $r=.446$ ; Plan & Organise,  $r=.439$ ; Task Monitor,  $r=.312$ ; and Organisation of Materials,  $r=.313$ . Lastly, IQ is negatively correlated with Self-Monitor,  $r=-.157$ ,  $p<.05$ .

To determine whether these variables could account for nationality- and DEBQ-R-related differences in EFs, multivariate analyses of covariance (Appendix 8.5) have been conducted on the nine-clinical sub-scales of BRIEF-A, with BMI, preoccupying cognitions, depression, and IQ to be included together as covariates, as they are significantly correlated with the DVs (Tabachnick & Fidell, 2007).



When the variance attributable to the covariates (BMI, preoccupying cognitions, depression, & IQ) is partialled out, the overall observed difference in nationality group remains significant,  $F(9, 188)=2.61$ ,  $p<.01$ ,  $\Lambda=.889$ , partial  $\eta^2=.111$ ; the ES is reduced by 4.4%.

In the Univariate analysis the observed difference of nationality on Emotional Control is still significant, with the ES to be only increased by 0.6%. The remaining differences on Self-Monitor, WM, and Task Monitor have become non-significant. Regarding DEBQ-R, the significant differences on Shift, Initiate, and WM are no longer present. No Nationality x DEBQ-R differences have been observed on EFs. Please refer to Table 8.5.

Table 8.5: Mediating effect of BMI, preoccupying cognitions, depression, and IQ on Executive Function Performance for Nationality, DEBQ-R, and Nationality x DEBQ-R

	<i>F(1,196)</i>					
	Nationality		DEBQ-R		Nationality x DEBQ-R	
	F	$\eta^2$	F	$\eta^2$	F	$\eta^2$
<b>Executive Functions</b>						
Inhibit	.12		.24		.02	
Shift	.46		.60		.18	
Emotional Control	7.10**	.035	.56		1.31	
Self-Monitor	2.24		.23		.81	
Initiate	.04		.11		1.75	
Working Memory	3.62		1.09		3.72	
Plan & Organise	.27		.01		.42	
Task Monitor	3.46		.02		.00	
Organisation of Materials	.21		.40		4.07	

\*  $p < .018$ ; \*\*  $p < .01$

Since the variance is partially mediated by the inclusion of BMI, preoccupying cognitions, depression, and IQ, a further analysis of covariance has been conducted in order to indicate how much each of the covariate affects the ES for the multivariate effect of nationality and the univariate effects of nationality and DEBQ-R groups (please refer to the Appendix 8.6 for further details). B-Y method has been used to assess where the significant differences exist ( $p < .018$ ). Table 8.6 demonstrates the findings and a discussion of these findings is provided in general discussion (Chapter 9; 9.2.5).

Table 8.6: The importance of BMI, preoccupying cognitions, depression, and fluid intelligence for multivariate effect of nationality and univariate effects of nationality and DEBQ-R

	BMI						Preoccupying Cognitions					
	Multivariate effect			Univariate effect			Multivariate effect			Univariate effect		
	<i>F</i> (9, 191)			<i>F</i> (1, 199)			<i>F</i> (9, 191)			<i>F</i> (1, 199)		
	Nationality			Nationality		DEBQ-R	Nationality			Nationality		DEBQ-R
	F	$\eta^2$	F	$\eta^2$	F	$\eta^2$	F	$\eta^2$	F	$\eta^2$	F	$\eta^2$
<b>BRIEF-A</b>	3.14**	.129					3.62**	.146				
Shift					5.58						.06	
Emotional Control			5.78*	.028					10.39**	.050		
Self-Monitor			4.32						3.79			
Initiate					4.52						1.59	
Working Memory			4.80		7.35**	.036			2.51		.08	
Task Monitor			5.81*	.028					4.59			

\*  $p < .018$ ; \*\*  $p < .01$

Table 8.6 *continue*

	Depression						Fluid Intelligence					
	Multivariate effect			Univariate effect			Multivariate effect			Univariate effect		
	<i>F</i> (9, 191)			<i>F</i> (1, 199)			<i>F</i> (9, 191)			<i>F</i> (1, 199)		
	Nationality			Nationality		DEBQ-R	Nationality			Nationality		DEBQ-R
	F	$\eta^2$	F	$\eta^2$	F	$\eta^2$	F	$\eta^2$	F	$\eta^2$	F	$\eta^2$
<b>BRIEF-A</b>	4.20**	.165					3.58**	.144				
Shift					3.13						5.59	
Emotional Control			10.88**	.052					5.46			
Self-Monitor			5.67*	.028					5.25			
Initiate					2.21						5.97*	.029
Working Memory			5.61		4.32				6.65*	.032	7.81**	.038
Task Monitor			8.50**	.041					9.15**	.044		

\*  $p < .018$ ; \*\*  $p < .01$

## **8.5: Summary of the Findings**

To the best of the researcher's knowledge, the current study is the first systematic investigation, which explores a range of EFs, in the context of DR in English and Greek non-eating disordered females, via the BRIEF-A questionnaire. The use of this self-report measure, rather than the traditional three-component Baddeley's model of WM often adopted in this area (e.g., Kemps et al., 2005; Green et al., 2003), is thus innovative. Overall, the findings have provided clear evidence for an effect of nationality on EFs. Specifically, a cross-cultural comparison has allowed the researcher to argue cultural-related differences between English and Greek students in field of EFs. BMI, preoccupying thoughts about food, diet, and body-shape, depression, as well as fluid intelligence appear to mediate the differences associated with nationality on self-monitoring ability, WM, and task monitoring function, but did not mediate the observed difference between English and Greek females on emotional control. Regarding the differences between restrained and unrestrained eaters on shifting ability, initiate, and WM performance the inclusion of covariates reduced these differences to below statistical significance.

Group differences have been observed within this study. Nationality group has been found to differ in terms of age, BMI, preoccupying cognitions, and IQ. With the exception of fluid intelligence, English females have reported greater levels on the remaining variables than Greeks. Although the cross-cultural literature on those variables is limited for these specific nationalities, the current study suggests that (older) English females have elevated BMI levels and are more preoccupied

about their food, diet, and body shape, but their scores on IQ are lower than those of the Greeks.

DEBQ-R group has revealed differences in terms of depression and preoccupying cognitions, with restrained eaters to demonstrate higher levels on both than unrestrained eaters. These differences are well established in DR-related literature, as previous studies have found that restrained eaters show more depressive episodes (Smoller et al., 1987) and are more preoccupied with their thoughts about food, diet, and body shape (Jones & Rogers, 2003; Rogers & Green, 1993) than unrestrained eaters.

It was hypothesised that nationality would play a role on the domain of EFs, as well as restrained eating would have an impact on EFs performance. Trends in the means indicate that English females have poorer neuro-cognitive performance when compared to Greeks, as they have reported higher levels on eight out of nine clinical sub-scales of BRIEF-A. Specifically, English females are worse in maintaining appropriate regulatory control of their behaviour, with deficits evident in the areas of inhibition, shift, and self-monitor as well as to systematically solve problems, with deficits presented in meta-cognitive components of EFs including initiate, WM, plan and organise, task monitor, and organisation of materials. However, English females have found to perform better on emotional control sub-scale of BRIEF-A, suggesting their ability to control the emotional responses better than Greek females. Additionally, it is clear that restrained eaters have worst performance on all components of EFs than unrestrained eaters, suggesting that restrained eating has an impact on EFs.

Regarding the differences associated with nationality, the analysis have revealed an overall effect on nine-clinical sub-scales of the BRIEF-A. This difference accounts for 15.5% of the overall variance. Thus in relation to the present sample, it appears that nationality has an impact on EFs performance. In relation to restrained eating and the interaction between nationality and restrained eating, the findings have failed to reveal any overall differences. Inspection of the ESs for DEBQ-R (5.3%) and nationality x DEBQ-R (7.4%) indicates that either the sample size may have been too small to detect a real or non-trivial statistical effect for both groups (Tatsuoka, 1993); or that the relatively high correlations between the BRIEF-A sub-scales that potentially reduced the multivariate group ESs and with that the power of the procedure (Zumbo & Hubley, 1998).

With regard to cognitive processing, Tapper et al.'s (2008) study was alone in comparing English and Greek sample within a cross-cultural context. The present study extends this work by evaluating cultural-related differences between English and Greek non-eating disordered female University students within the broader context of EF. The findings have shown that Greek females have difficulties to modulate their emotional responses in everyday life. This difficulty may be related to the way Greek people exaggerate their emotional reactions to apparently inconsequential events, such as to be more vulnerable with little provocation. Cross-cultural studies have indicated that cultures differ in appraisal that lead to emotion and these differences may correspond with situation selection. Additionally, they have argued that cultures differ in emotional expression as well



as in coping, which is a process related to cognitive reappraisal (Matsumoto, Yoo, Nakagawa et al., 2008).

In contrast to this outcome the English sample performed worse on all other BRIEF-A subscales. They exhibited difficulty in their self-monitoring ability, namely the extent to which they observe their own behaviour/attitudes and the negative effect of these on others. Cross-cultural studies based on self-monitoring function have revealed that people with low self-monitors can lead to many difficulties in an international environment as well as to be less comfortable in a new culture (Ickes, Holloway, Stinson, & Hoodnpyle, 2006).

Moreover, English females were found to perform worse on WM (i.e., the ability to hold information in mind while completing an on-going task); as well as to score lower on task monitor, namely the degree to which English females keep track of their own problem-solving success or failure. These findings support the literature suggesting that deficits on meta-cognitive components of EFs, including WM and task monitoring function, may be dependent on culture (Ardila, 2008).

Although in multivariate terms, the analysis has failed to provide any overall effect of restrained eating on self-reported components of EFs, the univariate analysis has provided evidence for DEBQ-R group differences on shift, initiate, and WM performance, with restrained eaters showing noticeably lower performance on those components than unrestrained eaters.

More specifically, restrained eaters have problems with their shifting ability, such as to adapt their behavioural set or actions in response to environmental or situational change (i.e., behavioural shifting). Using a laboratory task, dieters with restrained eating style have been reported to show reduced task switching abilities than non-dieters (Kemps et al., 2005). Additionally, restrained eaters have difficulties to solve their problems in a flexible manner (i.e., cognitive shifting). It is documented that a rigid, rather than a flexible control over eating behaviour has been linked with adverse behavioural outcomes (e.g., higher levels of anxiety and depression), low dieting success, and ED symptoms (Meule et al., 2011; Timko & Perone, 2006).

Initiation problems have been, also, found to be associated with restrained eating, meaning that restrained eaters show difficulties in beginning a task or activity and in independently generating their own ideas, responses, and problem-solving strategies. The finding supports Johnson, Pratt, and Wardle's (2012) argument that restraint is often initiated as a response to weight gain. Therefore, restrained eaters may have difficulties to begin an activity, such as a diet, and independently generate their problem-solving in order to lose weight.

The impact of DR on WM is well documented (Ball et al., 2010; Tiggemann et al., 2010; Kemps et al., 2005; Green et al., 2003; Vreugdeburg et al., 2003; Green & Rogers, 1998; Green et al., 1997). The current research is consistent with this, as restrained eaters performed worse on WM than unrestrained eaters, indicating their inability to actively hold information in mind for an appropriate amount of time in order to complete a task.

Since this study has provided evidence for nationality- and DEBQ-R-related EFs impairments, further analysis has been conducted in order to address the basis of these differences. It has been expected that groups' differences on EFs performance would be at least partly attributable to mediating factors impinging on central executive mechanisms. Although age-related differences were found to exist between the two Nationalities, age was not significantly related to EFs. In contrast, this study has revealed that BMI is positively associated with all self-reported components of EFs, except in relation to shift and emotional control. Preoccupying cognitions and depressive affect have been, also, found to be positively associated with all EFs. Also, fluid intelligence has found to be negatively related to self-monitor ability. Therefore, on the one hand higher levels of BMI, preoccupying thought about food, diet, and body shape, as well as more depressive episodes are associated with executive dysfunctions. On the other hand, lower IQ appears to be associated with increased EFDs.

When the variance attributable to BMI, preoccupied cognitions, depression, and fluid intelligence was controlled for, the overall nationality effect on EFs performance remained largely unaffected. This is reflected in the fact that the ES was reduced by 4.4%, suggesting that most of the variance (over 11%) is attributable to other differences between the two Nationalities. With the exception of emotional control, the findings have revealed that self-monitor ability, WM, and task-monitoring function share variance with these covariates and the group Nationality effect. Regarding the observed differences of restrained eating on

shifting ability, initiate, and WM performance, the inclusion of the covariates have, further, demonstrated evidence for their mediating role on EFs.

In the line with previous investigations, this study has, further, provided evidence that BMI and depressive affect (Kemps et al., 2005; Green et al., 2003; Green & Rogers, 1998), as well as fluid intelligence (Johnstone et al., 2000) do not invariably influence EFs; especially the hot components of EFs that are related to behavioural and emotional regulation, such as the emotion control. Interesting is, however, the finding referring to preoccupying cognitions. According to the previous literature, preoccupying cognitions are thought to reduce the capacity of the articulatory loop and central executive components of the WM system (Baddeley, 1997); thus potentially mediating any group-related impairments connected to central executive components of WM (Vreugdenburg et al., 2005). However, this thesis has revealed evidence that preoccupying thoughts about food, diet, and body shape do not necessarily mediate differences related to Nationality in the specific component processes that relate to emotional regulation, namely emotional control.

Additionally, the findings provided in this study support the literature that argues the mediating role of BMI (Cserjesi et al., 2009; Volkow et al., 2009; Boeka & Lokken, 2008; Gunstad et al., 2007), preoccupying cognitions (Kemps et al., 2005; Jones & Rogers, 2003; Vreugdenburg et al., 2003; Rogers & Green, 1993), depression (Gohier et al., 2009; Micco et al., 2009), and fluid intelligence (Friedman et al., 2006) on EF.

In summary, the findings appear fruitful for cross-cultural differences in EFs, as this thesis has documented that nationality has an impact on components of EFs that are measured by the BRIEF-A, which covers a wide range of EFs and argues the fractionalisation of EFs. The observed impairments on self- and task-monitor as well as on WM among nationality group appear to co-vary with one or more of BMI, preoccupying thoughts about food, diet, and body-shape, depression, and fluid intelligence. Nationality is a fruitful area that should be taken into serious consideration in future research in the area of EFs, especially in relation to the hot components of EFs (the behavioural regulation domains), i.e., the emotional control function as differences in this component appear not to be mediated by other factors, such as depressive affect.

Additionally, although the findings have failed to provide any overall effect of restrained eating on EFs and this null finding may be dependent on sample size that has probably been too small to detect a real statistical effect, the observed differences presented between restrained and unrestrained eaters apparent in the univariate analysis indicate that restrained eating has an impact mostly on the cold components of EFs (meta-cognitive domains). These differences are partly mediated by the potential mechanisms of BMI, preoccupying cognitions, depressive affect, and IQ. Taking into serious consideration the findings provided in the present study as well as the previous research based on EP and EFs, the following chapter critically discusses and evaluates them.

## **Chapter 9: “General Discussion”**

### **Overview**

*Chapter 9 critically discuss and evaluates the findings of the current thesis in relation to the previous research.*

### **9.1: Eating Psychopathology and Cognitive Functioning: A Review**

The *Continuum Model of Eating Psychopathology* suggests that there is a very thin line between restrained eating and the development of BN within vulnerable individuals demonstrating the importance of employing non-eating disordered populations in eating-related research. Support for the continuum model has emerged from studies employing various information-processing methodologies related to attention and memory biases. Findings of such investigations have, however, revealed an inconsistent picture. On the one hand attention and memory biases in response to food-related stimuli are greater for restrained eaters than unrestrained eaters. On the other hand, studies have failed to provide any particular difference on attentional or memory biases between restrained and unrestrained eaters. The conclusion is, therefore, that maladaptive schemata probably underpin the desire to restrict food intake, but paradoxically this increases food craving in non-clinical restrained eaters. Also, the findings that demonstrated no evidence for

DR-related differences on information-processing biases might be due to an approach-avoidance conflict to food cues in which heightened appetitive responses to food are inhibited by food-related anxiety (Chapter 3 for a review). These information processes biases have been attributable to central executive processes otherwise known as EFs. This terminology is used as an umbrella term reflecting the operation of a general purpose controller through which the individual regulates a wide range of cognitive and behavioural phenomena (Chapter 4 for a review).

With regards to EFs, researchers have recently focused on the integrity of executive functioning in relation to severe eating, especially dieting and restrained eating. An evolving viewpoint from Green and colleagues argues that impaired cognitive performance in which thoughts regarding dieting, body-shape, food, and eating may place demands on the limited cognitive resources, like WM performance, leaving fewer available for the performance of cognitive tasks. Although this is a new area of research, the findings that have emerged appear to be very promising. Researchers have revealed that dieters and restrained eaters are impaired in cognitive processes, including components of WM, the visuospatial sketchpad, and phonological loop. Additionally, studies have demonstrated deficits on inhibitory control and set-shifting ability in groups with severe eating (Chapter 5 for a review).

### 9.1.1: Limitations of the existing Literature

Although the role of EFs is well investigated in everyday life within children (Hosenbocus & Chahal., 2012; Garon, Bryson, & Smith, 2008), adults (Salthouse, 2005), and elderly (Mirelman, Herman, Brozgol, et al., 2012) populations, with and without cognitive impairments (Pickens, Ostwald, Murphy-Pace, & Bergstrom, 2010; Boonstra, Oosterlaan, Sergeant, & Buitelaar, 2005), either employing laboratory-based tasks or well-established self-report measures (Jurado & Roselli, 2007), and mostly based on Baddeley's model of WM (McCabe, Roediger, McDaniel, et al., 2010; McVay & Kane, 2009), the existing literature does not address the role of EFs in healthy university students with severe eating behaviours and attitudes, including restrained eating.

Another limitation within this area of investigation is the extremely widespread use of laboratory measures in order to assess cognitive and executive functioning (e.g., Boon et al., 2010; Chapter 5 for a review). However, Goldberg and Podell (2000) have posited that laboratory tasks of EFs fail to measure the individual's multidimensional decision making that is commonly demanded in real word situations. With the intention of evaluating the limitations of laboratory measures, well-designed self-report measures of EFs, such as the BRIEF-A, have been designed in order to grasp the individual's EFs performance in the everyday environment (Chapter 4 for a review).

Finally, the role of culture needs to be further investigated within the field of EFs, as there is a growing body of research suggesting that impairments mainly on cold



components of EFs are dependent on culture (Ardila, 2008); as well as due to the limited amount of research investigating cultural-related differences on EFs performance in this cohort (Tapper et al., 2008).

## **9.2: Self-Reported Executive Functions in Restrained Eaters: A Cross-Cultural Comparison**

Taking into serious consideration the importance of EFs in everyday life as well as the limited amount of literature considering the impact of culture and restrained eating on EFs performance, the current research has aimed to cross-culturally investigate whether non-eating disordered females with restrained eating styles exhibit deficits in self-reported components of EFs. Additionally, to the best of the researcher's knowledge, this is the first systematically study assessing EFs through a well-established self-report measure, the BRIEF-A in this cohort. Finally, the potential mechanisms underlying central executive impairments in restrained eaters, such as age, BMI, alcohol consumption, depression, preoccupying thoughts about food, diet, and body-shape, as well as fluid intelligence, have been investigated in the current research (Chapter 8 for a review).

### 9.2.1: Group Differences

Group differences have been observed within this study. The two nationalities have been found to differ in terms of age, BMI, preoccupying cognitions, and IQ. With the exception of fluid intelligence, English females have reported greater levels on the other variables than Greeks. Although the cross-cultural literature on those variables is limited for these specific nationalities, the current study indicates that the (older) English sample have elevated BMI, are more preoccupied about their food, diet, and body-shape, although their scores on IQ measure are lower than those of the Greek females.

The two DEBQ-R groups differed in terms of preoccupying cognitions and depression, with restrained eaters demonstrating higher levels on both compared to unrestrained eaters. These differences are well-established in DR-related literature, as previous studies have found that restrained eaters are more preoccupied with their thoughts about food, diet, and body-shape (e.g., Jones & Rogers, 2003; Rogers & Green, 1993) as well as showing more depressive episodes (e.g., Greeno & Wing, 1994; Smoller et al., 1987) than controls.

### 9.2.2: The impact of Culture on Executive Function Performance

As has been documented in Chapter 4, the impact of culture on EFs performance should be shaped to some degree of an individual's cultural environment. Greenfield (1997) has defined the role of culture in EFs as a polemic matter. He has mentioned this term because culture is unquestionably related to the values and meanings, and modes of knowing that each culture adopts. For instance, some people may consider that in the Raven's Progressive Matrices test (Raven et al., 1998), the better response should be the one follows a visual principle (i.e., the figure that looks better in that position) rather than a conceptual principle (i.e., the figure that continues the sequence) (Greenfield, 1997).

Furthermore, a recent review based on the evolutionary origins of EFs by Ardila (2008) suggests that meta-cognitive EFs, including problem-solving, abstracting, planning, strategy development and implementation, as well as WM are mainly dependent on culture and cultural instruments, usually known as conceptualisation instruments. Ardila has, also, argued that language, as well as written language as an extension of verbal language, may be the most important keys for exploring EFs cross-culturally. As for the behavioural components of EFs, which are mostly responsible for co-ordinating cognition and emotion, probably are the result of a biological evolution shared by other primate (Ardila, 2008).

For example, a study by Gomez-Perez and Ostrosky-Solis (2006) has revealed that although memory tests are sensitive to age norms, the tests measuring EFs have found to be associated with the level of education. Therefore it can be argued that

the level of education, including the level from both oral and verbal language, is an important element for exploring EFs cross-culturally that leads to the conclusion that researchers should focus mainly on student populations for exploring EFs cross-culturally.

Regarding the populations sampled in this research, Tapper et al. (2008) were the first to investigate the association between culture and increased food-rated processing bias, recruiting university students from UK, Greece, and Iran (including both males and females). They found no evidence for any relationship between culture and food-processing bias. In contrast, the findings of the current thesis demonstrated potentially important cross-cultural differences between English and Greek females in the domain of EFs.

In particular, this research has firstly provided evidence for the impact of culture on a wide range of EFs. The large ES 15.5% of the overall variance, which is assessed by Cohen (1988), have allowed the researcher to highlight potentially important differences between English and Greek female university students without any neuro-psychological disorder on their EFs performances. With the exception of emotional control, English females have demonstrated poorer neuro-cognitive performance on the remaining components of the BRIEF-A. These findings suggest that English females are having difficulties to maintain appropriate regulatory control of their behaviour, including appropriate abilities on inhibition, shift, and self-monitor; as well as to systematically solve problems through planning and organisation while sustaining these task-completion effects

in their active WM. In contrast, English females have found to perform better on their ability to modulate their emotional responses appropriately than Greeks.

A more detailed analysis has revealed nationality differences on emotional control, self-monitor, WM, and task monitor performances, but these differences have accounted for only 2.9%, 3.2%, 3.3% and 4.7% of the variance respectively, suggesting that the two nationalities did not differ substantially in terms of their performance on those specific components.

Specifically, Greek females have found to perform worse on emotional control component when compared to English, indicating their difficulties to modulate and self-control their emotional responses in everyday life. Therefore, culture, and Greek culture in particular, has an impact on emotional regulation, namely on the way Greek females exaggerate their emotional reactions to apparently inconsequential events. Cross-cultural studies examining emotional control within healthy individuals have proposed that cultures differ in appraisals that lead to emotion and these differences may correspond with situation selection. They have, also, revealed that cultures differ in emotional expression as well as in coping, which is a process related to cognitive reappraisal (Matsumoto et al., 2008; Matsumoto, 2006).

More detailed evidence for cross-cultural differences in the area of emotion regulation has emerged from a recent study by Matsumoto and colleagues (2008)

who have recruited volunteers from 23<sup>13</sup> countries, including Greece, in order to investigate two processes of emotion regulation: reappraisal<sup>14</sup> and suppression<sup>15</sup> employing the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003). The findings suggest evidence for an association between cultural dimensions and the two processes of emotion regulation. They have, also, demonstrated a relationship between country-level emotion regulation and country-level indices of both positive and negative adjustment. As for Greece, the results have indicated that Greek people minimise the maintenance of social order and value individual Affective Autonomy and Egalitarianism. Greek people have, also, found to score lower on suppression, and to be negatively correlated with the two processes of emotion regulation.

Consistent with previous research the current study has, further, documented that Greek females face difficulties on the emotional control dimension of the BRIEF-A which is concerned with the extent to which individuals exaggerate their emotional reactions to apparently inconsequential events, consistent with impairments on both the reappraisal and suppression processes of emotion regulation. Therefore, relative to their English counterparts, Greek females are potentially less able to self-regulate their emotional experiences by changing the

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<sup>13</sup> The data consisted by 3,018 university students (57.6% women, 42.3% men; mean age\_22.91 years) from Australia, Bangladesh, Brazil, Canada, China, Denmark, Germany, Greece, Hong Kong, India, Israel, Italy, Japan, Korea, Mexico, New Zealand, Nigeria, Poland, Portugal, Russia, Switzerland, U.S.A, and Zimbabwe.

<sup>14</sup> Reappraisal is the way in which people construe an emotion-eliciting situation in order to change its impact on emotional experience.

<sup>15</sup> Suppression is the inhibition of emotional expressive behaviour.

contents of their thoughts after an emotion has been elicited or by re-evaluating the emotion-eliciting stimuli.

This research has, also, provided evidence for culturally-related differences on self-monitoring ability. Relative to the Greek sample, English females were found to be more impaired on their self-monitoring function, suggesting that they are less effective in monitoring their behaviours and attitudes as well as the negative effect that these may have on others.

Studies examining cultural variability and self-monitoring have revealed that the latter ability is an important factor explaining differences in cross-cultural adjustment (Harrison, Chadwick, & Scales, 1996) and conflict communication styles (Trubisky, Ting-Toomey, & Lin, 1991). To help with these general perceptions, Snyder (1974) has defined self-monitoring as an individual's ability to self-regulate his/her behaviour and attitude to external, situational factors. Snyder has, also, suggested that self-monitoring has two dimensions: i) high self-monitor, which is one's ability to gather the behavioural requirements for a certain situation, and ii) low self-monitor, which refers to the ability of an individual to not change his/her actions or behaviour in order to meet the needs of a specific situation, but to keep his/her own personality (Snyder, 1974). In cross-cultural research, people with high self-monitors are more flexible to analyse social cues and decide which is the appropriate behaviour that they should adopt for the situation. On the other hand, low self-monitor leads to the difficulty of an individual to meet the needs of a specific situation, such as to be comfortable in a new culture (Ickes et al., 2006; Mehra, Kilduff, & Brass, 2001).

Consistent with the previous literature, the findings of this research have, further, offered evidence for the difficulties of English individuals on self-monitoring. Therefore, they are less sensitive to social contexts, and they are less able to analyse the situational cues present in their social environment. Additionally, these impairments on self-monitoring function might have an impact on English females to be less comfortable in a new culture.

In addition to the above, this study has offered new evidence for the impact of culture on WM performance. Different theories based on how culture affects cognitive development suggest that culture is a factor that influences memory processes, including WM performance (Leong, 1996; Shore, 1996; Cacioppo & Berntson, 1992; Ratner, 1991; Resnick, 1991; Vigotsky, 1978). Researchers have mentioned the importance of language for investigating cross-cultural differences on EFs, especially on cold components of EFs, such as WM (e.g., Ardila, 2008; Schrauf, 2000); and deficits on WM could be due to the level of education, including the level of oral and verbal language, between the countries (Gomez-Perez & Ostrosky-Solis, 2006).

This study has revealed that culture has an impact on WM, as it has been demonstrated that English females have performed worse on this specific component than Greeks. This finding indicates important differences in the way English and Greek females actively hold information in mind in order to complete a task or to generate a response. To the best of the researcher's knowledge, the current research is the first empirical investigation that provides evidence for the



role of culture on WM performance between two European countries that mainly share the same values and meanings, and modes of knowing.

Finally, cultural-related differences have been reported on task monitoring. As has been mentioned previously, culture has an effect on meta-cognitive components of EFs, including task monitoring ability (Ardila, 2008). The current investigation has observed English females to perform worse on the task monitoring component of EFs, indicating their inability to keep track of their own problem-solving success or failure. They are, therefore, less able to check their work and to properly consider their performance during or after the completion of a task or activity making it difficult for them to determine whether the current goal has been achieved.

In summary, the current thesis provides tentative evidence for the impact of culture on both the hot and cold components of EFs within healthy English and Greek female university students. It appears that cultural differences may affect behavioural and meta-cognitive performances in everyday life, particularly in the areas of emotional regulation, self-monitoring, WM, as well as task monitor ability.

### 9.2.3: The impact of Restrained Eating on Executive Function Performance

As has been set out in Chapter 5, dieters and restrained eaters operate lower performance on CES. Previous studies for the most part employing Baddeley's model of WM in this cohort, have found that female current dieters display poorer sustained attention and immediate free-recall. Additionally, it is documented that current dieters and restrained eaters are impaired on WM, the phonological loop, and the visuo-spatial sketchpad.

Trends in the means indicate that restrained eaters have noticeable lower levels on all components of EFs than unrestrained eaters, indicating their inability to successfully perform those everyday tasks and activities which relate to the specific components assessed by the BRIEF-A. As for the overall effect of restrained eating on the combined components of EFs, the analysis has failed to reveal any difference. Inspection of the ES on DEBQ-R group (5.3%) suggests that the reason why this null hypothesis exists may be due to the small sample size in order to detect a real or non-trivial statistical effect (Tatsuoka, 1993); or due to the relatively high correlations between the BRIEF-A sub-scales that potentially reduced the multivariate group ESs and with that the power of the procedure (Zumbo & Hubley, 1998). In contrast, more detailed analysis has revealed that restrained eaters are impaired on those abilities which relate to both the hot (shift) and cold (Initiate & WM) aspects of EFs.

Specifically, this thesis has revealed that restrained eating has an impact on shifting ability, but the ES (3%) in relation to this difference was observed to be small. Therefore, restrained eaters have difficulties on both behavioural and cognitive shifting ability. The difficulties referring to behavioural shifting indicate that females with restrained eating style are less able to adapt behavioural set of actions in response to environmental of situational change. This finding supports previous studies that have, additionally, revealed impairments on switching abilities between dieters with restrained eating style and controls (e.g., Kemps et al., 2005).

Regarding the observed difference of restrained eating group on cognitive shifting, restrained eaters have demonstrated deficits in their ability to solve problems in a flexible manner. It is well-documented that a RC, rather than a FC over eating behaviour to be related to adverse behavioural outcomes, like higher levels of anxiety and depression, low dieting success, and ED symptoms (e.g., Timko & Perone, 2006; Chapter 2 for a review). Therefore, it could be argued that restrained eaters are characterised by the dichotomous all or nothing approach of eating, weight, and dieting due to their difficulties to cognitively shift their task or activity.

Further support for the impact of restraint eating on shifting component of EFs has been provided by the use of Median split ( $\text{Median} \geq 27$ ) for the current data, as it goes along with previous studies that the Median split for their data has been reported in approxiamtelly same level; one such study is by Kemps et al. (2005). Kemps and colleagues (2005) using the restraint sub-scale of DEBQ in order to

classify their female participants as dieters with restrained eating and dieters with unrestrained eating found that dieters with self-reported restrained eating behaviours and attitudes equal and above the Median split of 26 are impaired in their shifting ability when compared to controls. Therefore, it could be argue that although the cut-off of DEBQ-R mostly depends on the size and characteristics of the sample, people who self-reported restrained eating in a range of about 27 are more likely to show deficits on shifting component of EFs.

In the results presented here, impairments on initiate have also been found to be associated with restrained eating, but the ES (2.8%) in relation to this difference was observed to be small. That said, restrained eaters have potentially showed difficulties in their ability to begin a task or activity and to independently generate their ideas, responses, or problem-solving strategies. Johnson et al. (2012) have argued that restraint is often initiated as a response to weight gain; and initiate problems might be linked to the inability of restrained eaters to control their impulses and urges, as well as their self-control and self-regulation ability (e.g., Hofman et al., 2012; Miyake et al., 2012; Moffitt et al., 2011).

Additionally, Roth et al. (2005) have mentioned that people who self-reported difficulties on initiate sub-scale of BRIEF-A might be a secondary consequence of other types of EFDs, such as to be poorly organised consequent them to become overwhelmed with large tasks, as well as to have greater difficulty to begin the task.

Taking these observations into consideration, it could be proposed that difficulties on initiate could be associated with the restrained eaters' inability to successfully complete the task of dieting, because they have difficulties in getting started. Differences in susceptibility to this EFD might be the reason why some restrained eaters or dieters can resist the temptation of a forbidden food while others cannot, even when they are on a diet. Also, the fact that restrained eaters have performed worse on initiate, might possible have difficulties in performing tasks that are related to plan & organise, or organisation of materials. To the best of the researcher knowledge, no previous study has directly assessed the initiate component of EFs among restrained eaters classified by the restraint sub-scale of DEBQ. Therefore, this is the first systematic investigation which provides evidence for the impact of self-reported restraint eating equal and above of 27 on this specific component of EFs.

Restrained eaters have been, also, found to be impaired on WM; but the difference between restrained and unrestrained eaters on this component is again small (with an ES of 3.8%). This finding supports the existing literature demonstrating a relationship between DR and impairments on WM (e.g., Ball et al., 2010; Tiggemann et al., 2010). Although previous studies have revealed impairments of WM in restrained eaters and dieters via the Baddeley's model, the current thesis has, further, provided evidence for the utility of BRIEF-A for detecting deficits on WM.

Therefore, restrained eating has an impact on central executive functioning, particularly on the WM component, suggesting that restrained eaters have

difficulty in actively holding information in their mind in order to successfully complete a task. They are not able to retain information that is important for ongoing everyday tasks even momentarily. They might lose their concentration or their motivation as they work a specific task, or even forget what they are supposed to do when instructed.

Additionally, support for the impact of restrained eating on WM has been provided by the use of Median split. Previous studies, such as a study by Ball et al. (2010; Median  $\geq 25$ ) and Tiggemann et al. (2010; Median  $\geq 23$ ), have also revealed that those females who self-reported restrained eating behaviours and attitudes according to their Median split are impaired on their WM performances than controls. Taking into consideration the cut-off of the current data with previous investigations, it could be clearly argued that restrained eaters who are classified with a Median split between 23 to 27 are more likely to present deficits on the WM component of EFs rather than those restrained eaters who are classified with restrained eating outside of this cut-off.

In summary, the current thesis has offered further insights as to the impact of restrained eating on EF performance using a well-established self-report measure of EFs, the BRIEF-A, and thereby going beyond Baddeley's traditional model of WM. Restrained eaters have been found to be impaired on both behavioural and meta-cognitive components of EFs, particularly in their shifting ability, initiate, as well as WM. Although the use of Median split depends mostly on the size and the characteristics of the sample, these findings could be supported by previous studies discussed in the current section which reported similar Median splits. Therefore, it

could be argue that females who self-reported restrained eating in a range of about 27 are more likely to show deficits on component of EFs.

#### 9.2.4: The Mediating Effect

Since this thesis has provided evidence for cultural- and DR-related differences on components of EFs as well as important group differences on age, BMI, preoccupying cognitions, depression, and fluid intelligence, the potential role of these moderating variables underlying central executive impairments has been investigated in order to determine the unique variance associated with cultural and DR group differences; as previous studies have revealed that these factors are at least partly attributable to mediate EFs performances (Chapter 5 for a review).

Although average age differed significantly between the English and Greek participants, age was not significantly associated with EFs. Although not evident in the present sample, much of the age-related literature in this area suggests that older adults are more impaired on CES than younger adults, even in those adults without any neuro-psychological disorder (Sander et al., 2012).

In contrast, BMI was found to be positively associated with all sub-scales of BRIEF-A, except with shift and emotional control. This means that elevated BMI could account for at least some of the group differences on the components of EFs, but not in relation to shifting ability and emotional regulation. A positive association between the components of EFs and preoccupying cognitions as well

as depression has been, also, revealed within this research. These findings suggest that females with greater levels of preoccupying thoughts about food, diet, and body-shape, as well as females who experienced more depressive symptoms are more likely to show lower performances on both the behavioural and meta-cognitive components of EFs. Finally, fluid intelligence was found to be negatively associated only with the self-monitor sub-scale of BRIEF-A, indicating that lower IQ could affect more EFDs in this domain.

When the variance attributable to BMI, preoccupying cognitions, depression, and IQ, the observed overall (multivariate) cultural-related difference on EFs performance has been unaffected. This has been confirmed by the ES that has been only reduced by 4.4%, suggesting that most of the variance was attributable to group differences associated with nationality. Specifically, on the one hand, the results have indicated that these factors could not mediate the observed differences on emotional control between English and Greek females. On the other hand, the observed differences between the two nationalities on self-monitor, WM, and task monitoring function, as well as the observed differences between restrained and unrestrained eaters on shifting ability, initiate, and WM performance have been attenuated following the inclusion of the covariates indicating that group differences in these specific components of EFs are partly attributable by the mediating role of BMI, preoccupying cognitions, depression, and IQ.

Regarding the mediating role of BMI on EFs, the findings of this research support previous studies suggesting no effect of BMI on EFs performances (Sweat et al., 2008; Kemps et al., 2005; Green et al., 2003). Therefore, it is proposed that the



difference in emotional control between English and Greek females is not attributable to group differences in BMI levels, but it potentially reflects some underlying difference in the way in which individuals from these two countries modulate their emotional regulation in everyday environment, with Greek females to be more impaired than English. On the other hand, this study has revealed that females, especially English, as well as restrained eaters and those with high levels of BMI have poorer cognitive performance in components of EFs (Cserjesi et al., 2009; Volkow et al., 2009), including self- and task-monitoring function, shifting ability, initiate, and WM performance.

As for the mediating role of preoccupying cognitions, the findings support previous investigations arguing an association between preoccupation and EFDs (Kemps et al., 2005; Jones & Rogers, 2003; Vreugdenburg et al., 2003; Rogers & Green, 1993). Thus, the observed deficits on self- and task-monitor, and WM among nationality groups, as well as the existing impairments between restrained and unrestrained eaters on shifting ability, initiate, and WM are mediated by the way English and Greek females and restrained eaters are preoccupied with their thoughts about food, diet, and body-shape. However, the unaffected nationality-related difference on emotional control can provide evidence that deficits in emotional regulation are not mediated by preoccupying cognitions; namely, Greek females are impaired on the way modulating their emotional responses, without any influence on how preoccupied they are about their diet, food, and body shape.

In the line with previous studies, this research supports the mediating role of depressive affect (Gohier et al., 2009; Micco et al., 2009) and fluid intelligence

(Friedman et al., 2006) on EFs. Therefore, both depression and IQ can influence the nationality-related differences on self- and task-monitoring, and WM; as well as the differences on shift, initiate, and WM between restrained and unrestrained eaters. However, the persistent difference on emotional control indicates that these mechanisms could not influence this specific component. This finding supports previous studies that argue that neither depression nor fluid intelligence can mediate all the components of EFs (Kemps et al., 2005; Johnstone et al., 2000).

In summary, the current thesis has provided evidence for the potential role of BMI, preoccupying cognitions, depressive affect, and IQ on EFs in mediating group-related differences in EF. With the exception of emotional control, the remaining deficits on self- and task-monitoring functions, as well as WM between English and Greek females; as well as the impairments on shifting ability, initiate, and WM between restrained and unrestrained eaters are at least partly attributable to the mediating effect of those factors.

#### 9.2.5: The Moderating Effect

Taking into consideration the mediating effect of BMI, preoccupying cognitions, depressive affect, and fluid intelligence on nationality and DEBQ-R groups in components of EFs, the researcher has further explored which of these factors could moderate the overall effect of nationality in EFs as well as the main effects of nationality and restrained eating in EFs.

When the variance attributable to BMI, the overall (multivariate) nationality effect on EFs has been unaffected. This has been confirmed by the ES that has been only reduced by 2.6%, suggesting that most of the variance is attributable to group differences associated with nationality. The observed (univariate) differences of nationality group on emotional control and task monitor are still significant, with the ESs to be only reduced by .1% and 1.9% respectively. Regarding the restrained eating group, BMI could not moderate the existing difference on WM, with the ES to be only reduced by .2%. These findings indicate that the differences of nationality group on emotional control and task monitor, as well as the differences of restrained eating group on WM are due to the group differences rather than the partial role of BMI. In contrast, BMI has found to moderate the nationality-related differences on self-monitor and WM, as well as the DEBQ-R differences on shift and initiate, suggesting that group differences in these specific components of EFs are partly attributable by the moderating role of BMI.

Regarding the role preoccupying cognitions on overall nationality effect in EFs, the analysis has indicated that the variance is attributable to nationality group differences and not due to the inclusion of the covariate. This has been confirmed by the ES that has been only reduced by .9%. With the exception of emotional control the remaining nationality differences on self-monitor, WM, and task monitor, as well as the observed differences between restrained and unrestrained eaters on shift, initiate, and WM have been reduced after the inclusion of preoccupying cognitions; indicating that group differences in these specific components of EFs are partly attributable by the moderating effect of

preoccupying cognitions. The unaffected nationality-related difference on emotional control suggests that this difference is due to nationality group differences and that preoccupying cognitions cannot control this difference. This has been confirmed by the ES that has been increased by 2.1%.

When the variance attributable to depressive affect, the overall nationality effect on EFs has been unaffected; this has been confirmed by the ES that has been only increased by 1%. The observed difference of nationality group on emotional control remains significant, with the ES to be increased by 2.3%. Furthermore, the findings have indicated that depression could not moderate the nationality-related differences on self- and task-monitor, with the ESs to be only reduced by .4% and .6% respectively; but could influence the group differences on WM performance. Regarding the differences between restrained and unrestrained eaters on shift, initiate, and WM have been reduced after the inclusion of the covariate. Therefore, the nationality-related differences in WM, as well as the DEBQ-R differences in shift, initiate, and WM are partly attributable by the moderating role of depression.

Finally, when the variance attributable to fluid intelligence, the overall nationality effect on EFs remains significant. The ES has been only reduced by 1.1% suggesting that most of the variance is attributable to nationality group differences. Surprising is the finding presented on emotional control between English and Greek females, as IQ seems to be the only factor that tested within this thesis that partially moderates this difference. The observed nationality group difference on self-monitor has been also reduced after the inclusion of the covariate. In contrast, the existing group differences on WM and task monitor have been unaffected

when the variance attributable to IQ, with the ESs to be only reduced by .1% and .3% respectively. With regards to the observed difference of restrained eating group on shift, the analysis has indicated that this difference is partially moderated by the IQ; while the observed group differences on initiate and WM remain significant, with the ESs to be only reduced by .1% and .0% respectively.

Therefore, it can be argued that the most important factor to moderate the overall nationality effect in EFs is the BMI as it has been found to mostly reduce the ES by 2.6%. As for the main effects of nationality group in components of EFs, the most important variable that can moderated group differences is the preoccupying cognitions. In addition to preoccupying cognitions, fluid intelligence is important to moderate the effect of nationality on emotional control. Finally, both preoccupying thought about food, diet, and body shape, as well as depressive affect are important factors to moderate the differences between restrained and unrestrained eaters in components of EFs.

#### 9.2.6: Evidences from BRIEF-A

As has been suggested in Chapter 4 and further discussed in Chapter 6, the BRIEF-A is a well-validated self-report measure that has been designed in order to capture the adult's ability to cognitively manage attention and problem-solving; as well as to maintain appropriate regulatory controls of their behaviour and emotional responses in the everyday environment. With regards to the utility of BRIEF-A within non-clinical (e.g., Hadjiefthyvoulou, Fisk, Montgomery, & Bridges, 2011)

and clinical (e.g., Toplak et al., 2009) populations, the current thesis is able to provide further evidence for its utility in a new area of investigation which explores cross-cultural and DR-related differences on EFs performances within healthy university females.

Additionally, as has been documented within this thesis, researchers have increasingly adopted the Baddeley's model of WM (e.g., Kemps et al., 2005; Green et al., 2003) or laboratory tasks (e.g., Ball et al., 2010) in order to evaluate and examine CES, mainly components of WM. This thesis, has further revealed that restrained eaters are impaired not only on WM via the BRIEF-A, but also on their cognitive and behavioural shifting ability, as well as on initiate. Regarding the observed differences between restrained and unrestrained eaters on shifting, it could be argued that the BRIEF-A contextualises the shifting component of Miyake et al.'s (2000) model of EF in a real word context and in terms of everyday behaviours which may be more relevant to the investigation of these functions in the context of EDs in general and restrained eating in particular.

Furthermore, BRIEF-A appears to have utility in investigating cross-cultural differences on EFs. The observed differences on emotional control, self- and task-monitoring function, and WM indicate that BRIEF-A can capture these specific components cross-culturally. The values for Cronbach's alpha obtained in the present study also support the proposition that the BRIEF-A is a reliable self-report measure. The pattern of associations observed between the BRIEF-A subscales and the various covariates and the univariate differences associated with the DEBQ-R contribute to evidence supporting the validity of the measure

highlighting its ability to capture the behavioural and cognitive manifestations of executive functioning in real word situations thereby going beyond laboratory-based tasks.

### **9.3: Implications of the present Research and Contribution to the existing Literature**

The findings of the present research have implications that make several important contributions to the literature based on EF and cognitive functioning cross-culturally. First of all, this thesis is able to provide additional evidence for the utility of BRIEF-A within academic students without any neuro-psychological disorder; and allow the researcher to argue not only for the fractionalisation of EFs, but to further reveal important evidence for the unitary and non-unitary role of EFs that Baddeley's model of WM fails to provide.

Secondly, the results presented here demonstrate potential the impact of culture on EFs, particularly on components that are related to emotional regulation, self- and task-monitoring function, as well as WM. These findings could involve on the contribution of cultural-related differences on the domain of executive functioning that is still elusive in this cohort.

Thirdly, the observed differences between restrained and unrestrained eaters on shift, initiate, and WM sub-scales of BRIEF-A, suggest that deficits on those specific components of EFs are indicative of a particular wide-ranging

consequence of restrained eating, which may serve to compromise a female's ability to conduct their everyday lives at an optimal level on those specific components of EFs.

Fourthly, the partial mediating role of BMI, preoccupying cognitions, depressive affect, and fluid intelligence of the observed impairments on self- and task-monitor, shift, initiate, and WM provides further information regarding this area of investigation. However, the fact that the emotional control deficit in nationality group has been unaffected by these mediators, suggests that individuals, especially Greek females, show difficulties on emotional self-regulation independently for their levels of BMI, depression, and IQ, as well as how preoccupied they are for their diet, food, and body-shape.

Finally, the current thesis has offered new evidence for the moderating role of BMI for controlling the overall nationality effect in EFs; and preoccupying thoughts about food, diet, and body-shape for controlling specific components of EFs, such as WM. In addition to BMI and preoccupying cognitions, the role of IQ has found to be the most important variable moderating the cultural-related difference on emotional control. With regards to restrained eating, the role of preoccupying cognitions and depressive affect has found to moderate the group differences in EFs.



#### **9.4: Limitations of the present Research**

It is worth to mention that this study is not without limitations. First of all the disparity in sample sizes of Greek and English participants does not allow the researcher to argue for aberrant results, as English females are perhaps less likely to constitute a representative sample of the underlying population compared to the Greek case. An additional limitation can be the specificity of the sample. For instance, the results cannot be generalised beyond female university students and further in that only two institutions were sampled. Furthermore, although the use of a Median split on the DEBQ-R is necessary in order to handle multiple DVs in a between participant design, this will possible have resulted in a loss of precision in relation to this variable. Finally, the relatively high correlations between the BRIEF-A sub-scales potentially reduced the multivariate group EFs for DEBQ-R and nationality x DEBQ-R groups and with that the power of the procedure.

#### **9.5: Recommendations for Future Research**

The findings of the current thesis appear to be potentially useful for informing future directions in field of EP and cognitive functioning, especially in the domain of EFs. First of all, it is recommended that further research should employ the BRIEF-A or other ecologically valid methodologies in order to examine components of EFs in this cohort.

Secondly, further work needs to be done in order to confirm the existence of cultural-related differences in EFs, especially on the hot components of EFs. Additionally, the current investigation has shown that culture has a global impact on emotional regulation between English and Greek female students independently of their rates of BMI, preocculying cognitions, depressive effect, and levels of IQ, with Greek females to clearly present more executive dysfunctions on this component of EFs. Therefore, it is proposed the need for the design of early intervention plan in order to detect the impact of culture on emotional regulation and to prevent such negative occurrences in future. The development of an intervention plan on this particular area could offer real-world applications of this research, such as to improve the quality of life of people, especially among Greek female students, who show difficulties on their everyday emotional regulations, as well as to decrease the pessimistic effects of executive functioning in individuals. One possible intervention plan could apply CBT therapy sessions which could help people to modulate their emotional responses in everyday environment and offer more individually tailored sessions addressing various EF performances, such as impulsiveness related to inhibitory control.

In addition to the above, the current research has clearly highlited the impact of restraint eating on EFs within university female population. Due to the fact that many restrained eaters are more likely to develop Bulimic Symptomatology along the *Continuum model of EP*, further experimental investigations are needed to estimate if deficits presented by restrained eaters are due to DR or due to Bulimic Symptomatology.

## **9.6: Conclusion**

To conclude, the current thesis has aimed to cross-culturally determine whether non-eating disordered females with restrained eating style exhibit deficits in a wide range of EFs via a well-established self-report measure, the BRIEF-A, and not through Baddeley's traditional three-component model of WM often adopted in this area of investigation. Additionally, this study has further examined potential mechanisms underlying central executive impairments, including the moderating role of BMI, preoccupying cognitions, depressive symptoms, and fluid intelligence.

The findings of this research appear to be interesting and provide evidence that culture and restrained eating both potentially impact on central executive functioning. This impact is at least partly a function of the mediating variables addressed in this study. Therefore, this thesis provides tentative evidence for cross-cultural differences on EFs, as well as the impact of restrained eating on everyday performances related to EFs. As such it could provide a basis for future research in the domain of EP and executive functioning within non-clinical populations cross-culturally.

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## APPENDIX (by Chapter)

### Chapter 6

#### Appendix 6.1: Demographic Questionnaire (English)

**What is your Nationality?** .....

**Age** .....

**Gender**

☐ Male

☐ Female

**Level of Education**

☐ Bachelor's Degree

☐ Master's Degree

☐ Doctorate

☐ Other

**Current Weight** .....

**Current Height** .....

**Are you currently on a diet to lose or maintain your weight?**

☐ YES

☐ NO

*If YES, then please specify*

➤ What diet are you on? .....

➤ How long have you been dieting for? .....

➤ How much of weight have you lost? .....

Do you have ANY medical problems, including epilepsy, hypertension, anxiety, depression, problems with your digestion or eating behaviours?

- ☐ YES  
☐ NO

If YES, please give details below.

.....  
.....  
.....  
.....

Are you on ANY medication?

- ☐ YES  
☐ NO

If YES, please give details below.

.....  
.....  
.....  
.....

Do you drink alcohol?

- ☐ YES  
☐ NO

If YES, please specify how many units you drink per week (one unit of alcohol approx equals to half glass of wine, half pint of beer or cider, or one measure of spirits (40% alcohol):

- ☐ Up to 14 units per week  
☐ 15-35 units per week  
☐ Over 35 units per week

## Appendix 6.1: ΔΗΜΟΓΡΑΦΙΚΕΣ ΕΡΩΤΗΣΕΙΣ (Greek)

Ποια είναι η εθνικότητά σας; .....

Ηλικία .....

Φύλο ☐ Άνδρας  
☐ Γυναίκα

Επίπεδο σπουδών ☐ ΑΕΙ/ΤΕΙ  
☐ Μεταπτυχιακό  
☐ Διδακτορικό  
☐ Άλλο

Βάρος (Τελευταία μέτρηση) .....

Ύψος .....

Βρίσκεστε αυτό το χρονικό διάστημα σε δίαιτα προκειμένου να χάσετε κιλά ή να διατηρήσετε το βάρος σας; ☐ ΝΑΙ  
☐ ΟΧΙ

Εάν ΝΑΙ, παρακαλώ διευκρινίστε

- Τι δίαιτα ακολουθείτε? .....
- Πόσο καιρό ακολουθείτε τη δίαιτα? .....
- Πόσα κιλά έχετε χάσει? .....



Έχετε κάποιο ιατρικό πρόβλημα, συμπεριλαμβανομένου και της επιληψίας, υπέρτασης, άγχους και στρες, κατάθλιψης, προβλημάτων του πεπτικού σας συστήματος, ή διαταραχών διατροφής ;

☐ ΝΑΙ  
☐ ΟΧΙ

Εάν **ναι**, παρακαλώ δώστε πληροφορίες παρακάτω:

.....  
.....  
.....  
.....

Ακολουθείτε κάποια φαρμακευτική αγωγή;

☐ ΝΑΙ  
☐ ΟΧΙ

Εάν **ναι**, παρακαλώ δώστε πληροφορίες παρακάτω:

.....  
.....  
.....  
.....

Καταναλώνετε αλκοόλ;

☐ ΝΑΙ  
☐ ΟΧΙ

Εάν **ναι**, παρακαλώ διευκρινίστε πόσες μονάδες αλκοόλ, καταναλώνετε εβδομαδιαίως (με τον όρο μονάδα εννοείται περίπου μισό ποτήρι κρασί ,ένα μπουκάλι μπίρα ή ένα ποτό(40% αλκοόλ):

- ☐ Μέχρι 14 μονάδες την εβδομάδα
- ☐ 15-35 μονάδες την εβδομάδα
- ☐ Πάνω από 35 μονάδες την εβδομάδα

## Appendix 6.2: Dutch Eating Behavioural Questionnaire-Restraint (DEBQ-R) (English)

Please read each question and then decide whether each item is true in relation to you, using the following rating scale:

- Never (1)
- Rarely (2)
- Sometimes (3)
- Often (4)
- Very often (5)

***Please circle the box that corresponds to your rating.*** Please respond to all items, making sure that you circle the box for the rating that is true about you.

	Never	Rarely	Sometimes	Often	Very often
If you have put on weight, do you eat less than you usually do?	1	2	3	4	5
How often do you refuse food or drink offered because you are concerned about your weight?	1	2	3	4	5
Do you try to eat less at mealtimes than you would like to eat?	1	2	3	4	5
Do you watch exactly what you eat?	1	2	3	4	5
Do you deliberately eat foods that are slimming?	1	2	3	4	5
When you have eaten too much, do you eat less than usual the following days?	1	2	3	4	5
Do you deliberately eat less in order not to become heavier?	1	2	3	4	5
How often do you try not to eat between meals because you are watching your weight?	1	2	3	4	5
How often in the evening do you try not to eat because you are watching your weight?	1	2	3	4	5
Do you take into account your weight with what you eat?	1	2	3	4	5

## Appendix 6.2: Ολλανδικό Ερωτηματολόγιο Συμπεριφοράς Κατανάλωσης (Greek)

Παρακαλώ διαβάστε κάθε ερώτηση και μετά αποφασίστε ποια απάντηση σας αντιπροσωπεύει περισσότερο, χρησιμοποιώντας την παρακάτω κλίμακα:

- Ποτέ (1)
- Σπάνια (2)
- Μερικές φορές (3)
- Συχνά (4)
- Πολύ συχνά (5)

**Κυκλώστε τον αριθμό που αντιπροσωπεύει την απάντησή σας.** Παρακαλώ απαντήστε σε όλες τις ερωτήσεις, δίνοντας προσοχή στο να σημειώσετε την αληθή απάντηση για τον εαυτό σας.

	Ποτέ	Σπάνια	Μερικές Φορές	Συχνά	Πολύ συχνά
Εάν έχετε πάρει κιλά, τρώτε λιγότερο από ότι συνήθως;	1	2	3	4	5
Πόσο συχνά αρνείστε φαγητό ή ποτό που σας προσφέρεται γιατί ανησυχείτε για το βάρος σας;	1	2	3	4	5
Προσπαθείτε να φάτε λιγότερο στα γεύματα από όσο πραγματικά θέλετε να φάτε;	1	2	3	4	5
Παρατηρείτε ακριβώς τι τρώτε;	1	2	3	4	5
Τρώτε επιμελώς τροφές που αδυνατίζουν;	1	2	3	4	5
Όταν έχετε φάει αρκετά, τις επόμενες μέρες τρώτε λιγότερο από ότι συνήθως;	1	2	3	4	5
Τρώτε επιμελώς λιγότερο προκειμένου να μην παχύνετε;	1	2	3	4	5
Πόσο συχνά προσπαθείτε να μην φάτε ανάμεσα στα γεύματα γιατί προσέχετε το βάρος σας;	1	2	3	4	5
Πόσο συχνά προσπαθείτε να μην φάτε τα απογεύματα επειδή προσέχετε το βάρος σας;	1	2	3	4	5
Παρατηρείτε ακριβώς το βάρος σας με τα φαγητά που τρώτε;	1	2	3	4	5

# Appendix 6.3: Behavior Rating Inventory of Executive Function- Adult Version (BRIEF-A)(English)

Date:

Gender:

Male

Female

Age:

Date of Birth:

Years of Education:

Level of education:

Less than High School

High School

College

Master's Degree

Doctorate

Other

*During the past month*, how often has each of the following behaviors been a *problem*?

*N= Never, S=Sometimes, O=Often*

I have angry outbursts	N	S	O
I make careless errors when completing tasks	N	S	O
I am disorganized	N	S	O
I have trouble concentrating on tasks (such as chores, reading or work)	N	S	O
I tap my fingers or bounce my legs	N	S	O

I need to be reminded to begin a task even when I am willing	N	S	0
I have a messy closet	N	S	0
I have trouble changing from one activity or task to another	N	S	0
I get overwhelmed by large tasks	N	S	0
I forget my name	N	S	0
I have trouble with jobs or tasks that have more than one step	N	S	0
I overreact emotionally	N	S	0
I don't notice when I cause others to feel bad or get mad until its too late	N	S	0
I have trouble getting ready for the day	N	S	0
I have trouble prioritizing activities	N	S	0
I have trouble sitting still	N	S	0
I forget what am I doing in the middle of things	N	S	0
I don't check my work for mistakes	N	S	0
I have emotional outbursts for little reason	N	S	0
I lie around the house a lot	N	S	0
I start tasks (such as cooking, projects) without the right materials	N	S	0
I have trouble accepting different ways to solve problems with work, friends, or tasks	N	S	0
I talk at the wrong time	N	S	0
I misjudge how difficult or easy tasks will be	N	S	0
I have problems getting started on my own	N	S	0
I have trouble staying on the same topic when I am talking	N	S	0
I get tired	N	S	0
I react more emotionally to situations than my friends	N	S	0
I have problems waiting for my turn	N	S	0
People say that I am disorganized	N	S	0
I lose things (such as keys, money, wallet, homework, etc.)	N	S	0

I have trouble thinking of a different way to solve a problem when I am stuck	N	S	0
I overreact to small problems	N	S	0
I don't plan ahead for future activities	N	S	0
I have a short attention span	N	S	0
I make inappropriate sexual comments	N	S	0
When people seem upset with me, I don't understand why	N	S	0
I have trouble counting to three	N	S	0
I have unrealistic goals	N	S	0
I leave the bathroom a mess	N	S	0
I make careless mistakes	N	S	0
I get emotionally upset easily	N	S	0
I make decisions that <i>get</i> me into trouble (legally, financially, socially)	N	S	0
I am bothered with having to deal with changes	N	S	0
I have difficulty getting excited about things	N	S	0
I forget instructions easily	N	S	0
I have good ideas but I cannot <i>get</i> them on paper	N	S	0
I make mistakes	N	S	0
I have trouble getting started on tasks	N	S	0
I say things without thinking	N	S	0
My anger is intense but ends quickly	N	S	0
I have trouble finishing tasks (such as chores, work)	N	S	0
I start things at the last minute (such as assignments, chores, tasks)	N	S	0
I have difficulty finishing a task on my own	N	S	0
People say that I am easily distracted	N	S	0
I have trouble remembering things, even for a few minutes (such as directions, phone numbers)	N	S	0
People say I am too emotional	N	S	0

I rush through things	N	S	0
I get annoyed	N	S	0
I leave my room or home a mess	N	S	0
I disturbed by unexpected changes in my daily routine	N	S	0
I have trouble coming up with ideas for what to do with my free time	N	S	0
I don't plan ahead for tasks	N	S	0
People say that I don't think before acting	N	S	0
I have trouble finding things in my room, closet, or desk	N	S	0
I have problems organizing activities	N	S	0
After having a problem I don't get over it easily	N	S	0
I have trouble doing more than one thing at a time	N	S	0
My mood changes frequently	N	S	0
I don't think about consequences before doing something	N	S	0
I have trouble organizing work	N	S	0
I get upset quickly or easily over little things	N	S	0
I am impulsive	N	S	0
I don't pick up after myself	N	S	0
I have problems completing my work	N	S	0

### Appendix 6.3: Κατάλογος Εκτίμησης Συμπεριφοράς Λειτουργίας Ενήλικου (Greek)

Ημερομηνία:

Φύλο :        Αρσενικό

                  Θηλυκό

Ηλικία:

Ημερομηνία γέννησης:

Έτος εκπόδευσης:

Επίπεδο εκπόδευσης:        Μικρότερο από Λύκειο

                                  Λύκειο

                                  Ανώτατα εκπαιδευτικά υδρίματα/Κολλέγιο

                                  Μεταπτυχιακή σπουδή

                                  Διδακτορική σπουδή

                                  Άλλο



Κατά τη διάρκεια του *προηγούμενου μήνα.....*, πόσο συχνά κάθε μία από τις ακόλουθες συμπεριφορές σας δημιούργισαν *πρόβλημα*;

Παρακαλώ βάλτε ένα *χ* στο αντίστοιχο κουτί.

	Ποτέ	Μερικές φορές	Συχνά
Έχω ξεσπάσματα	Π	Μ	Σ
Κάνω απρόσεκτα λάθη κατά την ολοκλήρωση των υποχρεώσεών μου	Π	Μ	Σ
Είμαι αποδιοργανωμένος/-η	Π	Μ	Σ
Έχω πρόβλημα να επικεντρώνομαι στους στόχους μου (όπως οι μικροδουλειές, η ανάγνωση ή η εργασία)	Π	Μ	Σ
Χτυπώ τα δαχτυλά μου στο τραπέζι ή τα πόδια μου στο πάτωμα	Π	Μ	Σ
Χρειάζομαι υπενθυμιση για να ξεκινίσω κατι ακόμη κ' αν έχω πρόθεση να το κάνω	Π	Μ	Σ
Έχω ένα ακατάστατο ντουλάπι	Π	Μ	Σ
Έχω πρόβλημα να αλλάζω μια δραστηριότητα ή στόχο σε ένα άλλο	Π	Μ	Σ
Καταπιεζομαι οταν έχω να κάνω πολλές δουλειές	Π	Μ	Σ
Ξεχνώ το όνομά μου	Π	Μ	Σ
Έχω πρόβλημα με τις εργασίες ή τους στόχους που έχουν περισσότερο από ένα βήμα.	Π	Μ	Σ

Αντιδρώ υπερβολικά συναισθηματικά	Π	Μ	Σ
Δεν παρατηρώ όταν στεναχωρώ ή νευριάζω τους ανθρώπους μέχρι που είναι πολύ αργά	Π	Μ	Σ
Έχω πρόβλημα να έτοιμαστώ για την ημέρα.	Π	Μ	Σ
Έχω πρόβλημα στο να βαζω προτεραιότητες στις δραστηριότητές μου	Π	Μ	Σ
Έχω πρόβλημα με το να στέκομαι ακίνητος	Π	Μ	Σ
Ξεχνώ αυτό που κάνω στη μέση των πραγμάτων	Π	Μ	Σ
Δεν ελέγχω την εργασία μου για λάθη	Π	Μ	Σ
Έχω συναισθηματικά ξεσπάσματα για μικρό λόγο	Π	Μ	Σ
Τεμπελιάζω	Π	Μ	Σ
Αρχίζω τους στόχους (όπως το μαγείρεμα, προγράμματα) χωρίς τα σωστά υλικά	Π	Μ	Σ
Έχω πρόβλημα να δεχτώ διαφορετικούς τρόπους για να λύσω τα προβλήματα με την εργασία, τους φίλους, ή τους στόχους	Π	Μ	Σ
Μιλώ με λανθασμένο χρόνο	Π	Μ	Σ
Εκτιμώ εσφαλμένα πώς οι δύσκολοι ή εύκολοι στόχοι θα είναι	Π	Μ	Σ
Έχω πρόβλημα στο να ξεκινήσω κάτι μόνος/-η μου.	Π	Μ	Σ
Έχω πρόβλημα στο να συζητώ γιατί το ίδιο θέμα όταν μιλώ	Π	Μ	Σ

Κουραζομαι	Π	Μ	Σ
Αντιδρώ πιό συναισθηματικά στις καταστάσεις από τους φίλους μου	Π	Μ	Σ
Έχω πρόβλημα να περιμένω τη σειρά μου	Π	Μ	Σ
Οι άνθρωποι λένε ότι είμαι αποδιοργανωμένος/-η	Π	Μ	Σ
Χάνω πράγματα (όπως κλειδιά, χρήματα, πορτοφόλι, εργασίες, κ.λ.π.)	Π	Μ	Σ
Έχω πρόβλημα να σκεφτώ έναν διαφορετικό τρόπο επίλυσης για ένα πρόβλημα όταν είμαι κολλημένος/η	Π	Μ	Σ
Αντιδρω υπερβολικά σε ασυμαντα προβλήματα	Π	Μ	Σ
Δεν προγραμματίζω μελλοντικές δραστηριότητες	Π	Μ	Σ
Αποσπάτε η προσοχή μου πολύ εύκολα	Π	Μ	Σ
Κάνω ακατάλληλα σεξουαλικά σχόλια	Π	Μ	Σ
Δεν καταλαβαίνω γιατί οι άνθρωποι εκνευρίζονται μαζί μου.	Π	Μ	Σ
Εχω πρόβλημα να μετρήσω μέχρι το 3.	Π	Μ	Σ
Έχω μη ρεαλιστικούς στόχους	Π	Μ	Σ
Αφήνω το λουτρό ακαταστατο	Π	Μ	Σ
Κάνω απρόσεκτα λάθη	Π	Μ	Σ

Επιρεάζομαι συναισθηματικά πολύ εύκολα	Π	Μ	Σ
Παιρνω αποφάσεις που με οδηγούν σε πρόβλημα (νόμιμα, οικονομικά, κοινωνικά)	Π	Μ	Σ
Δυσκολευομαι να αντιμετωπισω αλλαγες.	Π	Μ	Σ
Δυσκολευομαι να ενθουσιαστω για πραγματα	Π	Μ	Σ
Ξεχνώ τις οδηγίες εύκολα	Π	Μ	Σ
Έχω καλές ιδέες αλλά δεν μπορώ να τις γραψω σε χαρτί	Π	Μ	Σ
Κάνω λάθη	Π	Μ	Σ
Έχω πρόβλημα να ξεκινήσω ένα στόχο	Π	Μ	Σ
Λέω πράγματα χωρίς να τα σκέφτω	Π	Μ	Σ
Ο θυμός μου είναι έντονος αλλά τελειώνει γρήγορα	Π	Μ	Σ
Έχω πρόβλημα να τελειώσω ένα στόχο (όπως για παραδειγμα μικροδουλειές, εργασία)	Π	Μ	Σ
Αρχίζω πράγματα την τελευταία στιγμή (όπως οι αναθέσεις, οι μικροδουλειές, οι στόχοι)	Π	Μ	Σ
Δυσκολευομαι να τελειωσω τον στοχο μονος/-η μου	Π	Μ	Σ
Οι άνθρωποι λένε ότι αποσπάται η προσοχή μου εύκολα	Π	Μ	Σ
Έχω πρόβλημα να θυμάμαι πράγματα, ακόμη και για λίγα λεπτά (όπως οι κατευθύνσεις, οι τηλεφωνικοί αριθμοί)	Π	Μ	Σ

Οι άνθρωποι λένε ότι είμαι πάρα πολύ συναισθηματικός/-η	Π	Μ	Σ
Κάνω βιαστικά πράγματα	Π	Μ	Σ
Ενοχλούμαι από διάφορα πράγματα	Π	Μ	Σ
Αφήνω το δωμάτιο / το σπίτι μου ακαταστατο	Π	Μ	Σ
Αποσπομαι από τις απροσδόκητες αλλαγές στην καθημερινή ρουτίνα	Π	Μ	Σ
Έχω το πρόβλημα στο να βρω ιδέες να κάνω στον ελεύθερο χρόνο μου	Π	Μ	Σ
Δεν προγραμματίζω τους στόχους	Π	Μ	Σ
Οι άνθρωποι λένε ότι δεν σκέφτομαι πρίν ενεργήσω	Π	Μ	Σ
Έχω πρόβλημα να βρω τα πράγματα στο δωμάτιο, το ντουλάπι, ή το γραφείο μου	Π	Μ	Σ
Έχω προβλήμα να οργανώσω δραστηριότητες	Π	Μ	Σ
Μετά από ένα πρόβλημα δεν προσαρmozομαι εύκολα	Π	Μ	Σ
Έχω πρόβλημα να κάνω περισσότερα από ένα πράγματα τη φορά	Π	Μ	Σ
Η διάθεσή μου αλλάζει συχνά	Π	Μ	Σ
Δεν σκέφτομαι για τις συνέπειες πρίν κάνω κάτι	Π	Μ	Σ
Έχω πρόβλημα να οργανώνω την εργασία	Π	Μ	Σ
Νευριαζω γρήγορα ή εύκολα από μικρά πράγματα	Π	Μ	Σ

Είμαι παρορμητικός	<b>Π</b>	<b>Μ</b>	<b>Σ</b>
Είμαι ακαταστατος/-η	<b>Π</b>	<b>Μ</b>	<b>Σ</b>
Εχω πρόβλημα να ολοκληρώνω την εργασία μου	<b>Π</b>	<b>Μ</b>	<b>Σ</b>

## Appendix 6.4: Preoccupying Cognitions Questionnaire (English)

This questionnaire asks you about your thoughts *during the past month*.

Please read each question carefully and then circle the appropriate number for the category most applicable to you.

*During the past month....*

	Never	Rarely	Sometimes	Often	Very Often	Always
I have noticed the shape of other women/men and felt that my own shape compared unfavourably.	1	2	3	4	5	6
Being with thin women/men has made me feel self-conscious about my shape.	1	2	3	4	5	6
I am aware of the sugar and fat content in foods.	1	2	3	4	5	6
I have been worried that my flesh is not firm enough.	1	2	3	4	5	6
I am scared about being over-weight.	1	2	3	4	5	6
I think I am this shape because I lack self-control.	1	2	3	4	5	6
Worry about my shape has made me feel I ought to exercise	1	2	3	4	5	6
I think a lot about wanting to be thinner.	1	2	3	4	5	6
I am aware of the energy content in food.	1	2	3	4	5	6
I have been particularly self-conscious about my shape when in the company of other people.	1	2	3	4	5	6
I have worried about other people seeing rolls of flesh around my waist or stomach.	1	2	3	4	5	6
I spend most of the day thinking about food.	1	2	3	4	5	6
I think a lot about having fat on my body.	1	2	3	4	5	6
I am preoccupied with thoughts about food and eating.	1	2	3	4	5	6
I spend a lot of time thinking about my weight.	1	2	3	4	5	6
I am so worried about the shape of my body that I have been feeling the need to diet.	1	2	3	4	5	6
I give too much time and thought to food.	1	2	3	4	5	6
Thinking about my shape has interfered with my ability to concentrate.	1	2	3	4	5	6
I have a food dominated life.	1	2	3	4	5	6
I am preoccupied with thought about the shape of my body.	1	2	3	4	5	6

## Appendix 6.4: Ερωτηματολόγιο σχετικά με σκέψεις γύρω από το

### φαγητό και την εικόνα σώματος (Greek)

Αυτό το ερωτηματολόγιο ερευνά τις σκέψεις σας κατά τη διάρκεια του **τελευταίου μήνα**. Παρακαλώ διαβάστε κάθε ερώτηση προσεκτικά και μετά κυκλώστε το κατάλληλο αριθμό που αντιπροσωπεύει την απάντησή σας.

*Τον τελευταίο μήνα.....*

	Ποτέ	Σπάνια	Μερικές φορές	Συχνά	Πολύ συχνά	Πάντα
Έχω παρατηρήσει το σώμα άλλων αντρών/ γυναικών και συγκριτικά με το δικό μου, αισθάνθηκα μειονεκτικά.	1	2	3	4	5	6
Το να βρίσκομαι στον ίδιο χώρο με αδύνατους άντρες/ γυναίκες, με κάνει να προβληματίζομαι για το δικό μου σωματότυπο.	1	2	3	4	5	6
Γνωρίζω τις ποσότητες ζάχαρης και λιπαρών ουσιών που περιέχουν οι τροφές.	1	2	3	4	5	6
Στεναχωριέμαι γιατί το δέρμα μου δεν είναι αρκετά ελαστικό.	1	2	3	4	5	6
Τρομοκρατούμαι με τη σκέψη ότι μπορεί να γίνει υπέρβαρη/ος .	1	2	3	4	5	6
Σκέφτομαι ότι έχω αυτό το σώμα γιατί δεν μπορώ να έχω αυτό-συγκράτηση.	1	2	3	4	5	6
Ο προβληματισμός γύρω από το σώμα μου, με κάνει να αισθάνομαι ότι πρέπει να γυμναστώ.	1	2	3	4	5	6
Σκέφτομαι συχνά ότι θέλω να αδυνατίσω.	1	2	3	4	5	6
Γνωρίζω τη θερμιδική αξία της κάθε τροφής.	1	2	3	4	5	6
Όταν βρίσκομαι μαζί με άλλους ανθρώπους, σκέφτομαι ακόμα περισσότερο το σώμα μου και τη μορφή του.	1	2	3	4	5	6
Στεναχωριέμαι μήπως οι άλλοι προσέξουν το λίπος που υπάρχει γύρω από τη κοιλιά μου ή το στομάχι μου.	1	2	3	4	5	6
Ξοδεύω το περισσότερο χρόνο σκεπτόμενος το φαγητό.	1	2	3	4	5	6
Προβληματίζομαι πολύ σχετικά με το λίπος στο σώμα μου.	1	2	3	4	5	6
Είμαι προκατειλημμένος με σκέψεις γύρω από το φαγητό.	1	2	3	4	5	6
Ξοδεύω πολύ χρόνο σκεπτόμενος το βάρος μου.	1	2	3	4	5	6
Στεναχωριέμαι τόσο πολύ για το σχήμα του σώματος μου που αισθάνομαι την ανάγκη να κάνω δίαιτα.	1	2	3	4	5	6
Ξοδεύω πολύ χρόνο και σκέψη γύρω από το φαγητό.	1	2	3	4	5	6
Τα να σκέπτομαι το σχήμα του σώματός μου, μου αποσπά τη προσοχή και μου είναι δύσκολο να συγκεντρωθώ.	1	2	3	4	5	6
Ζω μία ζωή που καθορίζεται από τη σκέψη μου γύρω από το φαγητό.	1	2	3	4	5	6
Είμαι προκατειλημμένος με σκέψεις γύρω από το σχήμα του σώματός μου.	1	2	3	4	5	6



## Appendix 6.5: Center for Epidemiologic Studies – Depression scale

### (CES-D) (English)

*Please circle the appropriate number.*

*During the past week.....*

	Rarely or none of the time (less than 1 day)	Some or a little of the time (1-2 days)	Occasionally or a moderate amount of the time (3-4 days)	Most or all of the time (5-7 days)
I was bothered by things that usually don't bother me	0	1	2	3
I did not feel like eating; my appetite was poor	0	1	2	3
I felt that I could not shake off the blues even with help from my family and friends	0	1	2	3
I felt that I was just as good as other people	0	1	2	3
I had trouble keeping my mind on what I was doing	0	1	2	3
I felt depressed	0	1	2	3
I felt that everything I did was an effort	0	1	2	3
I felt hopeful about the future	0	1	2	3
I thought my life had been a failure	0	1	2	3
I felt fearful	0	1	2	3
My sleep was restless	0	1	2	3
I was happy	0	1	2	3
I talked less than usual	0	1	2	3
I felt lonely	0	1	2	3
People were unfriendly	0	1	2	3
I enjoyed life	0	1	2	3
I had crying spells	0	1	2	3
I felt sad	0	1	2	3
I felt that people disliked me	0	1	2	3
I could not get "going"	0	1	2	3

## Appendix 6.5: Κέντρο για Επιδημιολογικές μελέτες – Κλίμακα

### Κατάθλιψη (Greek)

Σε παρακαλώ πες μου πόσο συχνά ένιωσες με αυτόν τον τρόπο κατά....

*Την προηγούμενη εβδομάδα....*

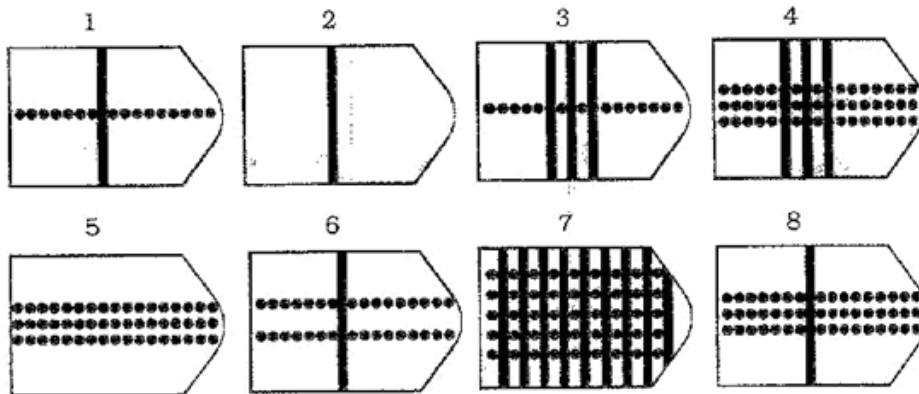
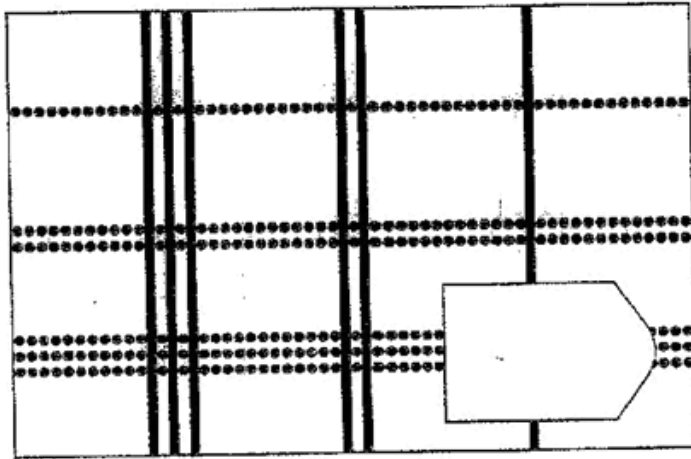
	Σπάνια ή ποτέ (λιγότερο από μια μέρα)	Μερικές ή λίγες φορές (1-2 μέρες)	Περιστασιακά / μερικές φορές (3-4 μέρες)	Τις περισσότερες φορές (5-7 μέρες)
Ενοχλήθηκα από πράγματα που συνήθως δεν με ενοχλούσαν.	0	1	2	3
Δεν ένιωθα να πεινούσα, δεν είχα όρεξη.	0	1	2	3
Ένιωθα ό, τι δεν μπορούσα να καταπολεμήσω την μελαγχολική μου διάθεση, ακόμη και με την βοήθεια φίλων και οικογένειας.	0	1	2	3
Ένιωθα ότι ήμουν όσο καλά όσο ήταν κι οι άλλοι.	0	1	2	3
Είχα πρόβλημα στο να συγκεντρώνομαι σε ό, τι έκανα.	0	1	2	3
Ένιωθα κατάθλιψη.	0	1	2	3
Ένιωθα ό, τι όλα όσα έκανα ήταν μια προσπάθεια.	0	1	2	3
Ένιωθα αισιοδοξία για το μέλλον.	0	1	2	3
Ένιωθα ότι η ζωή μου ήταν μια αποτυχία.	0	1	2	3
Ένιωθα έντρομος/η.	0	1	2	3
Έιχα ανήσυχο ύπνο.	0	1	2	3
Ήμουν χαρούμενος/η.	0	1	2	3
Μιλούσα λιγότερο από ότι συνηθίζω.	0	1	2	3
Ένιωθα μοναξιά.	0	1	2	3
Οι άνθρωποι δεν ήταν φιλικοί.	0	1	2	3
Απολάμβανα την ζωή.	0	1	2	3
Έκλαιγα κατά περιόδους.	0	1	2	3

## Appendix 6.6: Raven's Progressive Matrices (SET I) (English & Greek)

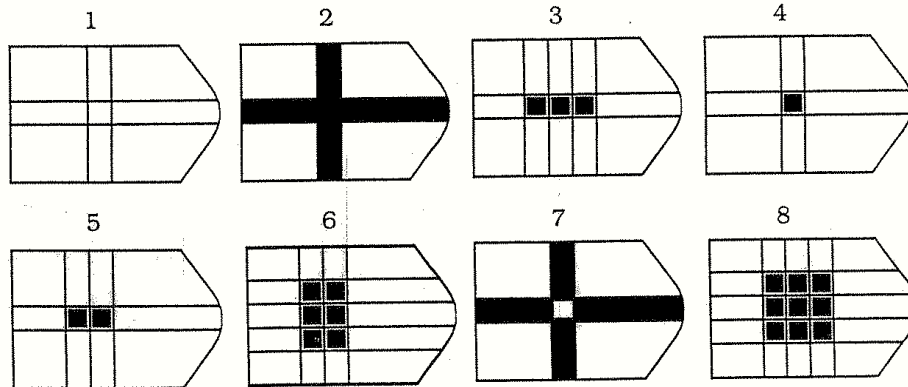
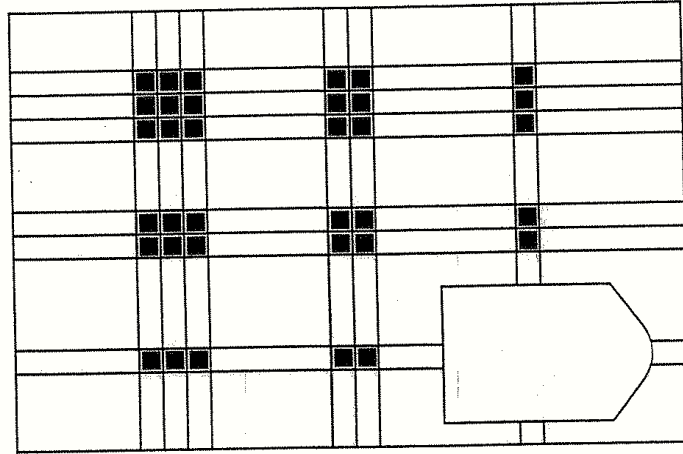
Please identify the item missing to complete the pattern of each abstract picture.

Παρακαλώ διαλέξτε το κομάτι που εσείς πιστεύετε ότι τοποθετώντας το θα ολοκληρωθεί η αρχική εικόνα.

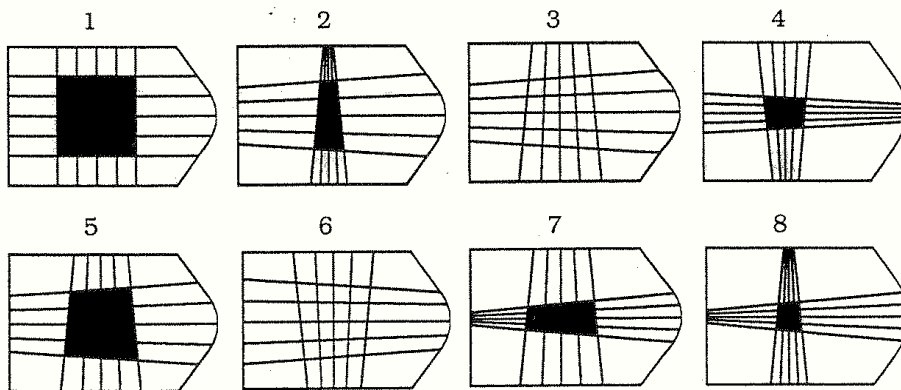
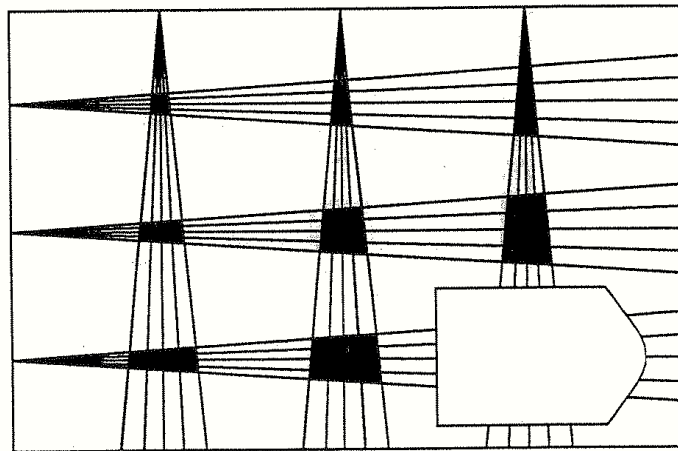
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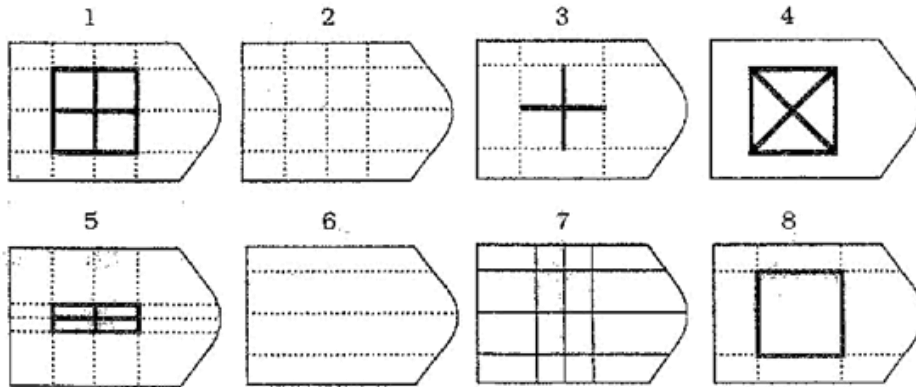
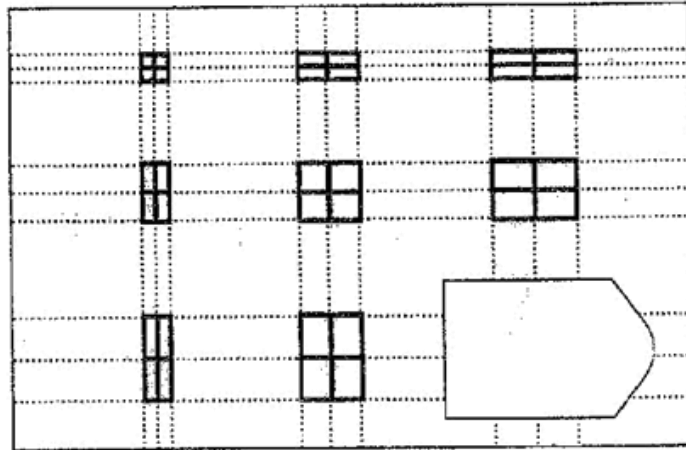
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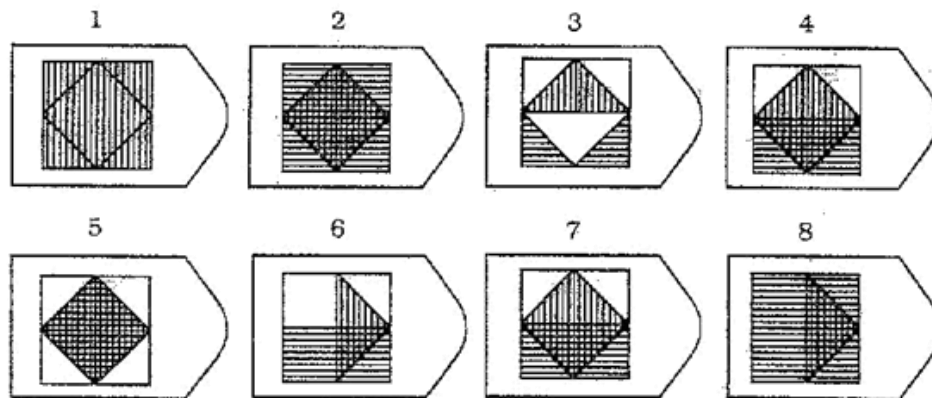
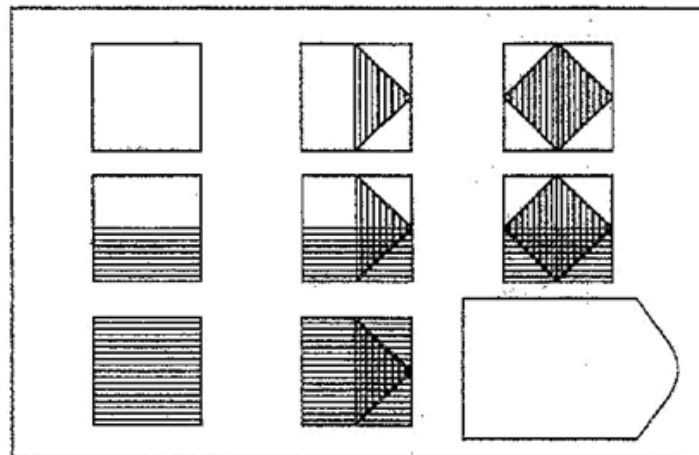
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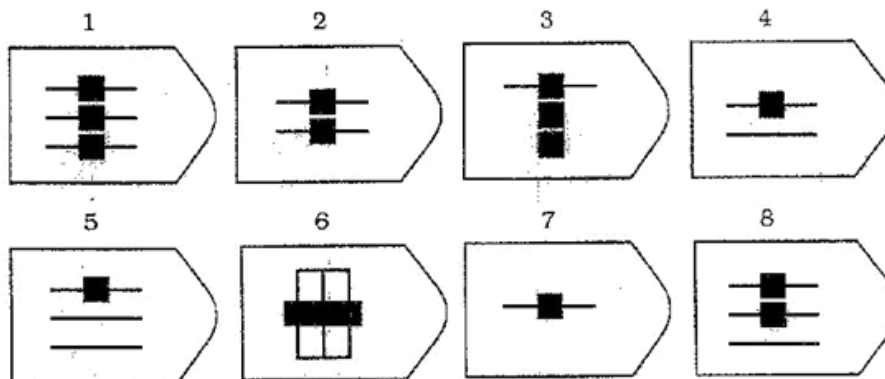
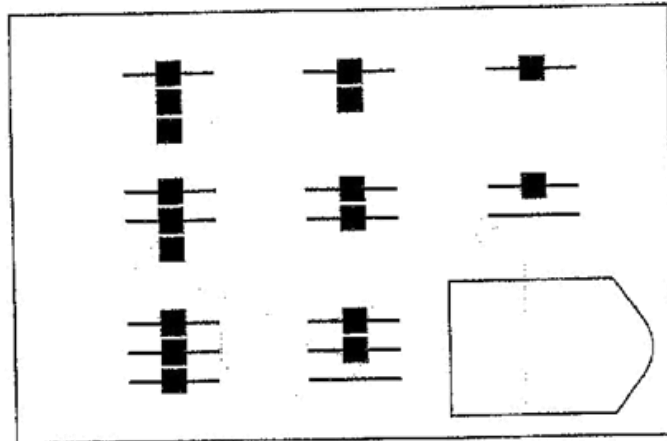


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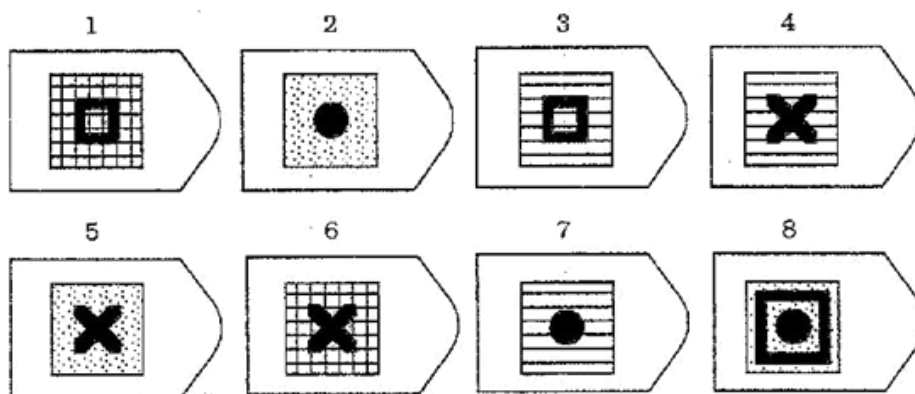
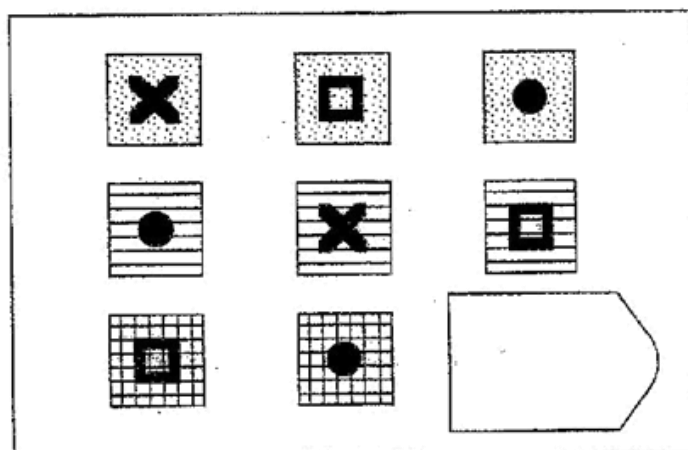




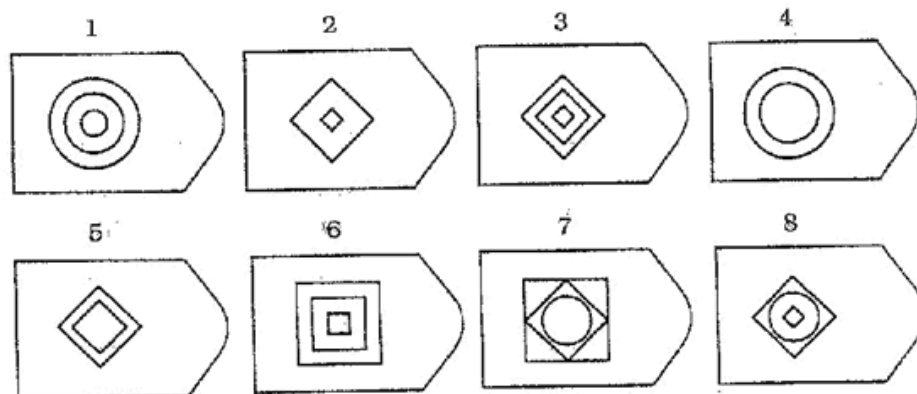
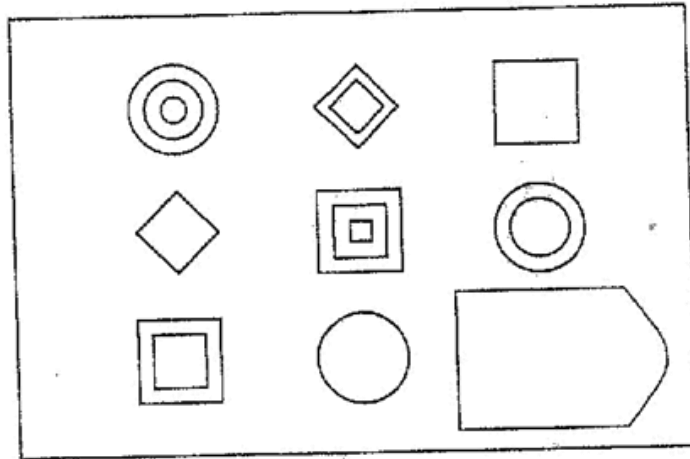
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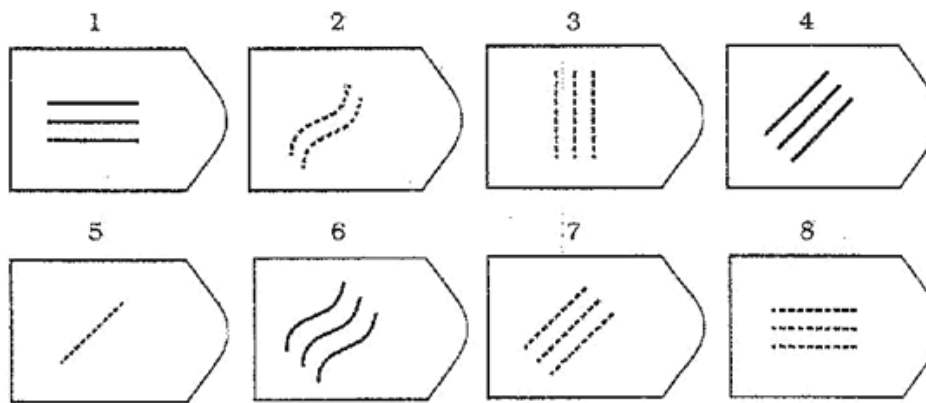
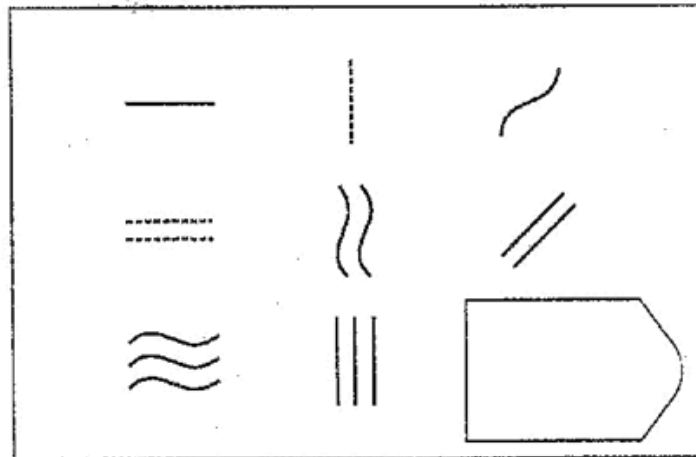
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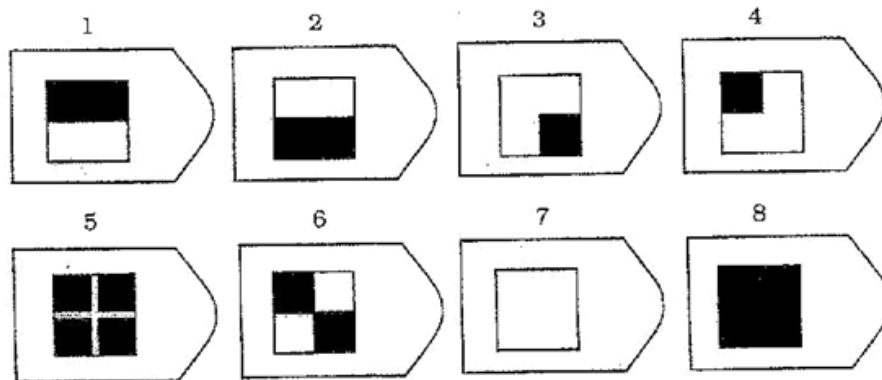
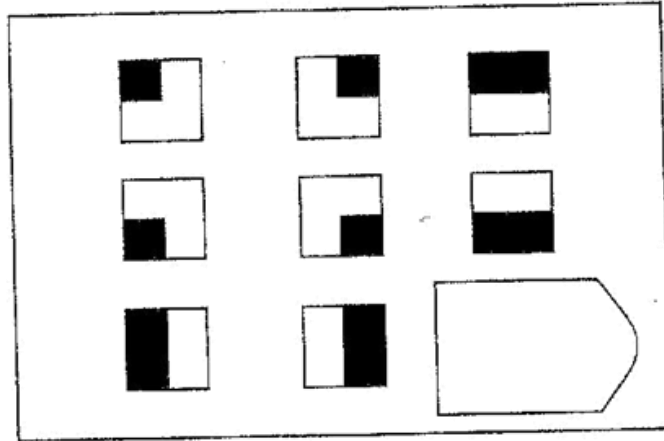
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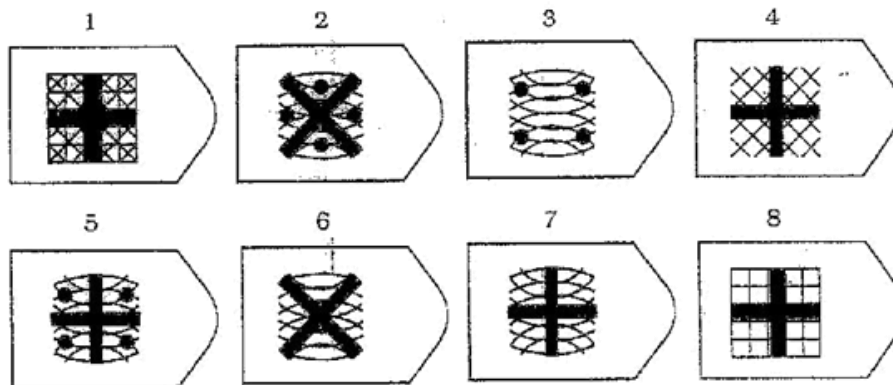
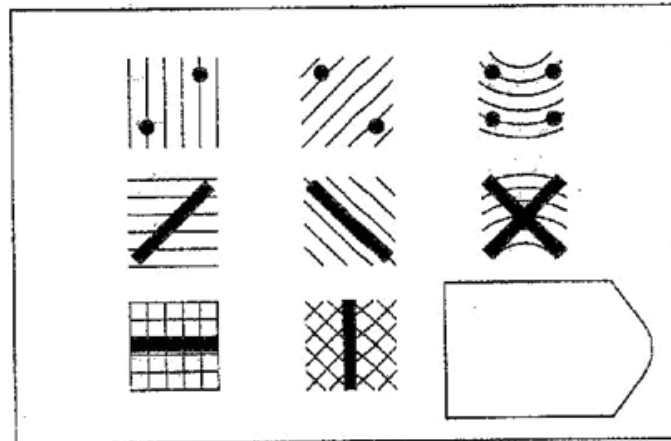
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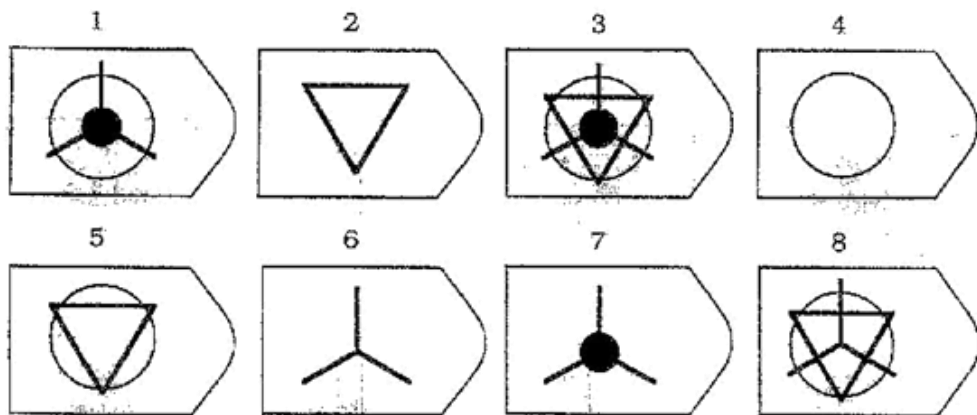
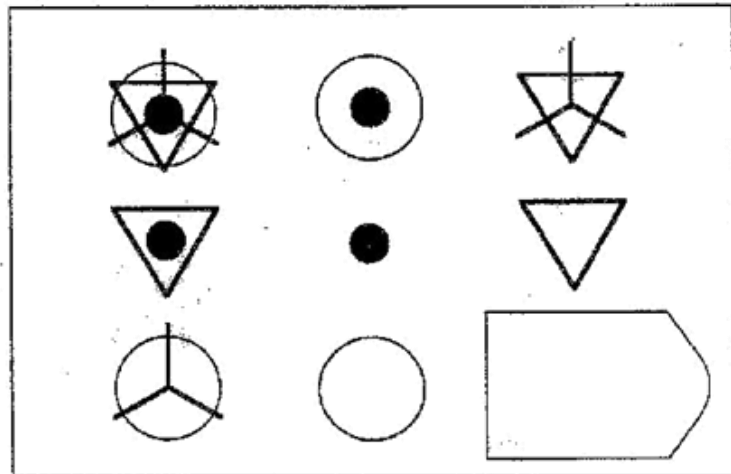
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11



12



## Appendix 6.7a: Briefing Information (English)

Hi,

This study is a part of my Research Masters course at the University of Central Lancashire. I am interested in looking at *what effects different eating attitudes and behaviours have on cognitions (e.g. how you think about things) between English and Greek university students*. 1<sup>st</sup> & 2<sup>nd</sup> year undergraduate Psychology students from UCLan will receive 4 participation credits for taking part in the current study.

If you agree to take part in my study,

you will be asked to complete questionnaires relating to:

- Demographic information
- Eating attitudes and behaviours (DEBQ-R)
- Executive function (How you think about things: BRIEF-A)
- Experienced thoughts about food and body shape
- Mood (Depression: CES-D)
- Rave's Progressive Matrices Scale (SET I; General Intelligence)

It should only take you about 40-50 minutes to fill in these questionnaires.

**The questionnaire booklet is anonymous so do not sign your name.** From the moment you complete the questionnaire pack **you give your consent** to use your answers for the purposes of the research. **You have the right to withdraw from the study up until the point when you submit the completed questionnaires.** After that, withdrawal is impossible, as the questionnaires are anonymous. The individual data will not be traceable to any participant. Data will be analyzed and may be used for journal publications and presentations; the results (data from all participants combined) will therefore be seen by relevant people

(e.g., my Supervisor, Journal Editor, etc...).

*I would like to thank you for your time and consideration,*

Researcher: **Eirini Tatsi**, BSc., MSc (Health Psychology), University of Central Lancashire, email [etatsi@uclan.ac.uk](mailto:etatsi@uclan.ac.uk).

Director of Studies: **Dr Noreen Caswell**, CPsychol, FHEA, University of Central Lancashire, Darwin Building, Room 201, email [ncaswell1@uclan.ac.uk](mailto:ncaswell1@uclan.ac.uk)



## Appendix 6.7a: Ενημερωτικές οδηγίες (Greek)

Γεια σας,

Η παρούσα έρευνα είναι ένα μέρος από το University of Central Lancashire (UCLan; UK). Ενδιαφέρομαι να εξετάσω τα συμπτώματα των διαφορετικών διατροφικών συμπεριφεριών στο γνωστικό κομμάτι της ψυχολογίας μεταξύ Ελλήνων και Άγγλων σπουδαστών.

**Εάν συμφωνήτε** να πάρετε μέρος στην ερευνά μου, θα σας ζητηθεί να συμπληρώσετε τα ακόλουθα ερωτηματολόγια τα οποία είναι:

- Δημογραφικές ερωτήσεις
- Διατροφικές συνήθειες και συμπεριφορές (DEBQ-R)
- Γνωστική λειτουργία (πώς σκέφτεστε για τα πράγματα: BRIEF-A)
- Ερωτηματολόγιο σχετικά με σκέψεις γύρω από το φαγητό και την εικόνα σώματος
- Διάθεση συμπεριφοράς (Κατάθλιψη: CES-D)
- Raven's Progressive Matrices Scale (SET I; IQ)

Ο συνολικός χρόνος που θα χρειαστεί για να συμπληρώσετε όλα τα ερωτηματολόγια, θα είναι περίπου 40-50 λεπτά.

Θα ήθελα να σας επισημάνω ότι δεν θα χρειαστεί να αναφέρετε **το ονομά σας**, αφού όλα τα ερωτηματολόγια είναι **ανώνυμα**. Από την στιγμή που θα συμπληρώσετε τα ερωτηματολόγια αυτόματα δίνετε την **εγκρίσή** σας να χρησιμοποιηθούν οι απαντήσεις σας για τον σκοπό της παρούσας έρευνας. Ωστόσο έχετε το κάθε δικαίωμα να αποχωρήσετε από την έρευνα μόνο εάν δεν παραδώσετε τα ερωτηματολόγια και αυτό γιατί μετά από την παράδοση τους, θα είναι πολύ δύσκολο να αποχωρήσετε αφού τα ερωτηματολόγια είναι ανώνυμα. Τέλος θέλω να σας ενημερώσω ότι οι απαντήσεις σας θα εξεταστούν **μόνο από εμένα και την επότριά μου και μόνο παρὰ μόνο το συνολικό αποτέλεσμα της έρευνας θα δημοσιευθεί.**

Σας ευχαριστώ για τον χρόνο σας,

Ερευνήτρια: **Ειρήνη Τάτσι**, University of Central Lancashire, email [etatsi@uclan.ac.uk](mailto:etatsi@uclan.ac.uk).

Επόπτρια: **Noreen Caswell**, CPsychol, FHEA, University of Central Lancashire, Darwin Building, Room 201, email [ncaswell1@uclan.ac.uk](mailto:ncaswell1@uclan.ac.uk)

## Appendix 6.7b: Debriefing Information (English)

The main goal of this research is to *investigate whether females with severe eating have deficits on executive functions cross-culturally.*

**If you felt distressed by any of the issues raised in this study then you may find the following contacts helpful:**

1. Eating Disorders Association (EDA), Helpline: 08456341414,  
Web: <http://www.edauk.com> (for information about eating disorders, self-help groups and contacts)
2. Your therapist or GP

**If you require any further details about this research, please contact:**

Me: Eirini Tatsi, [etatsi@uclan.ac.uk](mailto:etatsi@uclan.ac.uk)

Or

My Director of Studies: Dr. Noreen Caswell, CPsychol, FHEA, [NCaswell1@uclan.ac.uk](mailto:NCaswell1@uclan.ac.uk)

*Thank you for your time and participation; it's greatly appreciated.*

*Eirini*

## Appendix 6.7b: Ενημερωτικές πληροφορίες (Greek)

Η παρούσα έρευνα στοχεύει να εξετάσει κατά πόσο φοιτήτριες από την Αγγλία και την Ελλάδα με σοβαρές διατροφικές συμπεριφορές έχουν ελλείμματα σε εκτελεστικές λειτουργίες.

**Εάν κατά την διάρκεια συμπλήρωσης των ερωτηματολογίων πιστέψετε ότι οι ερωτήσεις σας αντιπροσωπεύουν ή ότι θέλετε να μάθετε περισσότερα σχετικά με τις διατροφικές διαταραχές, τότε θα βρείτε τις ακόλουθες επαφές χρήσιμες.**

1. Hellenic Psychiatric Association: <http://www.psych.gr/GR/default.asp>
2. Eating Disorders Association (EDA), Helpline: 08456341414,  
Web: <http://www.edauk.com/> (For information about eating disorders, self-help groups and contacts.)
3. The National Centre For Eating Disorders (Greece): <http://www.eatingdisorders.gr/>
4. ΑΝΑΣΑ (Greece): <http://www.anasa.com.gr/main.htm>
5. Τον προσωπικό σας ιατρό.

**Παρακαλώ μη διστάσετε να επικοινωνήσετε μαζί μου, εάν χρειάζεστε περισσότερες πληροφορίες σχετικά με την παρούσα έρευνα.**

Email: [etatsi@uclan.ac.uk](mailto:etatsi@uclan.ac.uk)

*Σας ευχαριστώ για τη συνεργασία σας*

*Ειρήνη*

Appendix 6.8: Reliability (please refer to CD)

## **Chapter 7** (please refer to CD)

Appendix 7.1: Screening & Cleaning the Data

Appendix 7.2: Missing Value Analysis

Appendix 7.3: Exploring Multivariate Outliers

Appendix 7.4: Exploring Univariate Outliers

## **Chapter 8** (please refer to CD)

Appendix 8.1: Median for DEBQ-R & Demographic

Appendix 8.2: Univariate ANOVA(s)

Appendix 8.3: Multivariate Analysis

Appendix 8.4: Correlations

Appendix 8.5: Multivariate Analysis of Covariance

Appendix 8.6: The importance of BMI, preoccupying cognitions, depression, & fluid intelligence for nationality and DEBQ-R differences