EXAMINING THE RELATIONSHIP BETWEEN INFORMATION PROCESSING STRATEGIES AND DISORDERED EATING BEHAVIOUR

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ABSTRACT

Many cognitive theories point to key factors underlying the development and maintenance of eating disorders, such as: unhealthy food-related cognitive biases, negative body attitude, and perfectionism. The present research utilised eye-tracking during reading as a novel implicit measure of how these factors may relate to eating disorder tendencies in females and males, followed by the development of two new male body dissatisfaction scales. In four experiments female and male (N = 360) participants' eye movements were monitored while they read third- and second-person perspective texts in which the characters' emotional responses to food-, body image-, and perfectionism-related scenarios were described. Overall, results from these studies suggest that on-line processing of characters' emotional responses to perfectionism-, and to a lesser extent, body image-related information is predictive of participants' disordered eating tendencies, thus supporting theories in which these two underlying factors are key to developing and maintaining eating disorders. Interestingly, the on-line processing of characters' emotional responses to food-related scenarios did not predict eating disorder tendencies, as participants read food-related scenarios similarly, regardless of having a higher eating disorder level. In Chapter V, two new male body dissatisfaction scales: The Male Body Scale (MBS; consisting of emaciated to obese figures) and the Male Fit Body Scale (MFBS; consisting of emaciated to muscular figures) were developed, tested, and re-tested. Male participants (N = 103) rated which of nine body figures on each scale most represented their current- and ideal- body figure, followed by the Drive for Muscularity Scale (DMS), the Eating Disorder Examination Questionnaire (EDE-Q 6.0), and the calculation of their actual body mass index (BMI), fat-, and muscularity-percentage. This was followed by a re-test and manipulation check two to six weeks later. Results found both new scales were

consistently valid and reliable between test and re-test, and importantly, each scale was sensitive to different types of body dissatisfaction within males. Specifically, the MBS revealed that males' desire for the thin-ideal significantly corresponded to higher eating disorder tendencies as shown by EDE-Q 6.0 scores, whilst the MFBS revealed much higher body dissatisfaction toward the larger, muscularity-ideal, predicting higher drive for muscularity as shown by DMS scores. Altogether, the present research findings provide novel insights into cognitive processes underlying disordered eating behaviour, demonstrate the utility of eye-tracking as a more natural implicit measure, provide tools to assess and predict eating disorder tendencies in females and males, and inform eating disorder related research.

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Finally, I am grateful and honoured to do what I love and have this opportunity to contribute toward the decades of research that aim to contend with this deadly disorder at the roots.

DECLARATION

I, Christina Ralph-Nearman, declare that this thesis and the work presented in it are the result of my own research. I thank Hollie Evans for collecting a small portion of the male eye-tracking data, and Caroline Hostettler-Smith for collecting a small portion of the female eye-tracking data under my co-supervision. This work was wholly conducted while I was registered as a PhD student at the University of Nottingham.

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1. CHAPTER I: COGNITIVE ATTENTIONAL BIASES AND EATING DISORDERS

1.1. THESIS OVERVIEW

Statistics reveal that three times more deaths result from eating disorders than all other psychiatric disorders (NICE, 2004). Although there have been at least four decades of eating disorder-related research, the key factors which underlie the development and maintenance of eating disorder tendencies and disordered eating behaviour are still not clear. The present research was performed with the dedication and intent to approach disentangling the underlying mechanisms and assessment of eating disorders in novel and objective ways, with the aim of informing continuing efforts in this important area of research. This thesis examines which underlying mechanisms predict eating disorder tendencies in a non-clinical population, as evidenced by monitoring eye movements during the natural task of reading. Also, this thesis provides new visual tools to assess body dissatisfaction in males in two distinct dimensions (adipose and muscularity), through the development, testing, and re-testing of two new scales: the Male Body Scale (MBS) and the Male Fit Body Scale (MFBS). Ultimately there are three distinct questions this thesis addresses:

(i) Does the way in which people read characters' expected and unexpected emotional responses within food-, body-, and/or perfectionism-related written texts predict eating disorder tendencies and/or BMI in the non-clinical population?

(ii) Which are the key underlying mechanisms (food-, body-, and/or perfectionism-related) of eating disorders in the non-clinical population?

(iii) Are the newly developed male body-dissatisfaction visual scales reliable and valid to measure the two independent dimensions of male body-dissatisfaction (adipose and muscularity)?

1.2. Chapter I Overview

Overall, this thesis aims to address the above three key questions, but first this introductory chapter is composed of three sections to provide an introduction to eating disorders, the research importance, and the current cognitive theories. Firstly, this chapter will define and explain what eating disorders are with a brief historical overview of each of the main three classified eating disorders today (i.e. anorexia nervosa, bulimia nervosa, and binge eating disorder). Secondly, the statistics displaying the importance of the investigation of the underlying mechanisms of eating disorders will be discussed. Finally, this introduction chapter will provide a theoretical overview of cognitive information processing strategies related to eating disorders.

1.3. Eating Disorders

1.3.1. What Are Eating Disorders?

Eating disorders are composed of harmful levels of disordered eating behaviours, which have been defined as individual abnormal eating patterns, such as eating in conjunction with intense emotions, preoccupation, restraint, over-eating, and/or compensatory behaviours to expel food, such as vomiting or over-exercise (Denny, Loth, Eisenberg, & Neumark-Sztainer, 2013). Although disordered eating behaviour has existed for different reasons throughout history, there are three key types of defined eating disorders that continue to emerge in various ways over the past 40 to 50 years in Western societies, which will be defined below.

1.3.1.1. Diagnostic Categories

Eating disorders are categorised as mental disorders, as the abnormal behaviours, emotions, thoughts and relationships seemingly centralised on the avoidance, expelling, and/or over-consumption of food are harmful and often deadly to those who engage in them (WHO, 2017). Two key classification manuals for mental

disorders have been developed which include the classification of eating disorders. One is the "International Statistical Classification of Diseases and Related Health Problems" (currently ICD-10), which is used by the World Health Organisation to classify eating disorders for the purpose of collecting essential international health statistics. The other, commonly referred to for diagnostic criteria, and which will be discussed in more detail, is the "Diagnostic and Statistical Manual" (currently DSM-V; American Psychiatric Association, 2013), created by a society of psychiatrists and published by the American Psychiatric Association (APA).

The three most-established eating disorders defined in the DSM-V are: Anorexia Nervosa, Bulimia Nervosa, and Binge Eating Disorder (see Table 1 for formal DSM-V diagnostic criteria). A fourth category which includes disordered eating outside of the criteria of the three main eating disorder diagnoses is called "Other Specified Feeding or Eating Disorders" (OSFED), which includes Atypical Anorexia Nervosa (when weight is of a normal range, but all other criteria for anorexia nervosa are met), and lower frequency of behaviours for binge eating disorder (less binge eating behaviour) and bulimia nervosa (less compensatory behaviour). OSFED also includes: purging disorder (frequent purging without bingeing), and night eating syndrome (frequently binge eating after dinner which causes significant distress).

TABLE 1
FORMAL DSM-V DIAGNOSTIC CRITERIA FOR EATING DISORDERS (TABLE TAKEN FROM STICE, MARTI, & ROHDE, 2013)

Formal DSM-V Diagnostic Criteria for Eating Disorders	
Anorexia nervosa	● BMI < 85% of the median expected for age and gender
	● Fear of weight gain > 75% of the days for ≥ 3 months
	● Shape and weight is a key aspect of self-evaluation
Bulimia nervosa	● ≥ 4 uncontrollable binge-eating episodes per month for ≥ 3 months
	● ≥ 4 compensatory behavior episodes per month for ≥ 3 months
	● Weight and shape is a main aspect of self-evaluation
Binge eating disorder	● ≥ 4 uncontrollable binge-eating episodes/days per month for ≥ 3 months
	● < 1 compensatory behavior on average per month during this period
	● Marked distress about binge eating
	● Binge eating characterized by ≥ 3 of: rapid eating; eating until uncomfortably full; eating large amounts when not physically hungry; eating alone because of embarrassment; feeling disgusted, depressed, or guilty after overeating

1.3.1.1.1. ANOREXIA NERVOSA (AN)

A key feature of anorexia nervosa is that it involves different levels and methods of self-starvation. Self-starvation behaviours have been documented long before the 19th Century, from Biblical 40-day fasting examples to early renaissance women starving themselves to death as a sign of piety and dedication to God, some of who were later revered to sainthood for their holy self-denial (Bemporad, 1996; Vandereycken & Van Deth, 1994). Self-starvation has been viewed historically as holy or evil, as well as self-liberation from femininity. These themes remain, and most prominently may be observed in how mainstream media commonly link eating and fasting with "clean", "pure", "self-discipline", "holy", "bad", "sinful", "detox", and "cleanse" terminology and concepts (Griffin & Berry, 2003). Still today, those suffering from anorexia nervosa often relate their behaviour to a controlling authoritative "voice" or "spirit" (Callahan, 1982), and children suffering from anorexia nervosa have expressed fear of adult sexuality and have related starvation to remaining childlike (Blitzer, Rollins, & Blackwell, 1961). However, anorexia nervosa is not distinguished solely by self-starvation, but also includes an intense fear of fat, which distinguishes it from many of the historical instances of self-starvation.

Although not commonly acknowledged, it appears that one of the first clinically published descriptions of several instances of anorexia nervosa was in the 1860 *Journal of Psychological Medicine and Mental Pathology* by Dr. Louis-Victor Marcé (Silverman, 1989). Several years later, Sir William Withey Gull read his paper about "anorexic hystérique", and in 1873 anorexia nervosa was formally named and published by both Sir Gull in London and Dr. Ernest-Charles Lasègue in Paris (Gull, 1997; Vandereycken, 2002), just a few months apart. In these papers, anorexia nervosa was

described similarly as it is today. In 1952 anorexia nervosa was included in the first Diagnostic and Statistical Manual (American Psychiatric Association, 1952).

Currently, anorexia nervosa is an eating disorder defined by restricting one's food intake or caloric intake to the point of acute weight reduction, a chronic fear of fat, and self-evaluation is highly influenced by body shape and weight (DSM-V). There are two subtypes of anorexia nervosa which point to the strategies utilised in order to maintain acute weight reduction, which are: anorexia nervosa of the restricting type and anorexia nervosa of the binge-eating/purging type.

Most commonly, anorexia nervosa is associated with the behaviours of anorexia nervosa of the restricting type, which come in many forms to limit, control, hinder, and restrict caloric intake. Some restrictive strategies include: excluding or including certain foods in one's diet, keeping a very low calorie count, eating less than two meals a day, and developing inflexible, obsessive rules around what one will or will not eat, etc. Less commonly realised is anorexia nervosa of the binge-eating/purging type in which a person not only participates in anorexia nervosa of the restricting type behaviours, but also consistently displays binge-eating or purging strategies, such as overuse of laxatives, enemas, diuretics, over-exercise, self-forced vomiting, etc.

1.3.1.1.2. BULIMIA NERVOSA (BN)

Two distinguishing behaviours of bulimia nervosa that appear throughout history include the quick intake and then quick expulsion of large amounts of food in a single sitting. For example, to display wealth, the Romans were known to habitually consume large amounts of food and vomit at feasts and meals (Crichton, 1996). Also, a condition called "bulimy" in Greek appears in the ancient Talmud (Kaplan & Garfinkel, 1984). However, as with the history of self-starvation and anorexia nervosa, many historical accounts do not include self-evaluation largely influenced by their body

shape, body weight, and the desire to be thinner. In fact, large and even obese body size in Roman times may have been ideal, as it portrayed wealth. Therefore, while these behaviours point to disordered eating, many of these accounts may not truly represent what is today considered clinical bulimia nervosa (Russell, 1997; Vandereycken, 1994).

The term "bulimia nervosa" emerged after it was first formally defined and labeled as an eating disorder in a 1979 published paper and was considered to be a threatening variation of anorexia nervosa (Russell, 1979). In 1980 "bulimia" first appeared in the DSM-III as generally diagnosable with episodes of binge eating, again in the 1987 revised DSM-III, then again in the DSM-IV, which describes a purging and non-purging type of "bulimia nervosa". However, bulimia nervosa appears to be defined more closely to Russell's (1979) original and current definition in the DSM-V. In this most current definition, bulimia nervosa is defined by episodes of binge eating (e.g. unusually large food intake in a short period of time) directly followed by means to expel the food quickly from the body, whether using purging- (e.g. over-use of laxatives, diet pills, enemas, diuretics, self-induced vomiting, etc.) or non-purging- (e.g. over-exercise, caloric restriction, fasting, etc.) compensatory strategies (DSM-V). For diagnosis, these behaviours must be engaged in once a week for longer than a three-month period.

1.3.1.1.3. BINGE EATING DISORDER (BED)

It appears that taking in large amounts of food in a short period of time, or bingeing, was historically interwoven with other eating disorder behaviours. As early as 1767, bingeing was noted by the Scottish physician Robert Whytt, tied to anorexic-type behaviours in a young boy (Beumont, 1991). In a 1959 published paper titled "Eating Patterns and Obesity", Albert Stunkard described compulsively consuming large amounts of food in unusual hours as "Night Eating Syndrome", due to people often

taking part in this behaviour at night. Not long after this, the term "binge eating disorder" encompassed this compulsive eating behaviour in both the day and night, but remained under "other eating disorder" classifications until recently. In 1980, binge-eating behaviour was initially included as one of the main features of "bulimia" in the DSM-III, and then was one of many behaviours that were under the expansive "eating disorder not otherwise specified (EDNOS)" umbrella category in the DSM-IV. Not until the DSM-V did binge eating disorder become a category in its own right, in conjunction with the "other specified feeding or eating disorder" (OSFED) category becoming the new EDNOS umbrella. OSFED currently represents those eating disorders that induce clinically significant distress but do not meet the full criteria of anorexia nervosa, bulimia nervosa, or binge eating disorder.

Therefore, binge eating disorder stands as a separate category and is defined by episodes of unusually large food intake in a short period with the feeling of being out of control, and typically includes distress, guilt, disgust, or shame, at least one time a week for longer than a three month period. Unlike bulimia nervosa, individuals with binge eating disorder engage in binge eating without any restrictive or purging types of compensatory strategies. Furthermore, in addition to the above criteria, one also must include at least three of the following in order to be properly diagnosed with binge eating disorder: hiding ones eating or eating alone due to embarrassment, eating very rapidly, eating large amounts of food despite not feeling hungry, feeling uncomfortable from eating too much, and/or negative feelings (e.g. guilt, disgust, and/or depression) after over-eating (DSM-V).

1.3.1.2. Co-morbidity Between Eating Disorders

Although there are different types of eating disorder behaviours, distinctions and diagnostic classifications between the three key eating disorders, it is controversial

whether eating disorders may be treated most effectively as separate mental illnesses with separate mechanisms, or as sharing similar cognitive mechanisms.

Interestingly, from the time that "bulimia" was introduced in the DSM-III as a distinct disorder and separate from anorexia nervosa, there have been many who viewed these disorders as a single disorder (Bruch, 1985; Sperling, 1978; Stangler & Printz, 1980). As researchers have more recently explored implicit eating disorder mechanisms, common key psychological factors (such as food-, body-, and perfectionism-related) have been theoretically proposed to aid in the development and maintenance of all three main eating disorders (i.e. anorexia nervosa, bulimia nervosa, and binge eating disorder), including the way in which people process information (Fairburn, Cooper, & Shafran, 2003). This growing perspective is based on the high rate of co-morbidity and migration between classified eating disorders. More than 50% of those with anorexia nervosa move between anorexic and bulimic behaviours (Bulik, Sullivan, Fear, & Pickering, 1997; Devlin, Jahraus, & DiMarco, 2010), and a large portion of those who were formerly diagnosed with anorexia nervosa or atypical eating disorders are then newly diagnosed with bulimia nervosa or atypical eating disorders (Agras, Walsh, Fairburn, Wilson, & Kraemer, 2000; Fairburn et al., 2003; Sullivan, Bulik, Fear, & Pickering, 1998). Therefore, viewing each eating disorder as a separate mental illness with distinct underlying mechanisms would lead to many "recovering" from one mental illness and "developing" a new mental illness, as, for example, they transition from anorexia nervosa behaviour to bulimia nervosa behaviour. Finally, there is a growing amount of research, which utilises more implicit measures (discussed later), which shows evidence of similar underlying cognitive mechanisms in the development and maintenance of eating disorders. Thus, the experiments within this

present thesis investigate key eating disorder underlying mechanisms utilising the transdiagnostic approach to eating disorders.

1.3.2. Why This Research Is Important

1.3.2.1. Eating Disorder Statistics

Current statistics aim to give an estimate of who is directly affected, the rates at which these issues are increasing, and the severity of eating disorders. Understanding the prevalence and incidence statistics surrounding eating disorders is important for erasing eating disorder myths, assessing the severity of a mental illness, as well as clarifying ways to best focus research pertaining to this area. In the following sections I will outline the current statistics concerning the severity of eating disorders.

Eating disorder statistics reported between 2012 and 2013 by the Health and Social Care Information Centre (HSCIC, 2014) reveal a rise in hospitalisations in the U.K. and in mortality rates, which will be described in more detail later in this chapter's sections "UK Eating Disorder Hospitalisations" and "Eating Disorder Mortality Rates". Anorexia nervosa alone is shown to take three times more lives than all other psychiatric disorders, taking 12 times more lives than all causes of death for 15-24 year old females (Nielsen, 2001; Sullivan, 1995). Eating disorder statistics also suggest the importance of prevention and early diagnosis and treatment, as recovery reduces dramatically when one remains untreated for over three years (Birmingham & Treasure, 2010). Of those who survive an eating disorder, less than half recover, a little over a third improve, and over a fifth remain critically ill (Steinhausen, 2002).

Considering what we do know about eating disorder prevalence and incidence, increased hospitilisations, and mortalities, more understanding of their development and maintenance is imperative. Eating disorder statistics, which will be examined, are

critical to guide the evidence-based development of more effective preventative, diagnostic, and treatment methods.

1.3.2.1.1. How Many, Who Suffers, and The Increase

As many may not seek treatment, or do not report their eating disorders for various reasons, it is difficult to know precisely how many and who are directly affected by an eating disorder, and these statistics are likely to be acutely underestimated. Generally, it is estimated that over 1.6 million people of all ages and genders in the United Kingdom (UK), and over 20 million people in the United States (US) will directly suffer from anorexia nervosa, bulimia nervosa, or binge eating disorder within their lifetime, with approximately 10 million of these diagnoses being male (Joint Commissioning Panel for Mental Health, 2011; Wade, Keski-Rahkonen, & Hudson, 2011). As males are less often diagnosed with an eating disorder, many falsely believe that mainly females are affected. However, individuals across gender, race, and socioeconomic status are affected by eating disorders. It is reported that the prevalence of eating disorders, with the exception of anorexia nervosa, is comparable between Asians, Hispanics, African-Americans, and Caucasians (Hudson, Hiripi, Pope, & Kessler, 2007). On average, eating disorders affect mainly women ages 15 to 40, and approximately 10% to 25% of those with anorexia nervosa and bulimia nervosa are male (Hudson et al., 2007; Weltzin, 2005).

Eating disorders have been noted to be increasing since 1930, with the frequency of anorexia nervosa in females aged 15-19 years substantially increasing every decade since then (Hoek & Van Hoeken, 2003). In addition, between 1988 and 1993 cases of bulimia nervosa tripled in 10-39 year-old females (Hoek & Van Hoeken, 2003; Hudson et al., 2007; Streigel-Moore & Franko, 2003; Wade et al., 2011). Furthermore, one of the most recent and largest UK studies of eating disorder incidence revealed that

diagnosis of an eating disorder between 2000 and 2009 increased 15% overall, and 27% in males alone (Micali, Hagberg, Petersen, & Treasure, 2013).

1.3.2.1.1.1. Average Occurrence Per Diagnosis

Reported incidence occurrences (i.e. the amount of new diagnoses of an eating disorder in the population over a period of time) point to 0.4% of females and 0.05% of males suffering from anorexia nervosa, typically during adolescence or as young adults. There are approximately five times as many who suffer from bulimia nervosa than anorexia nervosa, and the most common occurrence of all eating disorders is binge eating disorder (NICE, 2004). In one's lifetime prevalence (i.e. the proportion of those who will have an eating disorder at any point in their life), approximately 0.9% of women and 0.3% of men will be diagnosed with anorexia nervosa, approximately 1.5% of women and 0.5% of men will be diagnosed with bulimia nervosa, and approximately 3.5% of women and 2.0% of men will be diagnosed with binge eating disorder (Hudson et al., 2007; Westerberg & Waitz, 2013). Binge eating disorder affects approximately 30% of those seeking medical help for obesity, and although it is not limited to those who are obese, it has been shown to be strongly linked to risk for severe obesity (de Zwaan, 2001; Hudson et al., 2007; Hudson et al., 2006; Streigel-Moore & Franko, 2003).

Smink, Van Hoeken, and Hoek's (2012) eating disorder literature review points to 15 to 19 year old females as the highest risk group for anorexia nervosa incidence. Furthermore, increased incidence may be related to earlier detection, whilst increased mortalities over the past several decades may be related to earlier onset. One study by Turner and Bryant-Waugh (2004) found that 190 out of 200 participants from a United Kingdom eating disorder service for the community had a diagnosable eating disorder, with the majority of those diagnosed (70.5%) diagnosed with "eating disorder not

otherwise specified" (EDNOS). This category in the DSM-IV includes binge eating disorder, and also disordered eating which are now labeled as "otherwise specified feeding or eating disorder" (OSFED) in the DSM-V. Of the 190 clinically diagnosed participants, 23.7% were diagnosed with bulimia nervosa, and 5.8% with anorexia nervosa. However, many people transition from one type of eating disorder diagnosis to another. For instance, a follow-up study with 76 anorexia nervosa sufferers who received the medication cyproheptadine and also behavioural therapy treatment, found that five had died, 29 transitioned to a bulimia nervosa diagnosis, and only 18 had fully recovered. Thus, since many people migrate between eating disorder diagnoses (anorexia nervosa, bulimia nervosa, binge eating disorder, and OSFED), as previously discussed, it is increasingly common to consider them as having similar underlying mechanisms (Fairburn et al., 2003).

1.3.2.1.1.2. UK Eating Disorder Hospitalisations

Approximately half of those suffering from anorexia nervosa alone will need to be hospitalised at some point during their treatment, and although there are clear life-saving aspects to hospitalisation, some research suggests that longer-term admission may compromise lasting recovery (Gowers, Weetman, Shore, Hossain, & Elvins, 2000). As there is not adequate research into the possible negative aspects linked to longer hospital stays, such as the patient viewing the hospital as an escape from their role in recovery, there are no clear conclusions. Other research suggests that greater numbers of hospitalisations indicate a greater risk of unfavourable outcomes, including loss of life (Papadopoulos, Ekbom, Brandt, & Ekselius, 2009). However, these conclusions need to be interpreted with caution, as only those with more severe disorders, and thus more life-threatening, will likely be hospitalised longer and repeatedly.

As mentioned above, eating disorders have often been portrayed as an adolescent female from a middle-to-high income family issue, which is not accurate. Current reports from the HSCIC (2014) reveal that eating disorder diagnoses and the severity of these disorders leading to hospitalisations are growing at rapid rates across age and gender. In the United Kingdom alone, in only one year, the hospital admissions for eating disorders rose 14% in children from 10 to 14 years old, and there was an overall 8% increase, which includes men, women, and children. Not only are the hospitalisations rates rising for eating disorders, but these statistics also reveal that 1 in 17 eating disorder patients remain in the hospital longer than patients with all other conditions.

1.3.2.1.1.3. Eating Disorder Mortality Rates

Eating disorders have been reported to have the highest mortality rate of all mental disorders, which indicates that as a direct consequence from an eating disorder, at least one person dies every 62 minutes (NICE, 2004; Eating Disorders Coalition, 2016). Specifically, anorexia nervosa has the highest mortality rate of all other mental disorders (Arcelus, Mitchell, Wales, & Nielsen, 2011; Fichter & Quadflieg, 2016), and greatly reduces life expectancy. Steinhausen's (2002) meta-analysis of 5590 people within 119 studies (from 1953 to 1999) found that a crude rate of 5% of those diagnosed with anorexia nervosa had died from the disorder. Also, Harbottle, Birmingham, and Sayani (2008), using decision analysis software to analyse eating disorder mortality data, found that a female with the onset of anorexia nervosa at 15 years of age is estimated to live 25 years less than the predicted normal population.

There are some fluctuations in eating disorder-related statistics due to those with eating disorders often migrating from one eating disorder diagnosis to another, and therefore mortality rate studies may focus on the original diagnosis or a new, current

diagnosis. For instance, Bulik et al.'s (1997) three-year study showed that within two years, 54% of females with anorexia nervosa developed bulimia nervosa. Also, ambiguous eating disorder-related mortality statistics may be due to those with an eating disorder ultimately dying from other causes, such as heart or organ failure, malnutrition, electrolyte imbalance, or suicide. For example, a review investigating eating disorder "sudden death", which is abrupt, unexplained death, found that the majority of these types of mortalities derived from cardiovascular complications often preceded by heart arrhythmias (Jáuregui-Garrido & Jáuregui-Lobera, 2012). Furthermore, obesity was estimated to have been the cause of 18% of all 40 to 85 year old adult deaths in the United States between 1986 and 2006 (Masters et al., 2013). Although difficult to measure the exact statistics between binge eating disorder, obesity, and mortalities, binge eating disorder is highly related to obesity (Dingemans, Bruna, & Van Furth, 2002), and therefore related to increased risk of unreported binge eating disorder mortality (Smink et al., 2012).

Another major cause of death linked to eating disorders is death by suicide. Although many point to anorexia nervosa as a more severe type of eating disorder with higher rates or mortality, an increased mortality rate across eating disorders has been found. Crow et al. (2009) performed one of the first large-scale mortality investigations (N = 1885), which included those with EDNOS (including binge eating disorder). In an eight to 25 year longitudinal investigation of eating disorder death rates, they found mortality rates to be comparable between eating disorders (both for suicide and all-causes), with 4.0% crude mortality rates for anorexia nervosa (standardised mortality ratios (SMR) = 1.70 all causes; 4.68 suicide), 3.9% crude mortality rates for bulimia nervosa (SMR = 1.57 all causes; 6.51 suicide), and 5.2% crude mortality rates for EDNOS, which included binge eating disorder (SMR = 1.81 all causes; 3.91 suicide).

This study shows higher mortality rates not only for anorexia nervosa and bulimia nervosa, but especially severe for EDNOS (including binge eating disorder).

Arcelus et al. (2011) also included the investigation of EDNOS (from 1966 to 2010) within their meta-analysis investigation. Results showed that the weighted annual mortality rate (i.e. deaths per 1000 person-years of follow-up) in 35 studies were 5.10 for anorexia nervosa (SMR = 5.86), or 639 deaths in 12808 individuals with anorexia nervosa. Furthermore, results indicated that one in five of those with anorexia nervosa had died by suicide (i.e. 1.3 deaths per 1000 person-years). Fifty-seven deaths were reported in 2585 individuals with bulimia nervosa (1.74 per 1000 person-years; SMR = 1.93). Fifty-nine deaths were reported out of 1879 individuals with EDNOS (including binge eating disorder) who were followed up. Therefore EDNOS had slightly higher weighted annual mortality rates than bulimia nervosa (3.31 deaths per 1000 person-years; SMR = 1.92).

It is important to note that Arcelus et al.'s (2011) meta-analysis of studies that reported eating disorder-related mortality rates from 1966 to 2010 had higher mortality rates (especially pertaining to anorexia nervosa), than Crow et al. (2009). This may be due to the longer length of the Crow et al. (2009) follow-up (12.82 years versus 18.13 years), and also attributable to migration of eating disorder diagnosis over time. Nevertheless, both of these large-scale investigations, that included EDNOS with binge eating disorders, point to higher mortality rates amongst those with eating disorders, similarities between eating disorder diagnoses, as well as the severity and similar risk associated with all eating disorders for death by suicide, not only anorexia nervosa.

1.4. Theoretical Overview of Cognitive Information Processing Strategies Related to Eating Disorders

Many theorists have proposed psychological risk factors underlying the development and maintenance of eating disorders, and some have proposed cognitive or

attentional biases found in those with eating disorders or eating disorder tendencies. Cognitive attentional biases, or selective attention towards or away from certain information which is disorder salient, have been theorised to predispose one toward the development and maintenance of eating disorder symptomatology (Fairburn, Cooper, Cooper, McKenna, & Anastasiades, 1991; Fairburn, 1991; Faunce, 2002; Power, Cameron, & Dalgleish, 1996). Attentional biases underlying eating disorders have mainly been tested using the Stroop task (Stroop, 1935). This thesis will go into more depth about the Stroop task and other commonly used methods to measure attentional biases and information processing strategies related to eating disorder tendencies in the following Methodologies Chapter (see Chapter II).

Although there has been some investigation into the implicit processing of information related to eating disorders, many studies do not examine different factors independently and also fail to examine how people may process information other than body- and food-related information, which also may be important, such as perfectionism. Therefore, it is important to examine attentional and cognitive mechanisms underlying the potential predisposition towards eating disorders, which may be extended toward the prevention, diagnosis, and treatment of eating disorders. Several empirically supported factors related to the development of eating disorders were exhibited in Stice's (2002) meta-analysis review, including: thin-ideal internalisation, body dissatisfaction, dieting, and perfectionism. Both the thin-ideal internalisation and body dissatisfaction pertain to body-related factors, while dieting pertains to food-related factors, and perfectionism was also shown to be a key factor related to the development of eating disorders. In a review about the way in which those with eating disorder tendencies attend to certain information, mainly food- and body-related information has been investigated, and it is suggested that these stimuli are

possibly processed as threatening information to those with higher levels of eating disorder (Aspen, Darcy, & Lock, 2013). Therefore, for the purposes of this thesis, three main underlying factors that have been discussed within the literature as psychological features proposed in the development and/or maintenance of eating disordered behaviour will be focused theoretically on, which are: body-, food-, and perfectionism-related cognitive attentional bias theories.

1.4.1. Cognitive Bias Theories of Eating Disorders

1.4.1.1. Body- and Food-related Cognitive Bias Theories of Eating Disorders

For over 40 years, many researchers have supported the notion that body-image and self-concept distortions (i.e. overestimations of their own weight, size, and shape), and body dissatisfaction (i.e. highly negative attitude towards their own body compared to normal populations), contribute to the development and maintenance of eating disorders (Fairburn & Harrison, 2003; Russell, 1979; Vitousek & Hollon, 1990). Initially, the profound differences that those with eating disorders displayed in the over-estimation of their own body size was viewed as a body-related perceptual processing issue (Slade & Russell, 1973). However, as research into the processing of body-image and food-related concepts continued, researchers suggested that these differences might be in relation to information- or cognitive-processing instead (Fairburn & Harrison, 2003; Vitousek & Hollon, 1990). Some eating disorder etiology theories incorporate either eating/food-related or body-related cognitive aspects in the development or maintenance of an eating disorder, and others include both eating/food-related and body-related factors.

The basic tenets of the cognitive-behavioural theory of eating disorders are the impact of cognition on the development and maintenance of eating disorders, the focus on organisation of thoughts by schemata, which then determine the processing of

information and the automatic direction of attention (Williamson, Muller, Reas, & Thaw, 1999). If these schemata become distorted they may play out in self-destructive, disordered, and harmful behaviours, such as eating disorder behaviours (i.e. starvation, restriction, purging, bingeing, over-exercise, etc.). For instance, the cognitive model of eating disorders (Vitousek & Hollon, 1990) points to distorted body-schemata in those struggling with eating disorders which leads to automatic body, shape, and weight cognition, and therefore selective attention bias toward negative body-related information and away from positive body-related information. They point to those with anorexia or bulimia nervosa attributing their self-worth and identity to the way in which one may process what it means to be thin or fat, and code body-related information to positive or negative self-related constructs (Vitousek & Hollon, 1990). The distorted body-related schemata are evidenced by not only an individual perceiving their physical body to be too fat, but the rigid rules and mental agreements that one with an eating disorder connects with that perception. In other words, the person does not just believe they are too fat, but their very identity, who they are as a person, what they can and cannot do, their value, etc. is controlled by the perception of being too fat. Vitousek and Hollon (1990) hypothesised that those with an eating disorder have a distinct type of cognitive style, similar to a New Year's resolution; seeking simplicity and certainty, they spell out their goals and outcomes, believing that they will be a better person through what they perceive as proper conduct. Along these lines, other researchers have suggested that internalising thinness as the ideal body size will lead to the development of a cognitive schema which links thinness with favourable qualities such as attractiveness, happiness, and prestige (Thompson & Stice, 2001; Tiggemann, 2002). Multiple information processing and cognitive theories and research support the automatic self-schema activation linked to higher levels of eating disorder, many of

which will now be discussed, followed by a brief discussion about the construct of eating disorders.

Fairburn's (1981, 1984) original Cognitive Behavioural Theory of Bulimia Nervosa presented that a distorted assessment of self-worth leads to one placing too much value and focus on body size and shape. They proposed that this specific hyper-focus to body-related information leads to an attentional bias toward disliked body parts, which results in body dissatisfaction and severe food restriction, with the aim of increasing positive self-image. Likewise, Fairburn, Shafran and Cooper's (1999a) Cognitive Behavioural Theory of Anorexia Nervosa suggests that confirmatory cognitive attentional biases lead to selective attention in the direction of negative body- and food-related stimuli in those with anorexia nervosa. They suggest that anorexic behaviours are strengthened and maintained by critically investigating one's fatness (e.g. checking weight, clothes fit and size, squeezing skin, wrists, hips, and other areas to measure fat) as a confirmation bias. This confirmation bias is then thought to support their negative and distorted belief of needing to lose weight, while ignoring and avoiding any proof that challenges their anorexic-related thoughts and behaviours. Those with eating disorder tendencies who are highly preoccupied with body shape and weight develop a distorted over-concern and over-value related to negative body- and food-related information, especially concerned with the self.

Taken together, a bias toward negative body- and fatty food-related stimuli are underlying mechanisms proposed to develop (Cooper & Fairburn, 1994; Williamson, 1996), as well as maintain anorexia nervosa and bulimia nervosa (Fairburn, Cooper, Doll, Norman, & O'Connor, 2000). Robust attention biases in the direction of negative and neutral body- and food- related stimuli and avoidance of positive food-related stimuli is pointed to as causation of eating disordered behaviour (Shafran, Lee, Cooper,

Palmer, & Fairburn, 2007). Evidence suggests an increased sensitivity towards stimuli related to fatty food and eating as these types of stimuli may be considered threatening to those over-concerned with weight gain (Dobson & Dozois, 2004; Johansson, Ghaderi, & Andersson, 2005; Stormark & Torkildsen, 2004).

Williamson, White, York-Crowe, and Stewart (2004) integrated the findings of many empirically-based eating disorder research studies and theories, and incorporated psychological risk factors and attentional biases into the Integrated Cognitive-Behavioural Theory of Eating Disorders. This theory suggested that the over-concern with body thinness develops a body self-schema which leads to automatic cognitive attentional biases towards negative body- and food-related stimuli which confirm and reinforce one's distorted negative body assessment. The automatic attentional biases toward negative body-related information aids in a distorted mind-set which is theorised to result in harmful eating disorder-related behaviours, such as extreme food restriction, bingeing, and/or purging, etc. Research has shown binge eating behaviour often takes place after a period of food restriction; distorted thinking, and attentional biases related to body-related information may also indirectly lead to binge eating (Williamson, 1996; Williamson et al., 1999). The main trigger and major risk factor of binge eating is thought to derive from those not able to maintain restrictive eating. Thereby a cycle of restrictive eating begins with the "failure" of self-control, leading to abandoning restrictive efforts that brings on bingeing, which then increases body-related concerns, ultimately encouraging restrictive eating once again (Fairburn et al., 2003; Fairburn, Wilson, & Schleimer, 1993).

Attentional biases or cognitive avoidance point to heightened sensitivity towards, or an avoidance of, key environmental or emotional threats, demonstrated by unique information processing patterns. Although both attendance towards or

avoidance of disease-relevant stimuli are considered automatic responses, attendance toward is often detected earlier in the processing of information, whilst cognitive avoidance often emerges in later processing, as shown in an earlier information processing model of anxiety (Beck & Clark, 1997). As body fat and fattening foods are evidently threatening for one with eating disorders and over-concern for weight gain, these are two factors plausibly processed as threatening, and therefore may capture attention more so than emotionally neutral stimuli. Two meta-analyses have also supported these findings that those with an eating disorder attend to body- and food-related stimuli (Dobson & Dozois, 2004; Johansson et al., 2005). Aspen, et al.'s (2013) attention bias review for eating disorders points to most research for attentional biases investigating food- and/or body-related information. However, there is a further need to investigate food- and body-related information processing styles independently, in relation to eating disorder tendencies as many studies and theories combine these distinct factors.

Although many researchers have not investigated information processing strategies related to perfectionism, many theories indicate that perfectionism plays a factor in the development and maintenance of eating disorders in some individuals to some extent, which will now be discussed.

1.4.1.2. PERFECTIONISM-RELATED THEORIES OF EATING DISORDERS

Perfectionism was first linked to eating disorder behaviour by Hilde Bruch (1974), who was a pioneer in the field, and pointed to perfectionism as a key risk for eating disorders. Several years later, Peter Slade (1982) also suggested that perfectionism played a key role in those who would develop an eating disorder, and conceptualised the role of perfectionism maintaining eating disorder behaviour in his Functional Analytical Model of Anorexia Nervosa and Bulimia Nervosa. Perfectionism

influences a dichotomous perspective (i.e. perfect versus flawed), and may create the perception that successfully attaining the rigid restrictive eating behaviour goals of anorexia nervosa, for instance, is being successful overall. Alternatively, any slip of one's rigid restricting eating behaviour goals is perceived as complete failure as a person.

In 1991, Heatherton and Baumeister presented evidence that the frequent unmet self-imposed perfectionistic standards left those with bulimia nervosa feeling like failures, and therefore developed the Escape from Self-Awareness Theory, which suggests that those with bulimia nervosa will avoid the processing of personal threats, such as failure. Alternatively, other studies also found a significant relationship between sensitivity towards negative self-related information, especially pertaining to failures and inadequacies, and eating disorder tendencies (McManus, Waller, & Chadwick, 1996; Quinton, 1998; Waller & Meyer, 1997). In 1994, Vitousek and Manke also commented on those with anorexia nervosa as demonstrating high levels of perfectionism.

Over time, researchers began to distinguish between adaptive or healthy in comparison with maladaptive or neurotic forms of perfectionism (Frost, Marten, Lahart, & Rosenblate, 1990; Hamachek, 1978; Hewitt & Flett, 1991; Mitzman, Slade, & Dewey, 1994). They suggested that the ability to be flexible in one's high standards and the ability to set realistic goals is considered a more healthy or adaptive form of perfectionism (Hamachek, 1978). In contrast, more maladaptive forms of perfectionism, such as neurotic perfectionism, are hallmarked by setting unrealistically high, rigid, inflexible goals, whilst viewing anything less than meeting these unattainable goals as utter failure (Mitzman et al., 1994). These overly high standards and expectations of self, high amounts of concern over mistakes, having doubts about

actions, and overall perfectionism, have all been related to eating disorder risk and maintenance (Bastiani, Rao, Weltzin, & Kaye, 1995; Fairburn, Cooper, Doll, & Welch, 1999b; Hewitt, Flett, & Ediger, 1995; Slade & Dewey, 1986; Stice, 2002).

According to a number of literature reviews, perfectionism is also a key factor in the etiology of eating disorders (Bardone-Cone et al., 2007; Egan, Wade, & Shafran, 2011; Jacobi, Hayward, de Zwaan, Kraemer, & Agras, 2004; Lilenfeld, Wonderlich, Riso, Crosby, & Mitchell, 2006; Stice, 2002). While perfectionism is included in many theoretical models as both a risk factor and underlying mechanism which perpetuates the illness (Fairburn et al., 1999b; Lilenfeld et al., 1998; Lilenfeld et al., 2000; Schmidt & Treasure, 2006; Slade, 1982), and although Vitousek and Orimoto (1993) suggested the importance of understanding and investigating attentional biases pertaining to perfectionism-related information, there are very few studies that have examined this factor.

Perfectionism has been associated with restrictive eating by some theorists (Steiger, Puentes-Neuman, & Leung, 1991), and by others, the concern for making mistakes has been uniquely linked to both anorexia and bulimia nervosa, unlike other types of psychopathology (Bulik et al., 2003). Furthermore, "clinical perfectionism", or the overdependence of self-worth upon achieving unrealistic self-imposed goals, has been viewed as a direct expression of eating disorders in *some* individuals (Shafran, Cooper, & Fairburn, 2002). In other words, Shafran et al. (2002) suggested that those with an eating disorder might base their entire self-evaluation as a person upon being able to meet unattainable and very rigid eating- and body-related goals. Impaired cognitive-behavioural flexibility in the brain network related to emotion and motive toward achieving specific goals has also recently been shown in anorexia nervosa participants in an fMRI study (Zastrow et al., 2009).

Several theories have been developed over the years including some type of role of perfectionism as a key factor for some individuals in the development and maintenance of an eating disorder, in conjunction with other factors, such as: the Two-Factor Vulnerability-Stress Model (Joiner, Heatherton, Rudd, & Schmidt, 1997), the Three-Factor Interactive Model (Vohs, Bardone, Joiner, Abramson, & Heatherton, 1999), the Cognitive-Interpersonal Model of Anorexia Nervosa (Schmidt & Treasure, 2006; Treasure & Schmidt, 2013), and the Transdiagnostic Model of Eating Disorders (Fairburn et al., 2003). These theories will now be discussed.

1.4.1.2.1. Perfectionism-Related Theories and Bulimia Nervosa

Perfectionism in relation to bulimia nervosa was more initially viewed as the vulnerability factor, which is triggered by an individual's perception of being overweight in Joiner et al.'s (1997) Two-Factor Vulnerability-Stress Model. Importantly, those who perceived themselves as overweight, when they were not, showed significantly greater bulimia nervosa levels. To distinguish between those who engage in bulimic behaviours, which are self-defeating for losing weight, and those who aim for weight loss, Vohs et al. (1999) included self-esteem as a moderator between perfectionism and perceiving oneself as overweight into the Two-Factor Vulnerability-Stress Model, developing a Three-Way Interactive Model for Bulimia Nervosa. This model suggested that low levels of self-esteem with high levels of perfectionism and the perception of being over-weight predict bulimia nervosa symptomology more significantly than each factor alone. Vohs et al. (2001) then replicated Vohs et al.'s (1999) questionnaire findings with different self-esteem and body dissatisfaction questionnaires in a five-week longitudinal study, which suggested the Vulnerability-Stress Model was able to predict the development of bulimia nervosa behaviours. However, in another attempt to replicate Vohs et al.'s (1999) findings, with a more

sensitive and larger-scale study, the Three-Way Interactive Model was not able to predict increased bulimia nervosa symptomology (Shaw, Stice, & Springer, 2004). Bardone, Vohs, Abramson, Heatherton, and Joiner (2000) slightly altered the Three-Factor Interactive Model of Bulimia Nervosa by replacing the more broad self-esteem concept with a facet of self-esteem called self-efficacy. Self-efficacy is the evaluation of one's competence, and includes maladaptive (interpreting mistakes as failure) and adaptive (high self-standards) perfectionism. Bardone-Cone, Abramson, Vohs, Heatherton, and Joiner (2006) and Bardone-Cone et al. (2008) then tested and supported Bardone et al.'s (2000) Three-Factor Interactive Model for both bulimia nervosa and binge eating. Specifically, clinical and non-clinical studies suggested that high levels of maladaptive and adaptive perfectionism, with low self-efficacy, and greater body dissatisfaction predict higher frequency of bulimic nervosa behaviours (i.e. vomiting), and binge eating (Bardone-Cone et al., 2006; Bardone-Cone et al., 2008).

1.4.1.2.2. Perfectionism-Related Theories and Binge Eating

Several theories link perfectionism to binge eating (Abramson, Bardone-Cone, Vohs, Joiner, & Heatherton, 2006; Fairburn et al., 2003; Heatherton & Baumeister, 1991; Vohs et al., 1999). A more recent and tested theory which specifically links perfectionism to solely binge eating is Sherry and Hall's (2009) Perfectionism Model of Binge Eating, who utilised questionnaires and a seven day daily diary to build their model. This integrative model pointed to socially prescribed perfectionism as a risk factor and activates four triggers for binge eating, which are: interpersonal discrepancies (i.e. failing to meet others' expectations), depressive affect (i.e. feeling sad), interpersonal esteem (i.e. feeling of self worth connected to others), and dietary restraint. Mushquash and Sherry (2013) tested and supported Sherry and Hall's (2009) Perfectionism Model of Binge Eating between binge eating daughters and their mothers.

However, they chose to exclude interpersonal esteem in this questionnaire- and diary-based longitudinal study, as this factor was highly correlated in the original model and may not be an independent factor.

1.4.1.2.3. Perfectionism-Related Theories and Anorexia Nervosa

A model that includes perfectionism in relation specifically to anorexia nervosa is the Cognitive-Interpersonal Model of Anorexia Nervosa (Schmidt & Treasure, 2006; Treasure & Schmidt, 2013), which suggested that perfectionism is both a risk factor and maintenance factor of anorexia nervosa. Specifically, that people who have anxiety or perfectionism traits are more prone to the development of anorexia nervosa, and four key factors help to maintain the eating disorder, which include a perfectionistic, inflexible, focused information processing style (See Figure 1).

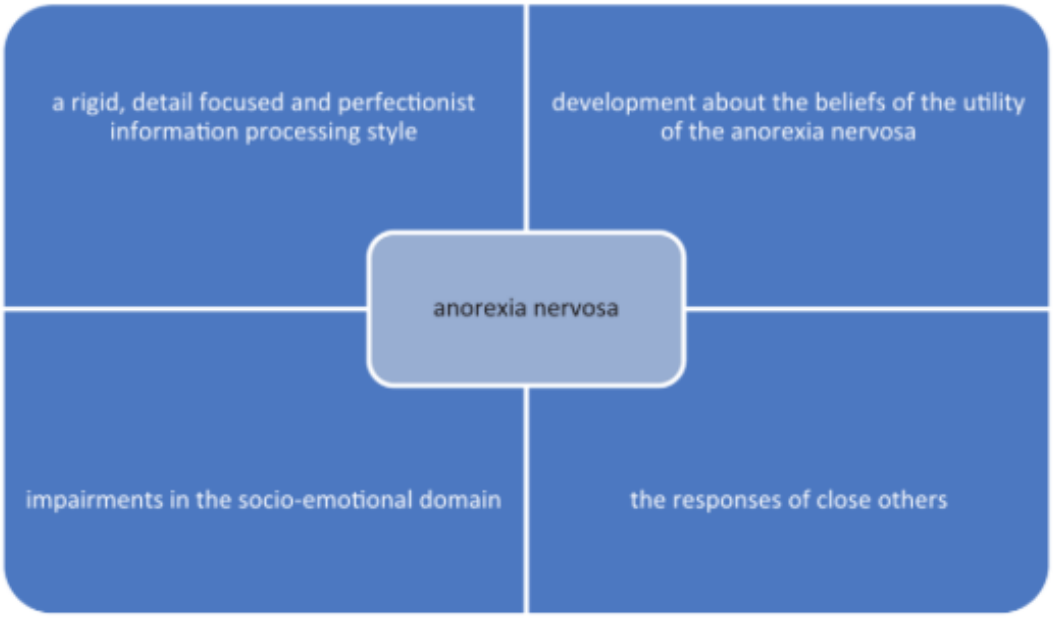


Figure 1. Cognitive Interpersonal Model of Anorexia Nervosa (Taken from Schmidt & Treasure, 2006; Treasure & Schmidt, 2013).

1.4.1.2.4. Perfectionism-Related Transdiagnostic Theory of Eating Disorders

While some cognitive-behavioural theories related to eating disorders treated anorexia nervosa, bulimia nervosa, and EDNOS (including binge eating) separately, as

though these disorders have dissimilar underlying mechanisms, in contrast, Fairburn et al. (2003) pointed to the frequent migration between different diagnoses of eating disorders (e.g. anorexia nervosa versus bulimia nervosa versus binge eating) as evidence for similar underlying mechanisms in eating disorders. Specifically, a large number of those struggling with bulimia or atypical eating disorders have formerly struggled with anorexia nervosa or atypical eating disorders (Agras et al., 2000; Sullivan et al., 1998). Although many theorists identify separate eating disorder models with separate risk and maintaining factors, the movement between different types of eating disorders is so frequent that a longitudinal comparison of anorexia nervosa subtypes suggested that anorexia nervosa (which restricts food) is simply a stage within the progression of an eating disorder (Eddy et al., 2002). Realising that the recovery rate through therapies for neither anorexia nervosa nor bulimia nervosa were very substantial, and the shared distinctive clinical features of anorexia nervosa, bulimia nervosa, and atypical eating disorders (including binge eating disorder), Fairburn et al. (2003) developed the evidence-based Transdiagnostic Model of Eating Disorders. They proposed that anorexia nervosa, bulimia nervosa, and EDNOS eating disorders (including binge eating disorder) all have common maintaining mechanisms, including attentional biases or information processing strategies. They extended their Cognitive Theory of Bulimia Nervosa to include clinical perfectionism as one of four key maintaining processes for *some* individuals, as well as former ideas of body- and food-related attentional biases for all clinical eating disorders (See Figure 2). Fairburn et al. (2009) pointed to the addition of clinical perfectionism, defined as "…the overdependence of self-evaluation on the determined pursuit of personally demanding, self-imposed, standings in at least one highly salient domain, despite adverse consequences" (Shafran et al., 2002, p. 778),

as a key maintaining factor of an eating disorder for *certain* people, and that the removal of clinical perfectionism would then assist in recovery for these individuals.

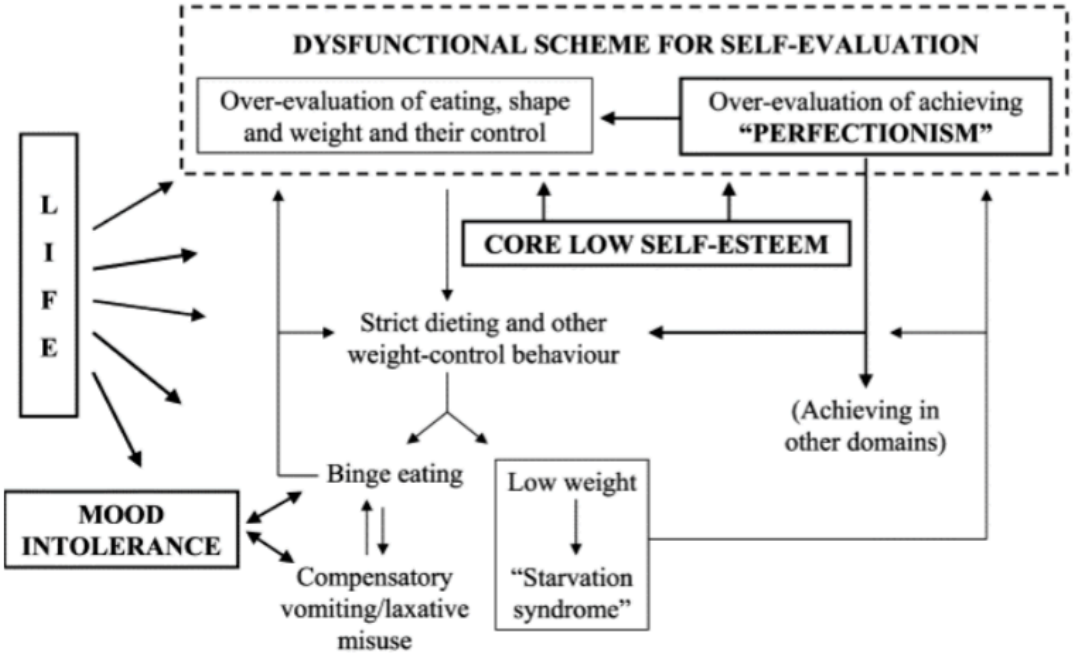


FIGURE 2. TRANSDIAGNOSTIC MODEL OF EATING DISORDERS (TAKEN FROM FAIRBURN ET AL., 2003).

1.4.1.2.5. PERFECTIONISM AND RECOVERY FROM EATING DISORDERS

Although most theories do not include the cognitive processing style of perfectionism, the reduction of perfectionism levels have recently been suggested as an important factor in the complete recovery of eating disorders. When ensuring full recovery (physically, behaviourally, and psychologically), perfectionism levels of healthy controls and those fully recovered from eating disorders have been shown to be significantly lower than those who were partially recovered or actively struggling with an eating disorder (Bardone-Cone, Sturm, Lawson, Robinson, & Smith, 2010). Perfectionism levels have also been shown to affect the response to anorexia nervosa treatment over time. Those with lower perfectionism when initially treated have been

reported to achieve a longer period of recovery, and those with higher levels of perfectionism at the onset of treatment have been reported to have poorer recovery outcomes (Bizuel, Sadowsky, & Rigaud, 2001; Blatt, Quinlan, Pilkonis, & Shea, 1995; Blatt, Zuroff, Bondi, Sanislow, & Pilkonis, 1998). In contrast, other studies have suggested that perfectionism did not reduce even when the eating disorder symptoms decreased (Bastiani et al., 1995; Lilenfeld et al., 2000; Nilsson, Sundbom, & Hägglöf's, 2008). Therefore, specifically the processing of perfectionism-related information independently from food- and/or body-related information needs to be investigated.

1.4.2. Eating Disorders As A Dimensional Construct

In addition to the cognitive theories of eating disorders, it is important to consider whether it is appropriate to test a non-clinical population when investigating the underlying mechanisms of eating disorders. In other words, that eating disorders are in fact a dimensional construct (i.e. continuous in nature up to a severe form of normal behaviour), and not taxonic (i.e. separate, distinct categories), and therefore able to be measured in a non-clinical population. In fact, although the DSM-V classifies distinct disorders, Wildes and Marcus' (2013) recent review found that these classifications of eating disorders might be strengthened by dimensional measures of eating disorders in clinical settings, suggesting a model of dimensions of eating disorder pathology. Furthermore, evidence has suggested that key characteristics of eating disorders occur on a dimensional continuum (e.g. BMI, frequency of bulimic and binge-eating behaviours, etc.), with many individuals shifting between diagnoses and symptomology along a continuous eating disorder range (Fichter & Quadflieg, 2007). In these common occurrences, it may be counter-productive to connote that an individual is recovered from one eating disorder, such as anorexia nervosa, and now has developed a new eating disorder, such as bulimia nervosa or binge eating disorder. Also, certain aspects

of eating disorder symptomology may stay fixed, whilst other aspects may fluctuate, which has been known to generate obstacles for the establishment of recovery guidelines (Couturier & Lock, 2006; Wonderlich et al., 2012). This occurrence may differ from individual to individual.

More recent research has supported the transdiagnostic dimensional approach to eating disorders. Using the transdiagnostic approach in a longitudinal study with 1002 twin women, Wade, Bergin, Martin, Gillespie, and Fairburn (2006) investigated lifetime eating disorder behaviours in relation to the ability to function, and found a positive relationship. Also supporting the transdiagnostic approach, Keel, Crosby, Hildebrandt, Haedt-Matt, and Gravener's (2013) study of 528 people all with bulimic symptomology between multiple types of eating disorders (i.e. AN, BN, BED, and EDNOS) found that it was the number of eating disorder behaviours and not the varying characteristics of the behaviours between eating disorder diagnosis that pointed to the severity of the eating disorder. Furthermore, Holm-Denoma, Richey, and Joiner (2010) explored dietary restraint, body dissatisfaction, and drive for thinness with 2836 females using taxometric analysis, and reported that all three eating disorder indicators in those with higher self-reported levels varied in intensity (not categorically) from those with lower levels.

Although it may continue to be debatable whether classifications, dimensional constructs, or a blend of both are the most empirically reliable method to distinguish, grasp, and treat eating disorders (Lavender, Crosby, & Wonderlich, 2013; Wildes & Marcus, 2013), there is growing evidence for a transdiagnostic dimensional approach to eating disorders (Fairburn et al., 2003; Keel et al., 2013; Wade et al., 2006).

1.4.3. EATING DISORDER THEORY CONCLUSION

To conclude, according to the current cognitive theories of eating disorders discussed above, three key factors which appear to be important to the development and maintenance of eating disorders are: body-, food-, and perfectionism-related factors. Although body- and food-related factors have mainly been investigated related to implicit information processing strategies, according to theory and research, the way in which one processes perfectionism-related information may also be a key underlying mechanism for eating disorders. Since perfectionism has been shown to be an important factor in the development and maintenance of eating disorders, and the way in which one processes information is linked to predicting eating disorders, then the cognitive processing strategies of body-, food-, and also perfectionism-related information may predict one's eating disorder tendency level.

Taken together, the research in this thesis is based on a transdiagnostic dimensional approach to eating disorders in the general population, and will be focused on exploring if the way in which an individual processes body-, food- and/or perfectionism-related information may predict one's eating disorder tendencies. Now some of the experimental paradigms used to investigate body-, food-, and perfectionism-related information processing strategies related to clinically diagnosed eating disorders will be discussed through a systematic review. This will be followed by a summary of non-clinical eating disorder-related eye-tracking studies, and then an introduction to eye-tracking and reading for processing of anomalies and emotional expectation.

2. CHAPTER II: METHODOLOGIES

2.1. METHODOLOGIES: A SYSTEMATIC REVIEW OF EXPERIMENTAL PARADIGMS USED TO INVESTIGATE BODY-, FOOD-, AND PERFECTIONISM-RELATED INFORMATION PROCESSING STRATEGIES RELATED TO EATING DISORDERS

Over two decades ago, Vitousek and Hollon (1990) pointed to disorder-related self-schemata, which may produce what some have considered to be automatic effects on the way individuals process information. Still, many current studies have solely implemented interview or self-report questionnaire measures, such as Rohde, Stice, and Marti's (2015) study, which found that negative body attitude was the most dependable predictor of the early onset of eating disorders (see for example Bulik, Sullivan, & Kendler, 2002; Coniglio et al., 2017; Dakanalis et al., 2015; Duarte, Pinto-Gouveia, & Ferreira, 2014; Gall et al., 2016; Goldschmidt, Lavender, Hipwell, Stepp, & Keenan, 2017; Goldschmidt et al., 2015; Jensen & Steele, 2009; Loth, MacLehose, Bucchianeri, Crow, & Neumark-Sztainer, 2014; Slane, Burt, & Klump, 2010; Stephen, Rose, Kenney, Rosselli-Navarra, & Striegel Weissman, 2014; Troisi et al., 2006). More recently, studies have begun to investigate eating disorders using more implicit measures (such as Stroop and eye-tracking), which will be discussed in this chapter. Whilst questionnaire measures are beneficial, these other more implicit measures have indicated attentional biases and information processing tendencies that are linked to eating disorder symptomology. Further development of novel measures may help identify subtle processing variations, guide more successful preventions and interventions, and increase our understanding of the cognitive information processing strategies involved in developing and maintaining an eating disorder (Smith & Rieger, 2006).

These more implicit measures, defined by measuring quick, subtle behaviours, may be less susceptible to missing implicit attentional biases or cognitive information processing strategies, such as non-clinical females with negative weight attitude, and

thus can provide valuable insights into dynamic cognitive processing research (Gao et al., 2011). These paradigms may also be used to investigate how an individual with higher and lower levels of eating disorder tendencies processes potentially threatening information. They may also be useful to further investigate if the more obvious and widely tested food- and/or body-related factors are the key mechanisms underlying eating disorders, as well as better understand the way in which people process perfectionism-related information and its relationship to eating disorder tendencies (which has not yet received much attention in the empirical literature).

This chapter will first examine the implicit methods that have been utilised to investigate the way in which clinically-diagnosed individuals with an eating disorder process body-, food-, and/or perfectionism-related information compared to healthy controls. A review of the investigation of these factors within clinical populations will provide insight from more severe levels of eating disorder, to develop the most robust method and experimental design to investigate these factors within the non-clinical population. Second, this chapter will give a brief overview of the most common methods utilised to investigate eating disorder-related information processing strategies for body-, food-, and/or perfectionism-related stimuli in the non-clinical or subclinical population. Finally, this chapter will introduce and summarise eye-tracking and reading information processing style within the psycholinguistics literature.

According to past reviews in this area, which focus primarily on investigating body- and/or food-related stimuli studies (no reviews could be found investigating the implicit information processing strategies of perfectionism-related stimuli in a clinical eating disorder population), the attentional bias and information processing strategy study results pertaining to clinical ED populations are somewhat conflicting. Studies report greater attention towards, avoidance of, and/or maintaining attention on disease-

salient information related to eating disorder tendency levels. This may be because there are many different paradigms and stimuli utilised, with many different approaches to eating disorder populations. Prior reviews (see Aspen et al., 2013; Brooks, Prince, Stahl, Campbell, & Treasure, 2011b; Dobson & Dozois, 2004; Faunce, 2002; Johansson et al., 2005; Lee & Shafran, 2004), have reported that the modified Stroop colour-naming task is the most common paradigm to investigate the way in which those with eating disorders process body and/or food-related stimuli (perfectionism was never included). As the focus of this review is the implicit processing tendencies of body-, food-, and perfectionism-related information, the applicable prior attentional and information processing strategy reviews related to eating disorders will briefly be discussed next. This will be followed by an explanation of the current systematic review process, and then the description of each main experimental paradigm, along with the studies that have used them.

2.1.1. Brief Attentional Biases and Eating Disorder Review Main Findings

There have been several reviews investigating the attentional biases and information processing style of people with eating disorders over the past two decades. Generally they point to differing processing of eating disorder-salient information in clinical populations compared to healthy controls, most commonly utilising the modified Stroop colour-naming task, which will be described later in this chapter.

Faunce's (2002) review reported that both AN and non-clinical participants (who restrict food) all displayed difficulty (slower response time) with colour-naming food-related stimuli on the modified Stroop colour-naming task. In contrast, BN participants primarily displayed slower colour-naming response time with body-related stimuli (Faunce, 2002). Dobson and Dozois' (2004) review, which included studies which investigated the same populations (AN, BN, and non-clinical restraining

participants), using the same primary method reported different results. They found that AN participants primarily displayed slower response times solely for body-related stimuli, whilst BN participants displayed slower response time for both body- and food-related stimuli. Non-clinical restraining participants did not display attentional biases for either body- or food-related stimuli.

Another review, taking more of the transdiagnostic approach (investigating eating disorders as one ED group) to investigate visual information processing strategy, found that participants with eating disorders, as well as non-clinical "at risk" individuals (e.g. restrained eaters, those with a drive for thinness, dieters, etc.), displayed longer colour-naming response times to food- and body-related words including the Stroop and dot-probe studies (Lee & Shafran, 2004). Johansson et al.'s (2005) review, also utilising the transdiagnostic approach, found that those with eating disorders showed a significantly slower response time to both body- and food-related stimuli compared to non-clinical females with body concerns and healthy controls.

Consistently, the modified Stroop colour-naming task has been noted as the most common paradigm utilised to investigate attentional biases of people with eating disorders. This method measures the length of time a participant takes to name the colour of the text of a word on a card (i.e. blue, red, yellow, etc.), rather than the word on the card. Typically, slower Stroop colour-naming response time has been suggested to show the interference of these disease-specific types of stimuli (food- and/or body-related words), due to attentional biases for those with eating disorders. However, one main weakness of the Stroop task is the inability to determine whether the slower response time derives from the participant avoiding or attending to the target stimuli (De Ruiter & Brosschot, 1994). Therefore, other implicit measures have been utilised more recently to investigate body-, food-, and/or perfectionism-related processing

strategies, such as: the modified dot-probe task and startle eye-blink modulation, as well as other paradigms, which have not been reviewed before, such as fMRI and eye-tracking studies.

As discussed in the previous chapter, there are many different cognitive theories which propose the differential processing of body-, food-, and perfectionism-related stimuli as key factors in developing and maintaining an eating disorder, such as the: Two-Factor Vulnerability-Stress Model (Joiner et al., 1997), Three-Factor Interactive Model (Vohs et al., 1999), Cognitive-Interpersonal Model of Anorexia Nervosa (Schmidt & Treasure, 2006; Treasure & Schmidt, 2013), and the Transdiagnostic Model of Eating Disorders (Fairburn et al., 2003). More commonly utilised methodologies (e.g. Stroop task, dot-probe task, EEG, startle response task, eye-tracking, etc.) to investigate eating disorder-related attentional biases and information processing strategies will be discussed within this systematic review, and how the current study findings reviewed relate back to more recent cognitive theories discussed in the prior chapter (see "Theoretical Overview of Cognitive Information Processing Strategy Related to Eating Disorders").

2.1.2. Main Aims

This chapter is a review, which extends prior body- and food-related information processing tendency reviews. It will investigate peer-reviewed studies including that of clinical AN, BN, and BED eating disorder groups with healthy controls for 18 to 39 year old adults, which study implicit visual attentional biases and information processing style of body-, food-, and also perfectionism-related pictorial or linguistic stimuli.

Although all the studies in this thesis test individuals with a range of eating disorder level within the general population, this review was carried out in order to

inform the most robust experiment designs to investigate the underlying cognitive mechanisms that contribute to the development and maintenance of eating disorders. Hence, this review focused on what has been found regarding the way in which individuals with clinically diagnosed degrees of eating disorder implicitly process food-, body-, and perfectionism-related information compared to individuals without eating disorder symptomology (healthy controls). Accordingly, the aim of this review was to provide a current systematic review of studies utilising implicit methods to identify information processing tendency differences relating to food-, body-, and/or perfectionism-related stimuli in eating disorder (AN, BN, and BED) clinical adult individuals compared to healthy controls.

2.2. METHOD

Following PRISMA Guidelines (Moher, Liberati, Tetzlaff, Altman, & Prisma Group, 2009), a systematic review of literature focusing on information processing style related to body-, food-, and/or perfectionism-stimuli in the clinical eating disorder and healthy control adults was conducted (see Figure 3 PRISMA Flow Chart). These results will then be used to elucidate robust methods and experimental design to investigate the underlying mechanisms of eating disorders, and inform the eye-tracking studies in this present thesis.

2.2.1. SEARCH METHOD

Peer-reviewed, English articles were gathered by searching the Pubmed, Scopus, and PsychInfo electronic databases using no publication date limitations. The search terms in the title, abstract, or keywords comprised: ("Body Image Disturbance" OR "Body Dissatisfaction" OR "Body Concerns" OR "Body Image" OR "Food" OR "Perfectionism") AND ("Eating Disorder" OR "Anorexia" OR "Bulimia" OR "Binge Eating Disorder") AND ("Attention" OR "Cognitive" OR "Attentional" OR

"Information Processing" OR "Dot-Probe" OR "Neutral" OR "Stroop" OR "Eye-tracking" OR "Visual Search Task") on 25th March, 2017. Relevant and applicable studies from past reviews were also obtained, and all full-texts of those meeting the title and abstract inclusion (n = 102) criteria were thoroughly assessed, with 54 final studies included in the systematic review.

2.2.2. Selection and Eligibility Criteria

The PRISMA selection and eligibility process of studies was used for this systematic review (see Figure 3 for flowchart). Firstly, the articles and database search results from the three databases were manually combined, and duplicates were removed. Secondly, all of the remaining titles and abstracts were read thoroughly to make sure that each paper met the inclusion criteria. Most studies excluded in this first step either investigated processes/illnesses other than eating disorders, did not use adult human subjects, did not use implicit measures such as the Stroop task, dot-probe task, electroencephalography (EEG), startle response task, or eye-tracking, or were not in English. Then, full-text papers, which appeared to meet the inclusion criteria from the abstract were obtained, if possible, and thoroughly assessed, in order to assure that they met the current review's inclusion criteria. Any studies that did not meet the inclusion criteria are briefly explained (see "Studies Excluded" section below). Finally, a total of 54 papers met the inclusion criteria and were read and significant information was put into Table 2.

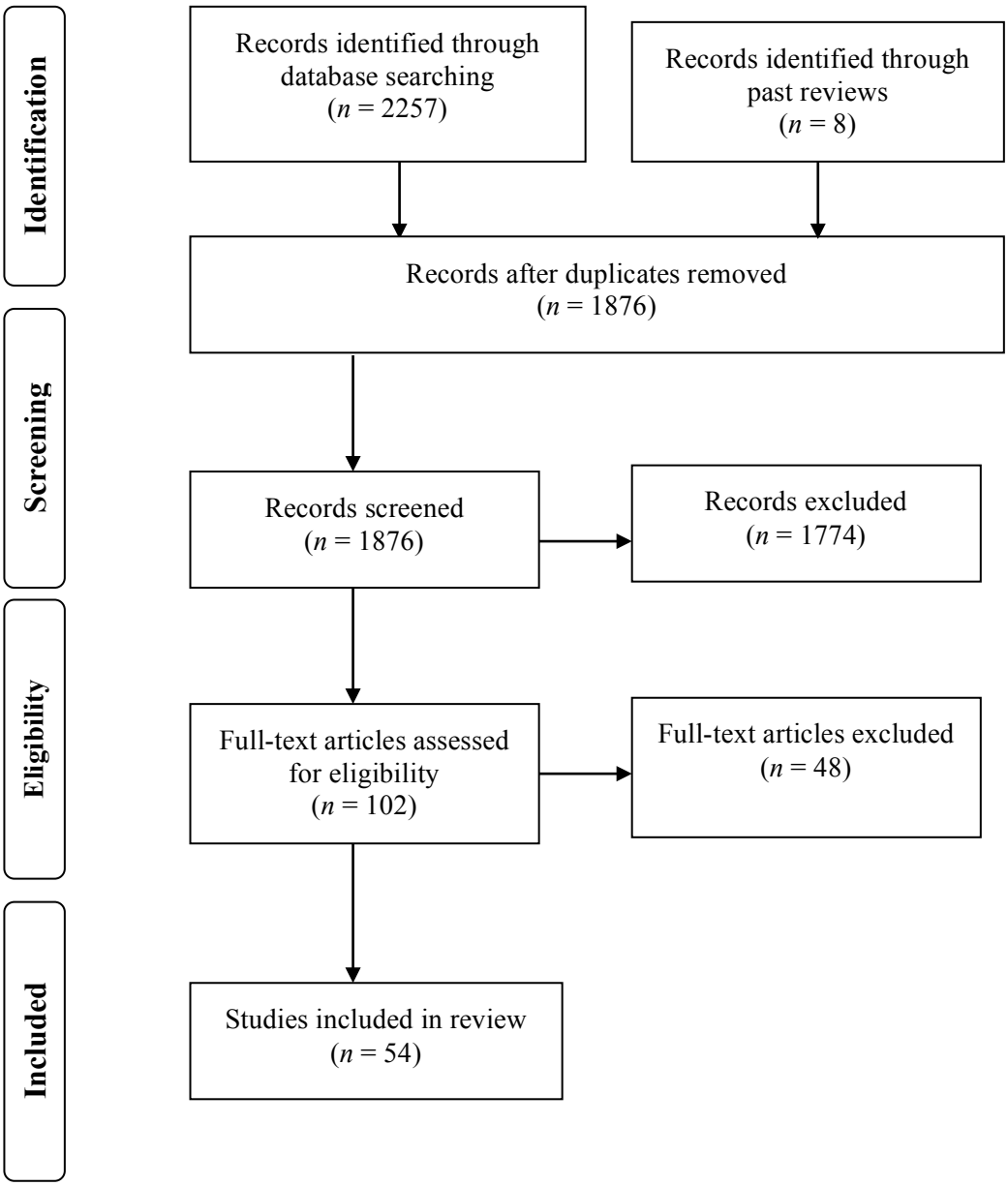


FIGURE 3. SYSTEMATIC LITERATURE REVIEW PRISMA FLOWCHART.

2.2.3. Inclusion and Exclusion Criteria

2.2.3.1. Participants

Inclusion criteria are that studies should be from peer-reviewed journals in English, investigating adult humans from 18 to 39-years-old with AN, BN, or BED, according to the DSM-V. The paper must include Healthy Controls (HC's), along with clinical ED adult participants, in order to be eligible, and all other papers were excluded.

2.2.3.2. Experimental Paradigms

Included were studies with a main focus of utilising implicit methods to investigate information processing strategies (pictorial or linguistic) of food-, body-, and/or perfectionism-related stimuli (all other studies were excluded). Also excluded were structural brain studies, biological or pharmacological studies, memory/recall biases studies, non-visual processing studies (e.g. gustatory, olfactory, mood or somatosensory processing biases), and studies based on treatment outcomes (e.g. CBT).

2.2.3.3. Study Design

Included were original, peer-reviewed studies. All reviews, case studies, conference papers, and other papers that were not peer-reviewed were excluded.

2.2.3.4. Studies Excluded

From the initial unduplicated search papers (n = 1876), most papers were primarily excluded (n = 1774) during the thorough title and abstract screening, as these investigated illnesses or disease, which are not relevant to eating disorders. These irrelevant factors include: encephalitis, autism, depression, trauma, physical pain, seizures, and schizophrenia, or brain structure (e.g. cortical thickness in regions involved in emotional processing related to childhood abuse, bipolar disorder, PTSD, TBI, attachment, schizophrenia, OCD, self-injury). Otherwise, studies were excluded

when they did not fulfill other inclusion criteria (i.e. did involve any implicit paradigms for information processing style with 18-39 year old clinically diagnosed population and HCs, or did not include food-, body-, and/or perfectionism-related stimuli).

From the remaining papers (n = 102), studies were excluded (n = 48) during the thorough full-text screening in which participants did not include an actively ED clinical and a HC sample (Bohon & Stice, 2011; Boon, Vogelzang, & Jansen, 2000; Boutelle, Monreal, Strong, & Amir, 2016; Brooks et al., 2012; Carter, Bulik, McIntosh, & Joyce, 2000; Cooper & Fairburn, 1994; Cowdrey, Park, Harmer, & McCabe, 2011; Flynn & McNally, 1999; Formea & Burns, 1996; Franzen, Florin, Schneider, & Meier, 1988; Hege et al., 2015; Jansen, Nederkoorn, & Mulkens, 2005; Kostopoulou, Varsou, & Stalikas, 2013; Legenbauer et al., 2011; Mauler, Hamm, Weike, & Tuschen-Caffier, 2006; Placanica, Faunce, & Job, 2002; Rieger et al., 1998; Riva, Bacchetta, Baruffi, Rinaldi, & Molinari, 1999; Schmitz, Naumann, Biehl, & Svaldi, 2015; Schmitz, Naumann, Trentowska, & Svaldi, 2014; Svaldi, Tuschen-Caffier, Peyk, & Blechert, 2010; Tammela et al., 2010; Trentowska, Svaldi, & Tuschen-Caffier, 2014; Vocks et al., 2011), and did not primarily study implicit visual attentional biases or information processing tendencies pertaining to food-, body-, and/or perfectionism-related stimuli (Holsen et al., 2012; Léonard, Pepinà, Bond, & Treasure, 1998; Neveu et al., 2014; Probst, Vandereycken, Vanderlinden, & Van Coppenolle, 1998; Steinglass, Foerde, Kostro, Shohamy, & Walsh, 2015; Torres et al., 2011; Vocks, Legenbauer, Wächter, Wucherer, & Kosfelder, 2007; Waller & Hodgson, 1996). Instead, these studies investigated other aspects of ED, including: resting-state structural brain studies (Biezonski, Cha, Steinglass, & Posner, 2016), biological or pharmacological studies (Bulik, Sullivan, Lawson, & Carter, 1996; Bulik, Lawson, & Carter, 1996; Cambridge et al., 2013; Chamberlain et al., 2012; Holsen, Lawson, Christensen, Klibanski, &

Goldstein, 2014; Kim et al., 2014), memory/recall tasks that did not measure immediate, implicit information processing style (Dickson et al., 2008; Hermans, Pieters, & Eelen, 1998), non-visual biases (e.g. gustatory, olfactory, mood or somatosensory processing) (Cardi, Esposito, Clarke, Schifano, & Treasure, 2015; Eshkevari, Rieger, Longo, Haggard, & Treasure, 2014; Monje Moreno, Alvarez Amor, Ruiz-Prieto, Bolaños-Ríos, & Jáuregui-Lobera, 2014; Oberndorfer et al., 2013; Wagner et al., 2015), or were focused on a therapy program (e.g. Cognitive Behavioural Therapy; CBT; Bulik, Sullivan, Carter, McIntosh, & Joyce, 1998).

2.3. Results and Brief Summary Of Included Studies

A final 54 papers were included in the current systematic review. The five most common paradigms utilised in this area are: modified Stroop colour-naming task (n = 20), fMRI (n = 17), eye-tracking (n = 5), modified dot-probe task (n = 2), and go/no-go task (n = 2). There was also one study utilising a modified Stroop colour-naming task combined with fMRI, one study investigating with a startle eye-blink modulation (SEM) combined with facial electromyography (EMG), another study measuring event-related potentials (ERPs), a study that combined positron emission tomography (PET) with heart rate (HR), two studies utilising a distractor task (i.e. a visual search task and an inversion effect paradigm (visual discrimination)); and two studies applying word solving tasks (a word association task, and a task solving anagrams; see Table 2). Now each method will be discussed one-by-one, reviewing the research studies that employed these methods, followed by a discussion to sum up the findings.

2.3.1. The Modified Stroop Colour-Naming Task

The modified Stroop colour-naming task is the most common measure for implicit attentional biases in eating disorders (Faunce, 2002), in which an eating disorder salient word (i.e. “fat”) is presented in a specific colour of ink (e.g. blue). The

participant is then asked to ignore the meaning of the word (i.e. "fat"), and only name the ink colour of the letters of the word (e.g. blue). The longer it takes the participant to name the ink colour of the letters of the word, the greater the interference, which many point to an indirect measure of attentional bias (Faunce, 2002). Eating-disorder salient words (e.g. "fat") may be threatening or distracting for those with an eating disorder. As these individuals are distracted by these disorder-salient words, they may take longer to be able to name the colour of ink of these words (e.g. red, blue, green, etc.), due to greater interference.

Incorporating disorder-salient words is a modification from the original Stroop task (Stroop, 1935), which assessed the time a participant took to name the ink colour (e.g. red), which was incongruent from the word itself ("Blue") compared to the time it took to name an ink colour (e.g. red), which was congruent to the word itself ("Red"). The length of time it takes to name the ink colour of the word in the modified Stroop task, instead of the ED salient written word, has been considered to be an implicit method to detect attentional bias, as those with greater levels of ED are reported to be distracted by the threatening ED word. However, this paradigm does not provide a method to determine if the increased response time to seemingly threatening and salient ED words are attentional biases in which the bias is hyper-vigilant (fixating on the word longer and therefore being distracted from the colour of the word) or avoidance (avoiding the threatening ED word, and therefore the colour of the word).

Those studies which utilised the modified Stroop colour-naming task (n = 20), the most common of all the implicit visual attentional biases in this review, mainly investigated ANs, BNs, and HCs together (n = 8), and ANs and HCs (n = 8). Four studies investigated BNs and HCs. Most of these Stroop studies include both food- and body-related word stimuli, while one study includes only food-related words (Black,

Wilson, Labouvie, & Heffernan, 1997), another study includes food-related words and pictures (Stormark & Torkildsen, 2004), and another study includes only body-related words (Green, Wakeling, Elliman, & Rogers, 1998).

2.3.1.1. Anorexia Nervosa/Bulimia Nervosa/Healthy Controls Study Results

Utilising the Stroop task, some studies have reported interference with eating disorder-related stimuli in both non-clinical ED-related or recovered ED, which, if viewing eating disorders as a taxonomic construct, may make the Stroop task questionable as a tool for clinical identification. However, the interference with eating disorder-related stimuli of those who have some eating disorder symptomology (e.g. high levels of eating restraint), or those who are at some point of recovery from an eating disorder, may merely point to the continuous nature of the development and maintenance of eating disorders (eating disorders as a dimensional construct). For instance, Perpina, Hemsley, Treasure, and de Silva (1993) found that not only did those with ED (AN/BN) display body shape and food-related (eating) processing difficulties, but so did the non-clinical restrained eating controls with a high drive of thinness. In comparison to recovered BN and HCs, Lovell, Williams, and Hill (1997) found an ongoing interference to body shape concern words in recovered AN participants, as well as BN participants, which may point to these interference effects lasting into recovery. Another study including both AN and BN clinical participants pointed to diagnosis-dependent information processing strategy differences, as BN participants displayed processing difficulties with body-related words, whilst AN participants displayed difficulties with food-related words (Johansson, Carlbring, Ghaderi, & Andersson, 2008).

However, more commonly, studies with both AN and BN participants and both food- and body-stimuli found similar processing issues (no significant differences

between the selective attention of AN and BN individuals). These results may support a transdiagnostic theoretical view that different eating disorders have similar underlying mechanisms and maintainers. For instance, Ben-Tovim and Morton (1989) found that those with AN and BN are slower to colour-name food words, and a trend toward difficulty with body-related words for AN and significant difficulty for BN participants. Ben-Tovim and Walker (1991) found that those with ED (AN and BN) were significantly slower to colour-name food- and body-related words than HCs and Controls with a drive for thinness. Cooper and Todd (1997) also found no significant differences in selective processing between AN and BN individuals for food- and body-related words. Cooper and Fairburn (1992) found that AN, BN, and symptomatic dieters displayed selective processing of food- (eating) and body-related (weight and shape) words that appeared to be specific with maintenance of eating disorder symptomology.

Therefore, the majority of Stroop task studies, including both AN and BN participants with HCs, support a more transdiagnostic theoretical view (Fairburn et al., 2003), as well as cognitive theories that include food- and body-related stimuli (e.g. Cooper & Fairburn, 1994; Fairburn, 1981; Fairburn, 1984; Fairburn et al., 1999a; Williamson et al., 2004). Furthermore, utilising food-related words and pictures, Stormark and Torkildsen (2004) found that both ANs and BNs were slower to colour-name food- and emotion-related words and also pictures compared to neutral stimuli. Not only did this study support the transdiagnostic theoretical approach for EDs, but suggested that attentional biases with food-related stimuli extend beyond linguistic representations, to also include pictorial processing for EDs (AN, BN, and AN/BN participants), as well as differences in emotion-related word processing.

2.3.1.2. ANOREXIA NERVOSA/HEALTHY CONTROLS STUDY RESULTS

Several studies investigating AN participants and HCs found that AN individuals were generally significantly slower in colour-naming words than HCs, but still found that ANs were slower for both food- and body-related words (Channon, Hemsley, & de Silva, 1988; Green et al., 1998; Long, Hinton, & Gillespie, 1994; Sackville, Schotte, Touyz, Griffiths, & Beumont, 1998), or body-related words only (Fassino et al., 2002; Green, McKenna, & de Silva, 1994; Green, Corr, & de Silva, 1999) than healthy controls.

Of interest, is that in addition to food- and body-related attentional biases, Long et al. (1994) also found no significant differences in responses between food restrained obese participants and the clinical AN sample, which may point to a continuum in ED behaviours linked to attentional biases. Only one Stroop study found no differences between ANs and HCs in colour-naming any words, including food- and body-related stimuli (Mendlewicz, Nef, & Simon, 2001).

An interesting study found different results between masked, or preconscious stimuli (i.e. stimuli word covered by five X's "XXXXX"), and unmasked, or conscious stimuli response times with thin and fat body words, and high and low calorie food words (Sackville et al., 1998). In the unmasked conditions, or the condition that the participant was able to consciously view and read the words, AN participants had significantly slower response with both thin and fat body words, and also with high-calorie food words, but to a lesser extent, compared to HCs. However, they found no preconscious attentional bias differences between AN individuals and HCs in the masked conditions, when the stimuli were covered by five X's. These results suggest an overall body-related selective processing, as well as food considered fattening, in ANs compared to HCs. Therefore, there is an inconsistency between studies that find those

with AN displaying interference with only body-related stimuli, and other studies which found this slower response to both body- and food-related stimuli. The results also leave open the question of whether these slower responses exist in both negative and positive emotional aspects of these dimensions. These differences between study results for individuals with AN may be due to the differences in stimuli and possibly the differences in the timing of stimulus presentation.

2.3.1.3. Bulimia Nervosa/Healthy Controls Study Results

Regarding studies with BN and HC participants, only one study, including only food-related words, found no significant differences between BN, restrained and unrestrained healthy controls (Black et al., 1997). The other three studies within two papers suggest that those with BN experience delayed processing of both body- and food-related words, whilst displaying no delayed effects for neutral words (Cooper, Anastasiades, & Fairburn, 1992; Jones-Chesters, Monsell, & Cooper, 1998). These studies suggest that the Stroop task may be an objective and implicit tool for BN eating disorder-specific cognitive disturbances. Jones-Chesters et al. (1998) also pointed to the block design (i.e. words presented from one category condition in a set) versus a mixed design (i.e. words presented from a mixture of category conditions in a set) for the modified Stroop colour-naming task to be more robust to identify the eating disorder specific cognitive interferences to food- and body-related words. As there was only one study investigating the differences between designs, these findings would need to be replicated.

2.3.2. functional Magnetic Resonance Imaging Studies

Functional magnetic resonance Imaging (fMRI) is a method that indirectly measures brain activity, by measuring blood flow and oxygenation in response to brain

activity and neural activity. fMRI studies are able to bring clarity as to which brain areas and networks are involved with specific mental processes.

Unlike the majority of Stroop Test studies, the studies that investigated visual information processing tendencies and attentional biases with fMRI (n = 17) rarely incorporated both body- and food-related stimuli (n =1), but instead body- (n = 11) *or* food-related (n = 5) stimuli. Also unlike the majority of Stroop test studies, all of the 17 studies utilised pictures, except for one study, which incorporated negative body-related words (Miyake et al., 2010b). Also dissimilar to the Stroop task studies, fMRI studies most commonly investigated only ANs and HCs (n = 8), and then ANs, BNs, and HCs (n = 6), and two studies investigated BNs and HCs, and another study with BEDs and HCs. The one study investigating both body- and food-related stimuli found that self-focus brain activation increased (i.e. insular activation) when BN females evaluated themselves against images of slim women, compared to HCs (Van den Eynde et al., 2013). Similar brain activation patterns were found between ANs and HCs and also BNs and HCs in this study.

2.3.2.1. ANOREXIA NERVOSA/HEALTHY CONTROLS FMRI RESULTS

The majority of the fMRI studies investigating ANs and HCs used body-related pictorial stimuli (n = 6). The body-related studies have very different tasks, and therefore it is difficult to compare and contrast fMRI studies. Results mainly pointed to robust differential brain activation between ANs and HCs to self-referential images (Mohr et al., 2010; Sachdev, Mondraty, Wen, & Gulliford, 2008; Suda et al., 2013), as well as during the visual processing of other human bodies (Friederich et al., 2010; Sachdev et al., 2008; Suchan et al., 2013; Suda et al., 2013). Some studies focus on the lack of activation of the attentional system (e.g. insula) whilst viewing the participants' own image (Mohr et al., 2010; Sachdev et al., 2008), and others focus on an impairment

of the visual system network (including the occipital cortex) in ANs, which is suggested to alter body-size processing and contribute to body-size misjudgment (Suchan et al., 2013). For instance, Mohr et al. (2010) presented body images that were distorted from 1 to 15% thinner or fatter than the participant's actual body size. AN participants produced stronger insular and lateral prefrontal cortex brain activity during satisfaction rating of thin-ideal self-images, and the strongest emotional activity during their thin-ideal self-image. This same study also suggested that the brain activation differences between ANs and HCs during a body-size estimation task may be related to body-size overestimation in ANs related to the precuneus. Another study presenting participants with normal self-body image compared to under- and over-sized self-body images, found that ANs displayed the widest brain activation (i.e. greater salience) to their distorted over-sized self-body image condition, whilst HCs displayed the widest brain activation (i.e. greater salience) to their under-sized disordered self-body image (Castellini et al., 2013). A different study, with similar activation to non-self images between AN and HC individuals, revealed ANs had greater activation in the medial frontal gyrus and no significant regions of activation in the attentional system or insula when viewing self-images, which was in contrast to HCs pattern of activation to self-images (Sachdev et al., 2008).

There were two fMRI studies that used food-related pictorial stimuli. One of the studies which only used food-related stimuli, and included AN, recovered AN, and HC individuals, found that the recovered AN group and HCs had similar brain responses to food-related stimuli, whilst those who were not recovered displayed a lack of lateral frontal brain response, which may be an AN state marker (Uher et al., 2003). The other study that utilised food-related images (high/low-calorie, sweet/savoury) with restricting AN, binge-purging AN, and HCs, found that the ANs (both types) displayed less brain

activation in cortical and limbic areas than HCs (Brooks et al., 2012). The findings of this study point to visual and prefrontal region differences between ANs and HCs, which may be related to food control ruminations.

2.3.2.2. ANOREXIA NERVOSA/BULIMIA NERVOSA/HEALTHY CONTROLS FMRI RESULTS

The studies that included AN, BN, and HC participants either used body- (n = 4) or food- (n = 2) related stimuli. Again, the tasks in the studies were diverse, and therefore it is difficult to compare and contrast them. One study with restricting ANs, binge-purging ANs, BNs, and HCs presented morphed self- and other-body images (thin to fat) during fMRI scanning (Miyake et al., 2010a). The different ED groups showed dissimilar brain activity whilst processing self-fat-images, and pointed to differences in attentional biases, which may be dependent upon specific eating disorder diagnoses. For instance, BNs did not display the significant amygdala activation to self-fat-images that both ANs and HCs displayed. There also seemed to be differences between self- and other-body processing, as Vocks et al. (2010) found differing results in amygdala activation to other females' body images. Specifically, when participants (ANs, BNs, and HCs) were presented with self- versus other-body images, the ANs displayed greater amygdala brain response to other-female-body-images than both BNs and HCs.

Two other studies found that ANs and BNs processed body-related information similarly, again supporting the transdiagnostic theoretical view (Fairburn et al., 2003) of similar underlying mechanisms and maintainers. For instance, Uher et al.'s (2005) fMRI study presented body-shape and house line drawings to participants, and found that viewing body shapes may point to emotional reaction variability, and underactive lateral fusiform gyrus and parietal cortex in both ANs and BNs compared to HCs. Miyake et al.'s (2010a) fMRI study presenting negative body-related words to

participants also suggested that the processing of these words for both ANs and BNs involve fearful emotional processing (right amygdala in ANs and left mPFC in BNs), which may be related to fear of gaining weight and also abnormal body image perception.

The two fMRI studies with ANs, BNs, and HCs that used food-related visuals found some similar brain activity between ANs and BNs which differed from HCs. Brooks et al.'s (2011a) fMRI study, which presented high/low calorie, sweet/savoury food images to participants found that EDs (ANs and BNs) generally displayed top-down cognitive control during food-related visual presentation, with BNs displaying increased brain activation in the somatosensory and reward-based regions. This may be related to reduced cognitive control related to BNs' overeating and bingeing behaviour. Uher et al. (2004) found similar symptom-provoking brain responses in those with an eating disorder (both ANs and BNs) compared to HCs, with greater (i.e. left medial orbitofrontal and anterior cingulate cortices) and lesser (i.e. lateral prefrontal cortex, inferior parietal lobule, and cerebellum) brain activation to food stimuli. These results suggest a transdiagnostic response at the neural level for EDs (ANs and BNs).

2.3.2.3. BULIMIA NERVOSA/HEALTHY CONTROLS FMRI RESULTS

The one fMRI study investigating BNs and body-related stimuli presented participants with thin and overweight female images in a self-referencing context, and found that BNs and HCs both had no mPFC brain response to thin images (Spangler & Allen, 2012). However, only BNs displayed significant brain response for emotional processing (i.e. mPFC subregions) for overweight body images compared to HCs. These results support the Cognitive Behavioural Theory of Bulimia Nervosa (Fairburn, 1981; Fairburn, 1984), which points to emotional body-related information processing

tendencies tied to self-schema as key underlying mechanisms and maintainers of eating disorders.

2.3.2.4. Binge Eating Disorder/Healthy Controls fMRI Results

Unlike the Stroop task review results, there was only one fMRI BED study. Geliebter, Benson, Pantazatos, Hirsch, and Carnell (2016) presented BED, obese controls, and healthy weight HCs with high- and low-calorie food pictures and spoken words. Similar to Brooks et al.'s (2011a) study results for BNs, the BED participants displayed significantly greater brain activation and functional connectivity when viewing high-calorie food images (compared with low-calorie food images) in the reward-based regions (i.e. dorsal ACC regions), which may be tied to lack of cognitive control for binge-eating. BED participants were hyper-responsive to high-calorie food compared to low-calorie food stimuli in regions that are key for reward-based decision-making, emotional processing, and conflict processing, which was not the case for obese or healthy controls. These results suggest that attentional bias is not tied to body weight or obesity, but is instead BED specific.

2.3.3. Modified Stroop Colour-Naming Task and fMRI combined Study

There was one study that combined the Stroop task and fMRI paradigms, presenting AN individuals and HCs with body-related (thin and fat) words (Redgrave et al., 2008). ANs displayed a general attentional bias to all body-related words, both thin and fat words, with distinct activation of brain regions (see Table 2 for more details). Whilst HCs displayed greater brain activation in fat body-related words compared to the neutral conditions (i.e. "XXXX"), ANs displayed greater brain responses to thin body-related words compared to the neutral conditions (i.e. "XXXX"). By combining the Stroop task and fMRI, this study attempted to relate the interference of body-related linguistic stimuli to brain activity and response towared attentional bias direction

(approach versus avoidance) for words. Redgrave et al. (2008) reported insular brain activation related to craving for mainly positively-valenced thin words, which was connected to language and task performance areas for those with AN, suggesting that treatment had produced more thin-related ambiguity in these individuals. Unexpectedly, ANs displayed no amygdala brain activity to fat body words compared to the neutral condition, which is typically found for threatening stimuli. As the majority of AN participants were binge/purge type, authors suggested fat body words may not be as threatening to this type of anorexia. Combining the Stroop task with fMRI brain activity results still needed to be inferred toward information processing style direction, and there may be more natural methods available, such as eye-tracking.

2.3.4. EYE-TRACKING STUDIES

Eye-tracking is a non-invasive technique that is able to measure both the movement of the eye, the direction of eye gaze, and the duration of the fixation or avoidance of areas of interest. Eye-tracking stimuli are often presented on a monitor, and therefore may be used to assess quite natural tasks, such as reading. Eye-tracking is a remarkable tool to directly investigate attentional biases and information processing style Unlike the Stroop task or fMRI, one is able to specifically identify attentional biases toward or avoidance of the stimuli in a continuous measure, as well as precisely reveal what aspects and patterns of visual attention are displayed. Unlike the Stroop tasks and fMRI studies, the eye-tracking studies (n = 5) included in this review did not investigate any linguistic stimuli, and none of the studies involved both ANs and BNs together, or BED participants. There were four AN/HC studies, and one BN/HC study. Four of the studies involved only body-related images, and one study investigated food-related images.

2.3.4.1. Anorexia Nervosa and Healthy Controls Eye-tracking Results

As with other studies in this review, stimuli varied, and some eye-tracking study results also conflicted. In one study in which participants were asked to judge the attractiveness and body-size of pictures of other females with lower and higher BMI than the participant, ANs overestimated body-size compared to HCs, and reported those body pictures with lower BMI as more attractive (George, Cornelissen, Hancock, Kiviniemi, & Tovée, 2011). ANs had a wider pattern of fixation on the body, which included the groin area up to the collarbone of the body image, and attended to the bony areas of the body (hip bone, collar bone, etc.) to make judgments. In contrast, the HCs mainly fixated on the centre of the stomach to make judgments.

Another eye-tracking study that included rating body images (self- and others-) in attractiveness also showed differences in fixation on the body to make judgments between ANs and HCs (von Wietersheim et al., 2012). AN individuals spent less time fixating on their own breasts, and significantly more time fixating on their own thighs compared to HCs. ANs were overall more critical in their attractiveness judgments, and also judged themselves less attractive than HCs. Another eye-tracking study found that AN participants hyper-scanned (i.e. increased amount of fixations of shorter duration) body-related stimuli, which may suggest increased anxiety viewing this disorder-relevant stimuli (Phillipou et al., 2016). Unlike other studies, there were no differences in the areas of attention or fixation between ANs and HCs.

Regarding food-related stimuli, Giel et al. (2011) found that AN participants did not display any early attentional biases when processing food pictures compared to HCs, but this early pattern was similar between ANs and HCs. After this typical early pattern, AN individuals fixated less on food-related pictures, thus avoiding disorder-salient stimuli, which increased according to the severity of AN symptomology.

2.3.4.2. BULIMIA NERVOSA AND HEALTHY CONTROLS EYE-TRACKING RESULTS

The eye-tracking study with BN individuals and HCs who were presented with body images found that BNs fixated longer on comparison bodies with lower BMIs than HCs, and fixated for a shorter time on comparison bodies with higher BMI bodies (Blechert, Nickert, Caffier, & Tuschen-Caffier, 2009). The gaze patterns suggested that BNs make an upward body comparison and this was positively related to greater body dissatisfaction (BISS) afterwards.

2.3.5. THE MODIFIED DOT-PROBE TASK STUDIES

The dot-probe task paradigm (MacLeod, Mathews, & Tata, 1986), unlike the modified Stroop colour-naming task, is reported to be able to identify if the attention bias is hyper-vigilant (toward or fixated on the salient threatening word or picture) or avoidant (avoiding or looking away from the salient threatening word or picture) stimuli. First created for anxiety-related research (MacLeod et al., 1986), the Stroop task was modified into the dot-probe task in order to assess the direction of attention bias (hyper-vigilance or avoidance).

Rieger et al. (1998) were some of the first researchers to use a modified dot-probe task for eating disorder-related research in a clinical population. The modified dot-probe task has been used to investigate the direction of implicit visual attention biases of people with eating disorders, as the participant was presented with two pictures or words (side-by-side) for 500 milliseconds, and often a neutral and threat-related stimuli (e.g. "chair"/ "chubby"). Immediately after the two stimuli disappeared off the screen, a probe (typically a black square or fixation mark) appeared where one of the stimuli previously was, and the participants were instructed to press a specific button when they saw the probe (often right or left computer keys) to indicate where the probe

was located on the computer screen. If the participant's attention fixated on the ED salient and threatening stimuli, then the participant would be expected to be slower in indicating the location of the probe following the neutral stimuli (e.g. "chair") compared to the threatening stimuli (e.g. "chubby"). In contrast, if the probe showed up on the screen where the threatening stimulus previously appeared, then the participant would press the appropriate key to indicate the probes location more quickly, as they had already been fixated on that area of the screen upon the threatening stimuli.

There were two modified dot-probe task studies that met the inclusion criteria in this review. Blechert, Ansorge, and Tuschen-Caffier (2010) presented ANs, BNs, and HCs with self- versus other-body photos, and found that ANs displayed significantly faster saccades toward self-body photos compared to other-body photos, whilst BNs demonstrated the opposite pattern, which was not significant. This study was the first to provide evidence of ANs' attentional bias for self-body photos compared to other-body photos, and also differences between ANs and BNs in attentional biases. This study supports Shafran et al. (2007) who presented clinical ED participants (unspecified in type) with both food- and body-related images. They found that those with EDs demonstrated significant eating disorder attentional biases for food- (negative and positive eating images) and body-related stimuli (negative and neutral shape images, and neutral weight images), compared to HCs. This study supports cognitive theories, which point to food- and body-related attentional biases such as Williamson et al.'s (2004) Integrated Cognitive Behavioural Theory of Eating Disorders, and a transdiagnostic theoretical perspective (Fairburn et al., 2003). Whilst able to differentiate the type of processing strategy and direction (i.e. hyper-vigilance, maintained attention (difficulty with disengagement), and avoidance) of salient stimuli,

the modified dot-probe task only provides "snapshots" of processing (Starzomska, 2017).

2.3.6. Go/No-Go Task Studies

The go/no-go task requires a participant to make a binary decision on each presented stimulus, and then, as instructed, either to perform a motor response (go), such as pressing a button, or to refrain from making a motor response (no-go). The reaction time and accuracy are typically measures of inhibition, attention, and response control.

Two studies used both food- and body-related words in a go/no-go task. One study investigating BED participants with non-BED obese controls, and HCs (Mobbs, Iglesias, Golay, & Van der Linden, 2011), found that both obese groups (BED and non-BED participants) displayed significant general difficulty focusing attention and more impulsivity (pressing the button when instructed not to) across conditions, compared to HCs. These general cognitive impairments escalated with body weight in obese participants, and were most severe in BED participants. There were no reaction time differences that were food- or body-stimuli-specific between participants. Another study with BN and HC participants found that BNs, compared to HCs, were more impulsive overall, but especially with food-related stimuli (Mobbs, Van der Linden, d'Acremont, & Perroud, 2008). BNs also displayed poorer discrimination abilities especially related to food stimuli. This study supports theories in which food-related cognitive impairments play a key role in the development and maintenance of BN, such as Fairburn's (1981, 1984) Cognitive Behavioural Theory of Bulimia Nervosa, and Williamson et al.'s (2004) Integrated Cognitive-Behavioural Theory of Eating Disorders.

2.3.7. VISUAL SEARCH TASK

The Visual Search Task measures attention by the speed that an individual is able to detect a target item or word amongst many other distractor items or words by visually scanning the items.

There was one visual search task study that investigated the detection speed of EDs, restraining ANs, purging ANs, BNs, and HCs, for body- and food-related words amongst distracter words presented together on a computer monitor (Smeets, Roefs, Van Furth, & Jansen, 2008). ANs and BNs both displayed quick detection of body-related words amongst distractor words, whilst slower detection of food-related words. This study may point to a transdiagnostic theoretical perspective of EDs (Fairburn et al., 2003), and also support cognitive theories with disease-dependent information processing tendencies (food- and body-related) as underlying mechanisms (Williamson et al., 2004).

2.3.8. INVERSION EFFECT PARADIGM (VISUAL DISCRIMINATION)

The inversion effect paradigm is a visual discrimination task that measures the way in which an individual recognises an image of an upright, typical face, body, or isolated feature (e.g. leg, lips, etc.) in comparison to an inverted version of the same image. In order to reduce the inversion effect, length of time, or ability to recognise the inverted image, the individual has to move away from processing the inverted image holistically (e.g. an entire face) to processing the image as individual features (e.g. lips, eyes, nose, etc.).

One study presenting upright and inverted pictures of bodies, faces, and objects to ANs and HCs, found no selective cognitive deficits in ANs' discrimination of upright body stimuli, which involved configural processing (Urgesi et al., 2014). Also ANs and

HCs both displayed the ability to discriminate inverted bodies, which involved only detailed processing.

2.3.9. Startle Eye-Blink Modulation (SEM) and Facial electromyography (EMG)

Facial Electromyography (EMG) uses small receptors placed along certain muscular areas of the face, which are often used to measure the amplitude of an eye-blink reflex that is larger than baseline, as well as the startle amplitude inhibition (i.e. eye-blink reflex that is smaller than baseline) that is elicited during the startle eye-blink modulation (SEM) paradigm. During SEM, the individual is often presented with a variety of visual stimuli with and without a startle-eliciting stimulus, such as a loud, startling noise. SEM has been shown to indicate attentional and emotional processing (Filion, Dawson, & Schell, 1998).

One SEM study with ANs, BNs, and HCs, presented food- and body-related pictures along with an auditory noise (startle), measuring facial blinking movements related to being startled, and found that medication-free BNs displayed a reduced startle eye-blink response to food pictures (Friederich et al., 2006). This BN response pattern was significantly different than ANs' startle responses to food-related images, and suggests that BNs appetitive motivational system is activated in response to food stimuli. ANs and HCs both displayed a significantly greater food-related startle response than BNs, with HCs having the greater response, which is not typical. There were no significant startle differences displayed in response to body-related stimuli.

2.3.10. Electroencephalography (EEG)/Event-related Potentials (ERP)

Electroencephalography (EEG) is used to calculate event-related potentials (ERP's) (i.e. detectable neuronal activity voltage changes through electrodes attached to the scalp,) during the presentation of stimuli. Unlike fMRI, which indirectly measures

changes in blood flow, EEG is considered a more direct measure of brain activity. However, with EEG precise brain activity areas may be difficult to elucidate at times.

Blechert, Feige, Joos, Zeeck, and Tuschen-Caffier (2011) investigated attentional biases in AN, BN, and HC individuals, incorporating high- and low-calorie food pictures utilising EEG to measure brain activity. Early ERPs in the posterior electrodes for both high- and low-calorie food pictures were observed with AN and BN participants, compared to neutral images. This general attentional bias for food-related images (both high- and low-calorie) suggests a preoccupation with food in both ANs and BNs. This EEG study results also supports the transdiagnostic theoretical perspective (Fairburn et al., 2003), as both ED groups displayed similar attentional biases.

2.3.11. POSITRON EMISSION TOMOGRAPHY (PET) COMBINED WITH HEART RATE (HR)

Positron emission tomography (PET), similar to fMRI, detects changes in blood flow, and therefore indirectly measures brain activity to presented stimuli. Unlike fMRI, a radioactive drug (called a "tracer") is injected into the bloodstream of participants in order to aid the detection of blood flow into specific areas of the brain when these areas are activated by presented stimuli.

In contrast to the ERP study findings (Blechert et al., 2011), a PET and heart rate (HR) study investigated AN and HC participants' brain activity and heart rate level whilst exposed to food-related stimuli found attentional biases to food-related stimuli (Gordon et al., 2001). Specifically, in comparison to HCs, ANs displayed greater brain activation, significantly elevated HR, and expression of anxiety to high-calorie foods, compared to low-calorie foods in the bilateral visual association cortex. Therefore, this PET/HR study does not support a general food preoccupation in ANs, as in the ERP study, but instead attentional biases toward more fattening food stimuli.

2.3.12. Word Association Task

Also in contrast to the ERP study findings, Berry, Kelly Canetti, and Bachar's (1998) word association test, which tested the perceptual hypersensitivity to groups of words (including food-related words) with ANs, BNs, and HCs, found that ANs were slower than HCs for food-related words, whilst BNs were not significantly different than HCs. This study supports food-related attentional biases only with ANs and not BNs.

2.3.13. Anagram Solving Task

An anagram solving task study (Meyer et al., 2005), in which the response time was recorded while restrained ANs, binge-purge ANs, BNs, and HCs rearranged letters to create words, including food-related words, found that all groups (ANs, BNs, and HCs) solved food words (e.g. eack = cake) more quickly and ego threat words (e.g. lfia = fail) more slowly. This anagram study found attentional biases for food-related words, and an avoidance of ego threat-related words, regardless of diagnostic status.

2.4. Discussion

A systematic review was performed using the PRISMA Guidelines (Moher et al., 2009), in which studies investigating food-, body-, and/or perfectionism-related implicit visual attentional biases or visual information processing strategies in clinically eating disordered participants compared to HCs were collected. 54 studies were reviewed and briefly summarised.

The majority of studies (n = 23) that emerged in the current review included both food- and body-related stimuli, with mostly (n = 20) linguistic stimuli (i.e. words). Overall, body-related stimuli (n = 19), as images (n = 16), were the next most commonly used stimuli. Lastly, there were 12 food-related stimuli studies, mostly incorporating food-related images (n = 8).

As with prior similar reviews (discussed above), the modified Stroop task (n = 20) remained the most commonly utilised paradigm to investigate objective visual attentional biases, making up nearly 40% of the studies. Although it is not clear whether the colour-naming "interference" (slower response time) visible with the Stroop task may be interpreted as attentional bias hyper-vigilance (toward or fixated upon the stimuli), or as avoidance of the stimuli, the general overall combined results suggest body- and/or food-related underlying mechanisms of eating disorders in general. Taken together, the Stroop task results mainly support Fairburn et al.'s (2003) transdiagnostic theoretical view that different eating disorders have similar underlying mechanisms and maintainers.

The fMRI studies found for this review, as with many of the other paradigm studies, had very diverse tasks using either body- or food-related stimuli, and therefore made it difficult to draw solid conclusions. However, in general ANs and BNs had similar brain activation when processing these stimuli that may be problematic for those with an eating disorder (e.g. body- or food-related). The amygdala and insula brain activity may be related to the fear of gaining weight and abnormal body image perception, along with other somatosensory and reward-response to food, especially in BN and BED participants. This may be related to over-eating and binge-eating behaviours. Many of the results support cognitive theoretical understanding that body- and/or food-related information processing style is an emotion-activating process that underlies eating disorders, as individuals who had higher clinical levels of eating disorder typically displayed processing difficulty (attendance to and/or avoidance of) this disease-salient information. Visual and prefrontal processing deficits in AN participants may relate to ruminations about food control and also body-size perception distortions.

Most studies did not include both AN and BN participants together, and none included AN, BN, and BED participants. So it is difficult to make clear comparisons, but together many studies found similar emotional processing of body- and food-related stimuli between AN and BN brain activity, suggesting a transdiagnostic response (i.e. shared processing between different eating disorder diagnoses) for EDs at the neural level. The fMRI paradigm, similar to the Stroop task is still not ideal to investigate the visual nature of the attentional biases. While fMRI may help elucidate the brain activity associated with certain types of stimuli, it cannot clarify the areas of the stimuli that are fixated upon or avoided, for how long, or what regions of interest are included in the visual information processing style. Therefore, it may not be clear what aspects of processing are linked to which areas, and different brain areas may be active in a variety of processes.

Eye-tracking is a paradigm that seems better suited to evaluate the temporal information processing strategies in relation to disease-salient stimuli to investigate underlying mechanisms of eating disorders, as well as specific areas of the stimuli in a more natural manner than other methods discussed. Unlike many other methods (e.g. modified Stroop task, modified dot-probe task, go/no-go, etc.), eye-tracking is capable of tracking processing strategies in a continuous manner. Also, as eye-tracking requires less trials to robustly investigate processing strategies, these studies may be shorter in duration than when using other methods (e.g. fMRI, EEG, etc.), which may prevent participant fatigue. Unlike eye-tracking, fMRI must exclude participants who may not be exposed to the magnetic nature of this method, and relies on indirect measure of blood flow changes, which may take minutes instead of milliseconds. Though more recently utilised in attentional bias research, none of the studies which emerged in the current systematic review included both body- and food-related stimuli, and all studies

investigated AN, except one. The one study including food-stimuli pointed to similar early processing, with ANs then avoiding food-pictures, compared to HCs. Overall, the studies pointed to ANs hyper-scanning (i.e. an increased number of shorter fixations) body images, different patterns and areas of fixation between ANs and HCs, as well as differences in areas of attentional bias and fixation duration between self- and other-body images. In contrast to the Stroop task, these studies all incorporated images, and none included linguistic stimuli.

The modified dot-probe task is also a paradigm that is able to detect differing information processing style of specific stimuli, which are disorder-salient, but unable to track implicit processing strategies in a continuous manner. The two studies utilising this paradigm found mixed results, but it is difficult to draw conclusions, again, primarily due to the differences between stimuli. Information processing strategy differences were found between processing self- versus other-body images, providing the first evidence for self-body image attentional bias in ANs (Blechert et al., 2010), whilst transdiagnostic support was displayed with EDs attentional biases during presentation of food- and body-pictures (Shafran et al., 2007).

Altogether, both food- and body-related attentional biases were evidenced utilising multiple paradigms, different clinical participants, and a diverse range of body- and/or food-related stimuli. Importantly, these conclusions may primarily be drawn for females, as only one study of all that were reviewed report including any males (Mobbs et al., 2011). Some paradigms have greater limitations as to detecting the differing information processing styles for stimuli, as well as specific aspects of this visual processing of certain types of information. This review introduced new paradigms, such as eye-tracking, that have not been reviewed in prior studies of attentional biases related to eating disorders (e.g. Brooks et al., 2011b; Dobson & Dozois, 2004; Faunce, 2002;

Johansson et al., 2005; Lee & Shafran, 2004), as they are more recently utilised in this area of study. Unlike many other methods, eye-tracking has the unique capability to robustly track implicit processing styles in a continuous and natural manner.

Overall, investigating information processing strategies between many different studies with dissimilar paradigms in this review suggested that those with eating disorders processed food information as threatening. ANs displayed difficulty processing food information, often displaying less brain activation in food-processing, avoidance after early processing, and reduced sensitivity of the appetitive system, possibly related to restricting behaviour. BNs and BEDs also displayed difficulty processing food information, engaging the insula, and increased sensitivity of appetitive motivational system, as well as hyper-responsivity in reward-based and emotional areas to fattening food-stimuli possibly related to bingeing behaviour. Generally, modified Stroop results indicated that EDs also displayed quicker detection and more interference from body-related stimuli than HCs, as well as fMRI displaying differential brain activity in the presentation of body-related information than HCs, which may suggest emotional reaction variability to body-related stimuli in those with EDs. In eye-tracking studies, ANs were shown to hyper-scan the body images, and fMRI also showed reduced brain activity in human body processing in areas including the visual networks and areas related to self-reference and social cognition. This may explain body-size impairment (i.e. perceiving ones own body larger than it actually is), a key feature of AN. ANs and BNs both displayed greater brain activity in the emotional processing areas, typically toward negative body-related information, which may point to fear of gaining weight and impaired body image perception. There were also differences between the way in which self-images and other-related images were processed in those with ED.

Taken together, the majority of the studies in this review support differential information processing strategies in EDs compared to HCs, and more studies utilising paradigms that may indicate the hyper-vigilance, disengagement difficulty, or avoidance of body-, food-, and perfectionism-related linguistic stimuli for both females and males is lacking. Eye-tracking may be exceptionally informative to investigate momentary processing strategies related to the underlying mechanisms related to the development and maintenance of eating disorders. Eye-tracking may be used to better detect high temporal continuous measurement of implicit eye movements, and the direct manner in which one processes different types of stimuli for eating disorders, which many of the other paradigms are unable to clarify (e.g. Stroop, dot-probe, fMRI, ERPs, etc.). This newly utilised paradigm may be expanded to incorporate linguistic materials, and to include perfectionism-related stimuli, along with body- and food-related stimuli, as there were no studies investigating implicit perfectionism-related information processing style, which may be a key underlying mechanism of EDs.

While perfectionism is included in many theoretical models as both a risk factor and underlying mechanism which perpetuates the illness (Fairburn et al., 1999b; Lilenfeld et al., 1998; Lilenfeld et al., 2000; Schmidt & Treasure, 2006; Slade, 1982), there were no studies that emerged in this review that directly investigated the attentional biases or implicit cognitive processing of perfectionism-related stimuli. This was surprising as it has been some time since Vitousek and Orimoto (1993) suggested the importance of understanding and investigating attentional biases pertaining to perfectionism-related information. Furthermore, many theories point to perfectionism-, along with some body- and/or food-related mechanisms, as key to eating disorders, such as: the Two-Factor Vulnerability-Stress Model (Joiner et al., 1997), the Three-Factor Interactive Model (Vohs et al., 1999), the Cognitive-Interpersonal Model of Anorexia

Nervosa (Schmidt & Treasure, 2006; Treasure & Schmidt, 2013), and the Transdiagnostic Model of Eating Disorders (Fairburn et al., 2003). Also, perfectionism is suggested to be a key factor in the etiology of eating disorders in many eating disorder reviews (Bardone-Cone et al., 2007; Egan et al., 2011; Jacobi et al., 2004; Lilenfeld et al., 2006; Stice, 2002). Therefore, perfectionism-related information processing style is a significant factor that needs objective investigation in order to clarify its role in attentional biases related to ED tendencies in a similar way as food- and body-related processing have been studied.

2.4.1. COMPARISON WITH PREVIOUS REVIEWS

Unlike previous attentional bias reviews including body- and/or food-related stimuli (e.g. Brooks et al., 2011b; Dobson & Dozois, 2004; Faunce, 2002; Johansson et al., 2005; Lee & Shafran, 2004), the current review reveals that, just second in popularity to the modified Stroop task, researchers are newly utilising fMRI in order to understand the brain activation similarities and differences when processing these eating disorder salient stimuli. fMRI has been more commonly used in anxiety attentional bias studies, finding that fear-related information processing strategy is displayed in the amygdala, and suggests an automatic hyper-vigilance toward the threat- or panic-related stimuli (e.g. see review Cisler & Koster, 2010). In the current review, this amygdalar response may suggest emotional attentional bias to ED-threatening words and pictures (hyper-vigilance toward or avoidance from stimuli), and a top-down cognitive control mechanism may be responsible for regulating attentional bias to ED-salient stimuli which may be threatening.

Another paradigm for attentional biases and visual information processing style for food- or body-stimuli that was not reported in prior reviews is eye-tracking. This paradigm, unlike the modified Stroop task or fMRI, is able to detect more specific

information processing strategies, and also specific areas of visual attention, lack of disengagement, or avoidance in an area of interest. Eye-tracking is proficient in detecting very subtle time differences and information processing difficulties through eye movements and fixation duration.

2.4.2. LIMITATIONS

Most of the studies used the modified Stroop colour-naming task to investigate the visual attentional biases and information processing strategies of eating disorder-salient stimuli, which may be an indirect measure. There also were multiple types of stimuli, and some which merged food- and body-related information into one category. Others separated food- and body-stimuli, but there were differences such as using general, positive, and/or negative stimuli (e.g. a whole meal versus fattening or dieting foods). Some studies differentiated eating disorder diagnoses (mostly investigating participants diagnosed with AN), and other studies grouped all EDs together as one category. Most studies only included females, and therefore the study of information processing tendencies in males related to eating disorders is missing, as well as perfectionism-related stimuli, which may be a key underlying factor.

2.5. CONCLUSIONS

As with former reviews in this area, the modified Stroop colour-naming task remains the most common paradigm to investigate visual attentional biases and information processing style related to eating disorder pathology. New paradigms have also emerged, not included in past reviews, such as eye-tracking and fMRI. Eye-tracking in particular may be beneficial to study the way in which people process information, as it is able to detect implicit information processing strategies, and may be used to monitor behaviour during natural tasks (such as reading). Most results in this review point to similar underlying mechanisms across those diagnosed with ED,

therefore a transdiagnostic perspective of ED may important to further investigate, starting in ED behaviour range in a normal population. Attentional biases to food- and body-related stimuli may support cognitive theories, which ties self-schema deficits to underlying mechanisms and maintainers for eating disorder symptomology (e.g. Fairburn, 1981; Fairburn, 1984; Williamson et al., 2004).

Overall, this systematic review has revealed some gaps in the study of information processing strategies within ED literature, as no studies were found to investigate one of the potential main underlying mechanisms according to some ED theory such as Fairburn et al.'s (2003) Transdiagnostic Theory of Eating Disorders (e.g. perfectionism processing). Also, studies in this review were found to rarely investigate male populations, and natural tasks were most often not utilised to investigate ED-related information processing style. These gaps in literature informed the five studies in this thesis discussed in the following chapters.

TABLE 2

CHARACTERISTICS OF INCLUDED STUDIES

AUTHORS	PARTICIPANTS	GENDER	MEAN AGE	BMI	PARADIGM	STIMULI	DIMENSION	DEPENDENT VARIABLE	ATTENTION BIASES? APPLICABLE FINDINGS
Ben-Tovim & Morton (1989)	17 AN 19 BN 38 HC	F	25 27 23	16.7 22.6 21.3	modified Stroop colour-naming task cards, verbal	modified Stroop colour-naming task cards to verbally name colour of food and shape words ink	food- and body-related words stimuli	Reaction Time to name colour	Yes EDs slower food- and body-shape word
Ben-Tovim & Walker (1991)	22 AN 27 BN 66 HC (29 High drive for thinness; 37 controls with low drive for thinness)	F	24 27 14	16.6 23.3 20.8	modified Stroop colour-naming task cards, verbal	modified Stroop colour-naming task cards to verbally name colour of food and shape words ink	food- and body-related words stimuli	Reaction Time to name colour	Yes EDs slower food- and body- words
Berry et al. (1998)	19 AN 21 BN 20 HC	N.A.	N.A.	N.A.	word association test	psychosexual, food, emotionally loaded, neutral words	food-related words stimuli	Reaction Time	Yes AN slower food words, No BN attentional biases were not significant
Black et al. (1997)	16 BN 29 HC (16 R; 13 UR)	F	24 21 20.6 21.9	23.0 22.5 23.7 21.2	modified stroop	food words	food-related words stimuli	Probe Reaction Time	No significant differences

Blechert et al. (2011)	21 AN 22 BN 32 HC	F	23.2 26.1 26.2	16.6 22.6 20.7	EEG (early EPRs)	high/ low calorie food pictures; standard emotional and neutral pictures	food-related pictures stimuli	Early posterior ERPs reflecting stimulus salience/ selective attention	Yes EDs early posterior ERPs food images = general food bias
Blechert et al. (2010)	19 AN 18 BN 21 HC	F	23.5 26.9 27.1	16.5 22.9 20.3	modified dot-probe	own body pictures; other body pictures	body-related pictures stimuli	Saccade latency toward cue photos	Yes AN faster saccade toward self-photo; BN opposite pattern (but not sig.); First evidence of AB for self-photos in AN; and attentional bias differences between AN and BN
Blechert et al. (2009)	20 BN 22 HC	F	26.6 26.5	22.6 20.3	eye-tracking	own body images and comparison bodies (higher/lower BMIs) measured eye-movements	body-related pictures stimuli	eye-tracking fixations and patterns and BISS	Yes BN fixated longer on lower BMI bodies; reverse for higher BMI. Gaze pattern = upward BN comparison = to body dissatisfaction
Brooks et al. (2012)	18 AN 11 R. 7 BP 24 HC	F	26 26 25 26	15.7 15.2 16.4 21.7	fMRI	high/low calorie and sweet/ savoury food pictures	thinking of eating food-related pictures stimuli	fMRI neural activation viewing pictures of food while thinking of eating the food on	Yes Less activation in AN (bilateral cerebellar vermis); more in right visual Cortex differences in cortical & limbic regions. Visual & prefrontal differences in

								images	AN may lead to ruminations of food control
Brooks et al. (2011a)	18 AN 7 R 7 BP 8 BN 24 HC	F	26 26 25 25 26	15.7 15.2 16.4 21.6 21.7	fMRI	viewing food vs non-food images	food-related pictures stimuli	fMRI differential neural activation to viewing food images	Yes BN greater neural activation (visual cortex, rt dorsolateral prefrontal cortex, rt insular cortex, precentral gyrus); AN greater activation (rt dorsolateral prefrontal coretex, cerebellum and rt precuneus); BN group deactivation (bilateral superior temporal gyrus/insula, and visual cortex). EDs activate top-down cognitive control in response to food images, yet women with BN have increased activation in reward and somatosensory regions, which may lead to reduced cognitive control for BE
Castellini et al. (2013)	18 AN (R) 19 HC	F	24.7 26.4	16.1 20.8	fMRI	viewing pictures of their own body (normal and distorted in	body-related pictures stimuli (own body normal vs distorted	fMRI patterns of neural response to body image processing	Yes AN widest activation to oversize body; Increase brain activation in extrastriate body area,

						size)	in size)	(inferior and superior parietal lobules, dorsolateral prefrontal cortex	superior and inferior parietal lobule and prefrontal areas confirm clinical relevance to body image distortion in AN = reinforcing the key role of attention networks in AN visual processing of own distorted body image
Channon et al. (1988)	20 AN 20 HC	F	N.R. N.R.	15.5 21.1	modified Stroop colour-naming task	modified Stroop colour-naming task to verbally name colour of food & shape words ink	food- and body-related words stimuli	Reaction time to name colour	Yes AN generally slower with all words, and especially food words. Greater AN weight range = greater interference
Cooper & Todd (1997)	12 AN 12 BN 18 HC	F	N.R. N.R. N.R.	N.R. N.R. N.R.	modified Stroop task	eating-, weight-, shape-related words, and control cards	food-, body-related words stimuli	Time latency response time (using stop watch) in naming the colour of the ink of the words on cards	Yes EDs slow naming body (weight-) and food (eating) words; AN but not BN slower naming body (shape-) words. No sig. differences between AN & BN
Cooper et al. (1992)	36 BN 18 HC	F	24.3 22.1	21.8 20.9	modified Stroop colour-naming task	eating-, weight-, shape-related words	food-, and body-related words stimuli	Response Time in naming the colour of the ink of the words	Yes BN slower to name food and body words, but BN and HC similar in colour words. Stroop may be objective measure of ED-specific cognitive

									disturbance for BN
Cooper & Fairburn (1992)	12 AN 12 BN 12 'Norm Dieters' 12 'Symptomatic Dieters' 12 HC	F	N.R. N.R.	N.R. N.R.	modified Stroop test	eating-, weight-, shape-related words	food- and body-related words stimuli	Response Time in naming the colour of the ink of the words	Yes AN, BN, and SD slower naming food (eating) and body (weight and shape) words. Delay specific to those with eating disorder and EDs are maintained
Fassino et al. (2002)	20 AN 20 HC	F	24 23	15.2 20.6	modified Stroop colour-naming task	food style, body image words presented using the modified Stroop colour-naming task	food- and body-related words stimuli	Response Time of colour naming ink of words	Yes AN slower to name all words (nonspecific attentional biases). AN slower naming body images may be linked to alterations of abstraction and critical abilities with obsessive frontal functioning
Friederich et al. (2010)	17 AN 18 HC	F	24.9 23.3	15.6 21.9	fMRI	Brain activation to body-shape compared to interior design images. Scanned using fMRI while comparing self with images of slim idealized female bodies (active condition) or	body-related picture stimuli	Differences in neural correlates of self-other comparison of body shape between AN and HC using fMRI	Yes AN greater Activation (insula, putamen, premotor cortex, posterior cingulate cortex) and less activation (rostral ACC) compared to HC. No differences to neutral images

						interior home designs (control condition)			
Friederich et al. (2006)	13 AN 15 BN 25 HC	F	25.1 25.2 25.0	16.4 23.4 21.8	startle eye-blink modulation (SEM) while viewing ED-relevant stimuli	food pictures (savoury & sweet), female body pictures (slim models in German magazine with no visible face), and emotional pictures	food-, and body-related picture stimuli	Facial EMG measuring startle eye-blink reflex response to acoustically elicited SEM	Yes BN startle response pattern to food = engagethe appetitive motivational system (but rated food pictures highly anxiety provoking). No sig. startle potential for thin female model bodies in EDs. ANs generalized reduced sensitivity of the appetitive system = no attenuated startle response. BNs increased sensitivity of the appetitive motivational system in response, mirroring substance abuse
Geliebter et al. (2016)	10 BE 10 HC (5 Normal Weight; 5	F	22.1 21.3	27.4 27.7	fMRI	Viewing photos and hearing spoken words of food	food-related pictures and spoken words	fMRI Functional Connectivity brain response	Yes BE hyper-responsive (ACC and functional connectivity) in

	Obese)					(high-ED foods 3.5 Kcal/g or more & low-ED foods 1Kcal/g or less) and non-food stimuli	(high-calorie vs low-calorie)	measured in response to visual and auditory high-ED binge-type food stimuli in BE and HC	response to high ED binge type food visual and auditory presentations compared to low ED non-binge food cues. BEs (vs non-BEs) increased activation Visual and auditory high calorie foods (dorsal region of ACC) = imp conflict processing and reward-based decision-making and emotion. Dorsal ACC region = heightened activation in BE when viewing and/or listening to words representing high-ED foods, as well as increased connectivity with other brain regions associated with food reward. The circuitry regions specific for BE rather than weight
George et al. (2011)	16 AN 16 HC	F	26.2 26.1	16.8 22.8	eye-tracking	judging body pictures (lower and higher BMI)	body-related visual stimuli	eye-movements and fixation durations made when judging	Yes AN overestimated body size and find lower BMI bodies more attractive. AN wider fixation pattern from groin to

								bodies and after the visual info sampled when making a judgments.	collar bone. AN may attend to bony areas to judge body fat.
Giel et al. (2011)	19 AN 18 HC (Fasted) 20 HC (Non-fasted)	F	24.4 24.2 24.4	15.8 21.3 21.6	eye-tracking	free visual exploration of food vs non-food pictures	food-related picture stimuli	eye-tracking gaze fixation duration	Yes AN less attention to food pictures = AN severity, but no early attentional bias toward food pic. ANs processed food typically and then avoided (unlike HC).
Gordon et al. (2001)	8 AN 8 HC	F	20.1 23.7	18.0 21.7	PET heart rate	overnight fast, offline 2 high-calorie and 2 low-calorie food stimuli on a table 2 feet in front of subject with a 1 min audio directing attention to standardize assoc. cog processes for 2 baseline heart rates	food-related stimuli	baseline off-line Heart rate during viewing of 2 high and 2 low-calorie foods; PET brain activity (O-CO2 tracer inhalation) during viewing of high and low calorie food scan & pulse	Yes Greater mean rCBF values bilaterally (medial temporal lobes) suggesting body image distortion in AN; greater rCBF response to high-calorie versus low-calorie foods (bilateral visual association cortex) ANs activation pattern accompanied a significant heart rate elevation and anxiety feelings with presentation of high-calorie food stimuli

Green et al. (1994)	20 AN 41 HC	F	Age matched N.R.	17.9 21.2	modified Stroop colour-naming task	response to colour as fast as possible by pressing one of four buttons. stimuli consisted of body ('flabby', 'chubby', etc), food ('cream', 'crisps', 'sweets'), and neutral words	body- and food-related words stimuli	response time to colour naming (red, yellow, blue, green)	Yes AN slower naming body (shape) words decreased across experiment. No habituation with food-words.
Green et al. (1999)	34 AN 39 HC	F	21.9 21.9	17.2 21.1	modified Stroop colour-naming task	colour naming body shape ('chubby', 'flabby', 'hips') related words vs neutral words	body-related words stimuli	speed of colour naming	Yes AN slow to name body (shape) words and inter-associated neutral words. Suggests for body shape words by ANs and highly interconnected nature of body shape related schemata in AN, not affective valence
Green et al. (1998)	12 AN 18 HC	F	26 21	16.5 21.9	modified Stroop colour-naming task	'fattening' foods (cake, chips, chocolate) and 'fat' body ('fat', 'plump', 'chubby') words along with	food-, and body-related words stimuli	colour naming speed tested on three occasions (initial hospitalization, pre- (one week later) and post- 12	Yes AN slower in general and for both food- and body- (shape) words than neutral matched words. Impairment decreased as a function of weight gain and improvement in ED.

						semantically homogeneous words ('bison', 'slugs')		week refeeding and weekly cognitive therapy sessions focused on negative food appraisals treatment	food sord time improved more quickly than body words
Johansson et al. (2008)	13 AN 20 BN 27 Over-concerned with eating/body 31 HC	F	23.1 24.6 24.9 23.8	16.7 21.3 22.4 21.8	modified Stroop colour-naming task via internet	using modified Stroop colour-naming task via internet to name colour of food and shape words by button	food- and body-related words stimuli	Stroop response times to name colour of words	Yes BN slower with body words; AN slower with food words. May reveal core concerns differences between AN and BN
Jones-Chesters et al. (1998) Mixed	16 BN 16 HC	F	25 27	23.8 22.1	modified Stroop colour-naming task	mixed stimulus presentation of food/eating; weight/shape; emotion; or neutral words in coloured ink	food-, and body-related words stimuli	colour-naming latencies	Yes BN slower to name food (eating) and body (weight/shape) words. Not for neutral words
Jones-Chesters et al. (1998) Blocked	16 BN 16 HC	F	25 27	23.8 22.1	modified Stroop colour-naming task	blocked stimulus presentation of food/eating; weight/shape; emotion; or neutral words in coloured ink	food-, and body-related words stimuli	colour-naming latencies	Yes BN results were magnified prior presentation. Slower naming food (eating) and body (weight/shape) words than control words. BN showed

									increased naming-latency for 'emotion' words. No interference for neutral words
Long et al. (1994)	37 AN 45 HC	F	26 24	16.5 22.5	modified Stroop colour-naming task	presentation of food and body words in coloured ink on cards	food-, and body-related words stimuli	colour-naming latencies	Yes AN slower to food- and body-size words
Lovell et al. (1997)	31 AN 24 BN 23 AN (rec) 11 BN (rec) 33 HC	F	25 27 29 34 25	16.6 21.8 22.2 24.6 22.9	modified Stroop colour-naming task on cards	presentation of food and body words in coloured ink	food-, and body-related words stimuli	colour-naming response time	Yes BN & AN (rec) slower for body (shape). enduring cognitive bias AN (rec)
Mendlewicz et al. (2001)	16 AN 16 HC	F	18 19	16.5 20.0	modified Stroop colour-naming task	presented food (high and low calorie), body parts (problematic, neutral words	food- and body-related words stimuli	colour-naming response time	No differences between AN and HCs for food or body words
Meyer et al. (2005)	13 AN (R) 15 AN (BP) 22 BN 50 HC	F	27.8 24.3 27.0 22.6	16.8 16.9 22.0 22.2	solving anagrams on cards	15 food words, 10 ego words, 30 neutral words	food-related words stimuli	anagram solution times	No All solved food words more quickly and threat words more slowly = attentional bias to food materials and avoidance of threat-related materials regardless of diagnostic status. BN took sig. longer than HCs for threat words; AN (R) took longer than HC and shorter than

									BNs. Threat-related avoidance only with BN behaviours (bingeing & vomiting). No evidence of avoidance of disorder-related (food) cues
Miyake et al. (2010a)	11 AN (R) 11 AN (BP) 11 BN 11 HC	F	22.2 28.3 24.5 26.5	15.3 15.9 20.2 19.1	fMRI	presented with body images of participant and other females with morphed widths (+/-5, 10, 15, 20, 25% of orig)	body-related morphed own and others image stimuli	fMRI brain activity to presentation of size-morphed images of own body and another female body	Yes ANs amygdala sig. activated to own fat-image. PFC sig. activated in AN (BP) (but not AN (R)s or BNs) to own fat-image. EDs different with respect to amygdala and PFC during processing of own fat-image
Miyake et al. (2010b)	12 AN (R) 12 AN (BP) 12 BN 12HC	F	27.0 27.2 25.0 25.4	15.2 15.5 21.2 18.8	fMRI	select the more negative word from each negative body-image word set, and to select the most neutral word from each neutral word set	body-related words (negative) stimuli	fMRI brain activation to selecting most negative body-image words and most neutral of the neutral words	Yes RT Amygdala activated in ANRs & ANBPs, & LT mPFC activated in BN (may be fearful emotional processing of negative body image words & fear of weight gain), & ANBP (may be involved with abnormalities of body image perception)
Mobbs et al. (2011)	16 BED (obese) 16 non-BED	11F/5M	45.1	34.6	go/no-go task (set shifting task with	food and object words (set 1) and then body-	food- and body-related words	response time to target words,	No both obese groups made more errors (response to

	(obese) 16 HC	12F/4M 11F/5M	39.3 40.2	33.6 21.3	auditory error sound)	related and object words (set 2) rapidly presented one-by-one with participant pressing space bar for only target words (and refraining with distracters)	stimuli	number of errors (response to distracter stimuli), and number of omissions (failure to response to target stimuli)	distractors & omission of targets) than HCs. No difference concerning cog biases for food- & body-related targets. Obese = general inhibition problem and difficulty focusing attention, not stimuli dependent. Cognitive deficits severe in BED obese patients = increased cog problems with increased severity of BED
Mobbs et al. (2008)	18 BN 18 HC	F	25.1 24.3	20.4 21.0	go/no-go task (set shifting task with auditory error sound)	food & object words (set 1) and then body-related & object words (set 2) rapidly presented one-by-one with participant pressing space bar for only target words (& refraining with distracters)	food- and body-related words stimuli	response time to target words, number of errors (response to distracter stimuli), and number of omissions (failure to response to target stimuli)	Yes BN faster overall, and poorer discrimination ability especially when targets related to food. BN cognitive deficits and more impulsive esp. with food-related stimuli = may contribute to development and maintenance of BN
Mohr et al. (2010)	16 AN 16 HC	F	24.1 24.1	15.9 21.7	fMRI	Two tasks in fMRI to measure body	body-related subjects +/- 1 to 15%	fMRI brain activation during body	Yes AN stronger activation (insula and lateral

						estimation: presented with an image of themselves (randomized in terms of distortion from thin to big) for 4000 ms, and then were given 4000 ms to decide how much the presented image corresponded to their real body image body satisfaction: Same body presentation as prior but participants evaluate how much the shown image represented their ideal body image: x2=image is not identical at all, x1=image	distorted (thinner/fatter shoulders, chest, hips, thighs and calves)	satisfaction task of manipulated images and body size estimation task	prefrontal cortex) during satisfaction rating of thin self-images. Stronger emotional involvement when AN presented with distorted self-image close to own ideal body size. AN overestimated own body size. Differential modulations in activation of the precuneus during body size estimation in HC and AN = deficit in retrieval of multimodal coded body schema in precuneus/posterior parietal cortex related to body size overestimation in AN

						is not identical, +1=image is nearly identical, +2=image is identical to ideal body shape			
Perpina et al. (1993)	18 AN 14 BN 32 HC	F	26 26 27	17.2 26.6 23.4	modified Stroop colour-naming task cards	testing selective processing of food- and body- size-related info using modified Stroop task	food- and body-related words stimuli	colour-naming reaction time	Yes EDs and restrained with high drive of thinness slower body (shape) words.
Phillipou, et al. (2016)	24 AN 24 HC	F	23.1 22.7	16.5 22.3	eye-tracking during two biological motion tasks to identify gender and walkers' body size	body-size male or female figures (13 sizes) walking in biological motion tasks (one asks gender of previous stimulus; one asks 1-very underweight to 13- very overweight), while eye-tracking	body-related motion visual stimuli	fixation count, fixation duration and saccade amplitude calculated for each body size category. AOIs were created (head, shoulders, hips, knees, feet and arms). Investigate the proportion of fixations and	Yes AN hyper-scanned No difference in their estimation of body size. Hyper-scanning = increased anxiety to disorder-relevant stimuli in AN (body). AN was able to judge body size of others as accurately as HC

								fixation durations to AOIs and non-salient features, average fixation count and dwell times (total fixating on an AOI during a trial) to each AOI calculated for each body size	
Redgrave et al. (2008)	6 AN 6 HC	F	27 24	15.7 22.3	Stroop colour-naming task & fMRI	fat, thin, XXXX, neutral words presented using the modified Stroop colour-naming task during fMRI scanning	body-related words (fat/thin) stimuli	response time colour-naming the words and brain activation during presentation	Yes ANs longer to name body (thin/fat) and neutral words. AN had brain activation revealing AB to fat (left precentral, inferior and middle frontal gyri), and Thin (junction of insula, frontal and temporal lobes; auditory cortex; associational areas in the insula; Wernicke's area; and an area in the posterior frontal lobe) body words. AN to thin words had insular activity which may

									point to craving
Sachdev, et al. (2008)	10 AN 10 HC	F	18.8 22.6	16.4 22.2	fMRI	presented with images of self and non-self which were matched for BMI.	body-related (self- vs others) images stimuli	fMRI brain activation while viewing self- vs other bodies	Yes ANs had lack of activation of the attentional system or insula during self-images. Processing may underlie the distortion of self-images by ANs. No ANs process non-self images similarly to HCs,
Sackville et al. (1998)	AN HC (R) (UR)	F	20 53 20 33	19 19.5 18.7	modified Stroop colour-naming task	modified Stroop colour-naming task with masked and unmasked body, food, and neutral words	body- (thin/fat), food (high/low calorie), words stimuli	colour-naming response time	Yes AN slower naming body words (thin and fat), and no effects for emotional words or for preconscious attentional biases in masked conditions
Shafran et al. (2007)	82 ED 44 HC	F	26 26	21.6 23.1	modified pictorial dot-probe task	modified dot-probe task with pictures of negative/positive eating and neutral weight, and shape stimuli	food-, and body-related pictorial stimuli	Response time	Yes ED biases for food (neg and positive eating) and body (neutral weight) pictures, and also negative and neutral shape stimuli
Smeets et al. (2008)	68 ED 22 AN-R 24 AN-P 22 BN 60 HC	F	25.0 25.7 25.1 25.7	16.7 18.8 22.5 22.0	visual search task (body-related and food-related)	Task 1: body, countries (neutral), and musical	body- and food-related words stimuli	Response latencies: speed detection and	Yes EDs displayed speeded detection of body words, and increased distraction

						instruments (neutral) words (19 with one target word); Task 2: high/low-calorie food, colours (neutral); names (neutral) with one target word among 19 words		distraction increase	of food words = mechanism underlying the biased attention allocation of EDs is type-dependent
Spangler & Allen (2012)	12 BN 12 HC	F	18-38 18-30	19.3-27.8 18.5-26.9	fMRI	fMRI while viewing images of women with either thin or overweight bodies in a self-referencing context	body-related pictorial stimuli	fMRI brain activation to viewing thin vs overweight bodies of women in self-referencing context	No mPFC activation for HC or BN groups for thin body pictures. Yes mPFC sig. greater activation for BNs in sub-regions associated with emotional processing for overweight bodies. Consistent with cog models of ED pointing to neg. body-related stimuli more central to self-schemas and more emotionally provocative in EDs
Stormark & Torkildsen (2004)	20 ED (7 AN; 6 BN; 7 AN/BN)	F	27	N.A.	modified Stroop picture and word	linguistic and pictorial colour, food, and negative	food-related words and pictorial stimuli	Reaction time to colour-naming	Yes EDs slower to name words (incl. food words) and food pics. (but no

	24 HC		22	N.A.		emotional stimuli used as colour-interfering stimuli			other conditions). ED also slower in naming both food and emotional linguistic and pictorial stimuli in comparison to neutral stimuli. ED (AN and BN) females bias to food stimuli are not restricted to linguistic representation, and may be important to maintenance of EDs
Suchan et al. (2013)	10 AN 15 HC	F	26 30	15.7 22.0	fMRI	fMRI while viewing images of body and chair pictures	body-related Images stimuli	fMRI brain activity while viewing images of bodies vs chairs	Yes AN different network during visual processing of human bodies. ANs left sided effective connectivity in the occipital cortex highly neg. correlation with body size misjudgment. Evidence for altered networks for body processing in female AN. Also explain body size misjudgment, key feature in AN, based on reduced effective connectivity in the body processing network
Suda et al. (2013)	20 AN 15 HC	F	27.0 26.0	15.7 21.9	fMRI	blocks of healthy females in actions –	body-related visual stimuli	fMRI brain activity during body checking	Yes AN less activation (mPFC and right

						body checking images (i.e. pinching the skin, tape measure, etc.) and then other activities (i.e. writing, using a computer, etc.)	(body checking)	visuals compared to neutral action images	fusiform gyrus) with body checking images compared to neutral action images. Suggests that AN patients have reduced activation in cortical areas associated with self-reference, body action perception, and social cognition in females with AN
Uher et al. (2005)	13 AN 9 BN 18 HC	F	25.4 29.6 26.6	16.2 22.6 22.4	fMRI	Different fMRI activation viewing line drawings of underweight, normal weight, and overweight female bodies compared to controls (drawing of houses).	body-related line drawings stimuli	fMRI brain responses while viewing line drawings of underweight, normal weight, and overweight female bodies compared to controls (drawing of houses)	All more activation to bodies than houses. YES lateral fusiform gyrus and parietal cortex was less in EDs. Underactive distributed neural network processing for female body line drawings, in females with EDs. Emotion reaction variability to body shapes in ED is linked with differential activity in prefrontal cortex
Uher et al. (2004)	16 AN 10 BN 19 HC	F	26.9 29.8 26.7	16.0 23.7 22.4	fMRI	presented with food and aversive emotional images during fMRI scanning	food-related visual stimuli	fMRI brain activation to images	Yes EDs greater activation to food (left medial orbitofrontal and anterior cingulate cortices) and less

									activation (lateral prefrontal cortex, inferior parietal lobule, and cerebellum). This points to finding food stimuli as threatening and disgusting. BN also had less activation in lateral prefrontal cortex, compared to HCs. Non-specific emotional stimuli found in occipital cortex parietal cortex, and cerebellum. Medial prefrontal response to symptom-provoking stimuli common feature EDs = transdiagnostic at neural level
Uher et al. (2003)	8 AN 9 AN rec 9 HC	F	25.6 26.9 26.6	16.6 20.4 22.2	fMRI	presented pictures of food and emotionally provoking stimuli during fMRI scans	food-related pictoral stimuli	fMRI brain response to food and emotional visual stimuli	Yes ANs recovered compared to HCs had greater activation (medial prefrontal and anterior cingulate activation); lack of response (inferior parietal lobule) to food-stimuli. Increased activation (right lateral prefrontal, apical prefrontal, and dorsal

									anterior cingulate cortices) differentiated AN-recovered from ANs. AB specific to food stimuli, no emotional stimuli differences
Urgesi et al. (2014)	12 AN 12 HC	F	20.8 19.8	17.0 20.4	inversion effect paradigm visual discrimi-nation	upright and inverted pictures of whole bodies, faces, and objects	body-related pictorial stimuli	response time to discriminate the identity of the stimuli to correctly match the correct probe with the sample. Both sample & probe were presented upright or inverted	Yes AN selective deficits in the discrimination of upright body stimuli (configural processing). No both ability to discriminate inverted bodies (detailed-based processing), and discrimination of faces & objects
Van den Eynde et al. (2013)	21 BN 23 HC	F? (individuals, but intro talks about females only)	28.0 27.3	23.4 21.3	MRI	visual food, body (own and slim women), compare self to 'slim ideal' bodies	body- and food-related image stimuli	fMRI brain activation during presentation of food, and slim body images	Yes BN more activation (insula) and fusiform gyrus less evaluating themselves against images of slim women. increased self-focus BN during 'slim ideal' comparison. No food differences

Vocks et al. (2010)	13 AN 15 BN 27 HC	F	29.1 28.4 26.7	15.8 21.3 22.1	fMRI	fMRI whilst viewing standardized self-body pictures and another woman's body (in bikinis)	body-related pictorial stimuli (self- vs other- body images)	fMRI brain activity whilst viewing own body pictures versus other female body images in bikinis	Yes EDs reduced activity (inferior parietal lobule) viewing own body images. AN had higher amygdala activity than BN and HCs viewing another womens' body images
Von Wietersheim et al. (2012)	35 AN 32 HC	F	N.A.	N.A.	eye-tracking	eye-tracking whilst viewing young women and self, using eye movement tracer to view what body areas the participants look at. Rated attractiveness	body-related image stimuli (self vs others)	Areas of interest using eye-tracking fixation duration	Yes AN rate self less attractive than HCs, critical assessment of other-bodies, spent less time looking at own breasts & more at their thighs. Different ABs body dissatisfaction in AN, (small & vary greatly)

NOTES. ABS = ATTENTIONAL BIASES; AN = ANOREXIA NERVOSA; BED = BINGE EATING DISORDER; BN = BULIMIA NERVOSA; HCS = HEALTH CONTROLS; MOD. = MODIFIED; PICS = PICTURES; VS = VERSUS; BP = BINGE-PURGE; P = PURGE; R = RESTRICTION; UR = UNRESTRICTION; REC. = RECOVERED; N.A. = NOT AVAILABLE; F = FEMALES; M = MALES; SIG. = SIGNIFICANT; COG = COGNITIVE; GEN = GENERAL

2.6. Non-Clinical Eye-tracking Investigation Related to Eating Disorders

The studies identified within the systematic review investigated the implicit information processing strategy methods of disease-salient materials between clinical samples and healthy controls. This review provided important results across clinically diagnosed degrees of eating disordered individuals for the development of robust experiment designs to best investigate the underlying cognitive mechanisms that have been found to contribute toward the development and maintenance of eating disorders. The systematic review identified that eye-tracking was more recently implemented to detect subtle processing strategies in a continuous manner, unlike other common methods (e.g. Stroop task, dot-probe task, etc.). Whilst understanding clinically-severe processing difficulties is important to develop the experiments that may robustly investigate these underlying factors for this thesis, studying these development and maintenance factors within the general population is key to developing more effective prevention and treatments.

Similar studies have been conducted in non-clinical or subclinical populations, using similar tasks (i.e. modified Stroop, modified dot-probe, ERP's, visual search, eye-tracking, etc.), with the modified Stroop task reported as the most commonly utilised method to investigate body- and/or food-related information processing style (for reviews, see Aspen et al., 2013; Dobson & Dozois, 2004; Faunce, 2002; Jiang & Vartanian, 2017; Johansson et al., 2005; Lee & Shafran, 2004). Generally, in these studies, there is a wide range of results, as there are many population samples (e.g. external eaters, restraint eaters, body dissatisfied, obese, underweight, etc.).

Related to processing food-stimuli, studies utilising different methods to identify the processing styles of those who are prompted by food-related cues to eat in the absence of hunger (i.e. high levels of "external eating"), report different food-related

processing styles between methods. Whilst high levels compared with low levels of external eating has been reported to avoid food words utilising modified dot-probe (Johansson, Ghaderi, & Andersson, 2004), attendance toward food-related images measuring ERP's (Nijs, Franken, & Muris, 2009), and both high and low external eaters were reported to attend toward food words using the Stroop task (Newman, O'Connor, & Conner, 2008). Non-clinical and subclinical ERP studies generally report that restraint eaters tend to avoid food-related stimuli, whilst obese individuals display an approach-avoidant pattern with food-related stimuli, and those with BED display the difficulty to disengage attention when processing high-fat foods (see review, Wolz, Fagundo, Treasure, & Fernández-Aranda, 2015). Also, males and females are reported to process food-related stimuli differently. Watson and Garvey (2013) reported that in earlier processing strategies for food-related images only females exhibited significantly enhanced ERP's in the "no-go" food-image trials. Therefore, different methods may detect different aspects of processing, and also the gender and different types of tasks and stimuli (e.g. images vs. words) may influence results.

Recent studies, which have utilised eye-tracking to investigate eating disorder-related underlying factors within the general population, have reported differing results with regards to attendance, maintenance, and/or avoidance of disease salient materials. These mixed results may indicate the differences of populations (i.e. those who are obese vs. restricting vs. body dissatisfied, etc.), the considerable variance of severity within subclinical or non-clinical populations, the differences of the tasks, and/or the investigation focus. Subclinical and non-clinical studies related to underlying mechanisms of eating disorders using eye-tracking will now be briefly summarised, followed by an overview of utilising eye-tracking within the natural task of reading.

2.6.1. Non-Clinical Eye-tracking Studies With Images and Text

A recent review by Jiang and Vartanian (2017) of the most common measures for implicit eating disorder-related information processing strategies (i.e. the modified Stroop task, dot-probe visual search task, and eye-tracking) recommends eye-tracking combined with a task that detects the type of attention-based mechanism (i.e. avoidance from, hyper-vigilance toward, and/or maintained attention on/difficulty disengaging from the specific stimuli). Therefore, as discussed in the previous systematic review, eye-tracking during a natural reading task may be a robust method to temporally detect continuous information processing strategies related to the underlying cognitive mechanisms of eating disorders within a general population.

Similar to many of the studies that have utilised eye-tracking in the clinical samples to investigate processing styles related to eating disorders, the non-clinical or subclinical studies have also focused on image-related body and/or food materials. Fewer studies investigate with text-related body and/or food materials, and have produced mixed results. No studies were found to investigate the way in which these people process perfectionism-related information related to eating disorder level or body mass index.

Many of the body-related studies include body-satisfied and body-dissatisfied participants (mainly females). One study (Jansen et al., 2005), which investigated eating disordered symptomatic non-clinical individuals, reported that these individuals fixated longer on self-identified "ugly" body areas on images of their own body, and "beautiful" body areas on images of others, compared to healthy participants. Also, pupillometry and measurements of eye-blinks revealed a greater attendance towards their own body image compared to healthy participants. However, in a different study (Janelle, Hausenblas, Ellis, Coombes, & Duley, 2009) which investigated highly body

dissatisfied and satisfied women using eye-tracking to measure time course indicated a maintenance bias. Whilst participants with higher levels of weight dissatisfaction avoided viewing their own body image completely overall, in early processing measures (first fixation duration) participants attended longer to the pelvis area of fashion model body images, and on the legs of the fashion model images in later processing measures, than those who were body satisfied. In another study investigating body dissatisfied and body satisfied women, Gao et al. (2014) reported that women with body dissatisfaction attended to both thin and fat body images longer in both early and late processing tendencies, compared with women without body dissatisfaction in a free viewing eye-tracking experiment. While each of these studies consist of differing image-related stimuli, and differing populations between eating disordered non-clinical versus body dissatisfied populations, the Janelle et al. (2009) and Gao et al. (2014) studies point to the importance of time course within the processing strategies related to underlying mechanisms of eating disorders.

Eye-tracking has also been reported to detect subtle processing strategies, even when participants self-report improvement. For instance, Glashouwer, Jonker, Thomassen, and de Jong (2016) reported that women with high body dissatisfaction attended to 'ugly' body parts longer than 'beautiful' body parts for both their own and other people's body images. This attention maintenance upon 'ugly' body parts was found to be robust even after a five-week body positivity training, and self-reporting improvement.

There are far less studies investigating both males and females attentional bias of bodies using eye-tracking. One study (Cho & Lee, 2013) in which males and females with high and low levels of body dissatisfaction were shown thin, normal, muscular, and fat body images of others of the same gender reported that whilst males with higher

levels of body dissatisfaction fixated more frequently and longer toward muscular body images of other males, women with higher levels of body dissatisfaction attended toward thin body images of other females. Higher levels of body dissatisfaction were related to both extended and more repetitive attentional bias toward body images reported to be more attractive to those with higher levels of body dissatisfaction.

There are also fewer studies, which have utilised eye-tracking in non-clinical or subclinical samples to investigate eating disorder-related processing including text (mainly single words). In women with high levels of weight dissatisfaction, Gao et al. (2011) found that women quickly attended towards both fat- and thin-related body words, but also found a later avoidance of thin-related words compared to weight satisfied women. Weight dissatisfied women may find thin body words threatening, or 'ego-threat', which is displayed by the detection – avoidance pattern of processing these thin-related words.

2.6.2. Weight and BMI related to Eye-tracking Processing Studies

Not only are processing strategy differences related to body dissatisfied or subclinical participants, but one's weight may also play a role in how one processes disease salient information, as weight is often related to eating disorder behaviour. As one starves their body or binges on food, their body weight may often resemble these eating behaviours. Kessler et al. (2013) reported that 16% of those were without an eating disorder, 42% of those with binge eating disorder were overweight or obese, and the presence of an individual being under-weight for their age and gender is considered important to be diagnosed with anorexia nervosa (see Table 1).

A study by Warschburger, Calvano, Richter, and Engbert (2015) unexpectedly reported that both men and women with increased weight tended to fixate longer upon 'attractive' rather than 'unattractive' self-body image areas, than those with normal

weight, which may be either avoidance of the unattractive areas or a strategy for enhancement, as this pattern was displayed even in those with high levels of body dissatisfaction. Alternatively, Roefs et al., (2008) reported that normal-weight females with higher BMI (but still within the normal range) attended toward self-identified unattractive body areas, toward others attractive body areas, and rated their own body as generally less attractive. Another eye-tracking study with non-clinical weight-trained men, reported that viewing their own body, or viewing muscular bodies (compared to viewing other normal male bodies) greatly increased body dissatisfaction (Cordes, Vocks, Düsing, & Waldorf, 2017). Also, longer maintained attention toward self-disliked body areas was related to increased self-reported body dissatisfaction after the eye-tracking free viewing task. These studies also indicate that males and females may display differing eye-tracking processing patterns related to one's body size, and there may be some similar and some differing strategies between males and females, according to body-related goals.

As weight is used in the calculation of one's body mass index, BMI may also play a factor in an individual's processing strategies of body-related and disease salient information, and also in relation to eating disorder tendencies. For instance, Werthmann et al. (2011) reported an approach-avoidance pattern toward high-fat food images, attending toward these images, but for shorter duration than normal weight individuals, which influenced craving only in those who were overweight. Alternatively, Nijs, Muris, Euser, and Franken, (2010) did not find these attentional effects during a free viewing of food pictures during eye-tracking, but during a probing task which recorded time course, they did find an initial attendance toward food-related cues. These studies point to initial but not maintained attention for food-related images in those who are overweight or obese.

2.7. Non-Clinical Eye-tracking Summary

Taken together, most studies in the non-clinical or sub-clinical population investigate processing strategies between body-dissatisfaction with body-related images, and participants weight-related to food-related images. Similar to clinical studies, mainly females are included, and results between studies vary. This may be from a greater variance of degree of symptomology within the general population, but most likely these result differences are due to differing populations, methods, stimuli, and tasks that are also found in clinical studies. These studies point to the need to investigate implicit processing strategies in a more natural manner, with males and females, and those specifically including eating disorder symptomology within the general population. Results from studies that suggest differences of processing style related to weight stress the importance of taking body mass index into account related to disordered eating behaviour and processing strategies, which will be discussed in Experiment 1. First, eye-tracking related to reading will be discussed, as Experiment 1-4 in this present thesis incorporates the natural task of reading using eye-tracking to monitor the more continuous nature of information processing strategies to detect key underlying mechanisms of eating disorders.

2.8. Introduction to Eye-tracking and Reading

Whilst previously noted that questionnaire measures are informative, implicit measures may be imperative to understand the key underlying cognitive mechanisms that facilitate the development and maintenance of eating disorders. Although many methods have the ability to detect different aspects of eating disorder-related processing strategies, including the most popular method (i.e. modified Stroop task), often these include tasks that may be relatively unnatural to participants. In contrast, tracking eye movements during silent, natural reading is suggested to be an exceptional way of

measuring the information processing strategies of individuals, and a precise on-line behavioural measure (Liversedge & Findlay, 2000). Thus, the remainder of this chapter will provide an introduction to eye-tracking and reading.

During silent, natural reading of English text, the eyes move forward (left to right) through the text in a jerky motion, called a saccade (typically around eight characters at a time), which makes up approximately 85-90% of saccades (Rayner, Pollatsek, Ashby, & Clifton, 2012). Quite frequently, the eyes briefly stop and fixate on a text for approximately 250 milliseconds at a time, which interrupts the movement of the eyes along the text throughout the saccades. These brief interruptions during the saccades are called fixations. During this reading process the reader's eyes continue to fixate on words as they attempt to comprehend the information.

Although the eyes typically land towards the centre or beginning of a word, the reader is able to process approximately four previous letter spaces and 15 proceeding letter spaces from the point of fixation, which is often called the "perceptual span" (e.g. Henderson & Ferreira, 1990; McConkie & Rayner, 1975). Therefore, an undetected shift of attention and processing begins just before the eyes move (saccade), producing new fixations, and most of the information which is processed before the saccade is shown to be mainly in the direction of the proceeding eye movement (e.g. Henderson, Pollatsek, & Rayner, 1989; Rayner, Murphy, Henderson, & Pollatsek, 1989). For instance, Rayner, McConkie, and Ehrlich (1978) instructed participants to move their eyes toward, and quickly name, one of the words on either side of a fixation point. Both words became identical to the target word as their eyes moved in the direction instructed, but only the word previewed in the direction the eyes were going to move toward produced processing issues, shown by naming latency. This indicated that most information is processed in the direction that the eyes prepare to move toward.

At times, whilst naturally reading English, the eyes will regress back in the text (right to left), called a regression, which makes up approximately 10-15% of saccades (Rayner, 1998; Rayner et al., 2012). More frequent regressions and longer fixations may point to the difficulty of understanding or processing the information in the text, as one goes back to re-read, or pauses on the current word to try to make sense of the information that is being read. Often during this reading comprehension and information processing difficulty, a reader will return to and fixate upon the problematic area or word (e.g. Frazier & Rayner, 1982; Kennedy & Murray, 1987; Murray & Kennedy, 1988). Therefore, the more inconsistent the information is with the reader's expectations, the more processing difficulty the reader will display through longer reading times in these unanticipated areas of text, which I will now explain in more detail.

2.8.1. Processing Anomalies and Implausible Information Within Text

Since previous research has indicated that readers can respond to anomalies or expected information within scenarios in a number of ways (e.g. quickly detecting information, maintaining attention, and/or avoiding information), the current research reports a number of different reading time measures, in an effort to capture these different behaviours. If participants very rapidly detect the anomaly, this may be apparent in their initial fixations on the critical regions of text (e.g. Filik, Brightman, Gathercole, & Leuthold, 2017a; Warren & McConnell, 2007). For instance, if a character responds *pleased* when it would be expected that the character be very unhappy within the context of the scenario, this processing difficulty may be detected in a number of ways in earlier and later reading processing measures within the target sentence (e.g. *She was very*$_{\text{Region 1}}$ *pleased*$_{\text{Region 2}}$ *to have known that.*$_{\text{Region 3}}$). Thus, two measures of early processing are reported, specifically, first fixation duration and

first-pass reading times. *First fixation duration* is an early measure, which quantifies the duration of the first fixation in the area of interest. In the above example this would be the first fixation duration in Region 2 (e.g. *pleased*) and/or Region 3 (e.g. *to have known that*). *First-pass reading time* (or *gaze duration*, when the region comprises a single word) is the sum of all of the fixations within an area of interest, commencing at the onset of the first fixation and concluding when the participant's gaze moves outside the area of interest. As well as detecting early effects on the critical emotion word (Region 2 in the above example), effects in first fixation duration on the region of interest immediately following the target word (Region 3 in the above example) will also allow us to detect any "spillover effects" (see e.g. Clifton, Staub, & Rayner, 2007), that is, reflective processing of information after the eyes have moved on to the next area of interest.

When encountering unanticipated information, readers may also look back to re-read earlier parts of the text (e.g. Filik et al., 2017a; Rayner, Warren, Juhasz, & Liversedge, 2004; Warren & McConnell, 2007; Warren, McConnell, & Rayner, 2008). This behaviour is captured by later measures, such as regression path, and total reading time. *Regression path* (or *go-past*) *reading time* is the sum of fixations from the time that a region is first entered until a saccade transgresses the right region boundary. This measure includes fixations made to re-inspect earlier portions of text and is usually taken to reflect early processing difficulty along with (at least some) time spent re-inspecting the text in order to recover from such difficulty. *Total reading time* is the sum of all fixations in a region, and can be regarded as a global measure of disruption to reading. Thus, four standard measures of reading behaviour are reported and referred to; first fixation duration, first-pass reading time, regression path reading time, and total reading time. Calculating these four measures of reading behaviour gives a much more

detailed picture of the information processing style of the reader than other methods such as the modified Stroop task or dot probe task, and is therefore an excellent tool for assessing the underlying mechanisms of eating disorders related to the information processing style of the reader.

The processing of anomalies and implausible information within text, and the way in which the reader processes these factors, has been an important question for nearly a half a century. For instance, there has been a divergence in theories of how one processes syntactic information (the letter string or characters which together create a comprehensible word), and semantic information (the message or meaning of the word or text). Forster's (1979) model pointed to the processing of syntactic information as independent from semantic aspects of processing; the message of the text does not inform the syntactic processing. In contrast to this independent syntactic and semantic processing model, some view syntactic and semantic processing as an integrative process, according to Marslen-Wilson's (1975) model.

In 1991, Gernsbacher proposed the Structure Building Framework, in which the aim of reading comprehension is to construct interconnected mental representations. At the minimum, there are proposed to be three processing elements involved in constructing mental representations previously supported in literature, which are: laying foundations for mental representations (Carreiras, Gernsbacher, & Villa, 1995; Gernsbacher & Hargreaves, 1988; Gernsbacher & Hargreaves, 1992; Gernsbacher, Hargreaves, & Beeman, 1989), mapping on new knowledge in relation to former knowledge foundation (Carreiras & Gernsbacher, 1992; Deaton & Gernsbacher, 2000; Gernsbacher, 1991; Garnham & Oakhill, 1992; Oakhill, Garnham, Gernsbacher, & Cain, 1992), and when new knowledge is less comprehensive or not related to former mental representations, then new foundations are created (Foertsch & Gernsbacher,

1994; Foertsch & Gernsbacher, 1997; Gernsbacher, 1985; Gernsbacher, Hallada, & Robertson, 1998; Gernsbacher, Varner, & Faust, 1990).

Using eye-tracking with natural reading, both syntactic anomalies, which consist of grammatical inconsistency, and also pragmatic anomalies, which include incongruent meaning within the text ("mismatch" with the world knowledge of the reader), are both anomalies which simultaneously detected inconsistency. However, these two different types of anomalies reveal distinct eye movement reading patterns (Braze, Shankweiler, Ni, & Palumbo, 2002; Ni, Fodor, Crain, & Shankweiler, 1998). Specifically, a syntactic anomaly, which violates grammatical principles (e.g. "The walls will surely cracking after a few years in this harsh climate.") was typically detected with regressions from the target word (i.e. "cracking" used instead of "crack"). In contrast, semantic, or pragmatic, anomaly, in which the text meaning is incongruent from the expectations of the reader (e.g. "The walls will surely bite after a few years in this harsh climate."), typically resulted in greater numbers of regressions or longer reading times, which escalated from the semantic anomaly to the end of the target sentence. Therefore, more eye movement disruptions were detected in those conditions with anomaly, compared to texts without anomaly (e.g. "The walls will surely crack after a few years in this harsh climate."), however, differently. Reading times also continued to increase throughout the target sentence for only the unexpected meaning (semantic anomalies), in contrast to the pattern of those texts with the syntactic anomaly. These results compliment current neurocognitive findings, which indicate distinct processing systems for syntactic and pragmatic anomalies (e.g. Regel, Meyer, & Gunter, 2014), and that the specific demands of the text lead to distinguishable content-specific mechanisms for language processing (e.g. Ferstl, Rinck, & Von Cramon, 2005).

When a reader encounters information that is not expected, or that violates their worldview or knowledge, such as information which is anomalous or implausible, there are typically longer reading times resulting from longer information processing strategies. For instance, pertaining to an example of an implausible sentence from Rayner et al.'s (2004) eye-tracking studies: "John used the pump to inflate the large *carrot* for dinner last night". As it is perfectly plausible that a man may use a pump to inflate something, the scenario became anomalous only at the word *carrot*, because it is implausible that a man would use a pump to inflate a carrot for dinner and this leads to a plausibility effect for the reader. That is, this reading comprehension issue for the implausible information, which is incompatible with the readers' worldview, is often evidenced in eye-tracking with longer total reading time, longer gaze durations on and around the target word (e.g. *carrot* in the above example), and immediate disruptions in eye movement (Liversedge & Findlay, 2000; Liversedge, Gilchrist, & Everling, 2011; Rayner, 1998). Therefore, eye-tracking whilst naturally reading texts may objectively discriminate between information that is expected to the reader, in comparison to that information which does not meet the readers' expectations, violates the readers' worldview, or violates the knowledge of the reader. Information that is anticipated will result in shorter reading times; shorter gaze durations on and around the target area, and fewer immediate disruptions in eye movements. In contrast, information which is not expected by the reader will result in longer reading times, including longer gaze durations on and around the target sentence, and immediate disruptions in eye movements as soon as they encounter the anomaly. Monitoring eye movements using eye-tracking is an excellent method for detecting these reading comprehension difficulties during information processing.

Rayner pointed to "The Big Three Factors" related to lexical processing, which are the: frequency, length, and predictability within the context of the text. The amount that a word is used in every day life (i.e. frequency), and the letter length of a word (i.e. length), influence reading times for a word. More important to the current studies is predictability, when a reader anticipates the words and meaning within a text according to their world knowledge and expectation. Information that is predicted by the reader will be read more quickly (i.e. shorter fixation times), skipped, and revisited after reading more often than reasonable, but unexpected words or portions of text (e.g. Ehrlich & Rayner, 1981). There are longer reading times for the target word in implausible (not a reasonable theme) than plausible conditions (a reasonable theme), but faster than anomalous words (inappropriate theme) within the context of the text (e.g. Rayner et al., 2004; Warren et al., 2008).

During silent natural reading, it has been shown to be important to analyse the eye movements when reading the entire target sentence (e.g. *She was very*–Region 1 *pleased*–Region 2 *to have known that.*–Region 3) to obtain the full picture of the information processing strategies. For example, when the character responds *pleased* within a context that the reader would expect an unpleased response, effects of processing difficulty may emerge and be detected just prior to the unexpected emotion word (e.g. *She was very*) in total reading times, and for both later and earlier reading time measures on (e.g. *pleased*), and also immediately following the target word (e.g. *to have known that.*). For instance, total reading times recorded for a small region prior to the target word (e.g. *She was very*) includes the processing of the whole context of the scenario, as the reader may then re-read entire target sentence to process the information. Also, the reader may continue processing a target word (e.g. *pleased* in the above example) as they continue reading into the region just following the target word (e.g. *to have known*

that.), and therefore the cognitive and linguistic processing of the target word (e.g. *pleased*) is observed in the following region, which is sometimes called the "spillover effect" (Ehrlich & Rayner, 1983; Rayner & Duffy, 1986). Less predictable or unexpected information in the context of a sentence or text is reported to often be displayed in the "spillover effect". The "spillover effect" is exhibited by longer first fixations and gaze durations in the region just after the target word (e.g. *to have known that.*), as the reader reflectively pauses to make sense of information previously read, which may not fit their expectations. This points to continuous reflective processing of the target word, even after the eyes have moved on to the next word and region in the sentence, and evidence of further processing of the target word continuing even though the eyes have moved on in the text (Balota, Pollatsek, & Rayner, 1985). Important to the current research, Clifton et al. (2007) recommend reporting the spillover effect, or reflective processing, from the beyond the target word or area of interest (post-target region), and by taking into account the length of the initial fixation in and past the target region of interest when the target region is shorter (one or two words; Clifton et al., 2007). The reading time measures that commonly reveals a spillover effect, displayed when a reader first begins to read and fixate is called "first-fixation duration", defined earlier in this section. Taking all this into consideration, analysis of eye-movement behaviour over several regions of interest within a target sentence may be the most definitive method to solidly comprehend the processing of information during natural reading. Therefore, this method is incorporated in the present eye-tracking studies (i.e. Experiment 1-4), which analyses three regions within a target sentence of expected versus unexpected emotional response within context of what may be eating disorder salient stimuli.

Important to the current eye-tracking research, prior studies have shown that readers readily detect when a character's behavior and/or described emotional response is unexpected, given their world knowledge and expectations, which I will discuss next (e.g. de Vega, León, & Diaz, 1996; Filik, 2008; Filik & Leuthold, 2008; Filik & Leuthold, 2013; Leuthold, Filik, Murphy, & Mackenzie, 2012; Gernsbacher, Goldsmith, & Robertson, 1992; Gernsbacher, et al., 1998).

2.8.2. Eye-Tracking, Emotional Expectations, and Perspective Taking

The approach taken in all four of the current eye-tracking studies in the present thesis is based on evidence and the general assumption in the psycholinguistics literature that during a natural reading task, a reader develops and builds a "situation model" (Van Dijk & Kintsch, 1983). These mental cognitive representations regarding the text's general situation (i.e. characters, spatial information, events, activity, etc.) are formulated by integrating the incoming information one is reading, with existing world knowledge and expectation, or "expectation-driven processing" (Kintsch, 1988). Therefore, as a reader builds these situation models, inferred information from the scenarios being read, including the expectations involving the motives and emotional responses of the characters within the scenarios, are integrated with the reader's previous knowledge of the world (McKoon & Ratcliff, 1992; Zwaan & Radvansky, 1998). In this way, as one reads a scenario, they begin to build an expectation and automatically anticipate what the character will do or feel next. This world knowledge is the platform for which understanding of new information is first anticipated and then understood correctly. Sharkey's (1986) model of text comprehension proposed that expectation is the foundation of understanding in top-down processing, but bottom-up processing begins when the anticipation based on the reader's world knowledge does not fit or is incorrect. Therefore, the reader understands language and comprehends

texts by inferring and referencing their past experiences and personal understanding of the world onto the newly read information, building a "mental model" which surpasses the literal meaning (Johnson-Laird, 1983). A reader must therefore be able to conceptualise the situation within the discourse, as the construction of these "situational mental models" are acknowledged by many researchers as the foundation of understanding the discourse itself (Bower & Morrow, 1990; Van Dijk & Kintsch, 1983).

In the psycholinguistics literature, participants' eye movement behaviour demonstrates that people are good at keeping track of how they expect a character to behave in a fictional scenario during natural, silent reading. There are a number of studies that have shown that readers are able to quickly detect when a character in a story behaves in a way that does not match (or "mismatches") their expectations, given their knowledge of the world. This finding has been currently expanded on through eye-tracking and ERP studies, and is often illustrated by more disruption to eye movements during reading of a target sentence that contains information "mismatching" the reader's world knowledge (e.g. Filik, 2008; Filik & Leuthold, 2013, Experiment 2), and a larger N400 component in event-related brain potentials (see for examples Filik & Leuthold, 2008; Filik & Leuthold, 2013, Experiment 1; Kos, Van den Brink, & Hagoort, 2012), when reading about unexpected relative to expected behavior. For example, these reading patterns were displayed in Filik and Leuthold's (2013) eye-tracking study, which investigated eye movements when reading scenarios consisting of an initial context sentence (e.g. "Terry was annoyed at the traffic in front of him.") followed by a target sentence (e.g. "The angry man [glared at–^{match}/picked up the–^{mismatch}] lorry and continued on his way."), which contained a verb that "matched" (e.g. *glared at*) or "mismatched" (e.g. *picked up the*) the readers' expectation and real world knowledge. These same eye movement patterns were also consistent for well-known fictional

characters, such as "The Incredible Hulk" ("match") who has supernatural strength, or "Shaggy" ("mismatch"), who is physically too weak to lift a lorry.

Research consistently reveals that people are able to infer the emotions of characters within fictional scenarios they read, and quickly assess if these character's emotions "match" or "mismatch" the world knowledge and expectation of the reader. When one reads those character emotions that "match" the reader's expectation, according to one's emotional knowledge, (e.g. a positive response about something that would be considered positive) when comprehending the context of a scenario, these expected emotions are read more quickly than those emotions that "mismatch" the reader's emotional expectations (e.g. a positive response about something that would be considered negative). In several different studies, mere implicit suggestion of how one would feel within a read scenario constructs an expectation in the reader for that emotional response. For instance, a scenario about a person stealing money, which results in his best friend being fired, implies the emotion of "guilt". Therefore, the reader would expect the thieving character to feel the emotion of "guilt", in contrast to "pride" or "hope", when their best friend is fired (see e.g. Gernsbacher et al., 1992; Gernsbacher & Robertson, 1992). Therefore, the reader reads the target sentence, which includes the inferred and expected emotional response of the character (in this case "guilt"), significantly more quickly than a different emotional response that is unexpected, such as "pride" or "hope" (Gernsbacher, 1994).

These studies provided consistent evidence that the reader is able to build representations of emotion according to the context of the text, and also able to detect new implicit emotion information in the story, which is inconsistent with the readers' expectations. Within this thesis, the scenarios that do not match the expectation of the reader (responds as *pleased* to an *negative* situation) will be referred to as "mismatch"

scenarios or texts, and those texts that do match the expectation of the reader (the character responds as *pleased* to a *positive* situation) as "match" scenarios. These studies suggest that an individual will infer the expected emotional response of a character they read about within the context of a scenario, and whether the expected emotional word (e.g. the character experiencing "guilt" when their best friend is fired from their dishonesty), has similar or contrasting affective valence to the "mismatched" emotion (e.g. whether the character is expected to experience "pride" or "hope", respectively). Also, it was consistently found that the target sentences that "match" the emotional expectation of the reader are read much more quickly than those in which the target sentence "mismatched" the emotional state implied in the scenario, even when there is no explicit emotion indicated (Gernsbacher et al., 1992; Gernsbacher & Robertson, 1992). Similarly, de Vega et al. (1996) also investigated the way in which one builds emotion-related representation within scenario context during natural reading of scenarios in three experiments. One example in de Vega et al.'s (1996) study is a scenario about a character named "Arthur" who is asked by the most beautiful girl in class to teach her tennis. The reader understands, by the context of the scenario, that Arthur knows that he is irresistible, and thinks that the beautiful girl is looking for an excuse to be with him by asking for tennis lessons. In two experiments the target sentence explicitly "matched" or "mismatched" the reader's expectations of Arthur's emotion, by stating Arthur's emotion. For instance, within the above context, in the target sentence that "matches" the readers expectations, Arthur was clearly stated to be "flattered" by the situation, but in the target sentence that "mismatches" the readers' expectations, Arthur was clearly stated to feel "insecure". In contrast, another experiment only implicitly suggested Arthur's emotion. Only Arthur's behaviour suggested what he felt, such as Arthur approaching the girl with a smile and wink

(match), or him approaching the girl unsteady on his feet, without eye contact ("mismatch"). These studies replicated and extended Gernsbacher et al.'s (1992) findings, showing that both implicit and explicit emotions of the character are detected, which was displayed by longer reading times for the mismatch versus the match scenarios.

Not only do readers infer emotional states for fictional characters whilst naturally reading, but research findings also consistently suggest that this knowledge about human emotions is accessed automatically. For instance, Gernsbacher et al. (1998) performed an attention-dividing tone-identification task during the participants' reading of scenarios, with matching and mismatching emotional responses in the target sentence. If accessing the knowledge of the expected emotional response of the character in the scenario is more effortful, then identifying if the majority of the tones were high- or low-pitched during their reading would influence the target-sentence reading times, which was not the case. A "mismatch effect" was found, as participants continued to read those target sentences, which included expected emotional responses significantly more quickly than the mismatching target sentences, even with divided attention. Therefore, it was found that the emotional knowledge of a reader is automatically accessed. This leads to reading those texts which "match" the emotional expectation of the reader more quickly, and those which "mismatch" the emotional expectation of the reader more slowly, as the reader aims to make sense of what they are reading according to their worldview and knowledge (Gernsbacher et al., 1998).

More recent studies have used eye-tracking and ERP's to extend these findings to detect the expectations of the reader and reading processing difficulty of information inconsistent with the readers' worldview. For example, if a character was described as being pleased in response to a negative event ("mismatch"), indicated by longer reading

times, as opposed to a positive one ("match"; Filik & Leuthold, 2013, Experiment 2), indicated by shorter reading times. These match/mismatch reading time differences are not shown between matching (e.g. "depressed"), matching synonyms (e.g. "miserable"), or matching similar (e.g. "useless") target emotion words, unlike mismatching (e.g. "happy") target emotion words (Gygax, Garnham, & Oakhill, 2004). However, in self-paced, natural reading, these reading time differences have been shown consistently between those matching and mismatching emotion words and also inferences in relation to the context of the scenario or text, even when they are not specific (Gygax et al., 2004). Importantly, these findings also may be influenced by the perspective that the reader takes, which will be discussed next.

When someone is reading, he or she often takes on the perspective of one of the characters, which influences the world knowledge assessed, and therefore the way in which the situational model is established and constructed (Zwaan & Rapp, 2006). Currently, new eye-tracking research has also found that the reader is not only able to quickly detect emotion-related "mismatch" texts, experiencing processing difficulty (displayed by longer reading times for texts not compatible with the reader's situational mental models), but also that the emotion-response expectation that a reader builds for a character is impacted by the reader's perspective (Filik et al., 2017a). For instance, the reader may process the character's described emotional response to criticism with more or less processing difficulty, depending on whether the reader has taken the perspective of the victim or the protagonist within a scenario. Filik et al.'s (2017a) Experiment 1 found that readers displayed longer reading times when reading about an upset response to a critical comment when taking the victim's rather than the protagonist's perspective. Alternatively, in a conversational reading study, in which participants explicitly chose to what degree one was victimised in an aggressive argument between same-gendered

characters, Bowes and Katz (2011) pointed to perceiving the aggressor as less relationally aggressive and more humorous when reading from the victim's perspective. Other eye-tracking studies reported that when critical comments (directed at a victim) are read from the victim's perspective, the reader may fixate on the upsetting features of the criticism, and perceive positive victim responses as unexpected (i.e. a "mismatch" to their expectations from this perspective) (Filik et al., 2017a, Experiment 2; Toplak & Katz, 2000). Taken together, and important to the current eye-tracking studies, these findings indicate that the perspective the reader takes may influence their understanding and processing of the emotional response of characters within a text, which may be revealed by eye movements.

Finally, it is important to note that aspects of a reader's personality or inter-individual differences may influence the way in which they process such information in text, and these differences may lead to additional or extended processing, which is triggered by anomalous violations or information that "mismatches" the readers' worldview (see Kos et al., 2012). Although there is not much research in this area, from what we do know, various inter-individual differences may affect what a reader expects or does not expect in relation to what may come next within the scenario. An example of inter-individual differences influence on expectations during reading is Van den Brink et al.'s (2012) study. They found that greater self-reported empathy level was positively related to the larger amplitudes of N400 ERP effects (detecting a mismatch) in participants who heard statements which mismatched their expectations, both with inferred incongruent utterances (e.g. an upper-class child's voice saying: *"I have a large tattoo on my back.*") and also classic semantic anomalies (e.g. a voice saying: "*You wash your hands with horse and water.*"). Therefore, not only are high-empathising individuals better able to relate to and predict others' actions (Saxe & Baron-Cohen,

2006), but Van den Brink et al.'s (2012) ERP study suggests that high-empathising individuals are able to quickly integrate their personal expected response with a character's response. This empathy-driven cognitive style results in detecting semantically anomalous words and interference, revealed by a larger N400 effect for incongruent semantic information than for low-empathisers. Along these lines, a recent eye-tracking study performed by Filik, Howman, Ralph-Nearman, and Giora (2017b, *in revision*) found that personality factors affected whether one read critical comments within context as sarcastic by default (rather than as literal comments). Specifically, we found that greater levels of malicious humour (a facet of the Indirect Aggression Scale; Forrest, Eatough, & Shevlin, 2005) participants used in their everyday life correlated with the ease of reading critical comments (e.g. "*He's not the best hairdresser.*") as more sarcastically (meaning "*He is far from the best hairdresser.*") instead of literally (meaning "*He is not the best, but also not the worst.*"). Therefore, personality factors may influence the way in which people interpret the meaning of a text during reading. Important to the current research, these processing differences according to individual differences may also apply to the way in which an individual processes certain types of information, depending on their level of eating disorder tendencies. As discussed earlier in this chapter, individuals with an eating disorder selectively attend to, and process salient information (e.g. food-, body shape-, weight-related stimuli) differently than controls (see Faunce, 2002). Specific to reading, Channon et al. (1988), used the modified Stroop test to find that those with anorexia nervosa generally had more processing interference than controls (e.g. slower to name the colour of the word rather than reading the word itself), but even more so when reading food and eating words. Therefore, and critical to the current research, those words related to the concerns of the

individual were more difficult to process, depending on the existence and level of eating disorder tendencies.

3. CHAPTER III: IMPLICIT EXPECTATIONS ABOUT CHARACTER BEHAVIOUR AND EATING DISORDER TENDENCIES IN FEMALES: EVIDENCE FROM EYE MOVEMENTS DURING READING

3.1. CHAPTER OVERVIEW

As previously discussed in detail, eating disorders are serious psychiatric disorders, with mortality rates that triple other mental disorders (NICE, 2004), but still little is known about the cognitive mechanisms which drive these disorders. As discussed in detail in Chapter I, many cognitive theories point to key factors underlying the development and maintenance of eating disorders, such as: unhealthy food-related cognitive biases, negative body attitude, and perfectionism. In this chapter, eye-tracking during reading was used as a novel implicit measure of how these factors may be related to eating disorder tendencies in females. In two experiments female participants' eye movements were monitored while they read texts in which the characters' emotional responses (which could be either expected or unexpected) to food-, body image-, and perfectionism-related scenarios were described. The relationship between participants' eye-movement behaviour whilst reading these different types of scenarios and scores on the Eating Disorder Examination Questionnaire (EDE-Q 6.0; Fairburn & Beglin, 2008), as well as their body mass index (BMI) was examined. Results from both experiments suggest that on-line processing of characters' emotional responses to perfectionism-, and to a lesser extent, body image-related information is predictive of females' disordered eating tendencies, thus supporting theories in which these factors are key to developing and maintaining eating disorders.

3.2. Individual Differences and Measures

Now the measures of eating behaviour that were used will be briefly described. This present study incorporates questionnaire measures, in order to identify participants' levels of eating disorder tendency, as well as participants' BMI.

3.2.1. Eating Disorder Tendency Measures

3.2.1.1. Eating Disorder Examination-Questionnaire 6.0 (EDE-Q 6.0)

The Eating Disorder Examination Questionnaire (EDE-Q 6.0; Fairburn & Beglin, 2008) is a 28-item self-report measure based on the gold standard interview measure Eating Disorder Examination Edition-D 16.0 often utilised by clinicians to diagnose an eating disorder. The EDE-Q 6.0 is the only measure of a person's level of eating disorder pathology and monitoring currently recommended by the National Institute of Mental Health in England (NIMHE, 2008). The EDE-Q 6.0 consists of a global eating disorder score (total of four facets averaged), as well as four facets of eating disorder tendencies, which are the: (1) *Restraint category* (RC): five items that point to avoiding food and eating, (2) *Eating concern* (EC): five items which point to worry, preoccupation, guilt, and negative feelings associated with eating, (3) *Shape concern* (SC): eight items that point to concern over one's own body shape, such as fear of gaining weight, discomfort with viewing one's body, etc., and (4) *Weight Concern* (WC): five items which point to negative feelings associated with one's weight.

3.2.1.2. Body Mass Index (BMI)

Until the recent DSM-V, in order to diagnose an individual with anorexia nervosa, they had to weigh below 85% of what would be typical for that individual's height, age, and gender. Body Mass Index (BMI; Kg/M^2), which is a calculation between the individual's height, weight, and age, and has often been used to indicate if an individual were below weight (and how severely), within normal range, or

overweight (and how severely). However, many individuals met all other criteria for anorexia nervosa except the 85% weight cutoff, and therefore could not be properly diagnosed or treated. Also, one's weight may appear over or under normal range due to athleticism or natural body-type, and therefore the DSM-V changed this 85% weight cutoff criteria to "significantly low weight" in order to leave the decision to the clinician. However, this new, less specific criteria provides less certainty and structure to eating disorder diagnosis as defined by the DSM-V: "weight that is less than minimally normal or, for children and adolescents, less than minimally expected". The DSM-V attempts to provide some guidelines for the severity of BMI as: "Mild" > 17; "Moderate" between 16 to 16.99; "Severe" between 15 to 15.99; and "Extreme" < 15. Also, research has shown that individuals diagnosed with bulimia nervosa and binge eating disorder typically have significantly higher BMI than individuals without an eating disorder, but not significantly different between these two eating disorders (Kessler et al., 2013). Therefore, as BMI has been considered important to eating disorder symptomology, and as disordered eating behaviours often alter one's body weight and body size, BMI measurement was incorporated in all the experiments in this thesis. For Experiment 1, BMI for participants was computed by obtaining the height, weight, and age of each participant from the EDE-Q 6.0 questionnaire (see Appendix A for the full questionnaire).

3.3. EXPERIMENT 1 - THIRD-PERSON EYE-TRACKING STUDY WITH FEMALES

3.3.1. MAIN AIMS & HYPOTHESES

In the current study, eye-tracking during reading was employed in order to investigate participants' implicit expectations regarding how a story character might react in certain situations, and how these expectations might be related to indices of eating behavior. To my knowledge, this is the first research to use measures of on-line

language processing to investigate emotional expectations to food-, body-, and perfectionism-related factors associated to disordered eating behavior. Specifically, two experiments were conducted in which females recruited from a normal population read food-, body image-, and perfectionism-related scenarios, in which the target sentence contained a critical emotion-based word (e.g. *"pleased"* in Table 3) which would either "match", or "mismatch" with one's expectations regarding how the character might react (see Filik, 2008; Filik & Leuthold, 2013, Experiment 2). To determine participants' levels of disordered eating behaviour, following the eye-tracking task, they completed the Eating Disorder Examination Questionnaire (EDE-Q 6.0; Fairburn & Beglin, 2008), which is a measure of one's level of eating disorder pathology. Their body mass index (BMI) was also calculated.

If tendency towards eating disorders is primarily determined by participants' processing of food-related information (e.g. Shafran et al., 2007), then it is expected that their eye movement behavior whilst reading food-related items may predict their scores on the EDE-Q 6.0 and/or BMI. In relation to the example given in Table 3, if participants have a focus on unhealthy food, they may experience more processing difficulty integrating the word *"pleased"* in the mismatch condition compared to the match condition, since in this condition, the character is pleased that they have eaten an entire tub of ice-cream. Thus, it might be expected that the size of the "mismatch effect" (the reading time of those scenarios that "mismatch" the readers expectations regarding the characters' response minus the reading time of those scenarios that "match" the readers expectations regarding the characters' response) would be larger in participants with food-related scenarios. If such expectations about behaviour in these scenarios are key predictors of disordered eating behavior, then the size of the mismatch effect may be expected to predict participants' scores on the EDE-Q 6.0, or their BMI.

Specifically participants with larger mismatch effects might show higher scores on the EDE-Q 6.0, and perhaps a lower BMI.

In contrast, if body image-related information processing style is key (Gardner, Stark, Friedman, & Jackson, 2000; Stice, 2002; Stice, Presnell, & Spangler, 2002), then it might be predicted that the level of processing difficulty experienced on encountering the word *"pleased"* in body-related scenarios in the mismatch (her doctor comments that she has gained quite a bit of weight) compared to the match condition (her doctor comments that she has lost quite a bit of weight) would be a predictor of eating disorder tendencies. If perfectionism is the key factor underlying the development of eating disorders, then it would be instead expected that participants' tendencies towards disordered eating behavior would be predicted by the size of the mismatch effect for perfectionism-related materials. Finally, it may also be the case that some combination of these factors is predictive of eating disorder tendencies (such as a combination of body and perfectionism, as suggested by the Transdiagnostic Model of Eating Disorders for some individuals, Fairburn et al., 2003).

Firstly, it was explored as to whether eating disorder level is more related to food-, body image-, and/or perfectionism-related information processing style in third-person scenarios (i.e. those written about another person, Experiment 1). Then, it was the aim to replicate and extend the findings of Experiment 1 using second-person scenarios (i.e. scenarios designed to be about the participants themselves, Experiment 2).

3.4. METHOD

3.4.1. PARTICIPANTS

Ninety female native English speakers aged 18-38 (M = 21.39, SD = 4.37) with no history of neurological illness or reading disabilities and normal or corrected-to-normal vision were recruited from Nottinghamshire. The study was advertised as a general eye-tracking and reading study; without mention of health or eating disorders. None of the participants had been diagnosed as having an eating disorder. They received course credit or an inconvenience allowance for participation.

3.4.2. STIMULUS MATERIALS AND DESIGN

Thirty-six short texts were created, which consisted of food-, body image-, or perfectionism-related third-person scenarios (see Table 3 for Example Material; see Appendix B for full materials). Each scenario ended with a target sentence containing a critical emotion-based word (e.g. "*pleased"*) that either "matched" or "mismatched" with one's expectations concerning how the character might react in the given situation. Thus the experiment consisted of a 3 *dimension* (food vs. body image vs. perfectionism) x 2 *match* (match vs. mismatch) design, with both dimension and match as within-subjects and within-items factors.

TABLE 3
EXAMPLE MATERIAL FROM EXPERIMENT 1 WITH ANALYSIS REGIONS

Scenario Type	Example
Food-related Match	Barb stops by the shop on her way home from work./ She gets a large tub of ice cream, and goes home and eats a small portion./ She is very Region 1 / pleased Region 2 / to have done that. Region 3 /
Food-related Mismatch	Barb stops by the shop on her way home from work./ She gets a large tub of ice cream, and goes home and eats the whole thing./ She is very Region 1 / pleased Region 2 / to have done that. Region 3 /
Body image-related Match	Barb goes in for a regular check-up./ Her doctor comments that she has lost quite a bit of weight since her last appointment./ She is very Region 1 / pleased Region 2 / to have done that. Region 3 /
Body image-related Mismatch	Barb goes in for a regular check-up./ Her doctor comments that she has gained quite a bit of weight since her last appointment./ She is very Region 1 / pleased Region 2 / to have done that. Region 3 /
Perfectionism-related Match	Barb works on creating music and sounds for a soundtrack./ She listens to what she created and hears every note flows together perfectly./ She is very Region 1 / pleased Region 2 / to have done that. Region 3 /
Perfectionism-related Mismatch	Barb works on creating music and sounds for a soundtrack./ She listens to what she created and hears not every note flows together perfectly./ She is very Region 1 / pleased Region 2 / to have done that. Region 3 /

Six counterbalanced lists were created such that each participant only viewed one condition of each item. There were also 46 filler items of a similar length to the experimental items (see Appendix C for a full list of filler items). Filler items contained scenarios in which the final sentence described a positive, neutral, or negative emotional reaction from a character, which should match with a previously described event, or a positive or negative event without any emotional response from any of the characters.

After the eye-tracking task, participants completed the Eating Disorder Examination Questionnaire (EDE-Q 6.0; Fairburn & Beglin, 2008) and their BMI was calculated.

3.4.1. PRE-TESTING OF MATERIALS

The materials were pre-tested to determine that each scenario's three dimensions were interpreted by participants' as at least 75% uniquely related to the intended dimension (food-, perfectionism-, or body-related), and to make sure that each scenario included an appropriate "match" and "mismatch" condition.

3.4.1.1. DIMENSIONS PRE-TEST

Firstly, to create a final set of 36 materials clearly representing each dimension (food, perfectionism, and body), 18 native English-speaking females between 19 and 36 years old (M = 26.67, SD = 4.67) read one version of 49 initial materials. For each material, the participant was asked to indicate, on a 100-point sliding scale, from 0% (not at all about x) to 100% (absolutely about x), the extent to which the scenario was about: food, perfectionism, and/or the body (see Figure 4).

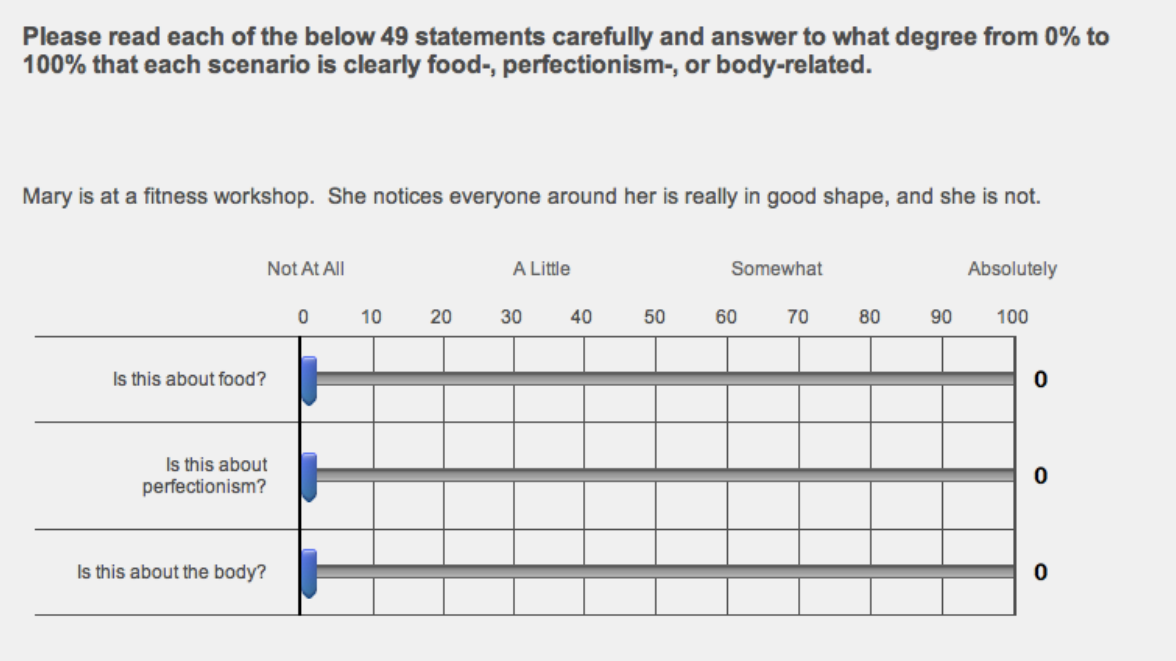


FIGURE 4. DIMENSIONS PRE-TEST SCREENSHOT EXAMPLE.

The 36 materials that were most highly rated (e.g. rated as closest to 100% "*about food*" in the food condition, etc.) and as exclusively related to the intended dimension (food-, perfectionism-, or body-related) were chosen out of the initial 49 that

were tested. The 36 top-rated materials all scored over 75% in the intended dimension (see Figure 5). Paired samples t-tests compared each dimension to the others (food vs. perfectionism vs. body) for each question (i.e. Q1: "*Is this about food?*" Q2: "*Is this about perfectionism?*" Q3: "*Is this about the body?*"), and confirmed that each of the three dimensions significantly represented the dimension intended (*ps* < 0.01).

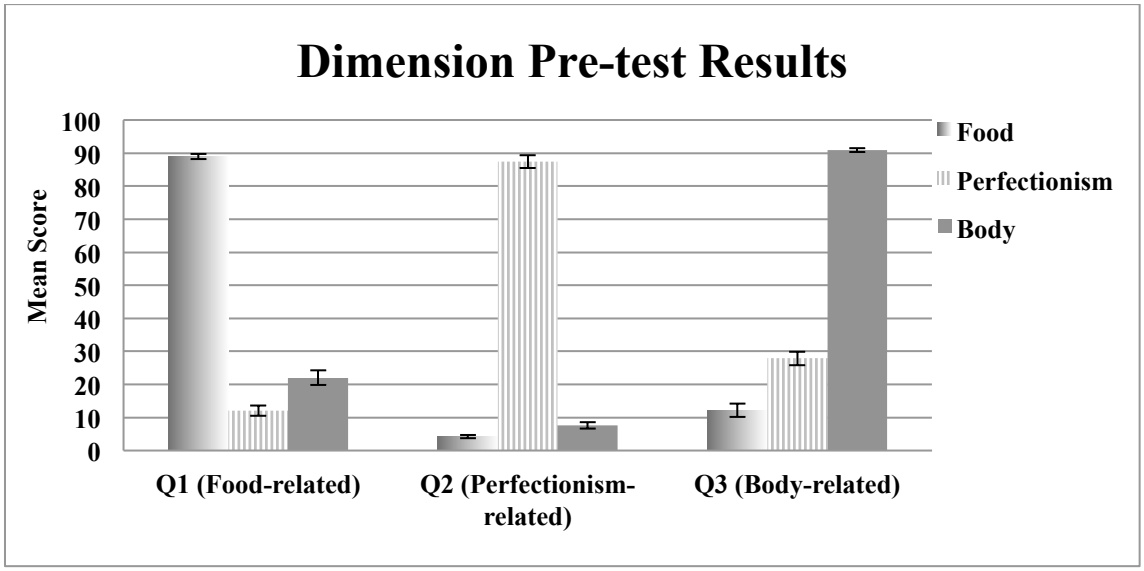


FIGURE 5. MEAN RATINGS GIVEN TO MATERIALS IN EACH DIMENSION (ERROR BARS REPRESENT STANDARD ERRORS).

3.4.1.2. MATCH/MISMATCH PRE-TEST

These 36 scenarios were then subjected to a second pre-test in order to determine that the "match" or "mismatch" emotional responses in the target sentences did actually match or mismatch with participants' expectations. In this pre-test, three counterbalanced lists were created such that each participant saw both the "match" and the "mismatch" version of 36 scenarios in one of the three dimensions (food-, perfectionism-, or body-related). Participants were 21 native English-speaking females between 24 and 37 years old (M = 30.57, SD = 3.88). They were instructed to carefully read both versions of one dimension of each item, to choose the version in which the reaction of the character was more unexpected, and to write why the character's response in the scenario she picked was unexpected (see Figure 6).

Results showed that only eight of the 216 scenarios (36 items * six conditions) had more than one participant selecting an incorrect choice (i.e. choosing the "match" condition rather than the "mismatch" condition as the scenario that is unexpected). These eight scenarios were thus slightly altered according to the feedback from participants, in order to create a final set of 36 "match" and "mismatch" version in each condition (36 food-, 36 perfectionism-, and 36 body-related scenarios).

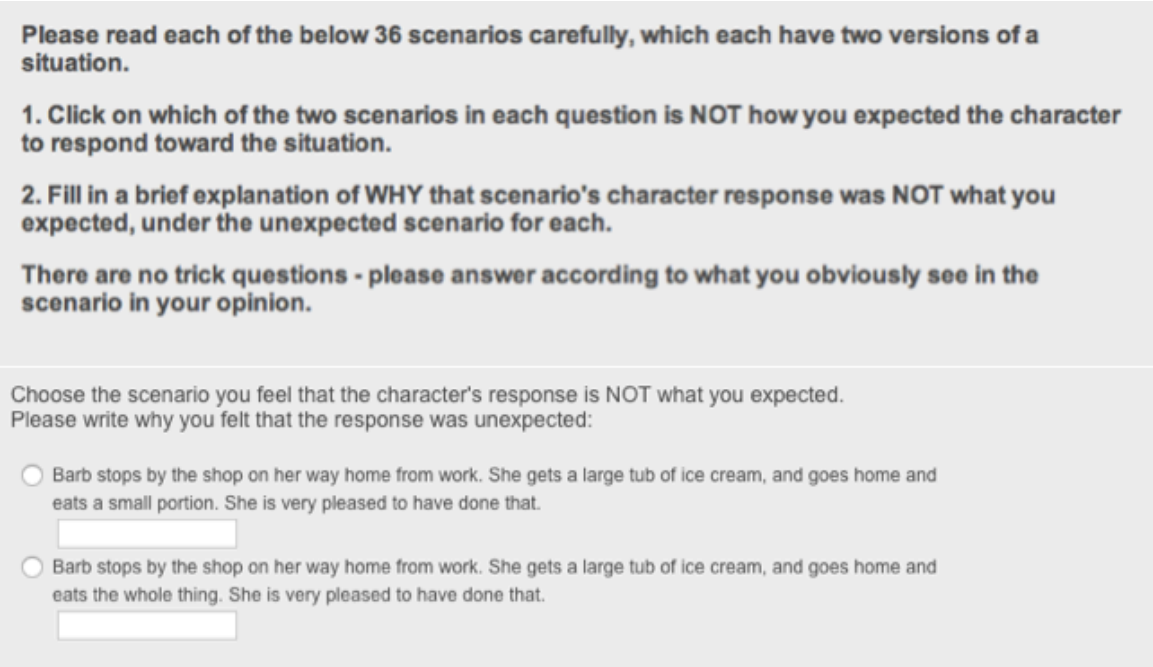


FIGURE 6. MATCH/MISMATCH PRE-TEST SCREENSHOT EXAMPLE.

3.4.4. PROCEDURE

An SR Research Eyelink 1000 eye-tracker was used to track each participant's eye position every millisecond. Viewing was binocular, but only one eye was recorded. Materials were displayed on a 17-inch monitor 56 cm from the participants' eyes. Prior to the experiment, each participant was given a health questionnaire, a consent form, and an instruction form. Then the participant was seated at the eye-tracker and the procedure was also verbally explained to them, with the instruction to read normally. A chin and forehead rest was used to reduce head movement. Before the start of the experiment, participants completed a calibration procedure. Prior to each trial, a

fixation circle appeared in the center of the screen, and once the participant fixated on this circle, a fixation square appeared in the upper left quadrant of the screen. Once the participant fixated on this square, the stimulus computer displayed the texts, beginning with two practice trials. The experimenter re-calibrated the eye-tracker in cases where the participant's point of fixation did not match with the fixation circle or fixation square. After reading each item, the participant fixated on a post-it note that was attached to the lower right-hand edge of the monitor, and then pressed the right-hand trigger on a controller in her hands. To ensure that participants were reading for comprehension, a *yes* or *no* comprehension question, such as: "*Did Beth stay home in the scenario? Yes; No*", was displayed following 25% of trials. An average accuracy rate of 94.21% (*SD* = .05) confirmed that the participants were engaged in the task. Once they completed the eye-tracking task, all of the participants filled out the EDE-Q 6.0 questionnaire and their self-reported height and weight onsite on a laptop computer, using Qualtrics online software (http://www.Qualtrics.com).

3.4.5. Eye-Tracking Data Analysis

Materials were divided into analysis regions (see Table 3), and reading times for the target sentence containing the emotional response are reported. *Region 1* was the first portion of the target sentence (e.g. "*She is very"*), up to the critical emotional target word. *Region 2* comprised the emotional target word (e.g. "*pleased"*), and was the first point at which participants may be able to infer that the described emotional response either matches or mismatches with their expectations. *Region 3* consisted of the remainder of the target sentence (e.g. "*to have done that."*). Fixations under 80 ms were integrated into larger adjacent fixations within one character and fixations under 40 ms which were not within three characters of another fixation were deleted, as well as fixations over 1200 ms. Prior to analysis, all trials with zero first-pass reading times

in two or more contiguous regions, and also any trials where participants had not read the second sentence of the context (the content of which is crucial in determining whether the target sentence should be a match or a mismatch), were removed. Following this procedure, 7.50% of the data were removed.

As discussed in the prior chapter, some previous literature (e.g. Filik, 2008) has detected disruption to eye movement behavior in response to anomalies in early measures such as first fixation and first-pass reading times. Therefore, both of these measures were reported, as well as total reading time, which is a more global measure of disruption to reading, and regression path reading time, which includes fixations made to re-inspect earlier portions of text and is usually taken to reflect early processing difficulty along with (at least some) time spent re-inspecting the text in order to recover from such difficulty. To define these reading measures again, *first fixation duration* is an early measure that quantifies the duration of the first fixation in the area of interest. *First-pass reading time* (or *gaze duration*, when the region comprises a single word) is the sum of all of the fixations within an area of interest, commencing at the onset of the first fixation and concluding when the participant's gaze moves outside the area of interest. *Regression path* (or *go-past*) *reading time* is the sum of fixations from the time that a region is first entered until a saccade transgresses the right region boundary. *Total reading time* is the sum of all fixations in a region (see Chapter II for more detail about different reading time measures). Thus, four standard measures of reading behaviour are reported.

Prior to analysis, all trials with zeros for each reading time measure in each region were removed. This procedure accounted for 18.95% of data in *Region 1*, 12.51% in *Region 2*, and 0.33% in *Region 3*, for first fixation duration, first-pass

reading time, and regression path reading time, and 5.01% in *Region 1*, 9.14% in *Region 2*, and 0.33% in *Region 3* for total reading times.

3.5. Results Experiment 1

3.5.1. Eye-tracking Data Results

Data for each of the three regions in the critical sentence were analyzed using two 3 *dimension* (food vs. body image vs. perfectionism) x 2 *match* (match vs. mismatch) ANOVAs, one considering participants ($F1$) and one considering items ($F2$) as random variables (see Figures 7a-9d for descriptive statistics). If sphericity could not be assumed, then the Greenhouse-Geisser correction was used.

Post-hoc bonferroni corrected ($p = .05/6 = .008$) paired t-tests were conducted on the average score independent of the match condition (match + mismatch/2) for fully significant main effects of dimension.

3.5.1.1. Region 1

In *Region 1* (e.g. "*She is very*") there were longer total reading times in mismatching than matching conditions, $F1$ (1, 89) = 11.61, $p = .001$; $F2$ (1, 35) = 13.66, $p = .001$. The main effect of dimension was significant by participants but not by items in total reading times, $F1$ (2, 178) = 4.51, $p = .01$; $F2$ (2, 70) = 2.58, $p = .08$, first fixation duration $F1$ (1.85, 164.78) = 6.53, $p = .002$; $F2$ (2, 70) = 2.76, $p = .07$, and first-pass reading times, $F1$ (1.79, 159.02) = 4.83, $p = .01$; $F2$ (2, 70) = 1.85, $p = .17$. There are no other significant effects ($Fs < 2.15$, $ps > .12$). As there were no effects in early measures, significantly longer total reading times in mismatching than matching conditions indicated that participants spent more time re-reading the beginning of the target sentence in mismatched conditions (see Figures 7a-d for Region 1 descriptive statistics).

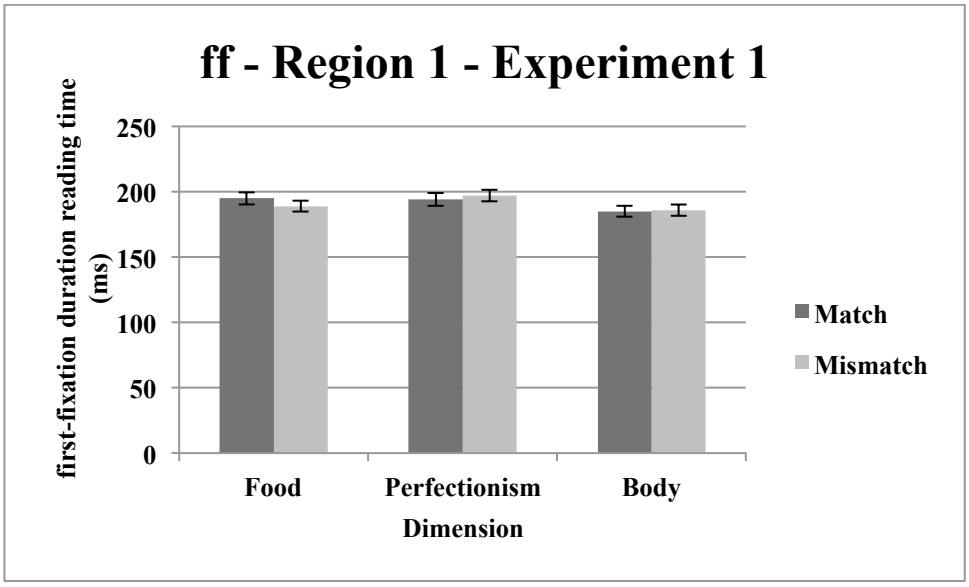


FIGURE 7.a. FIRST-FIXATION DURATION READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FF = FIRST-FIXATION DURATION.

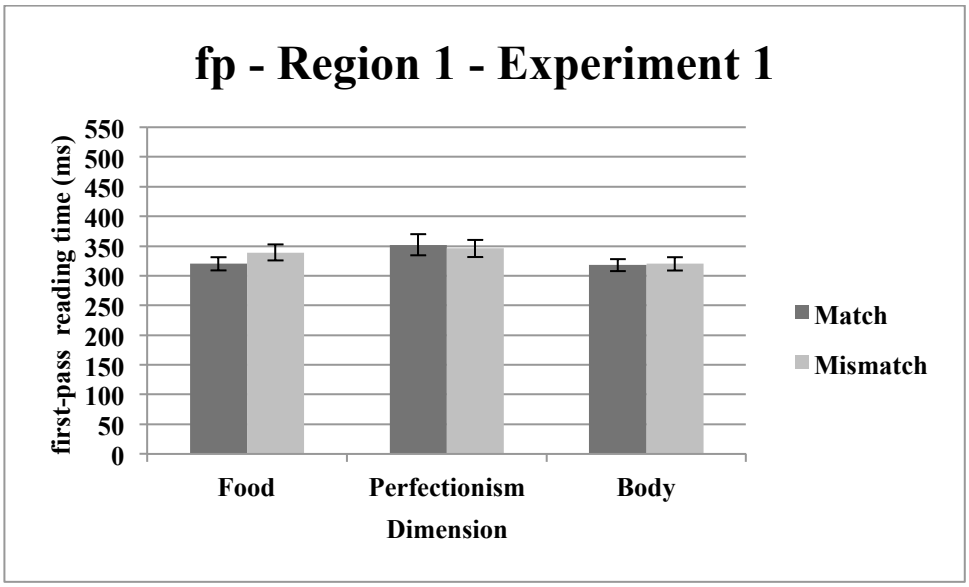


FIGURE 7.b. FIRST-PASS READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FP = FIRST-PASS.

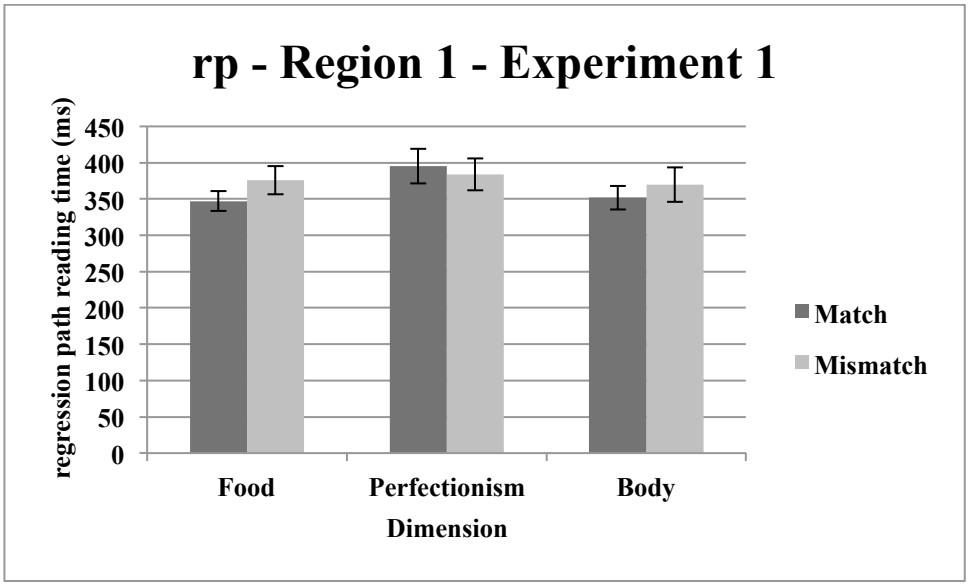


FIGURE 7.c. REGRESSION PATH READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. RP = REGRESSION PATH.

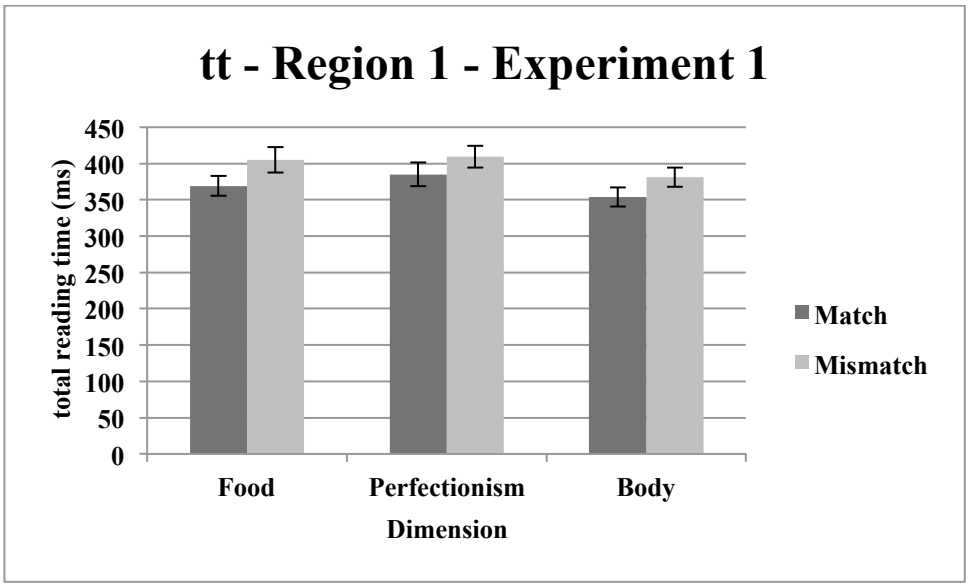


FIGURE 7.d. TOTAL READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. TT = TOTAL READING TIME.

3.5.1.2. REGION 2

In *Region 2* (e.g. *"pleased"*) there were again longer total reading times for mismatching than matching conditions, $F1\ (1, 89) = 27.05$, $p < .001$; $F2\ (1, 35) = 28.86$, $p < .001$. This effect was not present in earlier measures of reading time (first fixation duration, $F1\ (1, 89) = .96$, $p = .33$; $F2\ (1, 35) = 3.17$, $p = .08$; first-pass, $F1\ (1, 89) =$

.03, p = .86; $F2$ (1, 35) = .06, p = .81) suggesting that readers did not pick up on the mismatch straightaway. There was a main effect of dimension that was significant by items and not by participants in regression path reading times $F1$ (2, 178) = 2.56, p = .08; $F2$ (2, 70) = 3.87, p = .03. There were no other significant effects (Fs < 2.94, ps > .06) (see Figures 8a-d for Region 2 descriptive statistics).

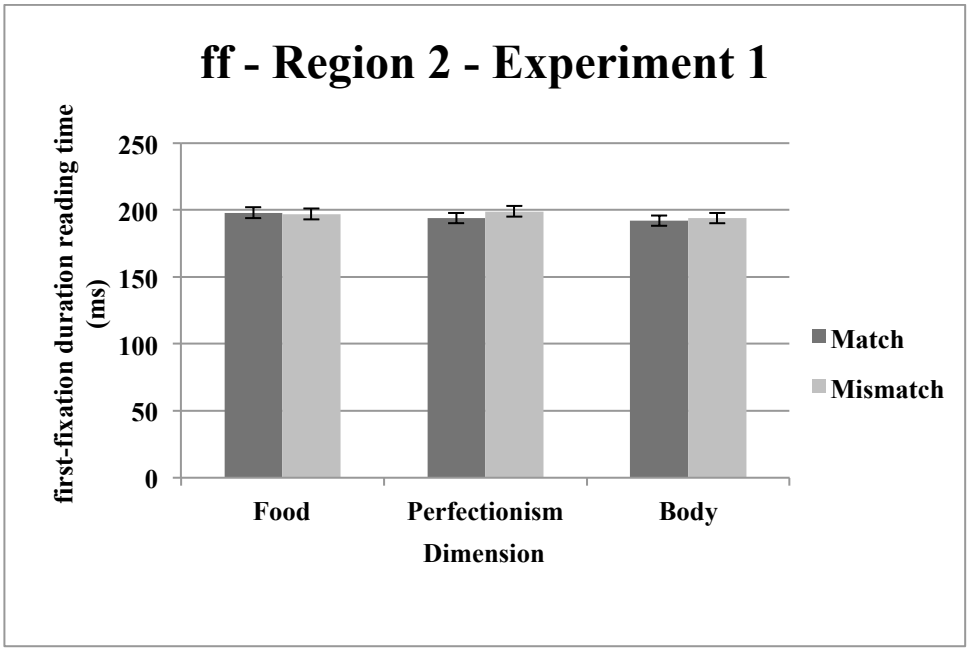


FIGURE 8.a. FIRST-FIXATION DURATION READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FF = FIRST-FIXATION DURATION.

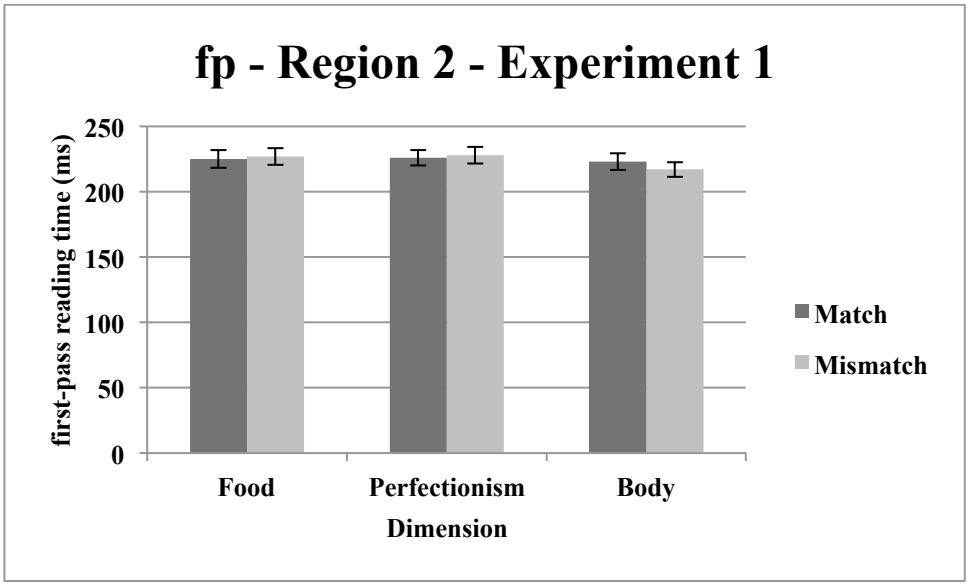


FIGURE 8.b. FIRST-PASS READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FP = FIRST-PASS.

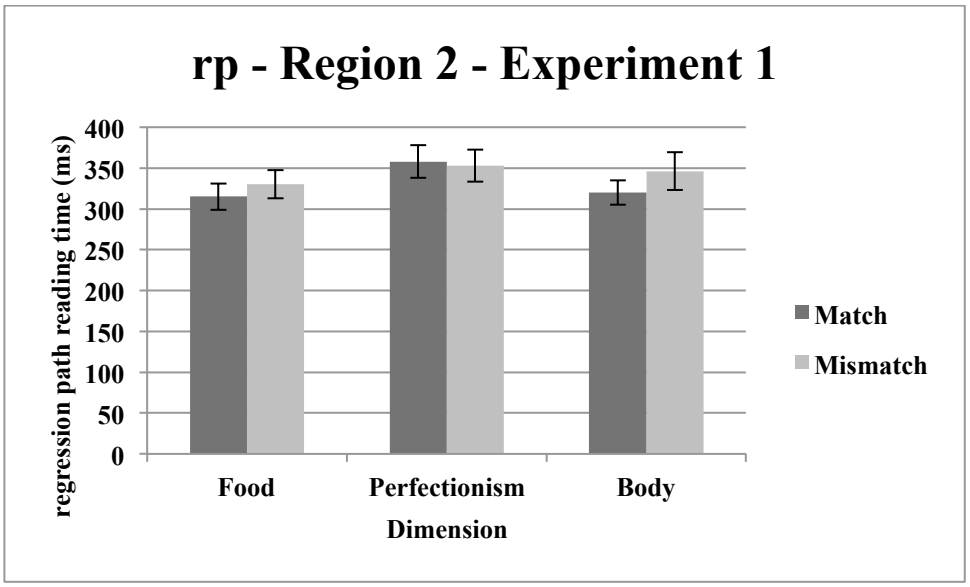


FIGURE 8.c. REGRESSION PATH READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. RP = REGRESSION PATH.

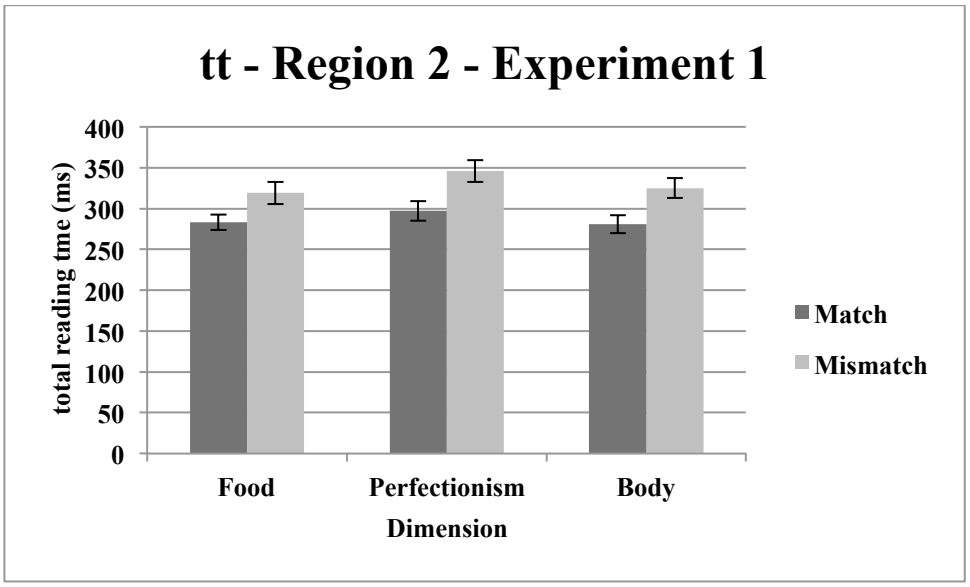


FIGURE 8.d. TOTAL READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. TT = TOTAL READING TIME.

3.5.1.3. REGION 3

In *Region 3* (e.g. *"to have done that."*) there were longer total reading times for mismatching than matching conditions, $F1$ (1, 89) = 38.25, $p < .001$; F2 (1, 35) = 51.46, $p < .001$. In regression path, there was also a main effect of match $F1$ (1, 89) = 77.76, $p < .001$; $F2$ (1, 35) = 41.38, $p < .001$, and a main effect of dimension $F1$ (1.82, 162.24) = 9.18, $p < .001$; $F2$ (2, 70) = 6.28, $p = .003$. Paired samples t-tests with bonferroni correction ($p < .008$) indicated that the mean score averaged for the match and mismatch conditions for perfectionism dimension ($M = 1269$, $SD = 617.9$) was significantly higher than the food dimension ($M = 1112$, $SD = 474.5$), $t1$ (89) = 3.67, $p < .001$; $t2$ (35) = 3.80, $p = .001$, and also higher than the body image dimension by participants but not by items ($M = 1117$, $SD = 530.9$), $t1$ (89) = 3.28, $p = .002$; $t2$ (35) = 2.49, $p = .02$. There was no difference between food and body image dimensions $ts < .43$, $ps > .67$. Total reading times and regression path also showed an interaction between dimension and match which was significant by participants but not by items $F1$ (2, 178) = 3.73, $p = .03$; $F2$ (2, 70) = 1.46, $p = .24$; $F1$ (2, 178) = 3.79, $p = .02$; $F2$ (2, 70) = 2.63, $p = .08$ (see Figures 9a-d for Region 3 descriptive statistics). There were no other significant effects ($Fs < 1.92$, $ps > .15$).

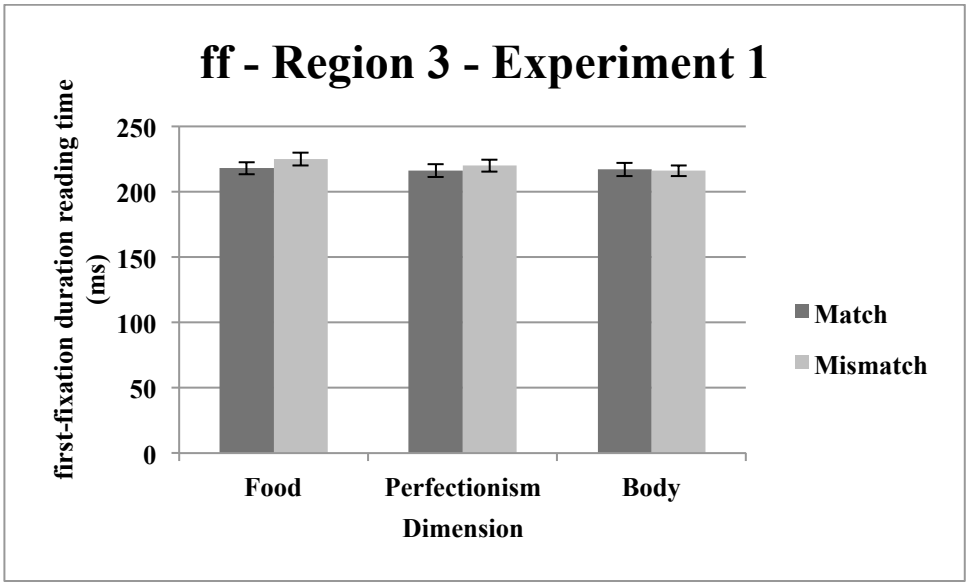


FIGURE 9.a. FIRST-FIXATION DURATION READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FF = FIRST-FIXATION DURATION.

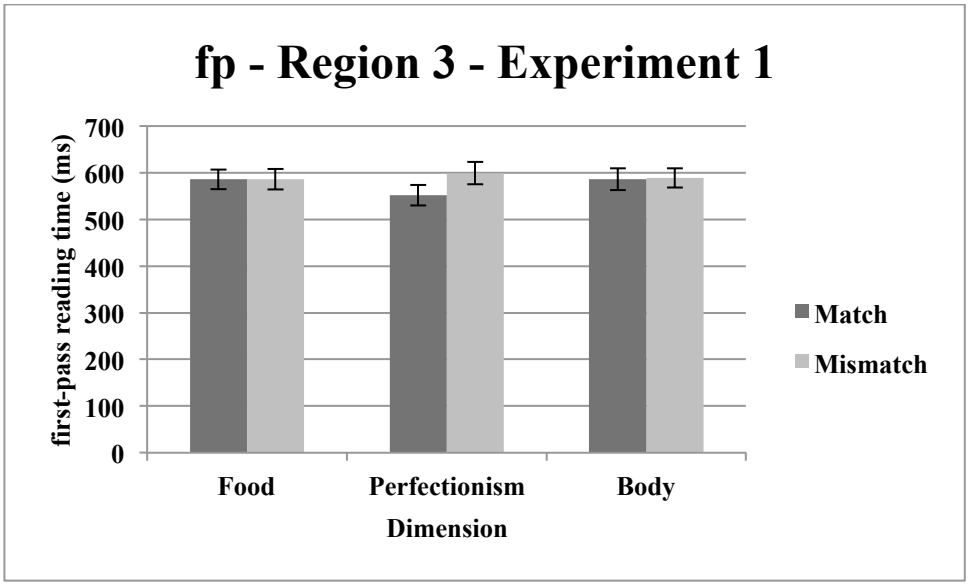


FIGURE 9.b. FIRST-PASS READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FP = FIRST-PASS.

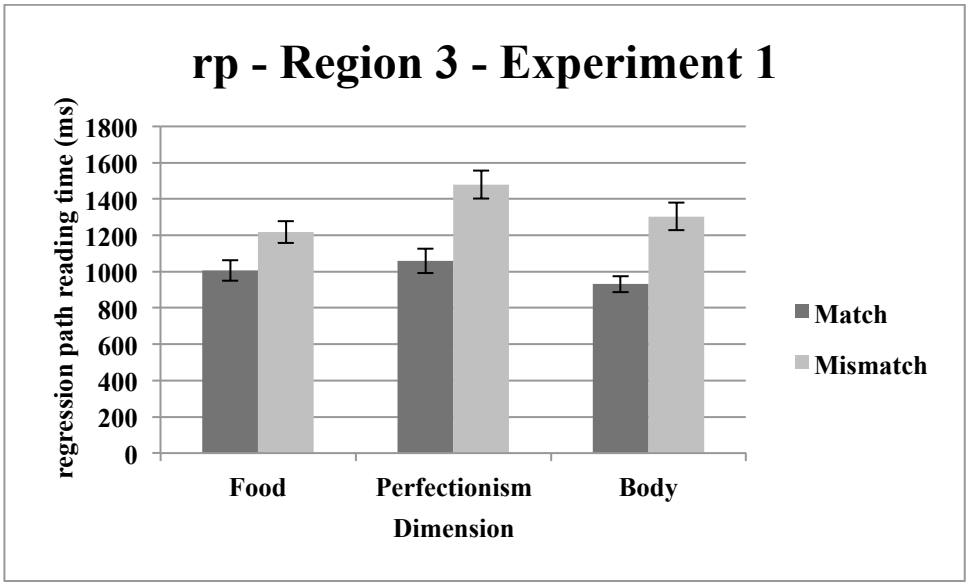


FIGURE 9.c. REGRESSION PATH READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. RP = REGRESSION PATH.

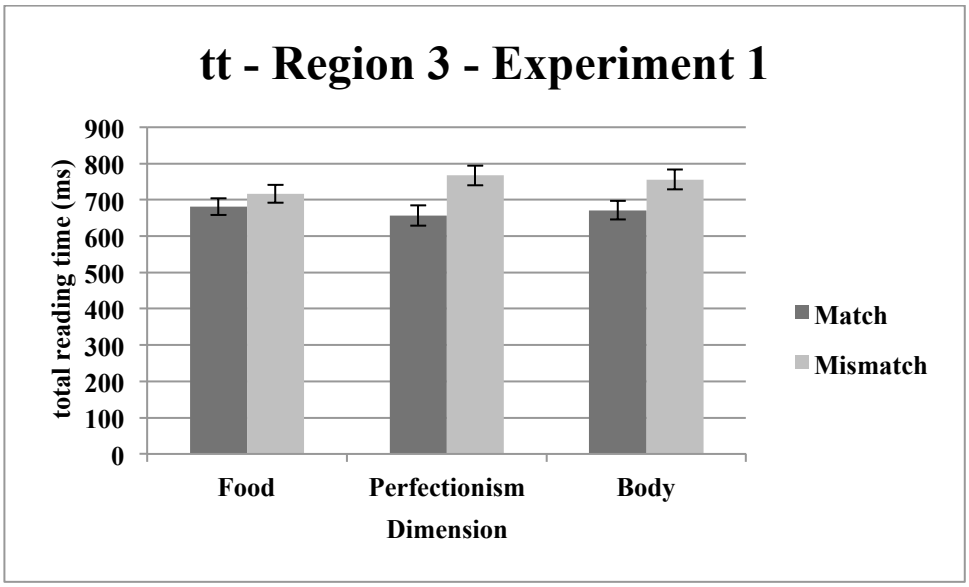


FIGURE 9.d. TOTAL READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. TT = TOTAL READING TIME.

In sum, there were no significant mismatch effects in early measures of reading behavior, but there were significantly longer total reading times for mismatching than matching conditions across all analysis regions, and also in regression path in *Region 3* which did not interact with dimension (e.g. food vs. body image vs. perfectionism).

3.5.2. Data Analysis for Questionnaire & Measures

3.5.2.1. Body Mass Index (BMI) Analysis

BMI was calculated by dividing each participant's self-reported weight (in kilograms) by the square of her height (in meters) (BMI = Kg/M^2). Participants ranged from 16.3 (very underweight) to 33.7 (obese) (M = 22.57, SD = 3.86; see Table 4 for British BMI health standards; Figure 10 for BMI Distribution of Participants).

TABLE 4
British BMI Health Standards Chart.

BMI Range	Weight Range
< 18.5	Underweight
18.5 – 24.9	Normal Weight
25 – 29.9	Overweight
> 30	Obese

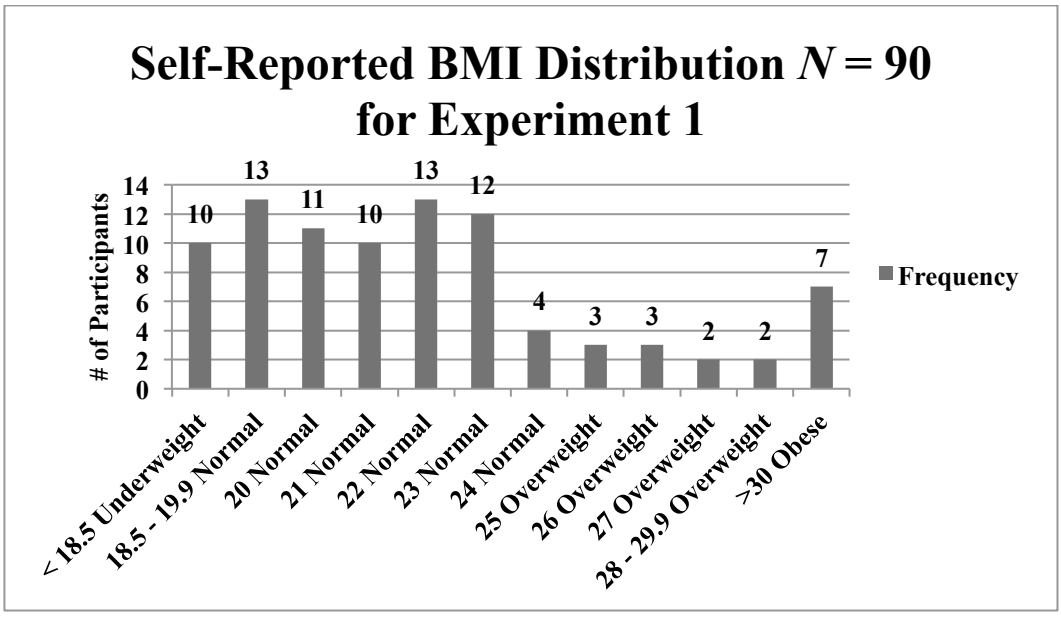


Figure 10. BMI Distribution of Participants for Experiment 1.

3.5.2.2. EDE-Q 6.0 ANALYSIS

Each participant's Global EDE-Q 6.0 score (eating disorder tendency level) was then computed, which may range from 0 (lowest level of eating disorder tendency) to 6.0 (extremely high eating disorder tendency). Participants' Global scores ranged from from 0 to 5.65 (M = 1.70, SD = 1.23), which were slightly higher compared to community norms (Fairburn & Beglin, 1994; Mond, Hay, Rodgers, & Owen, 2006; see Table 5a, 5b, & 5c; see Table 6 for percentile ranks). According to some papers establishing EDE-Q 6.0 norms, a cutoff ≥ 4 is considered clinically significant or severe eating disorder level (Carter, Stewart, & Fairburn, 2001; Luce, Crowther, & Pole, 2008). The Global EDE-Q 6.0 Cronbach's alpha coefficient was reliable at .95.

TABLE 5A
EDE-Q 6.0 SCORES AND MEANS OF PARTICIPANTS EXPERIMENT 1.

Measure	**Mean**	**SD**	***N***	**Score Range (Possible)**	**Score Range (Actual)**
Global EDE-Q 6.0 (all 4 facets)	1.70	1.23	90	.00 (low) to 6.0 (extreme)	.00 to 5.65
Restraint Concern (RC) facet	1.29	1.39	90	.00 (low) to 6.0 (extreme)	.00 to 5.80
Eating Concern (EC) facet	0.90	1.10	90	.00 (low) to 6.0 (extreme)	.00 to 5.00
Weight Concern (WC) facet	2.06	1.53	90	.00 (low) to 6.0 (extreme)	.00 to 5.80
Shape Concern (SC) facet	2.55	1.52	90	.00 (low) to 6.0 (extreme)	.00 to 6.00

TABLE 5B
EDE-Q 6.0 YOUNG FEMALE COMMUNITY NORMS EXAMPLE (FAIRBURN & BEGLIN, 1994).

Measure	**Mean**	**SD**	***N***
Global EDE-Q 6.0 (all 4 facets)	1.55	1.21	241
Restraint Concern (RC) facet	1.25	1.32	241
Eating Concern (EC) facet	0.62	0.86	241
Weight Concern (WC) facet	1.59	1.37	241
Shape Concern (SC) facet	2.15	1.60	241

TABLE 5C

EDE-Q 6.0 FEMALES (18-42 YEARS) COMMUNITY NORMS (MOND ET AL., 2006).

Measure	**Mean**	**SD**	***N***
Global EDE-Q 6.0 (all 4 facets)	1.52	1.25	5231
Restraint Concern (RC) facet	1.30	1.40	5231
Eating Concern (EC) facet	0.76	1.06	5231
Weight Concern (WC) facet	1.79	1.51	5231
Shape Concern (SC) facet	2.23	1.65	5231

TABLE 6

PERCENTILE RANKS FOR EDE-Q 6.0 SUBSCALE SCORES OF PARTICIPANTS FOR EXPERIMENT 1.

Percentile rank	**Restraint**	**EC**	**WC**	**SC**	**Global Score**
Mean (*SD*)	1.29 (1.39)	.90 (1.10)	2.06 (1.53)	2.55 (1.53)	1.70 (1.23)
5	-	-	-	.38	.22
10	-	-	.40	.50	.35
15	-	-	.53	.75	.48
20	.20	.20	.60	1.03	.57
25	.20	.20	.80	1.13	.75
30	.40	.20	.80	1.38	.83
35	.40	.20	1.00	1.86	1.08
40	.48	.40	1.20	2.25	1.15
45	.60	.40	1.40	2.38	1.25
50	.80	.40	1.70	2.50	1.42
55	1.00	.60	2.20	2.63	1.56
60	1.12	.60	2.40	3.08	1.68
65	1.20	.80	2.80	3.25	1.99
70	1.54	1.00	2.94	3.43	2.20
75	2.00	1.25	3.00	3.63	2.50
80	2.16	1.60	3.52	4.00	2.82
85	3.07	1.94	3.67	4.38	3.15
90	3.78	2.78	4.38	4.74	3.53
95	4.38	3.69	5.09	5.24	4.09
99	-	-	-	-	-

3.5.2.2.1. Dietary Restraint

15.6% of females reported restraining their diet for longer periods of time (≥ 8 hours) in order to influence their shape or weight, with 5.6% of females making this a regular occurrence (≥ 13 days in the prior 28 days).

3.5.2.2.2. Binge Eating

73.3% of participants reported eating unusually large amounts of food given the circumstances (35.5% as a regular occurrence; ≥ 4 times in the prior 28 days), and 47.8% of these binges included a sense of having lost control at the time (21.1% as a regular occurrence; ≥ 4 times in the prior 28 days). 63.3% of females reported binge eating and having a sense of loss of control at the time (4.5% as a regular occurrence; ≥ 13 days in the prior 28 days).

3.5.2.2.3. Compensation & Purging

52.2% of females reported exercising in a way which was driven or compulsive, in order to control her weight, shape, amount of fat, or to burn off calories, 3.3% as a regular occurrence (≥ 20 times in 28 days). 2.2% of females reported self-induced vomiting to control her shape or weight, and also 2.2% of females reported laxative misuse in order to control shape or weight in the past 28 days.

3.5.2.3. Examining the Relationship Between Reading & Eating Behaviour

Firstly, a mismatch effect score (mismatch – match reading times) for each measure of reading time in each region for each dimension was calculated. In order to investigate whether the way in which a reader processes food-, body-, and perfectionism-related materials predicts eating disorder level and/or BMI, regression analyses were conducted, using the enter method, with the size of the mismatch effect (mismatch – match for each dimension) as a predictor variable, and the participant's

score on the EDE-Q 6.0 and BMI as the criterion variables. Note that a lack of an overall significant mismatch effect in a particular region or measure does not mean that the size of the mismatch effect across participants cannot vary in relation to the measures of interest.

For all regressions in all eye-tracking studies in this thesis, Cook's Distance was used to measure the overall influence of a case and to check for influential outliers. In accordance with Cook and Weisberg (1982), all Cook's Distance values greater than 1 were removed from eye-tracking regressions in this thesis, and the regression performed again without these influential outliers. For Experiment 1, tests indicated that there were no influential outliers, as all Cook's Distance values were < 1.00 (≤ .185; ≤ .094). In addition, for all eye-tracking regressions in all experiments in this thesis, the Durbin-Watson test was used to assess the assumption of independent errors. A conservative rule of thumb is that Durbin-Watson statistic values below 1 or greater than 3 would be a cause for concern, whilst all values for all eye-tracking experiments in this thesis were in the 1.5 to 2.5 range and considered normal (Field, 2003). For Experiment 1, tests indicated that the data met the assumption of independent errors for both the EDE-Q 6.0- and BMI-related regressions (Durbin-Watson value = 2.082; 1.716). To ensure that multicollinearity was not an issue, variance inflation factor (VIF) and Tolerance statistics were performed in all four eye-tracking experiments in this thesis. Some authors, such as Myers (1990) and Stevens (2002), have considered VIF values > 10, and tolerance ≤ .1 as indicative of multicollinearity, whilst others, such as Allison (1999), have suggested a much more conservative VIF value (≥ 2.50), and tolerance value (≤ .40) to be considered to be in danger of biasing the regression. All VIF values and Tolerance values in all four eye-tracking experiments indicated that there were no multicollienarity concerns, by the more conservative measures (Tolerance values > .4;

VIF values < 2.5). In Experiment 1, multicollinearity was not a concern for either the EDE-Q 6.0- or BMI-related regression, as Tolerance values were > .4 (.946, 1.000), and VIF values were < 2.5 (1.001; 1.000).

3.5.2.3.1. EDE-Q 6.0 SCORES AND MISMATCH SCORE ANALYSIS

In relation to the EDE-Q 6.0, the size of the mismatch effect for perfectionism-related materials in total reading time for *Region 1* predicted eating disorder tendency. Specifically, participants with a *smaller* mismatch effect showed *higher* eating disorder tendencies, which would be in contrast to the prediction of a *larger* mismatch effect resulting in *higher* eating disorder tendency levels. However, in first-pass reading times for the *Region 2*, a higher perfectionism-related mismatch effect score predicted higher eating disorder tendency, which is in the expected direction. Also regression path reading times for the critical region revealed that higher body image-related mismatch effect scores predicted higher eating disorder tendency to a lesser extent, which was also in the expected direction (see Table 7).

TABLE 7
ENTER MULTIPLE REGRESSION MODEL: EDE-Q 6.0 EXPERIMENT 1 (N = 90).

Model	*b*	*SE b*	*ß*
Constant	1.70	.123	
Total Reading mm Region 1 Perfectionism	-.002	.001	-.23*
First-pass mm Region 2 Perfectionism	.004	.002	.23**
Regression path mm Region 2 Body	.001	.001	.21***

Notes. mm = Mismatch effect; R^2 = .17, * *p = .025; ** p = .026; *** p = .031*

3.5.2.3.2. BMI SCORES AND MISMATCH SCORE ANALYSIS

In relation to BMI, it was found that for total reading time for *Region 1*, *larger* perfectionism-related mismatch effect scores predicted *lower* BMI (see Table 8), which is in the expected direction.

TABLE 8
ENTER MULTIPLE REGRESSION MODEL: BMI EXPERIMENT 1 (N = 90).

Model	*b*	*SE b*	*ß*
Constant	22.76	.40	
Total Reading mm Region 1 Perfectionism	-.008	.003	-.29*

Notes. mm = Mismatch effect; R^2 = .08, * p = .006

3.6. EXPERIMENT 1 SUMMARY

In summary, results from Experiment 1 suggest that the way in which participants process perfectionism- and body image-related information may play a role in eating disorder tendencies, and only perfectionism-related processing was predictive of their body mass index. However, since there were both expected and unexpected results in terms of the direction of the effect, there is a need for further exploration. One issue is that it is difficult to assess whether participants read the third-person materials from their own perspective, or instead tried to imagine how another person would feel in the situation described. Since eating disorder tendencies have been linked to self-focus and internalization (Durso et al., 2012; Salmela-Aro, Pennanen, & Nurmi, 2001; Vartanian, 2009), and there is evidence of perspective effects on eye movements during the processing of emotional information within text (see Filik et al., 2017a), it was decided to replicate and extend the findings from Experiment 1 with a similar study in which the materials were designed to encourage the participants to read the materials from their own perspective. Specifically, the names of the characters in the scenario were replaced with the word "*you*" resulting in a second-person as opposed to a third-person perspective. In addition, participants' height and weight were physically measured, rather than relying on self-report data, in order to gain a more accurate calculation of their BMI.

3.7. EXPERIMENT 2 – SECOND-PERSON EYE-TRACKING STUDY WITH FEMALES

3.8. METHOD

3.8.1 PARTICIPANTS

Ninety female native English speakers aged 18-36 (M = 20.50, SD = 2.97) with no history of neurological illness or reading disabilities and normal or corrected-to-normal vision were recruited from Nottinghamshire. As with Experiment 1, the study was advertised as a general eye-tracking and reading study; without mention of health or eating disorders. None of the participants had been diagnosed as having an eating disorder, nor had they participated in Experiment 1. They received course credit or an inconvenience allowance for participation.

3.8.2. STIMULUS MATERIALS, DESIGN, PROCEDURE, & EYE-TRACKING ANALYSIS

In Experiment 2, the stimulus materials from Experiment 1 were slightly altered to be directed at the participant in second-person (see Table 9; see Appendix B for full set of materials; see Appendix C for filler items). Otherwise, the design, procedure, and eye-tracking analysis were all identical to Experiment 1.

TABLE 9
EXAMPLE MATERIAL FROM EXPERIMENT 2 WITH ANALYSIS REGIONS.

Scenario Type	Example
Food-related Match	You stop by the shop on your way home from work./ You get a large tub of ice cream, and go home and eat a small portion./ You are very Region 1 / pleased Region 2 / to have done that. Region 3 /
Food-related Mismatch	You stop by the shop on your way home from work./ You get a large tub of ice cream, and go home and eat the whole thing./ You are very Region 1 / pleased Region 2 / to have done that. Region 3 /
Body image-related Match	You go in for a regular check-up./ Your doctor comments that you have lost quite a bit of weight since your last appointment./ You are very Region 1 / pleased Region 2 / to have done that. Region 3 /
Body image-related Mismatch	You go in for a regular check-up./ Your doctor comments that you have gained quite a bit of weight since your last appointment./ You are very Region 1 / pleased Region 2 / to have done that. Region 3 /
Perfectionism-related Match	You work on creating music and sounds for a soundtrack./ You listen to what you created and hear every note flows together perfectly./ You are very Region 1 / pleased Region 2 / to have done that. Region 3 /
Perfectionism-related Mismatch	You work on creating music and sounds for a soundtrack./ You listen to what you created and hear not every note flows together perfectly./ You are very Region 1 / pleased Region 2 / to have done that. Region 3 /

Prior to analysis, all trials with zero first-pass reading times in two or more adjacent regions, and in the second sentence of the context, were removed, as this indicated that there was track loss or that this portion of text was not read. Following this procedure, 6.33% of the data were removed. Furthermore, all trials with zeros for each reading time measure in each region were removed. Specifically, this procedure accounted for 21.01% of data in *Region 1*, 6.99% in *Region 2*, and 1.09% in *Region 3* for first fixation duration, first-pass, and regression path reading time, and 6.99% in Region 1, 11.83% in Region 2, and 0.89% in Region 3 for total reading times. An average accuracy rate for the comprehension questions of 88.64% (*SD* = .06) confirmed that the participants were engaged in the task.

3.9. RESULTS

3.9.1. EYE-TRACKING DATA RESULTS

Data for each of the three regions in the critical sentence were analyzed using two 3 *dimension* (food vs. body image vs. perfectionism) x 2 *match* (match vs. mismatch) ANOVAs, one considering participants (*F*1) and one considering items (*F*2) as random variables (see Figures 11-13a-d for descriptive statistics). If sphericity could not be assumed, then the Greenhouse-Geisser correction was used.

Post-hoc bonferroni corrected ($p = .05/6 = .008$) paired t-tests were conducted on the average score independent of the match condition (match + mismatch/2) for fully significant main effects of dimension.

3.9.1.1. REGION 1

As in Experiment 1, in *Region 1* (e.g. *"You are very"*) there were longer total reading times for mismatching than matching conditions, $F1\ (1, 89) = 30.19$, $p < .001$; $F2\ (1, 35) = 30.40$, $p < .001$. There was a main effect of dimension that was significant by participants but not items in total reading times, $F1\ (2, 178) = 5.11$, $p = .007$; $F2\ (2, 70) = 2.46$, $p = .09$, and in regression path, $F1\ (2, 178) = 4.05$, $p = .02$; $F2\ (2, 70) = 2.91$, $p = .06$. There were no other significant effects (Fs < 2.99, ps > .09) (see Figures 11a-d for Region 1 descriptive statistics). Again, as in Experiment 1, as there were no effects in early measures, significantly longer total reading times in mismatching than matching conditions indicated that participants spent more time re-reading the beginning of the target sentence in mismatched conditions.

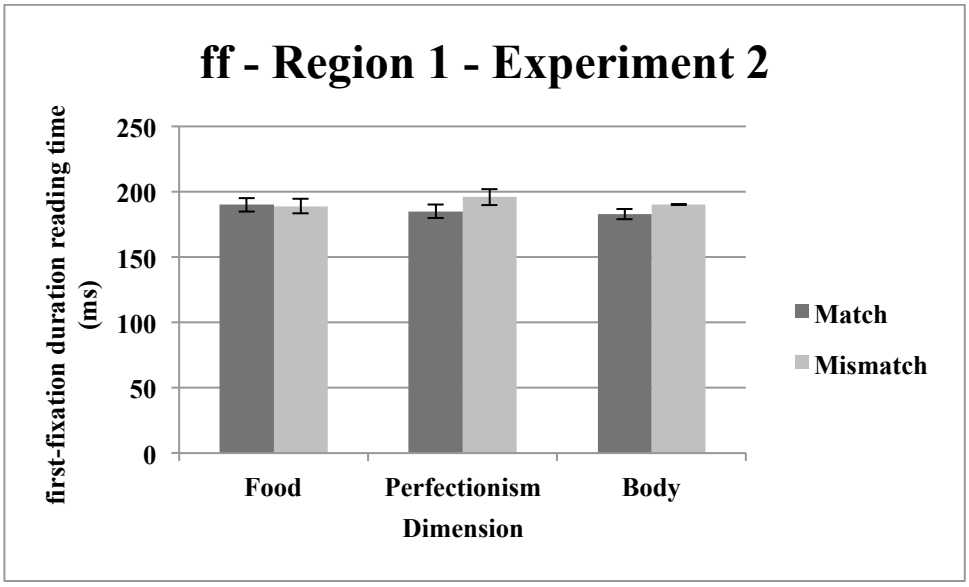


FIGURE 11.a. FIRST-FIXATION DURATION READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FF = FIRST-FIXATION DURATION.

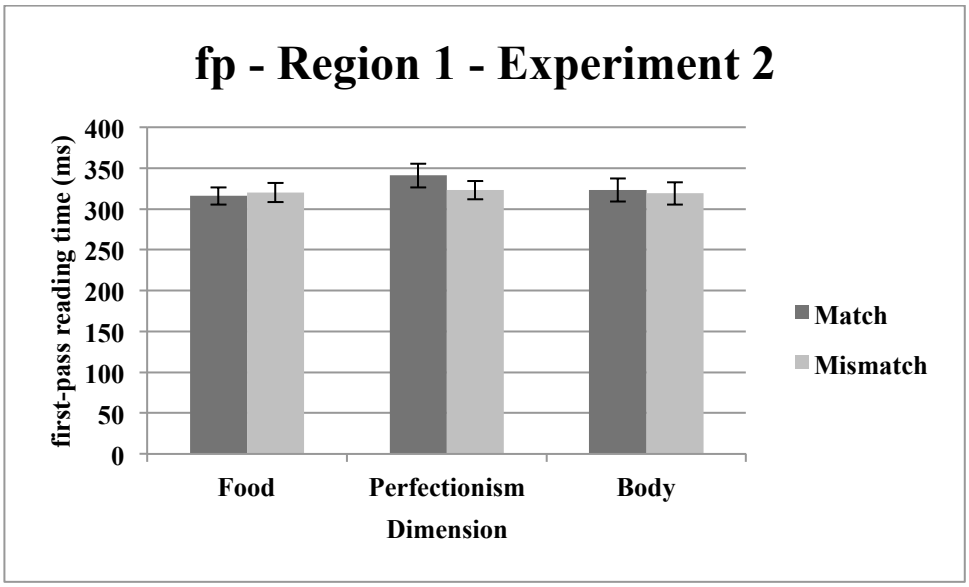


FIGURE 11.b. FIRST-PASS READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FP = FIRST-PASS.

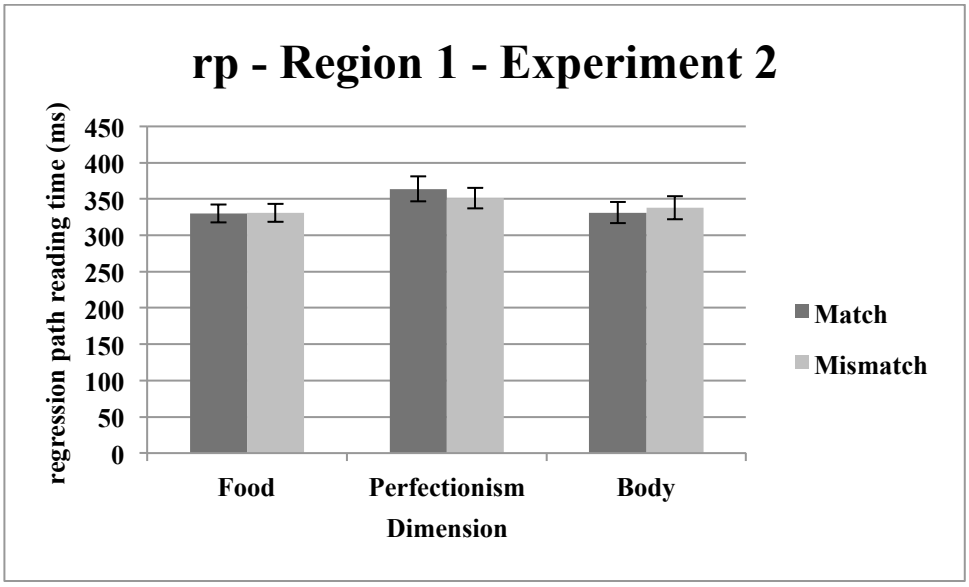


FIGURE 11.c. REGRESSION PATH READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. RP = REGRESSION PATH.

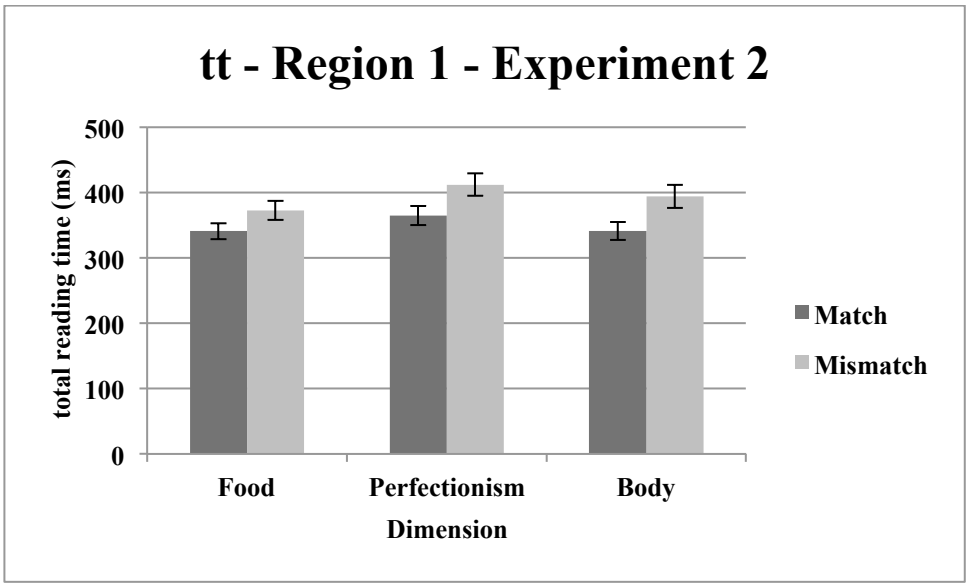


FIGURE 11.d. TOTAL READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. TT = TOTAL READING TIME.

3.9.1.2. REGION 2

As in *Region 1*, there were longer total reading times in mismatching than matching conditions, $F1$ (1, 89) = 17.82, $p < .001$; $F2$ (1, 35) = 27.38, $p < .001$ in *Region 2* (e.g. *"pleased"*). There was an interaction between dimension and match by participants but not items in first fixation duration $F1$ (1.86, 165.19) = 4.06, $p = .02$; $F2$

(2, 70) = 2.09, p = .13; and total reading times, $F1$ (1.61, 142.92) = 3.75, p = .04; $F2$ (1.58, 55.16) = 2.33, p = .12 (see Figures 12a-d for Region 2 descriptive statistics). There were no other significant effects (Fs < 2.55, ps > .11).

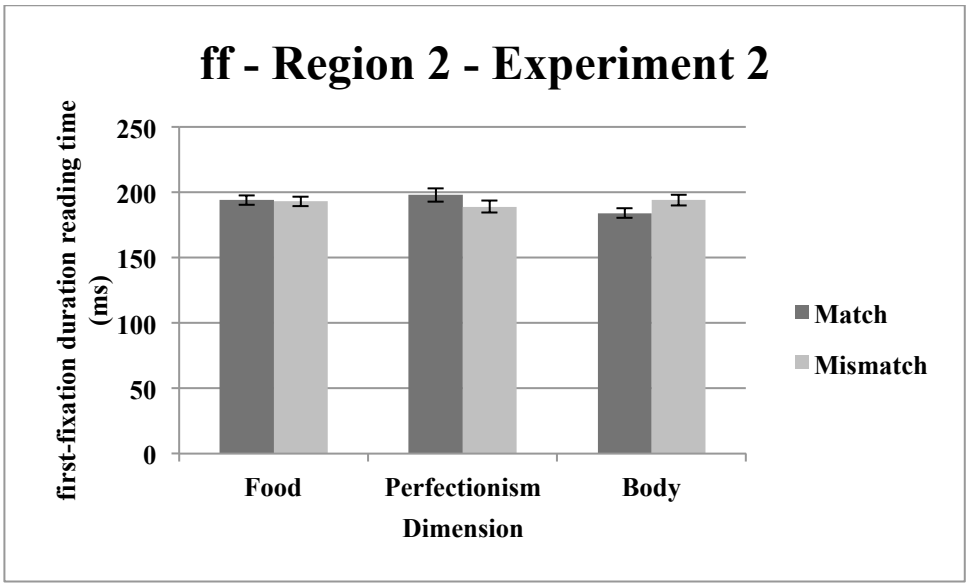


FIGURE 12.a. FIRST-FIXATION DURATION READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FF = FIRST-FIXATION DURATION.

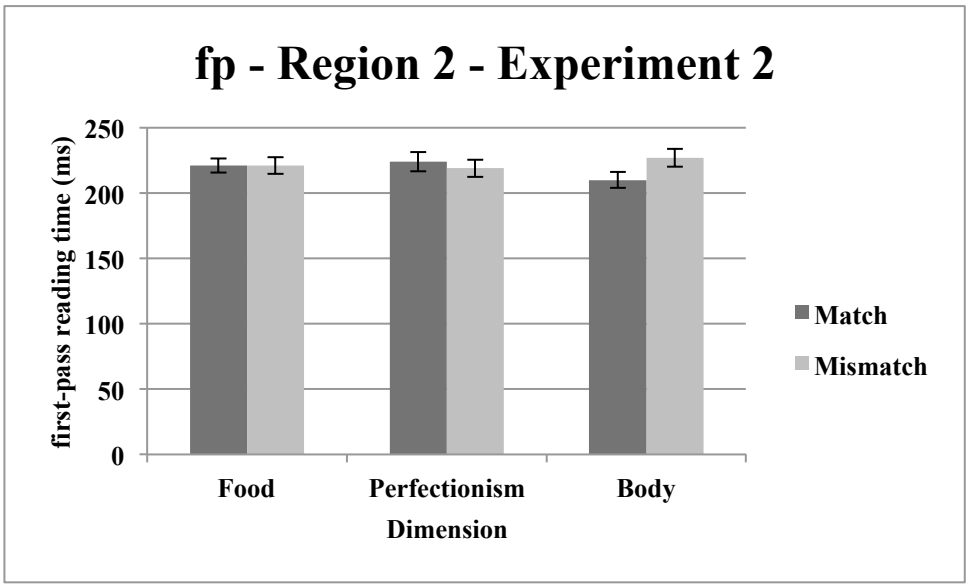


FIGURE 12.b. FIRST-PASS READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FP = FIRST-PASS.

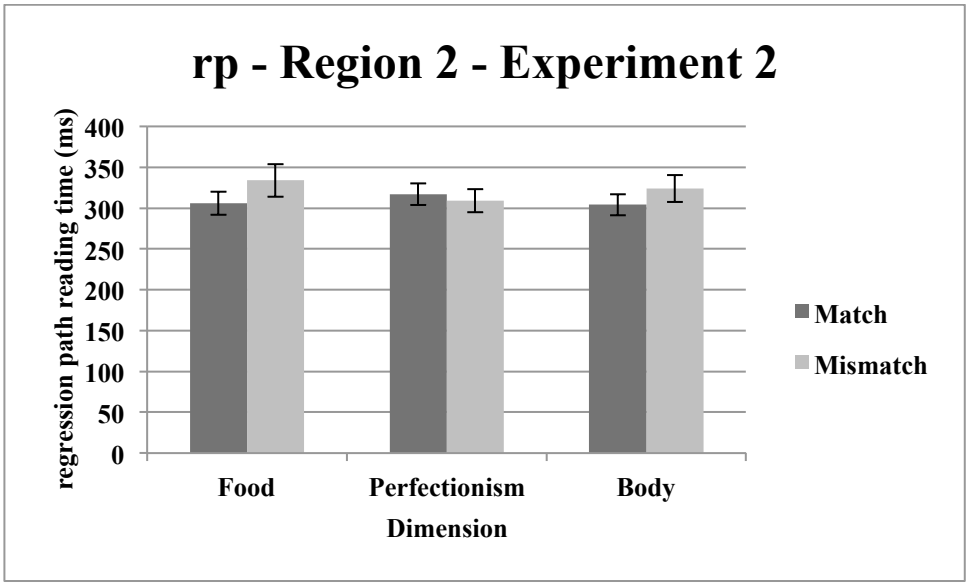


FIGURE 12.c. REGRESSION PATH READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. RP = REGRESSON PATH.

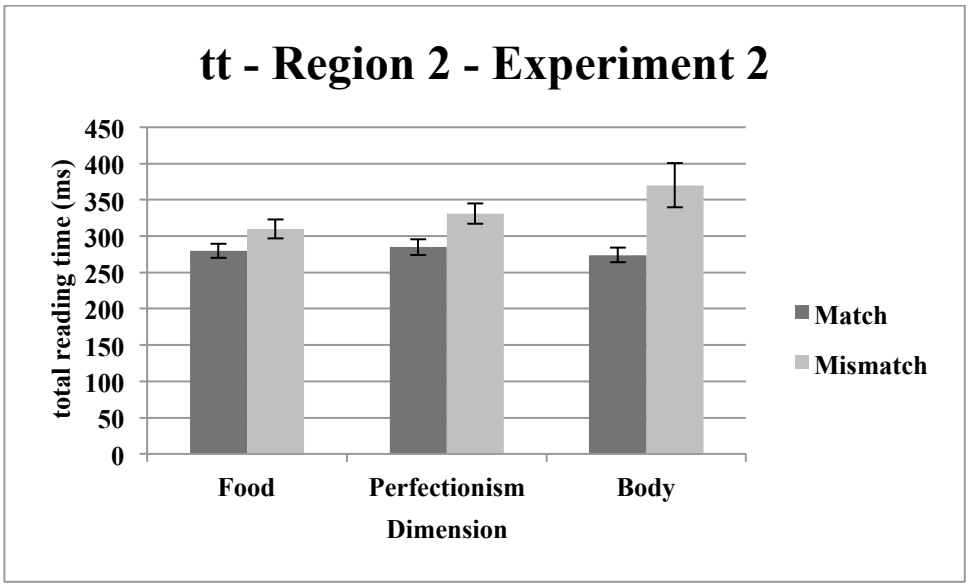


FIGURE 12.d. TOTAL READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. TT = TOTAL READING TIME.

3.9.1.3. REGION 3

Again, in *Region 3* (e.g. *"to have done that."*), total reading times were longer in mismatching than matching conditions, $F1\ (1, 89) = 63.69$, $p < .001$; $F2\ (1, 35) = 63.54$, $p < .001$, as were regression path reading times, $F1\ (1, 89) = 78.81$, $p < .001$; $F2\ (1, 35) = 69.82$, $p < .001$. Regression path also showed a main effect of dimension, $F1\ (2, 178) = 7.78$, $p = .001$; $F2\ (2, 70) = 8.09$, $p = .001$. Post hoc paired samples t-tests with

bonferroni correction ($p < .008$) indicated that the mean score averaged over match and mismatch conditions for the perfectionism dimension ($M = 1202$, $SD = 666.1$) was significantly higher than the food dimension ($M = 983$, $SD = 623.6$), $t1\ (89) = 3.79$, $p < .001$; $t2\ (35) = 3.67$, $p = .001$, but not the body dimension ($M = 1073$, $SD = 605.8$), and there were no differences between food and body dimensions ($ts < 2.41$, $ps > .018$). The main effect of dimension was significant by participants but not by items in total reading time, $F1\ (2, 178) = 5.50$, $p = .005$; $F2\ (2, 70) = 2.19$, $p = .12$ (see Figures 13a-d for Region 3 descriptive statistics). There were no other significant effects ($Fs < 2.96$, $ps > .06$).

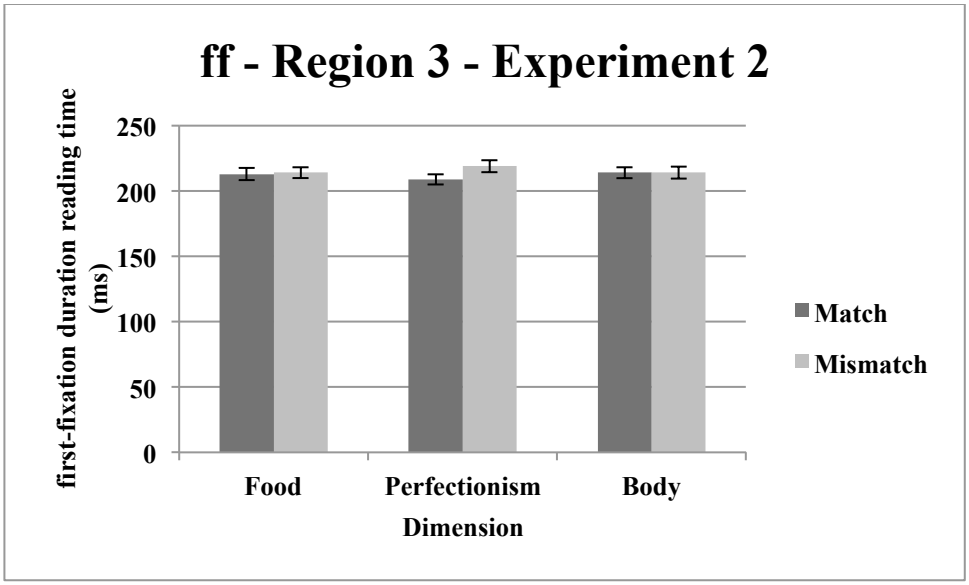


FIGURE 13.a. FIRST-FIXATION DURATION READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FF = FIRST-FIXATION DURATION.

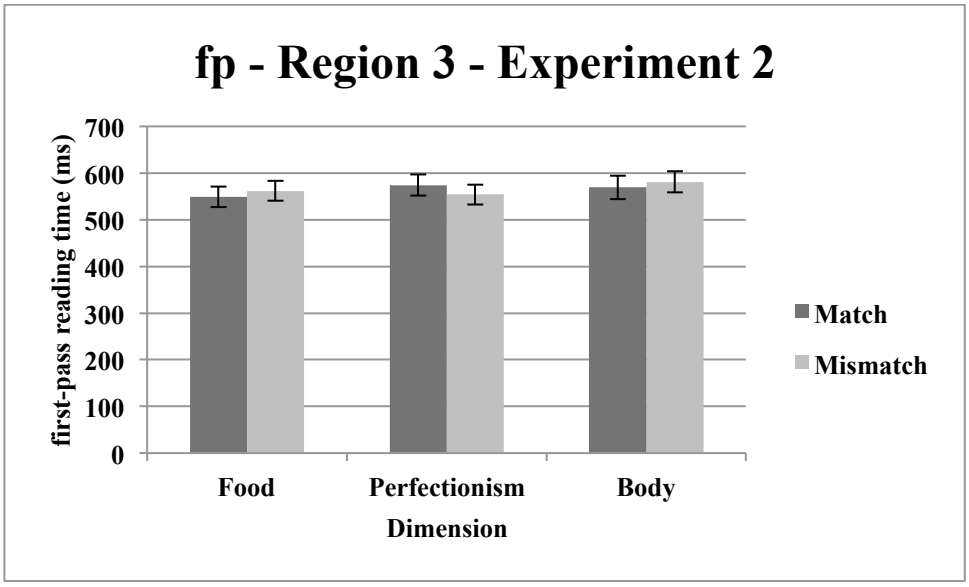


FIGURE 13.b. FIRST-PASS DURATION READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FP = FIRST-PASS.

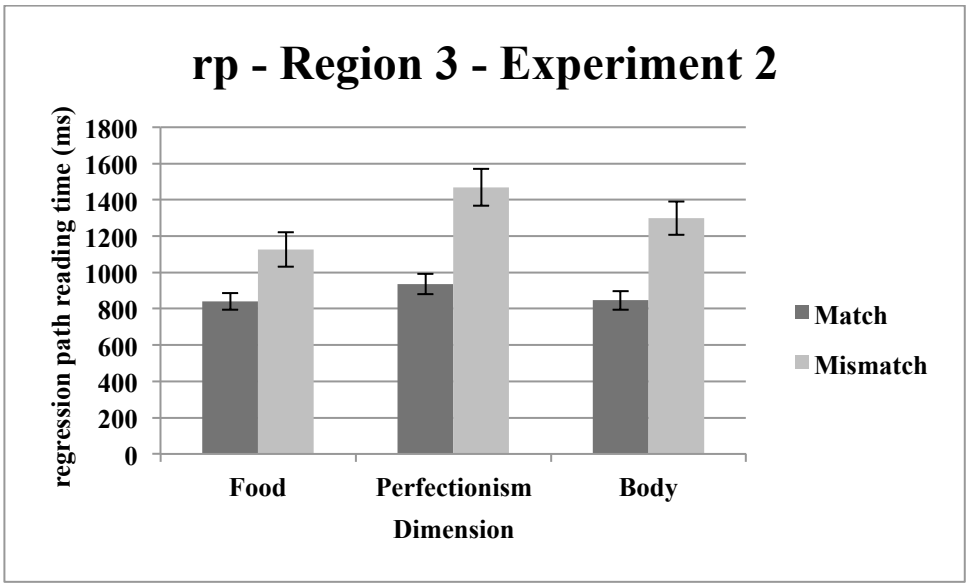


FIGURE 13.c. REGRESSION PATH READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. RP = REGRESSION PATH.

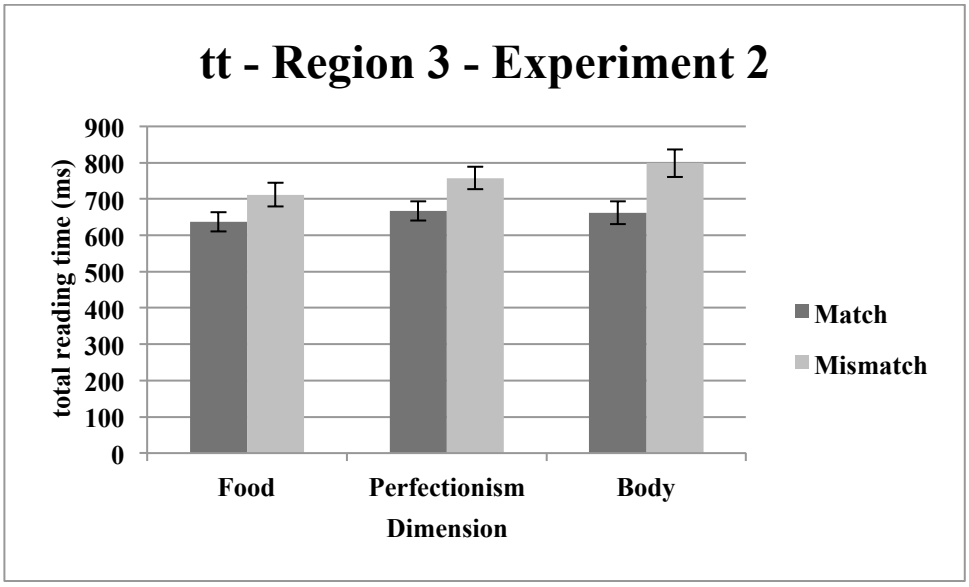


FIGURE 13.d. TOTAL READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. TT = TOTAL READING TIME.

In summary, there were no significant mismatch effects in first fixation duration or first-pass reading times, but there were significantly longer total reading times for mismatching than matching conditions across all analysis regions, and for regression path reading times in *Region 3*. This effect did not interact with dimension (e.g. food vs. body image vs. perfectionism).

3.9.2. DATA ANALYSIS FOR QUESTIONNAIRE MEASURES

3.9.2.1. BODY MASS INDEX (BMI) ANALYSIS

BMI was calculated by dividing each participant's actual measured weight (in kilograms) by the square of her actual measured height (in meters) (BMI = Kg/M^2). Participants' scores ranged from 17.8 (underweight) to 38.2 (obese) (M = 22.39, SD = 3.30; see Table 4 for British BMI health standards; Figure 14 for BMI Distribution of Participants).

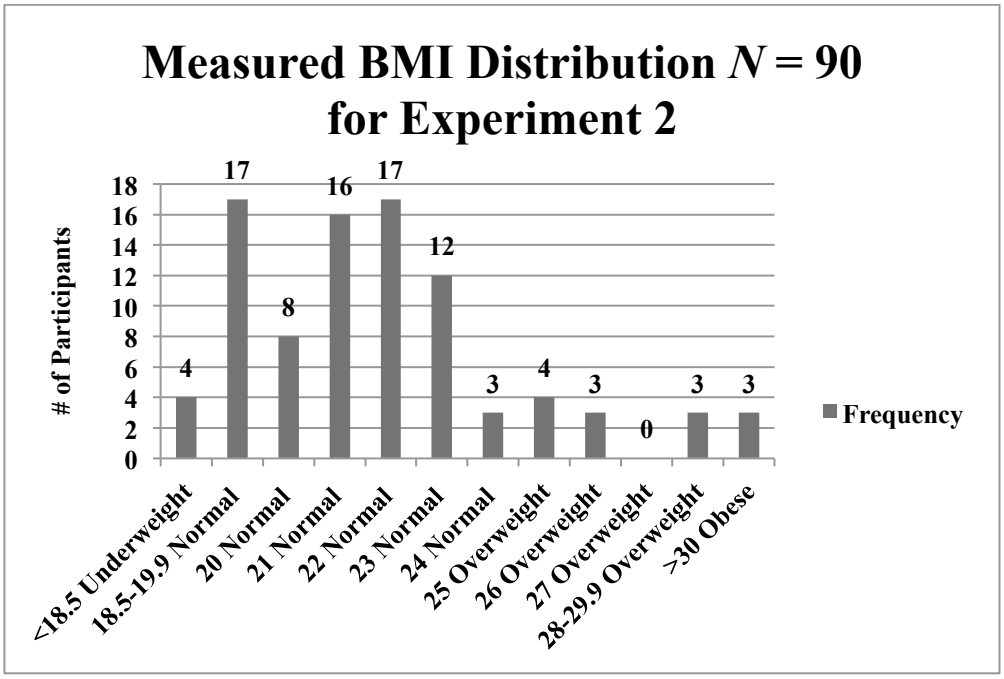


FIGURE 14. BMI DISTRIBUTION OF PARTICIPANTS FOR EXPERIMENT 2.

3.9.2.2. EDE-Q 6.0 ANALYSIS

Each participant's Global EDE-Q 6.0 score (eating disorder tendency level) was then computed, which may range from 0 (lowest level of eating disorder tendency) to 6 (extremely high eating disorder tendency). Participants scored from .16 to 5.30 (M = 1.84, SD = 1.27; see Table 11 Percentile Ranks of subscales). The Global EDE-Q 6.0 Cronbach's alpha coefficient was reliable at .95.

The range for each of the EDE-Q 6.0 facets: Restraint Concern (RC), Eating Concern (EC), Weight Concern (WC), Shape Concern (SC), and Global EDE-Q 6.0 are each from 0 (extremely low) to 6 (extremely high) levels of eating disorder tendency (see Table 10. EDE-Q 6.0 Scores and Means for Experiment 2). Participants' Global EDE-Q 6.0 scores means were again slightly higher compared to community norms (Mond et al., 2006; see Table 5.c.).

TABLE 10
EDE-Q 6.0 SCORES AND MEANS OF PARTICIPANTS EXPERIMENT 2.

Measure	**Mean**	**SD**	***N***	**Score Range (Possible)**	**Score Range (Actual)**
Global EDE-Q 6.0 (all 4 facets)	1.84	1.27	90	.00 (low) to 6.0 (extreme)	.16 to 5.3
Restraint Concern (RC) facet	1.57	1.55	90	.00 (low) to 6.0 (extreme)	0 to 6.0
Eating Concern (EC) facet	0.91	0.93	90	.00 (low) to 6.0 (extreme)	0 to 3.8
Weight Concern (WC) facet	2.24	1.56	90	.00 (low) to 6.0 (extreme)	0 to 6.0
Shape Concern (SC) facet	2.61	1.57	90	.00 (low) to 6.0 (extreme)	.1 to 6.0

TABLE 11
PERCENTILE RANKS FOR EDE-Q 6.0 SUBSCALE SCORES OF PARTICIPANTS FOR EXPERIMENT 2.

Percentile rank	**Restraint**	**EC**	**WC**	**SC**	**Global Score**
Mean (*SD*)	1.57 (1.55)	.91 (.93)	2.24 (1.56)	2.61 (1.57)	1.84 (1.27)
5	-	-	.31	.50	.25
10	-	-	.40	.63	.40
15	-	-	.53	1.00	.54
20	.20	.20	.80	1.00	.71
25	.40	.20	1.00	1.34	.82
30	.60	.20	1.20	1.63	1.06
35	.60	.20	1.40	1.75	1.27
40	.80	.40	1.60	1.88	1.33
45	.99	.59	1.79	2.13	1.45
50	1.20	.60	1.80	2.25	1.52
55	1.21	.80	2.00	2.50	1.61
60	1.60	.80	2.20	2.75	1.80
65	1.80	1.00	2.43	3.13	1.91
70	2.00	1.20	2.94	3.63	2.19
75	2.40	1.40	3.40	3.75	2.69
80	2.56	1.60	3.92	4.13	2.98
85	3.20	2.00	4.40	4.63	3.19
90	4.34	2.40	4.60	5.00	3.90
95	5.09	2.80	5.18	5.63	4.41
99	-	-	-	-	-

3.9.2.2.1. DIETARY RESTRAINT

25.6% of females reported restraining their diet for longer periods of time (≥ 8 hours) in order to influence their shape or weight, with 8.8% of females making this a regular occurrence (≥ 13 days in the prior 28 days).

3.9.2.2.2. BINGE EATING

73.3% of female participants reported eating unusually large amounts of food given the circumstances (42.2% as a regular occurrence; ≥ 4 times in the prior 28 days), and 47.8% of these binges included a sense of having lost control at the time (16.7% as a regular occurrence; ≥ 4 times in the prior 28 days). 58.9% of females reported binge eating and having a sense of loss of control at the time (4.4% as a regular occurrence; ≥ 13 days in the prior 28 days).

3.9.2.2.3. COMPENSATION & PURGING

48.9% of females reported exercising in a way which was driven or compulsive, in order to control her weight, shape, amount of fat, or to burn off calories, 3.3% as a regular occurrence (≥ 20 times in 28 days). 5.6% of females reported self-induced vomiting to control her shape or weight, and also 5.6% of females reported laxative misuse in order to control shape or weight in the past 28 days.

3.9.2.3. EXAMINING THE RELATIONSHIP BETWEEN READING & EATING BEHAVIOUR

Again, to assess which dimension (food, body image, perfectionism) might be most strongly related to disordered eating behavior and/or BMI, the mismatch scores (reading time in the mismatch condition minus reading time in the match condition) were first computed for each of the dimensions for each region and measure of reading behavior. This was followed by regression analyses using the enter method to assess whether the size of the mismatch score for any of the three dimensions predicts the eating disorder symptomology level (EDE-Q 6.0 scores), and actual Body Mass Index

(BMI scores). Tests indicated that there were no influential outliers as Cook's Distance values were not > 1.00 (Cook's Distance values were ≤ .287; .253), that residual terms were not correlated (Durbin-Watson value = 2.421; 1.722), and that multicollinearity was not an issue (Tolerance values = .998, 1.000; VIF values = 1.002, 1.000).

3.9.2.3.1. EDE-Q 6.0 SCORES AND MISMATCH SCORE ANALYSIS

Regarding the EDE-Q 6.0 score, results showed that for first fixation duration for *Region 3*, (e.g. *"to have done that."*) larger perfectionism-related mismatch effect scores (mm) predicted higher eating disorder tendency (see Table 12), which is in the expected direction.

TABLE 12
ENTER MULTIPLE REGRESSION MODEL: EDE-Q 6.0 EXPERIMENT 2 (N = 90).

Model	*b*	*SE b*	*ß*
Constant	1.759	.133	
First fixation mm Region 3 Perfectionism	.008	.003	.26*

Notes. R^2 = .07; * p = .014

3.9.2.3.2. BMI SCORES AND MISMATCH SCORE ANALYSIS

Regarding the BMI, *higher* mismatch effect scores for total reading times for perfectionism-related materials in *Region 3* (e.g. *"to have done that."*) predicted *lower* BMI (see Table 15), which is again in the expected direction. Also in first fixation duration for *Region 2* (e.g. *"pleased"*), it was found that *higher* body-related mismatch effect scores predicted *lower* BMI, which was also in the expected direction for females (See Table 13).

TABLE 13
ENTER MULTIPLE REGRESSION MODEL: BMI EXPERIMENT 2 (N = 90).

Model	*b*	*SE b*	*ß*
Constant	22.87	.365	
Total RT mm Region 3 Perfectionism	-.004	.001	-.26**
First fixation mm Region 2 Body	-.016	.008	-.21*

Notes. R^2 = .11; * p = .038; ** p = .014

3.10. EXPERIMENT 1 & 2 DISCUSSION

In sum, results from the first two experiments revealed a number of findings. Firstly, the results showed a mismatch effect for all three dimensions (food, body image, and perfectionism) when materials were presented from both a third-person (Experiment 1) and a second-person (Experiment 2) perspective. This finding supports prior studies which have shown that readers readily detect when a character's behavior and/or described emotional response is unexpected, given their world knowledge and expectations (e.g. de Vega et al., 1996; Filik, 2008; Filik & Leuthold, 2008; Filik & Leuthold, 2013; Filik et al., 2017a; Gernsbacher et al., 1992; Gernsbacher et al., 1998; Leuthold et al., 2012; Rayner et al., 2004; Warren & McConnell, 2007; Warren et al., 2008). The current findings also further suggest the importance of considering inter-individual differences when developing models of on-line language processing (Van den Brink et al., 2012), which will be discussed in more detail in the final Discussion chapter (see Chapter VI: Contribution to the Literature).

Regression analyses examining the relationship between the size of the mismatch effect in each dimension and participants' EDE-Q 6.0 global scores, as well as their BMI, were performed to investigate whether the way in which information relating to food, body image, and/or perfectionism is processed may predict eating disorder tendencies. Results showed that the size of the mismatch effect for body image-related materials about other characters (Experiment 1) predicted eating disorder

tendencies in a positive direction in regression path reading times for *Region 2* (the emotion word). Also, the mismatch effect for body-image materials about the reader (Experiment 2) predicted BMI in a negative direction in first fixation duration for *Region 2* (the emotion word).

The size of the mismatch effect for perfectionism-related materials had a more pervasive influence, consistently predicting both eating disorder level and also participants' BMI across a number of different regions and measures of reading time. Specifically, in Experiment 1, results for perfectionism-related materials showed that a larger mismatch effect in first-pass reading times for *Region 2* (the emotional response) predicted higher eating disorder levels, which is in the direction that one might expect. However, in total reading times for *Region 1* (which includes any re-reading of the beginning of the critical sentence) the opposite pattern was found, that is, that a *smaller* mismatch effect in perfectionism-related scenarios predicted higher eating disorder levels. To speculate, it may be that initially, participants with higher levels of eating disorder tendencies spent longer processing emotional responses that do not fit with their expectations (e.g. being happy about failure). However, since such scenarios may be perceived as threatening to themselves (McManus et al., 1996; Waller & Meyer, 1997), those with higher eating disorder tendencies may have avoided going back and re-reading portions of the critical sentence. Nevertheless, it was found that larger mismatch effects in total reading times for perfectionism-related scenarios in *Region 1* predicted a lower BMI, which is in the expected direction for females.

To be more certain that participants were reading the materials from their own perspective, rather than attempting to take the perspective of another person, Experiment 2 was conducted, in which materials were framed from a second-person rather than a third-person perspective. Results from Experiment 2 showed a clear and

consistent pattern of effects, in that a larger mismatch effect for perfectionism-related materials was the main predictor of higher eating disorder tendencies, and both a larger mismatch effect for perfectionism-related materials and body-related materials together were the main predictors of lower BMI, which is in the expected direction.

There were some differences in processing dependent upon perspective between females who read scenarios about other females (Experiment 1) and females who read scenarios about their own emotional response to the situation (Experiment 2). For instance when the scenario was directed at the female reader (Experiment 2) the larger body-related mismatch effect that predicted lower BMI took place on the unexpected emotion word in earlier measures (first fixation duration). Therefore, when the unexpected body-information was about the reader (e.g. the reader was pleased that she had gained quite a bit of weight), the unexpected body-related emotional response was initially maintained fixation (i.e. larger first fixation duration mismatch score). In contrast, larger perfectionism-related mismatch effect scores predicted lower BMI in both third- and second-female perspective (Experiment 1 and 2), detecting processing difficulties for unexpected perfectionism-related responses once the scenario was more fully processed (i.e. larger total reading time mismatch scores) within different regions of the target sentence (before and after the unexpected emotional response word, respectively). These information processing difficulty strategies detected between perspectives (third- versus second-person perspective) seem to support the idea that individuals' processes emotional information based upon the perspective that they take (Filik et al., 2017a, Experiment 2; Toplak & Katz, 2000). These results also extend prior psycholinguistic and reading research, as key underlying mechanisms of eating disorder tendencies and BMI level of females were predicted (perfectionism- and body-

related) through detecting their reading processing difficulties and information processing strategies in both third- and second-perspective.

Lastly, these results pick up temporal aspects of information processing strategies which predicted eating disorder and BMI level, which may support research about the quick attendance to, maintaining attendance to, and avoidance of emotional processing of disease-salient stimuli (see Cisler & Koster, 2010). In Experiment 1 females appear to have had initial difficulty processing in earlier reading measures (i.e. larger first pass mismatch scores), with longer fixations on the unexpected emotional response of the character (e.g. *"pleased"*) within perfectionism-related context predicting higher eating disorder level. Then, once the scenario was further processed in later measures (i.e. lower total reading time mismatch scores), there appears to be an avoidance of re-reading the beginning of the target sentence (e.g. "*She was very*") in perfectionism-related scenarios, which predicted higher EDE-Q 6.0 scores. There was also longer later processing (regression path) on the unexpected emotional response (e.g. *"pleased"*) within body-related context that predicted eating disorder level. Therefore, tracking eye movements during reading was able to predict eating disorder tendencies, and also more temporal detail (earlier and later processing strategies), which detected underlying mechanisms that contribute to the development and maintenance of eating disorders. This will be further discussed later in the Discussion for males and in the "The Final Picture and General Discussion" (see Chapter VI).

3.11. Experiment 1 & 2 Conclusion

In conclusion, using established methods in psycholinguistics to investigate the on-line processing of expectations regarding characters' behaviour in text, it was found that the key factor that predicted eating disorder tendencies and BMI in both third- and second-person scenarios was the processing of information relating to perfectionism. In

addition, the processing of body-related information about other characters (third-person scenarios) was a secondary predictor of eating disorder tendencies in Experiment 1, and the processing of second-person body-related information was a secondary predictor of BMI in Experiment 2 (when scenarios were about the reader). However, the processing of food-related information was not a predictor of eating disorder tendencies or BMI level in either third-person or second-person scenarios. Thus, the results from the current study would offer most support to theories that point to perfectionism as an underlying cognitive mechanism, along with some body-related influences involved in the development and maintenance of eating disorders, such as the Vulnerability-Stress Model (Joiner et al., 1997), the Three-Way Interactive Model for Bulimia Nervosa (Vohs et al., 1999), the Three-Factor Interactive Model for Bulimia Nervosa (Bardone et al., 2000), the Escape from Self-Awareness Theory for Bulimia Nervosa (Heatherton & Baumeister, 1991), the Cognitive-Interpersonal Model of Anorexia Nervosa (Schmidt & Treasure, 2006; Treasure & Schmidt, 2013), and the Transdiagnostic Model for Eating Disorders (Fairburn et al., 2003).

4. CHAPTER IV: IMPLICIT EXPECTATIONS ABOUT CHARACTER BEHAVIOUR AND EATING DISORDER TENDENCIES IN MALES: EVIDENCE FROM EYE MOVEMENTS DURING READING

4.1. CHAPTER OVERVIEW

Firstly, this chapter will provide an introduction and background pertaining to eating disorders and eating disorder tendencies related to males, which includes diagnosis, research, barriers to help and recovery, and body-related goals. Secondly, this chapter will go on to explain and discuss two eye-tracking studies conducted with 180 male participants, investigating information processing strategies during reading, and how this may predict eating disorder tendencies in males. Lastly, I will draw conclusions from these male studies in light of the current literature focused on males, information processing style, and eating disorder tendencies.

4.2. INTRODUCTION AND BACKGROUND TO EATING DISORDERS IN MALES

4.2.1. MALES AND EATING DISORDER DIAGNOSIS

Over the past 30 years, it has been estimated that only 1 in 10 individuals who were diagnosed with an eating disorder was a male, with males making up to 10% of the general population attempting to obtain eating disorder treatment, which marked one of the most drastic gender divergences in all psychiatric or medical disorders (Andersen, & Holman, 1997; Anderson & Bulik, 2004; Drewnowski & Yee, 1987). However, more current data, whilst still skewed, have pointed to higher prevalence and incidence rates, but with the extent of males diagnosed with an eating disorder masked by stigma.

Historically, an eating disorder has been mainly perceived as a female-related disorder. This perception, which carries on to the current day, may lead to fewer males seeking recovery, as they may want to avoid association with a "female" issue, or doctors may not recognise the differing symptomology (Mond, 2014; Raevuori et al., 2008). However, males are drastically neglected, under-diagnosed, and rarely

investigated concerning eating disorders, and therefore males' incidence of eating disorders and body dissatisfaction may be radically underestimated (Andersen, 1990; Pope, Phillips, & Olivardia, 2000b).

Eating disorders amongst males have been described from the first English language depiction and contemporary enquiry (Gull, 1874). An earlier account of a male eating disorder case was in 1694, from the King of England's physician, Dr. Richard Morton, who described a male and a female patient both with anorexia nervosa symptomology. Another early account in London was from Robert Willan in 1790, who detailed the death of a young man from severe restrictive eating, possibly related to religious fasting. After that time males were generally excluded from eating disorder-related theory or mention until the 1960's, when males with eating disorders began to be alluded to occasionally once again. One example during this time is Crisp and Roberts' (1962) case study and recovery account of a 14-year-old boy with severe anorexia nervosa symptomology. This near century of silence until the 1960's may be partially due to the fact that males did not meet the female-related criteria of common diagnostic hypotheses of that time. An example of a male-excluding criterion is the terminology that one is afflicted with the "fear of oral impregnation" (Andersen & Holman, 1997).

Although many may assume we have come a long way regarding female-related diagnoses criteria, until very recently female-only symptomology was still considered part of the key diagnostic criteria for anorexia nervosa. This, and other barriers which may prevent the diagnosis of eating disorders in males, will now be discussed.

4.2.1.1. Barriers Males with Eating Disorders Face

There are many barriers that may prevent males from identifying or seeking help for an eating disorder. Often males experience the stereotypical and stigmatising misunderstanding that an eating disorder is a female-related condition (Dakanalis et al.,

2012; Strother, Lemberg, Stanford, & Turberville, 2012). Currently there is still very little focus or evidence-based research on males and eating disorder tendency and risk, and one of the many barriers to males seeking help in this area is the continued female-focused approach of professionals framing eating disorders in a feminine way. Until recently, the standard Diagnostic Statistical Manual (DSM) included female-only issues as criteria for an eating disorder diagnosis. For instance, the DSM-IV included amenorrhea, a female-only condition, as one of the criteria of anorexia nervosa. Therefore, prior to the most current diagnostic manual for clinicians, one of the several principal diagnostic criterions pointed to eating disorders as mainly a female problem. Many males may encounter embarrassment and shame for struggling with a 'female' condition (Schneider & Agras, 1987).

Not only have the diagnostic guidelines been more female-related historically, but many of the measures for diagnoses were initially developed using female-related language, emotions, and behaviours (e.g. focused on the fear of fat and extreme desire to be 'skinny'), which was then also applied to males. The framing, diagnostic verbiage and criteria which has produced a lack of male-relevant measures for diagnosis, may all contribute to inaccurately reporting much lower rates of eating disorder tendencies (e.g. eating and body goals, behaviours, and dissatisfaction) in males than what may actually occur. Therefore, it is important to understand the different ways in which males and females exhibit eating disorder tendencies, and also process information through evidence-based research applicable to males, and aim to allocate appropriate research focus on males and females alike.

In addition to there being little evidence-based information that exists related to eating disorders in males, and most eating disorder research being focused on females, there are also very few heterosexual males reporting eating disorder symptoms.

Feldman and Meyer (2007) found that whilst 15% of the homosexual male population and 5% of heterosexual males have been diagnosed with an eating disorder, counter to what many believe, there are more heterosexual males with an eating disorder in the general population. Many heterosexual males may not disclose eating disorder symptoms as many may fear being seen as less masculine, or being perceived as 'feminine' or 'gay' (Drummond, 2002; Olivardia & Pope, 1997). There may also be social stigma attached to the diagnosis of anorexia nervosa, and sufferers may be mistakenly viewed as attention-seeking, and that their illness is self-inflicted (Stewart, Keel, & Schiavo, 2006). Therefore, males suffer a double stigma associated with suffering from an eating disorder. As fewer males are likely to seek help for an eating disorder, there appears to be a much lower prevalence in males with eating disorders, and this leads to an underestimation of the development, maintenance, and mortalities from eating disorders in males.

4.2.1.2. LIMITED MALE-FOCUSED ED RESEARCH

In fact, it is difficult to know how many males suffer from an eating disorder at any given time, or how many males newly develop an eating disorder annually, or in their lifetime. As there are different measures, range of dates, and sources, these statistics generally show that eating disorders in the male population are both rising and under-reported.

Recent HSCIC (2014) reports indicate that prevalence, incidence rates, hospitalizations, and mortality rates are all increasing in males. Prevalence refers to the proportion of the population who have or have had an eating disorder in a given time period, such as the percentage of the population. According to the current National Health Services (NHS) (2015) statistics it is estimated that approximately 25% of the estimated 1.6 million people suffering from an eating disorder in the United Kingdom

may be male, with approximately 15% of them undiagnosed. Of the 20 million people estimated to be affected by an eating disorder within their lifetime in the United States, it is believed that half are males, many of which are undiagnosed (Joint Commissioning Panel for Mental Health, 2011; Wade et al., 2011).

Incidence rates refer to the number of individuals who newly develop an eating disorder during a specific period of time, such as a month or a year. A recent report indicates that there is a 27% overall incidence increase in the United Kingdom alone between 2000 and 2009 for 10 to 49 year-old males (Micali et al., 2013). Additional incidence rates research in the United Kingdom reports that there are approximately two new cases of males with anorexia nervosa and one new case of males with bulimia nervosa per 100,000 people per year or person-years (Fairburn & Harrison, 2003). Also, approximately 25% of lifetime prevalence of anorexia nervosa is male, and there are likely fewer females with anorexia nervosa than males with bulimia nervosa (Hudson et al., 2007). However, there may be an increase of adolescent males presenting with an eating disorder in the United Kingdom (many of which are undiagnosed). To better illustrate this, of the 8% increase of hospitalisations for eating disorders (including men, women, and children) in the United Kingdom in 2013, the most common age of admission for males was only 13 years of age (HSCIC, 2014). Furthermore, the prevalence of eating disorders in males is increasing rapidly (Strother et al., 2012; Wade et al., 2011).

However, there is still very little eating disorder research that is male-focused (Fichter & Krenn, 2003). To clarify this lack of attention on males, Dobson and Dozois' (2004) meta-analyses of cognitive biases for eating disorders involving the Stroop task found that only three of the 26 studies reviewed included any male participants at all, with only one study investigating body- and food-related stimuli

gender differences (Green & McKenna, 1993). Males may have different symptomology than stated in the criteria for diagnosis, such as with binge eating disorder, as I will now discuss.

4.2.1.3. BED AND MALES

Binge eating disorder (BED) is the most common eating disorder in males and in the general population, with more lifetime prevalence than anorexia nervosa and bulimia nervosa together (Guerdjikova, Mori, Casuto, & McElroy, 2017). Eating disorders (i.e. anorexia nervosa and bulimia nervosa) are thought to be at least twice as common in women, except for BED, which was shown to be similar between women and men (Hay, Girosi, & Mond, 2015). Interestingly, in 1959, BED was first named Night Eating Syndrome (NES) by psychiatrist and obesity researcher, Dr. Albert Stunkard, for the behaviour of a male patient who ate excessively several times a night without feeling any hunger. Since that time, binge eating disorder symptomology developed from NES, excluding the nocturnal aspects of the initial observations. As with all eating disorders, BED has also been mainly viewed as a female issue. Binge eating disorder was first referred to in the DSM-II, but was only recently categorised as an actual key eating disorder in the current DSM-V. Interestingly, males with bulimia nervosa self-reported less distress related to bingeing than females express (Carlat & Camargo, 1991). As distress is a diagnostic criterion of binge eating disorder in the current DMS-V, and this lack of distress is related to bingeing in general for males, this may be another contributor of the under-diagnosis of males with eating disorders.

Although BED was initially based on a male patient and the number of males affected by BED are much more highly reported, still, BED (as with other eating disorders) has been historically perceived, diagnosed, assessed, and treated based on female presentations of these disorders, which are distinct from males (Murray,

Griffiths, Mitchison, & Mond, 2017a). Some statistics point to 40% of those with binge eating disorder as being male (National Association of Anorexia Nervosa and Associated Disorders, ANAD, 2016), and other researchers point to binge eating disorder as more common in males than in females (Smink et al., 2012). These numbers may suggest that men may have different eating or behavioural habits associated with eating disorder tendencies than those behaviours that women with eating disorder tendencies exhibit (Bergeron & Tylka, 2007; Chittester & Hausenblas, 2009; McCreary, Hildebrandt, Heinberg, Boroughs, & Thompson, 2007; Olivardia, Pope, Borowiecki, & Cohane, 2004; Tod, Morrison, & Edwards, 2012).

The idea that males and females have different eating and other behaviours related to eating disorder development and maintenance may be supported by the generally more muscular physique that males tend to idealise, rather than the thin-ideal or skinny physique that females tend to idealise (Dakanalis et al., 2012; Leit, Pope, & Gray, 2001; Pope, Olivardia, Gruber, & Borowiecki, 1999). For example, one study found that adolescent males with anorexia nervosa diagnoses displayed significantly lower anorexia nervosa-related behaviours (e.g. desire for a flat or empty stomach, desire to lose weight, or secret eating), and significantly lower Weight and Shape Concern on the Eating Disorder Examination (EDE; Cooper & Fairburn, 1987), than adolescent females with anorexia nervosa (Darcy & Lin, 2012). Furthermore, 27% of the males diagnosed with anorexia nervosa in this study reported vomiting to compensate for shape and weight regulation, in contrast to only 10% of the females. However, two studies, which aimed to determine normative ranges for males with eating disorders on the Eating Disorder Examination Questionnaire 6.0 (EDE-Q 6.0; Lavender, De Young, & Anderson, 2010; Reas, Øverås, & Rø, 2012), corresponded with Mond et al.'s (2006) female norms. Also, males were found to score significantly

lower on facets such as Body Dissatisfaction, Bulimia, and Drive for Thinness than females on the Eating Disorder Inventory – 2 (EDI; Garner, 2004), which is a measure used to assess eating disorder level, (Spillane, Boerner, Anderson, & Smith, 2004). Furthermore, another study, using the Bulimic Investigatory Test, Edinburgh (BITE; Henderson & Freeman, 1987), additionally showed differences between male and female bulimic symptomology, and males reported less distress than females regarding binge eating (DiGioacchino, Sargent, Sharpe, & Miller, 1999; Ricciardelli, Williams, & Kiernan, 1999).

These differences in ideal shape and weight between males and females that have been displayed may be the result of females and males adopting diverse eating and exercise patterns (Neumark-Sztainer & Eisenberg, 2014). For instance, whilst restrictive eating and dieting are often viewed as female-related tendencies (Weltzin, 2016), protein-based diets which are geared toward gaining more muscle, getting stronger, and becoming "healthier" have attracted males (Grogan, 2008). These muscularity goals may also lead to disordered eating tendencies. Another noted difference between male and female eating disordered behaviour is that males tend to display higher excessive exercise and physical activity with anorexia nervosa (Burns & Crisp, 1985; Fichter & Daser, 1987), and less weight concern and compensation (i.e. vomiting, laxatives, etc.) with bulimia nervosa than females (Garfinkel et al., 1995). However, males tend to focus on over-exercise which may act as compensatory behaviour, rather than females who may focus more on dieting or caloric restriction to slim down (Grogan & Richards, 2002). Taking these variations in behaviours into account, males may also process eating disorder-related information differently than females, due to their alternative eating disorder tendencies, symptomology, and body-related goals, which will now be discussed.

4.2.1.4. TYPICAL MALE BODY-RELATED GOALS

The typical male body-related shape and size goals may be in contrast to those of typical female body-related shape and size goals. As aluded to earlier, males are shown to be more often concerned with body shape goals, rather than the weight-related goals related to females (Andersen & Holman, 1997). Therefore, males may have significant exercise concern, to both lose fat and to gain muscle shape (Fichter & Krenn, 2003; O'Dea & Abraham, 2002). Furthermore, the media often depicts male exercise to obtain the revered more muscular 'sport-hero' image (Toerien & Durrheim, 2001), and therefore social norms may be extremely influential on the exercise behaviours of males.

Interestingly, although the negative effects on young girls from Mattel's Barbie, a female human doll with unrealistically thin body proportions, has received a lot of media and research attention over the years, there is very little which considers the increasingly unrealistic body muscularity and sizes of male human action figures. Recently Mattel has made efforts to include other body-types for Barbie (i.e. curvy, petite, and tall), whilst male action figure body size and muscularity have only become increasingly unrealistically larger. For example, one study measured the size of several male human action figures (i.e. Batman, G.I. Joe, Hulk, Spiderman, and Superman), and found that over 25 years the figures became significantly larger and had a more muscular physique, except the waist (Baghurst, Hollander, Nardella, & Haff, 2006). Supporting the way in which male action figures had become more unrealistic, they suggested that these male action figures were currently much more unrealistically lean and muscular than Pope et al.'s action toys male body-ideal study in 1999.

Unlike most females who may desire the thin-ideal, males are shown to have more of a drive for muscularity which explicitly demonstrates the strong, tough, and

independent characteristics of masculinity (Golombok & Fivush, 1994), both in western cultures such as the United Kingdom (Grogan & Richards, 2002), United States (Cafri, Van den Berg, & Thompson, 2006; Jones & Crawford, 2005; Smolak, Murnen, & Thompson, 2005), Australia (McCabe & Ricciardelli, 2001; Hargreaves & Tiggemann, 2006), and Canada (McCreary & Sasse, 2000), as well as non-western cultures such as China (Xu et al., 2010), the Pacific Islands (Ricciardelli et al., 2007), Turkey (Hünler, 2016), Asia and Africa (Williams & Best, 1990). These ideals that include desiring to lose fat and gain muscle may lead to disordered eating-related behaviours, which may become extreme enough to lead to reverse anorexia nervosa (i.e. bigorexia) or muscle dysmorphia disorder (McCreary et al., 2007; Pope et al., 2000b), a psychiatric condition closely linked to eating disorders (Dakanalis & Riva, 2013).

Some researchers and clinicians utilise similar eating disorder treatment for males and females (Fernández-Aranda et al., 2004), and most eating disorder tendency and body dissatisfaction measures used over the last three decades have been used for both males and females alike. However, if there are divergent ideals and differing eating disorder tendencies in males and females, it is of interest and of importance to contribute more attention to the investigation of eating disorder tendencies in males, understand the underlying eating disorder mechanisms in males, and how they process information. Of equal importance is the need to evaluate and understand which measures may most elucidate those unique behaviours, concerns, and ideals related to body dissatisfaction and eating disorder tendencies in males. It is imperative to provide evidence-based investigation to discover whether eating disorder tendencies and underlying factors are similar or different between genders, which may then influence prevention, measures, diagnosis, and treatment strategies for both males and females.

4.2.1.5. UNDERLYING MECHANISMS OF EATING DISORDERS IN MALES

As discussed prior, males have not often historically been included in ED research or diagnostic criteria, and many of the assessment tools to identify eating disorder tendencies are geared toward female symptomology. Therefore, many males remain undiagnosed, as men may have markedly different eating disorder symptomology compared to females, and also due to the stigma surrounding males and eating disorders. Still, most existing research have pointed to the same core cognitive factors proposed by theory to underlie the development and maintenance of eating disorders in general (as detailed in Chapter II), which are: unhealthy food-, negative body-, and perfectionism-related cognitive biases. Whilst these theoretically proposed developing and maintaining factors may be core cognitive mechanisms for both females and males, these mechanisms may exist to support differing goals by females and males. For instance, males and females may both share negative body-related cognitive biases, which manifest differently. Females may be more prone to a severe fear of fat and desire to become "skinny", whilst males may be more prone to avoid fat and gain a lean and muscular physique, but still both females and males would not be pleased to gain fat and would be pleased to lose fat in line with their differing physical goals. Likewise, both males and females may carry the same expectations that someone would be unhappy with eating fattening foods (food-related), or desire to maintain perfectionistic views and relate slight mistakes as being a failure as a person (perfectionism-related). Therefore, in this chapter, eye-tracking was also used as an implicit novel measure to investigate how the way in which males process information may predict indices of eating disorder behaviour and their expectations of the emotional response of male characters within food-, body image-, and perfectionism-related scenarios. In two experiments (Experiment 3 and 4), male participants' eye movements were monitored

while they read scenarios in which the characters made expected or unexpected responses in food-, body image-, or perfectionism-related scenarios. As in the prior experiment (Experiment 2), the relationship between participants' eye-movements were examined in relation to their eating disorder tendencies, as shown by their EDE-Q 6.0 (Fairburn & Beglin, 2008) scores and their actual BMI. In addition, male participants' body composition was measured using a bioelectrical impedance scale, in order to obtain both fat- and muscularity-percentages of participants.

4.3. EXPERIMENT 3 – THIRD-PERSON EYE-TRACKING STUDY WITH MALES

4.3.1. MAIN AIMS & HYPOTHESES

As with the female studies in the previous chapter, eye-tracking during reading was utilised, in order to investigate participants' implicit expectations regarding how a story character might react in certain situations, and how these expectations might be related to indices of eating behavior. Again, to my knowledge, these experiments are the first investigation to measure on-line language processing to investigate emotional expectations to food-, body-, and perfectionism-related factors associated to disordered eating behavior in males. Specifically, two experiments were conducted in which males read food-, body image-, and perfectionism-related scenarios in which the target sentence contained a critical emotion-based word (e.g. *"pleased"* in Table 14) which would either "match" or "mismatch" with males' expectations of how the male character might react (see Filik, 2008; Filik & Leuthold, 2013, Experiment 2). As with Experiments 1 and 2, the participants completed the EDE-Q 6.0 (Fairburn & Beglin, 2008) the only self-report endorsed in the UK to reliably measure eating disorder pathology. In order to have clarity as to which aspects of males' BMI were related to reading behaviour, participants' BMI, as well as their body fat- and muscularity-percentage was also measured using a bioelectrical impedance scale.

As hypothesised in Experiments 1 and 2, if tendency towards eating disorders is primarily determined by participants' processing of food-related information (e.g. Shafran et al., 2007), then it is expected that their eye movement behavior whilst reading food-related items may predict their scores on the EDE-Q 6.0 and/or BMI. Therefore, in relation to the example given in Table 14, if participants have a focus on unhealthy food, they may experience more processing difficulty integrating the word *"pleased"* in the mismatch condition compared to the match condition, since in this condition, the character is pleased that they have eaten an entire tub of ice-cream. Thus, it might be expected that the size of the 'mismatch effect' (the reading time of those scenarios that "mismatch" the readers expectations regarding the characters' response minus the reading time of those scenarios that "match" the readers expectations regarding the characters' response) would be larger in participants with food-related biases. If such expectations about behaviour in these scenarios are key predictors of disordered eating behaviour, then the size of the mismatch effect may be expected to predict participants' scores on the EDE-Q 6.0, or their BMI. Specifically, that participants with larger mismatch effects might show higher scores on the EDE-Q 6.0, and perhaps also a lower BMI in males.

In contrast, if body image-related information processing style is key (Gardner et al., 2000; Stice, 2002; Stice et al., 2002), then it might be predicted that the level of difficulty whilst processing the word *"pleased"* in body image-related scenarios in the mismatch (his doctor comments that he has gained quite a bit of fat) compared to the match condition (his doctor comments that he has lost quite a bit of fat) would be a predictor of eating disorder tendencies. This is because although many males desire to be larger in muscularity unlike many females, still males would not typically be happy to have gained body size by "quite a bit of fat". In contrast, males typically would be

happy to have "lost quite a bit of fat", as then their muscularity may be more pronounced. These two dimensions of male body dissatisfaction (adipose versus muscularity) will be discussed in more detail in Chapter V. If perfectionism is the key factor underlying the development of eating disorders, then it would instead be expected that participants' tendencies towards disordered eating behavior would be predicted by the size of the mismatch effect for perfectionism-related scenarios. Finally, it may also be that a combination of these factors is predictive of eating disorder tendencies, such as a combination of body and perfectionism, as predicted by the Transdiagnostic Model of Eating Disorders (Fairburn et al., 2003).

Firstly, whether eating disorder level is more related to food-, body image-, and/or perfectionism-related information processing strategies in third-person scenarios (i.e. those written about another male, Experiment 3) was investigated. Then, it was the aim to replicate and extend the findings of the prior experiments using second-person male-related scenarios (i.e. scenarios designed to be about the male participants themselves, Experiment 4).

4.4. METHOD

4.4.1. PARTICIPANTS

Ninety male native-English speakers aged between 18 and 38 years old (M = 21.50, SD = 3.65) with normal or corrected vision and no history of neurological illness or reading disability were recruited from the Nottinghamshire community. Nottinghamshire. As with Experiment 1 and 2, the study was advertised as a general eye-tracking and reading study; without mention of health or eating disorders. None of the participants had been diagnosed with an eating disorder. They received an inconvenience allowance or course credit for participating.

4.4.2. STIMULUS MATERIALS AND DESIGN

In Experiment 3, the stimulus materials from Experiment 1 were slightly altered to include male characters instead of female characters (see Table 14; Appendix B for full stimulus materials), and to apply more toward male-ideals (see Pre-testing Materials section below). Otherwise, the design, procedure, and eye-tracking analysis were all identical to Experiment 1 and Experiment 2. Thus the experiment consisted of a 3 *dimension* (food vs. body image vs. perfectionism) x 2 *match* (match vs. mismatch) design, with both dimension and match as within-subjects and within-items factors.

TABLE 14
EXAMPLE MATERIAL FROM EXPERIMENT 3 WITH ANALYSIS REGIONS.

Scenario Type	Example
Food-related Match	Kade stops by the shop on his way home from work. He gets a large tub of ice cream, and goes home and eats a small portion./ Kade is very Region 1 / pleased Region 2 / to have done that. Region 3 /
Food-related Mismatch	Kade stops by the shop on his way home from work. He gets a large tub of ice cream, and goes home and eats the whole thing./ Kade is very Region 1 / pleased Region 2 / to have done that. Region 3 /
Body image-related Match	Kade goes in for a regular check-up. His doctor comments that he has lost quite a bit of fat since his last appointment./ Kade is very Region 1 / pleased Region 2 / to have done that. Region 3 /
Body image-related Mismatch	Kade goes in for a regular check-up. His doctor comments that he has gained quite a bit of fat since his last appointment./ Kade is very Region 1 / pleased Region 2 / to have done that. Region 3 /
Perfectionism-related Match	Kade works on creating music and sounds for a soundtrack. He listens to what he created and he notices that every note flows together perfectly./ Kade is very Region 1 / pleased Region 2 / to have done that. Region 3 /
Perfectionism-related Mismatch	Kade works on creating music and sounds for a soundtrack. He listens to what he created and he notices that not every note flows together perfectly./ Kade is very Region 1 / pleased Region 2 / to have done that. Region 3 /

As in the previous experiments, after the eye-tracking task, participants completed the EDE-Q 6.0 (Fairburn & Beglin, 2008) to measure their eating disorder level, and participants' actual height and weight were measured in order to calculate their Body Mass Index (BMI). In addition, a bioelectrical impedance scale was used to

measure male participants' actual body composition (fat- and muscle-percentage) in order to clarify the body composition (i.e. fat- and/or muscle-percentage) of the BMI.

4.4.3. PRE-TESTING OF MATERIALS

Before Experiment 3, in order to ensure that materials were more natural to males, the items from Experiment 1 that would not be relevant to males were slightly adjusted and included all male characters. For instance, whereas Beth's *hips* have decreased in size from her last doctors appointment in Experiment 1 with females, Bob's *waistline* has decreased in size since his last appointment in Experiment 3 with males; whereas Kimberly notices her *rather curvy* or *very slender* body in the shower in Experiment 1 with females, in Experiment 3 with males, Isaac notices his *rather chubby* or *very toned* body in the shower.

Experiment 3 materials were then pre-tested online twice by different groups of native-English speaking males. Firstly, to determine that each scenario's three dimensions were viewed as at least 75% only as the condition intended (food-, body image-, or perfectionism-related), and secondly, to make sure that each dimension included an appropriate "Match" and a "Mismatch" in each scenario. That is, that each scenario and each dimension (food-, body image-, or perfectionism-related items) each had a version in which the character's emotional response would be expected by participants ("Match"), and also a version in which the emotional response of the character in the scenario would be unexpected by the majority of participants ("Mismatch"). These two separate pre-tests are described below, which were the same tests carried out for Experiment 1 and Experiment 2, but with male participants instead for Experiment 3.

4.4.3.1. DIMENSIONS PRE-TEST

Firstly, materials were pre-tested online with 30 native English-speaking males between 18 and 38 years old (M = 26.31, SD = 6.53) who did not participate in the second pre-test, nor in the eye-tracking study. In the first pre-test, each participant read one version of the 36 scenarios (36 food-, 36 body image-, and 36 perfectionism-related items), and indicated on a 100-point sliding scale, from 0% (not at all about the scenario) to 100% (absolutely about the scenario), their response to questions about what the scenario was about: food, perfectionism, and/or the body: Q1. "*Is this about food?*" Q2. "*Is this about perfectionism?*" *Q*3. "*Is this about the body?*" (see below Figure 15. Dimension Pre-test Screenshot Example).

The food-, perfectionism-, and body image-related items across each scenario were randomised using Matlab, and counterbalanced between three different stimulus presentation files using Qualtrics survey software (http://www.Qualtrics.com). Therefore each participant was certain to be presented with only one version (food-, body image-, or perfectionism-related scenario) of each item.

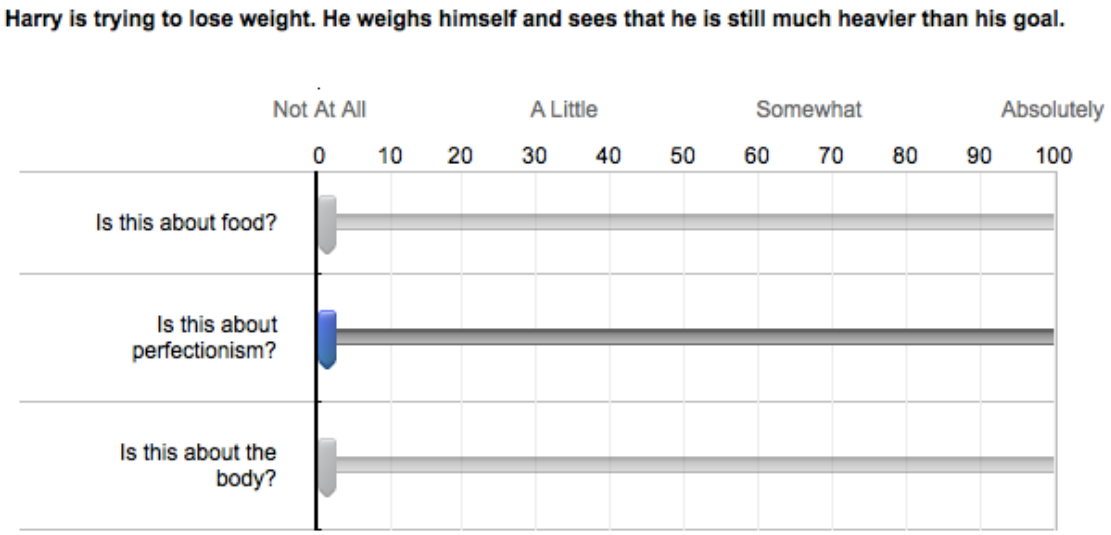


FIGURE 15. DIMENSIONS PRE-TEST SCREENSHOT EXAMPLE.

The 36 materials all scored over 75% in the intended dimension, and paired-sample t-tests that compared each dimension to the others (food vs. perfection vs. body-

image) for each question (i.e. Q1: "*Is this about food?*" Q2: "*Is this about perfectionism?*" Q3: "*Is this about the body?*"), confirmed that each of the three dimensions significantly represented the dimension intended (*ps* < 0.01; see Figure 16 for mean ratings). Specifically, the mean of the food-related condition was the highest in question 1 (e.g. "*Is this about food?*") compared to perfectionism- and body image-related scenarios when rated as a food-related scenario. The mean of the perfectionism-related condition was the highest in question 2 (e.g. "*Is this about perfectionism?*") compared to food- and body-related questions. The mean of the body image-related condition was the highest in question 3 (e.g. "*Is this about the body?*") compared to food- and perfectionism-related questions.

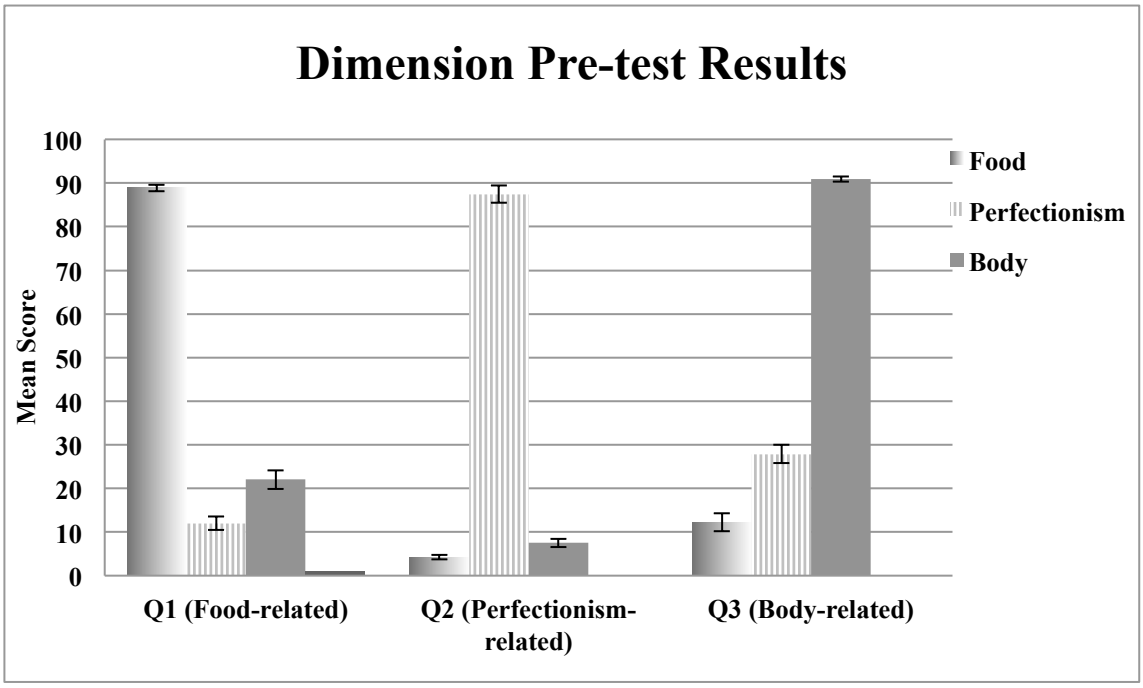


FIGURE 16. MEAN RATINGS GIVEN TO MATERIALS IN EACH DIMENSION (ERROR BARS REPRESENT STANDARD ERRORS).

4.4.3.2. MATCH PRE-TEST

The 36 scenarios (36 food-, 36 perfectionism-, and 36 body image-related versions of each scenario) were then put through a second pre-test, in order to determine that each of the character's emotional responses in the target sentences "matched" or

"mismatched" males' expectations within each scenario. In the second pre-test, 29 native English speaking males between 20 and 35 years old (M = 24.62, SD = 4.84), who had not participated in the first pre-test, nor in the eye-tracking experiment, filled out one of three different questionnaires. Participants were presented with only one version of each of the 36 scenarios (either the food-, perfectionism-, or body image-related version). In half of the scenarios presented to each participant, the character exhibited a positive emotional response, and in half of the scenarios presented to each participant, the character in the scenario exhibited a negative emotional response about the situation. The paired scenarios for each condition were randomly allocated to one of the three questionnaires using Matlab. Each participant was instructed to carefully read the "match" and the "mismatch" version of one scenario (either food-, perfectionism-, or body image-related), and then instructed to chose the one scenario in which the reaction of the character was more unexpected (e.g. "*Choose the scenario you feel that the character's response is NOT what you expected."),* and also then instructed to write why the character's response in the scenario he picked did not meet his expectations *(e.g. "Please write why you felt that the response was unexpected"*; see Figure 17. Match/Mismatch Pre-test Screenshot below).

Participants chose the dimension unexpected response, or the "mismatch" version in all three dimensions with an 87% (M = .87, SD = .04) average accuracy rate for the mismatch version of each dimension. Therefore the materials formed the 36 expected "Match" and unexpected "Mismatch" version in each dimension (36 food, 36 perfectionism-, and 36 body image-related scenarios) for native English-speaking males (see Appendix B for full stimulus materials; see Appendix C for filler materials).

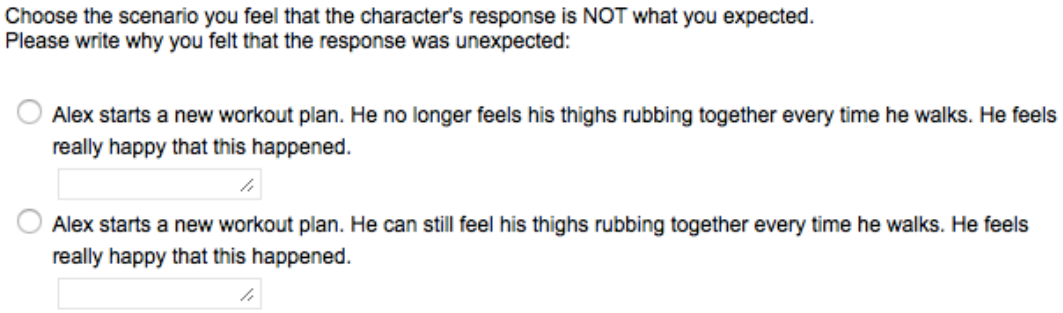


FIGURE 17. MATCH/MISMATCH PRE-TEST SCREENSHOT EXAMPLE.

4.4.4. PROCEDURE

The procedure for Experiment 3 was the same as for Experiments 1 and 2.

4.4.5. EYE-TRACKING DATA ANALYSIS

Prior to analysis, all trials with zero first-pass reading times in two or more adjacent regions were removed, as this indicated that there was track loss or that this portion of text was not read. The trials with zero first-pass reading times in the region, which created the context for the match or mismatch, or the second sentence, were also removed. Following this procedure, 8.24% of the data were removed. Prior to analysis, all trials with zeros for each reading time measure in each region were also removed. Specifically, for first-pass, first fixation duration, and regression path, this procedure accounted for 12.95% of data in *Region 1*, 10.83% in *Region 2*, and 0.24% in *Region 3*. For total reading times, this procedure accounted for 1.88% of the data in *Region 1*, 7.33% in *Region 2*, and 0.2% in *Region 3*. An average accuracy rate for the comprehension questions of 92.16% (*SD* = .07) confirmed that the participants were engaged in the task.

4.5. RESULTS EXPERIMENT 3

4.5.1. EYE-TRACKING DATA RESULTS

Data for each of the three regions in the critical sentence were analyzed using two 3 *dimension* (food vs. perfectionism vs. body image) x 2 *match* (match vs.

mismatch) ANOVAs, one considering participants ($F1$) and one considering items ($F2$) as random variables (see Figures 18-20a-d for descriptive statistics). Both dimension and match were treated as within-subjects factors in the $F1$ analyses, and both dimensions and match were treated as within-items factors in the $F2$ analyses. If sphericity could not be assumed, according to Mauchly's Test of Sphericity, then Greenhouse-Geisser was used. Post-hoc bonferroni corrected ($p = .05/6 = .008$) paired t-tests were performed on the average score independent of the match (match + mismatch/2) for any fully significant main effects of dimension.

4.5.1.1. REGION 1

As in Experiments 1 and 2, in *Region 1* (e.g. "Kade is very") there were longer total reading times for mismatching than matching conditions in Experiment 3, $F1$ (1, 89) = 4.14, $p < .05$; $F2$ (1, 35) = 7.30, $p = .01$. The main effect of dimension was significant by participants but not items in first-pass reading time, $F1$ (1.65, 146.90) = 3.75, $p < .05$; $F2$ (1.59, 55.62) = 1.61, $p = .21$; and in total reading times, $F1$ (2, 178) = 4.51, $p = .01$; $F2$ (1.61, 56.17) = 2.81, $p = .08$ (see Figures 18a-d for Region 1 descriptive statistics). There were no other significant effects (Fs < 2.12, ps > .14). As there were no early effects, significantly longer total reading times in mismatching than matching conditions indicated that participants spent more time re-reading the beginning of the target sentence in mismatched conditions.

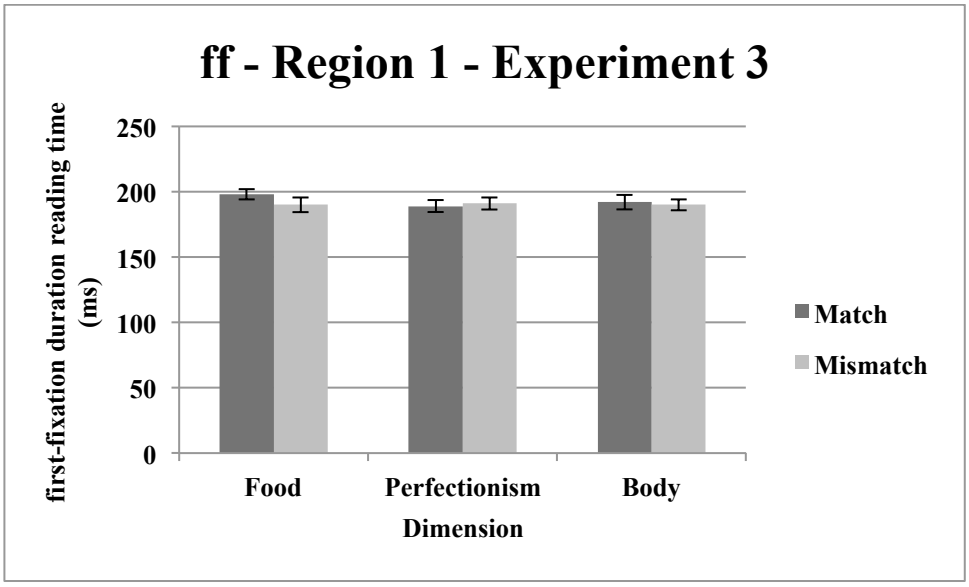


FIGURE 18.a. FIRST-FIXATION DURATION READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FF = FIRST-FIXATION DURATION.

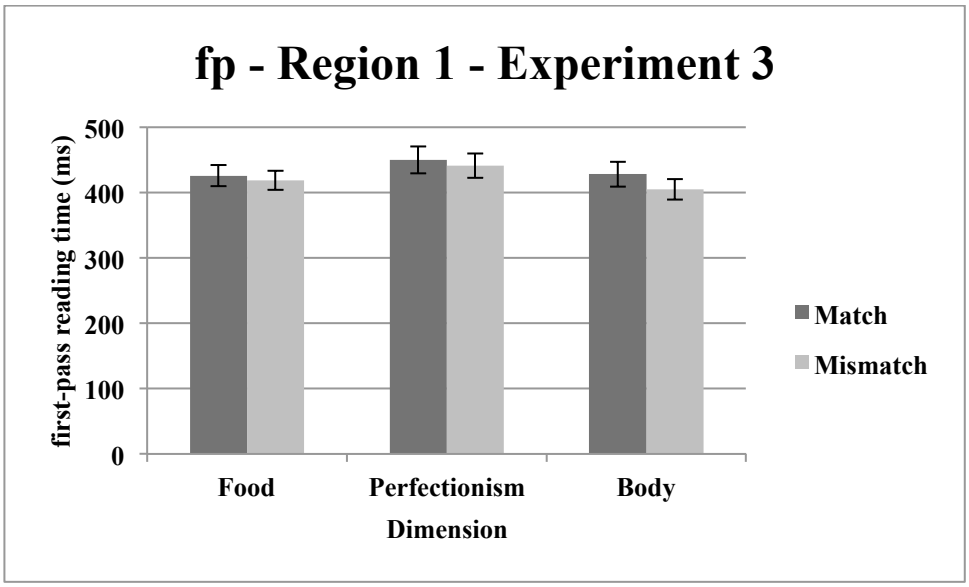


FIGURE 18.b. FIRST-PASS READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FP = FIRST-PASS.

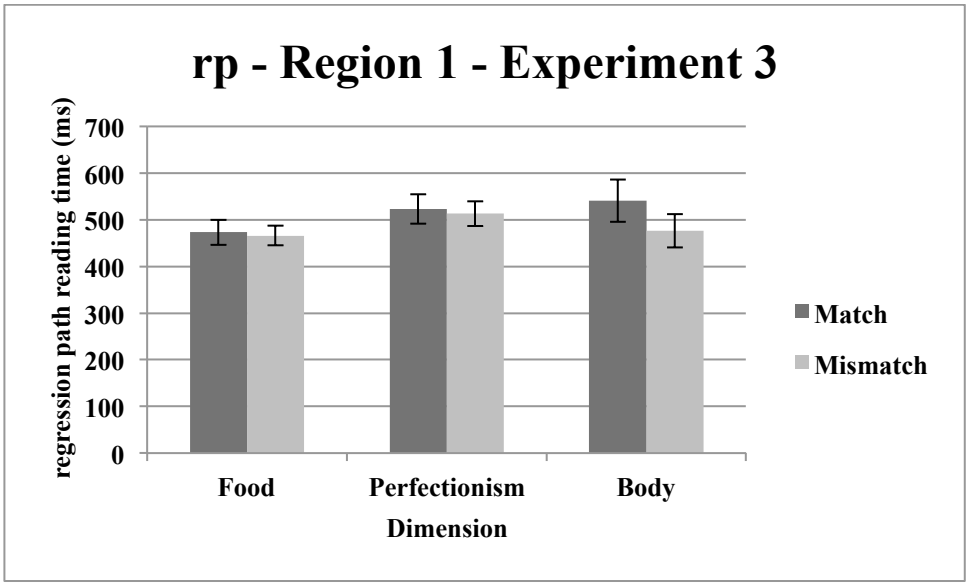


FIGURE 18.c. REGRESSION PATH READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. RP = REGRESSION PATH.

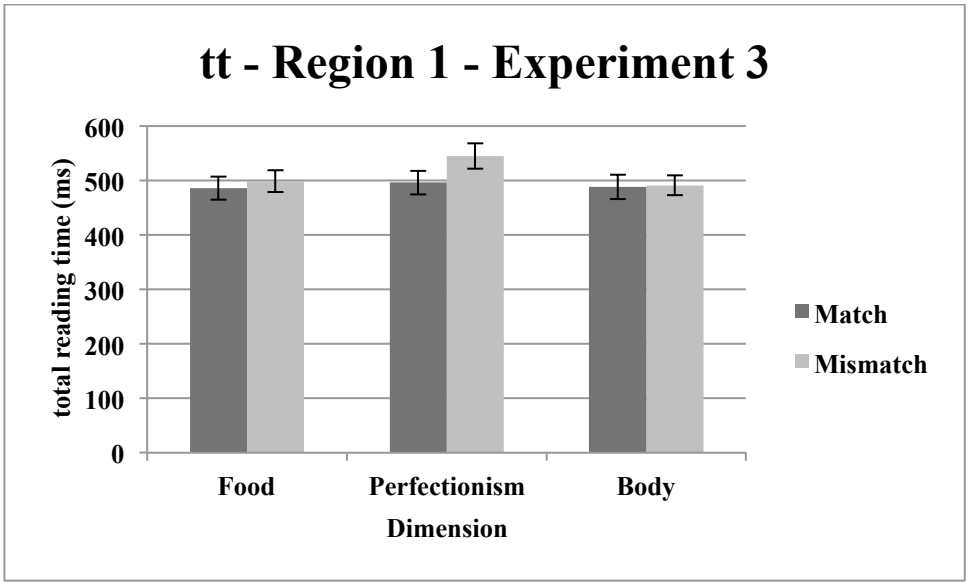


FIGURE 18.d. TOTAL READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. TT = TOTAL READING TIME.

4.5.1.2. REGION 2

As in *Region 1*, in *Region 2* (e.g. *"pleased"*) there were longer total reading times in mismatching than matching conditions, $F1\ (1, 89) = 9.67$, $p < .01$; $F2\ (1, 35) = 15.12$, $p < .001$. There was also a main effect of match in first-fixation duration significant by participants and approaching significance by items $F1\ (1, 89) = 5.58$, $p =$

.02; $F2$ (1, 35) = 3.00, p = .09. There was an interaction between dimension and match in total reading times significant by items but not by participants $F1$ (1.65, 147.01) = 3.54, p = .05; $F2$ (2, 70) = 5.73, p < .01 (see Figures 19a-d for Region 2 descriptive statistics). As the interaction was not fully significant, there was no need to decompose. There were no other significant effects in this region (Fs < 2.03, ps > .14).

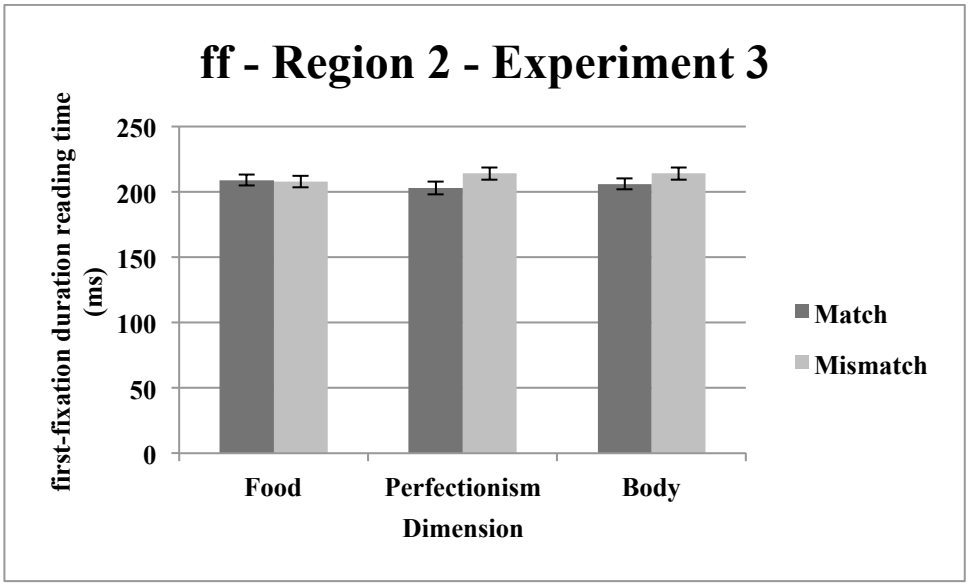


FIGURE 19.a. FIRST-FIXATION DURATION READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FF = FIRST-FIXATION DURATION.

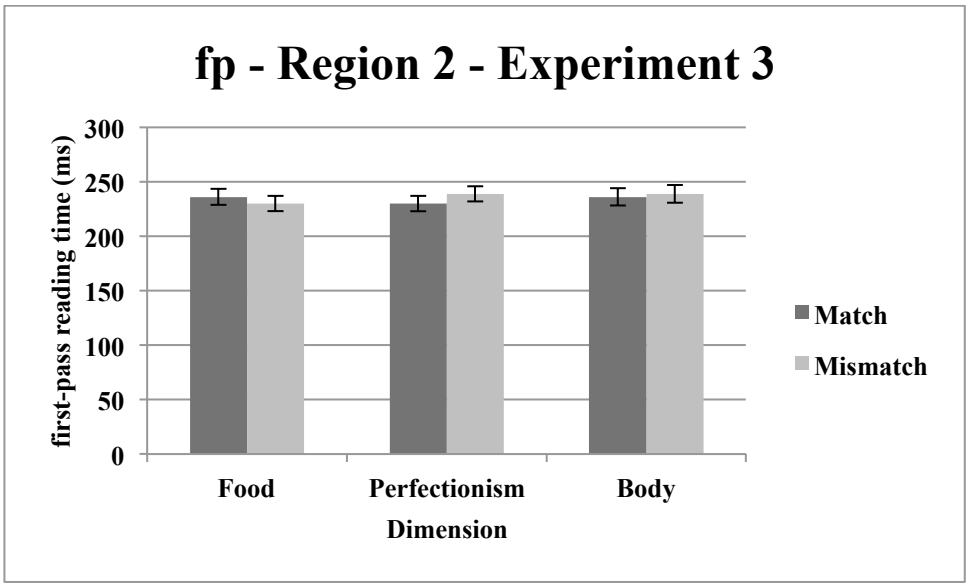


FIGURE 19.b. FIRST-PASS READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FP = FIRST-PASS.

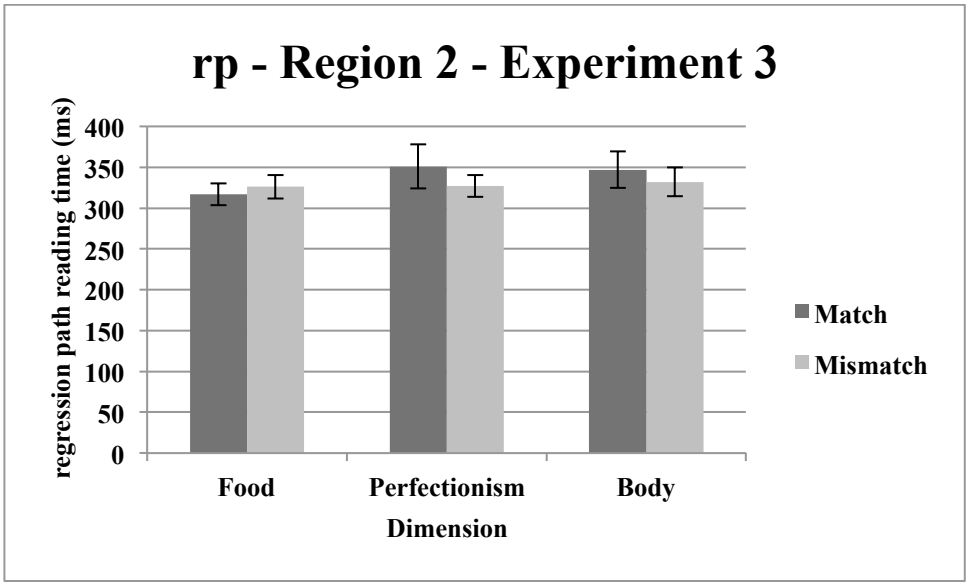


FIGURE 19.c. REGRESSION PATH READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. RP = REGRESSION PATH.

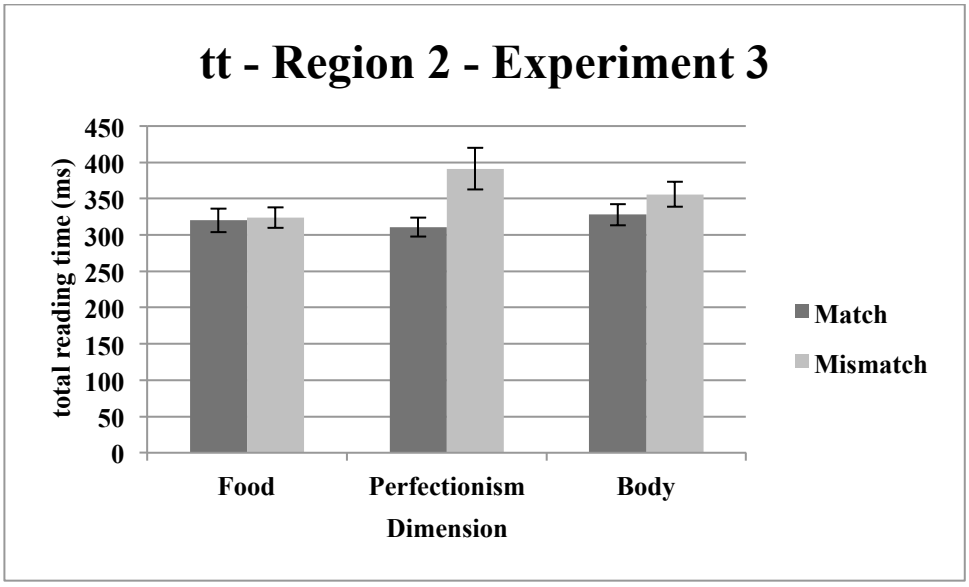


FIGURE 19.d. TOTAL READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. TT = TOTAL READING TIME.

4.5.1.3. REGION 3

Again, in *Region 3* (e.g. *"to have done that."*), total reading times were significantly longer in mismatching than matching conditions, $F1\ (1, 89) = 16.44$, $p < .001$; $F2\ (1, 35) = 43.05$, $p < .001$; and also in first-pass reading time, $F1\ (1,89) = 8.53$, $p < .01$; $F2\ (1, 35) = 8.01$, $p < .01$. There was a main effect of dimension that was

significant by participants but not items in total reading times $F1$ (1.84, 164.07) = 5.07, $p < .01$; $F2$ (2, 70) = 2.72, $p = .07$. There was a main effect of both match and of dimension in regression path $F1$ (1, 89) = 50.96, $p < .001$; $F2$ (1, 35) = 52.47, $p < .001$; $F1$ (1.30, 115.83) = 9.43, $p < .01$; $F2$ (2, 70) = 8.78, $p < .001$. Post-hoc paired t-tests with bonferroni correction (< .008) indicated the mean score averaged over match and mismatch conditions for the perfectionism dimension (M = 1377, SD = 972.0) was significantly higher than the food dimension (M = 1103, SD = 646.9) $t1$ (89) = -4.28, $p < .001$; $t2$ (35) = 4.62, $p < .001$ and the body dimension (M = 1139 1118, SD = 622.8; 55.7) $t1$ (89) = 2.67, $p < .001$; $t2$ (35) = 2.80, $p < .01$ by participants and by items. There was an interaction between dimension and match by participants but not by items in regression path $F1$ (1.77, 157.25) = 5.16, $p < .01$; $F2$ (2, 70) = 3.21, $p = .05$ (see Figures 20a-d for Region 3 descriptive statistics). As the interaction was not fully significant, there was no need to decompose. There were no other significant effects to report in Region 3 ($Fs < 1.76$, $ps > .18$).

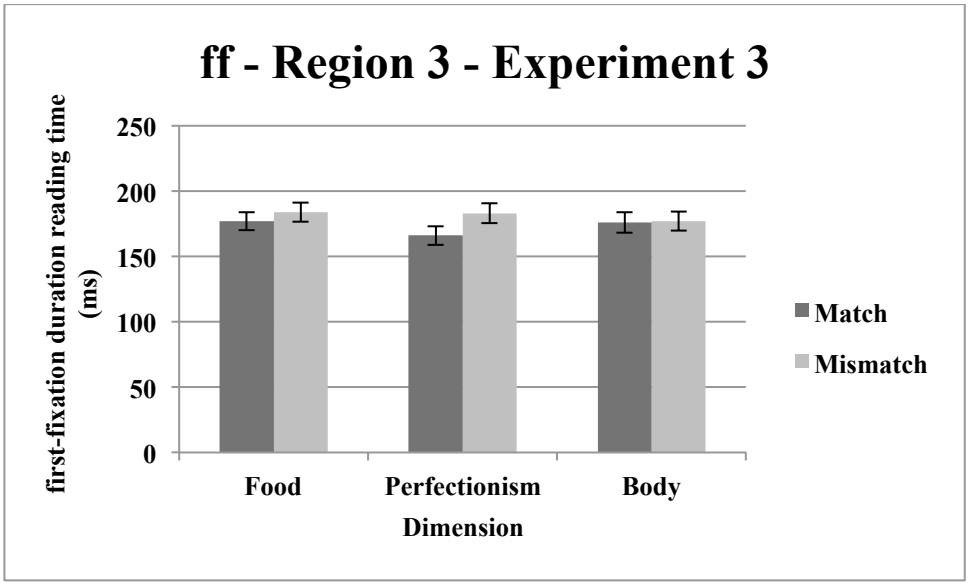


FIGURE 20.a. FIRST-FIXATION DURATION READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FF = FIRST-FIXATION DURATION.

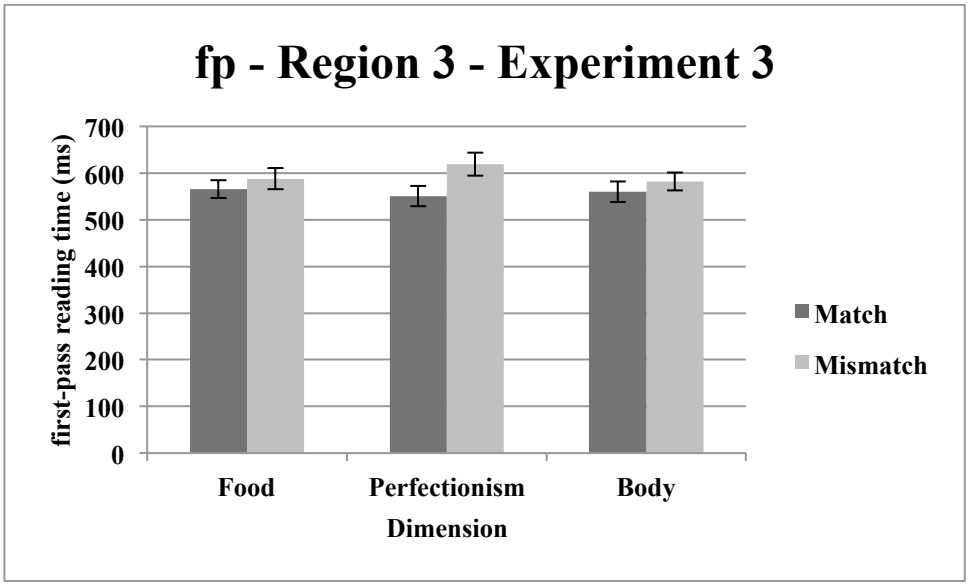


FIGURE 20.b. FIRST-PASS READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FP = FIRST-PASS.

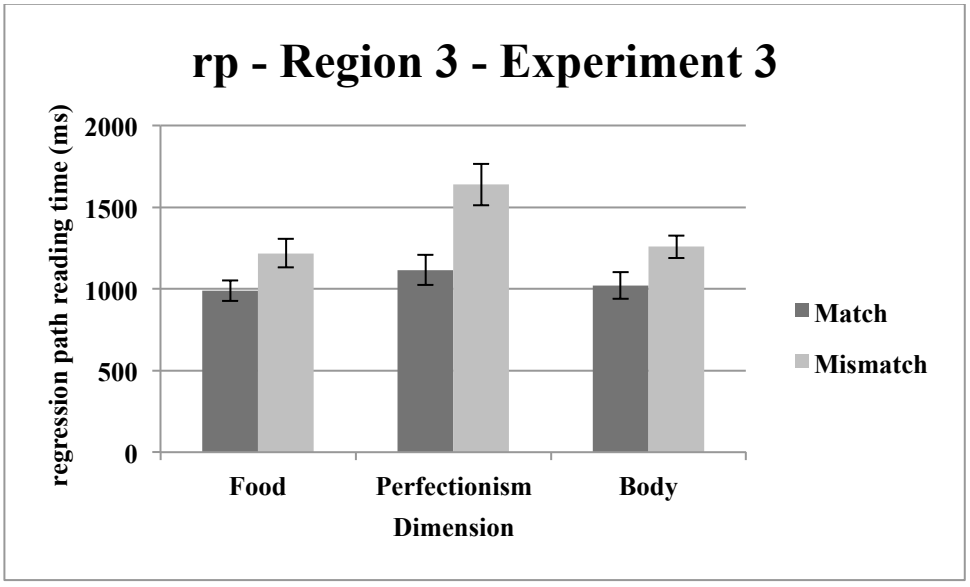


FIGURE 20.c. REGRESSION PATH READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. RP = REGRESSION PATH.

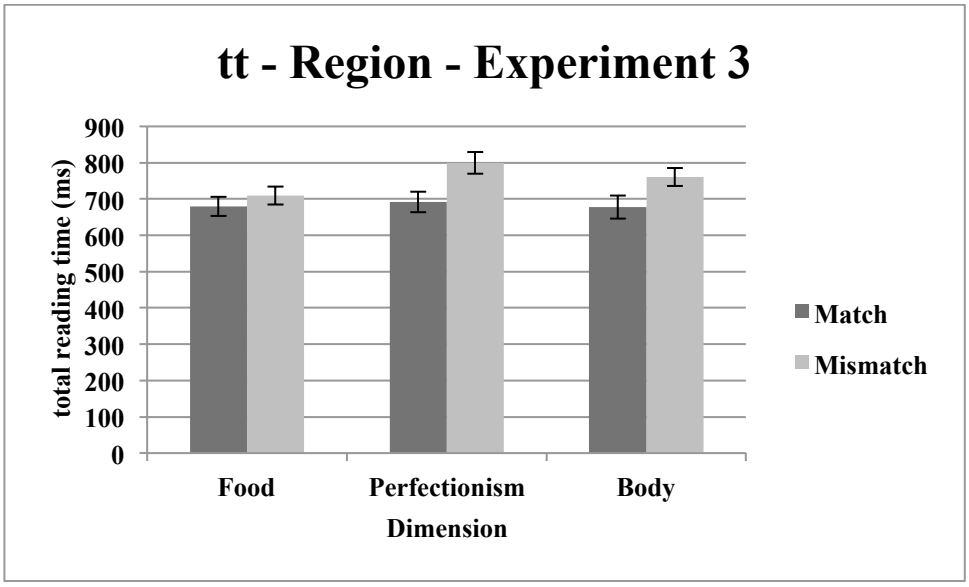


FIGURE 20.d. TOTAL READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. TT = TOTAL READING TIME.

In sum, as expected, there were no significant mismatch effects in early measures of reading behaviour before the emotional response (*Region 2*) was processed, and there were significantly longer total reading times for mismatching than matching dimensions across all analysis regions, as well as for first-pass reading times in *Region 3*. This did not interact with dimension (e.g. food vs. perfectionism vs. body).

4.5.2. DATA ANALYSIS FOR QUESTIONNAIRE MEASURES

4.5.2.1. BODY MASS INDEX (BMI) ANALYSIS

Body Mass Index (BMI) was calculated by dividing each participant's measured weight (in kilograms) by the square of his measured height (in metres) (BMI = Kg/M^2). Participants ranged from 17.17 (underweight) to 39.97 (obese) (M = 24.51, SD = 4.14; see Table 15 for British BMI health standards; Figure 21 for BMI Distribution of Participants).

TABLE 15
BRITISH BMI HEALTH STANDARDS CHART.

BMI Range	Weight Range
< 18.5	Underweight
18.5 – 24.9	Normal Weight
25 – 29.9	Overweight
> 30	Obese

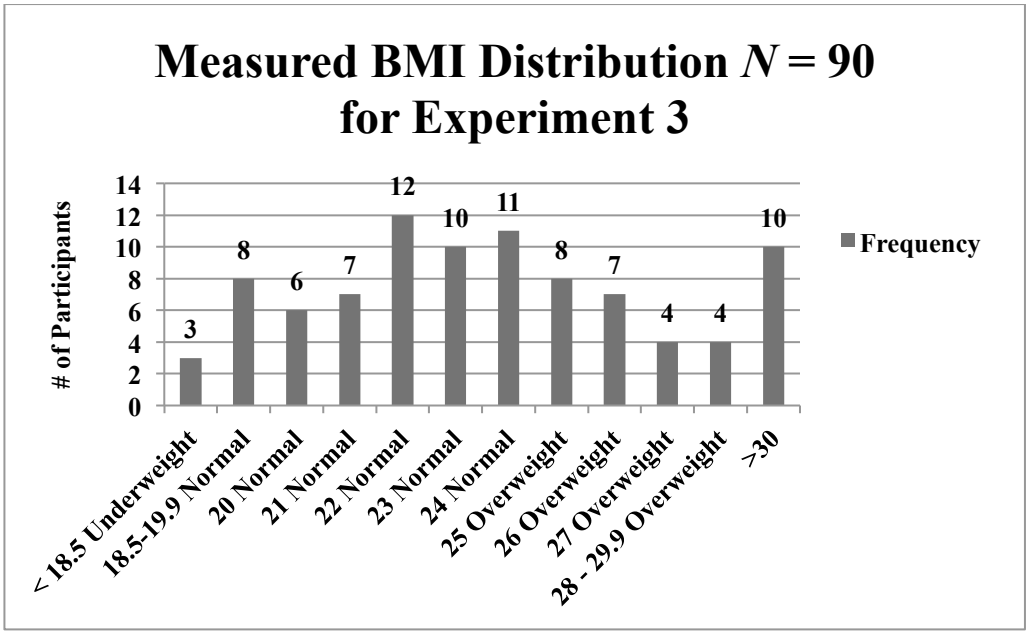


FIGURE 21. BMI DISTRIBUTION OF PARTICIPANTS FOR EXPERIMENT 3.

4.5.2.2. EDE-Q 6.0 ANALYSIS

All of the EDE-Q 6.0 facet scores (Restraint Concern (RC), Eating Concern (EC), Weight Concern (WC), Shape Concern (SC)) for the participants were then calculated using SPSS by adding all of the items for each facet and then dividing the sum by the number of items in that facet. Each participant's Global EDE-Q 6.0 score (eating disorder tendency level) was then computed by calculating the mean sum of all four EDE-Q 6.0 facets together, which may each range from 0 (lowest level of eating disorder tendency) to 6 (extremely high eating disorder tendency). Participants scored from 0 to 3.81 on the Global EDE-Q 6.0 (M = 1.03, SD = .76; see Table 16 for mean scores, and Table 18 for percentile ranks for each of the subscales and Global EDE-Q

scores). The Global EDE-Q 6.0 Cronbach's alpha coefficient was reliable at .87. Participants' scores were comparable to community norms for young men (Lavender et al., 2010; see Table 17 EDE-Q Norms for Young Men).

As with some prior EDE-Q normative studies, a cut-off of ≥ 4 was used to mark severe clinical significance (see Lavender et al., 2010). While none of the males' Global scores exceeded this clinically severe threshold; 2.2% on Restraint, 2.2% on Weight Concern, and 6.6% on Shape Concern facets did exceed the clinical severity threshold.

TABLE 16
EDE-Q 6.0 SCORES AND MEANS OF PARTICIPANTS EXPERIMENT 3.

Measure	**Mean**	***SD***	***N***	**Score Range (Possible)**	**Score Range (Actual)**
Global EDE-Q 6.0	1.03	0.76	90	0 (low) to 6 (extreme)	.00 to 3.81
Restraint Concern (RC) facet	1.16	1.15	90	0 (low) to 6 (extreme)	.00 to 4.60
Eating Concern (EC) facet	0.42	0.64	90	0 (low) to 6 (extreme)	.00 to 4.00
Weight Concern (WC) facet	1.01	1.00	90	0 (low) to 6 (extreme)	.00 to 4.00
Shape Concern (SC) facet	1.52	1.20	90	0 (low) to 6 (extreme)	.00 to 5.38

TABLE 17
EDE-Q 6.0 COMMUNITY NORMS FOR YOUNG MEN (LAVENDER ET AL., 2010).

Measure	**Mean**	***SD***	***N***
Global EDE-Q 6.0 (all 4 facets)	1.09	1.00	404
Restraint Concern (RC) facet	1.04	1.19	404
Eating Concern (EC) facet	0.43	0.77	404
Weight Concern (WC) facet	1.29	1.27	404
Shape Concern (SC) facet	1.59	1.38	404

TABLE 18

PERCENTILE RANKS FOR EDE-Q 6.0 SUBSCALE SCORES OF PARTICIPANTS FOR EXPERIMENT 3.

Percentile rank	Restraint	EC	WC	SC	Global Score
Mean (*SD*)	1.16 (1.15)	.42 (.64)	1.01 (1.00)	1.52 (1.20)	1.03 (.76)
5	-	-	-	.13	.19
10	-	-	-	.26	.24
15	-	-	.20	.46	.31
20	-	-	.20	.63	.36
25	.20	-	.20	.75	.39
30	.40	-	.40	.75	.53
35	.40	-	.40	.88	.59
40	.40	.20	.40	.88	.64
45	.60	.20	.60	1.00	.77
50	.90	.20	.60	1.13	.83
55	1.00	.20	.81	1.25	.94
60	1.20	.20	1.00	1.38	1.06
65	1.20	.40	1.20	1.63	1.20
70	1.54	.40	1.40	1.75	1.32
75	2.05	.60	1.40	2.16	1.42
80	2.40	.76	1.76	2.38	1.60
85	2.40	.80	1.87	2.75	1.75
90	2.78	1.20	2.40	3.74	2.17
95	3.60	1.58	3.38	4.06	2.60
99	-	-	-	-	-

4.5.2.2.1. Eating Disorder Behaviour Results

The proportion of males who reported engaging in disordered eating behaviours at all, and those who reported engaging in disordered behaviours as a regular occurrence were defined according to a prior male normative study (Lavender et al., 2010).

4.5.2.2.1.1. Dietary Restraint

11.1% of males reported restraining their diet for longer periods of time (≥ 8 hours) in order to influence their shape or weight, with 2.2% of males making this a regular occurrence (≥ 13 days in the prior 28 days).

4.5.2.2.1.2. Binge Eating

80.0% of male participants reported eating unusually large amounts of food given the circumstances (59.8% as a regular occurrence; ≥ 4 times in the prior 28 days), and 31.1% of these binges included a sense of having lost control at the time (21% as a regular occurrence; ≥ 4 times in the prior 28 days). 45.6% of males reported binge eating and having a sense of loss of control at the time (2.2% as a regular occurrence; ≥ 13 days in the prior 28 days).

4.5.2.2.1.3. Compensation & Purging

44.4% of males reported exercising in a way which was driven or compulsive, in order to control his weight, shape, amount of fat, or to burn off calories, 7.8% as a regular occurrence (≥ 20 times in 28 days). 1.1% of males reported self-induced vomiting to control his shape or weight, and also 1.1% of males reported laxative misuse in order to control shape or weight.

4.5.2.3. Examining the relationship between reading & Eating Behaviour

In order to evaluate the association between different processing of food-, perfectionism-, and body image-related materials and the participant's level of eating disorder tendency, enter multi-linear regression analyses was carried out with the size of

the mismatch effect (mismatch – match) for each appropriate dimension as a predictor variable, and the participant's score on the EDE-Q 6.0 and BMI as the criterion variables. Regarding the EDE-Q 6.0 related regression, tests indicated that there were no influential outliers (Cook's Distance values were ≤ .148), that residual terms were not correlated (Durbin-Watson value = 1.944), and that multicollinearity was not an issue (Tolerance values = .988; VIF values = 1.012). Cook's Distance revealed one outlier (value = 14.53), which was removed for the BMI-related regression, after which tests indicated there were no other influential outliers (Cook's Distance values were ≤ .115). Tests also indicated that residual terms were not correlated (Durbin-Watson value = 2.034), and multicollinearity was not an issue (Tolerance values = .880; VIF values = 1.136).

4.5.2.3.1. EDE-Q 6.0 Scores and Mismatch Score Analysis

In relation to the EDE-Q 6.0, the size of the mismatch effect for body image-related materials in total reading time for *Region 1* predicted eating disorder tendency. Specifically, participants with a *smaller* mismatch effect showed *greater* eating disorder tendencies, which would be in contrast to the prediction of a *larger* mismatch effect resulting in *higher* eating disorder tendency levels. However, in first-fixation duration for *Region 3*, *higher* perfectionism-related mismatch effect scores (mm) predicted *higher* eating disorder tendency (see Table 19), which is in the expected direction.

TABLE 19
Enter Multiple Regression Model: EDE-Q 6.0 Experiment 3 (N = 90).

Model	***b***	***SE b***	***ß***
Constant	.986	.079	
Total Reading Time mm Region 1 Body	-.001	.000	-.23*
First-fixation mm Region 3 Perfectionism	.002	.001	. 23**

Notes. R^2 = .09 for Model, * p = .027; ** p = .028

4.5.2.3.2. BMI SCORES AND MISMATCH SCORE ANALYSIS

Regarding the measured BMI, *larger* total reading time mismatch effect scores for perfectionism-related materials in *Region 2* predicted *smaller* measured BMI (see Table 20), which is in the direction expected for males having greater difficulty processing these scenarios. Also, to a lesser extent, higher regression path mismatch effect scores for perfectionism-related materials in *Region 3* (the spillover region) predicted higher measured BMI. This was in the unexpected direction for males having greater difficulty processing these scenarios.

TABLE 20
ENTER MULTIPLE REGRESSION MODEL: BMI EXPERIMENT 3 (N = 89).

Model	*b*	*SE b*	*ß*
Constant	24.162	.473	
Total Reading Time mm Region 2	-.007	.003	-.24*
Perfectionism	.001	.001	.23**
Regression Path mm Region 3 Perfectionism			

Notes. R^2 = .07, * p = .03; **p = .045

To clarify how males' fat- and muscle-percentage was related to their measured BMI, bivariate correlations between fat percentage, muscle percentage, and BMI were performed. This showed that males' actual muscle percentage was significantly negatively related to actual BMI (r = -.76, p < .001, N = 89), and males' fat percentage was significantly positively related to their actual BMI (r = .88, p < .001, N = 89), suggesting that males in this study with higher BMI were larger from fat-percentages rather from muscle-percentage.

4.6. EXPERIMENT 3 SUMMARY

In summary, Experiment 3 revealed several key findings for males and eating disorder tendencies. Firstly, as with Experiments 1 and 2 for females, the current eye-tracking results demonstrated a mismatch effect for all three dimensions (food-,

perfectionism-, and body image-related scenarios). This would suggest that both female and male readers notice an unexpected emotional response from a character, depending upon their personal expectations and world knowledge, causing them to look back and re-read the text (e.g. Filik, 2008; Filik & Leuthold, 2008; Filik & Leuthold, 2013; Filik et al., 2017a; Rayner et al., 2004; Warren et al., 2008).

Enter linear multi-regressions were used to investigate whether the reading behaviour of expected and unexpected character response toward unhealthy food, negative body, or perfectionism-related scenarios predicted eating disorder tendencies. The size of the mismatch effect for perfectionism-related scenarios predicted higher eating disorder tendencies in early measures (first-fixation) in spillover region (Region 3; e.g. *"to have done that."*) in these third-person materials, which was in the expected direction. This result supports theories of eating disorders that include perfectionism-related underlying factors contributing to the development and maintenance of eating disorders, such as the Vulnerability-Stress Model (Joiner et al., 1997), Vohs et al.'s (1999) the Three-Way Interactive Model for Bulimia Nervosa (Vohs et al., 1999), Bardone et al.'s (2000) Three-Factor Interactive Model for Bulimia Nervosa (Bardone et al., 2000), Heatherton and Baumeister's (1991) Escape from Self-Awareness Theory (Heatherton & Baumeister, 1991), the Cognitive-Interpersonal Model of Anorexia Nervosa (Schmidt & Treasure, 2006; Treasure & Schmidt, 2013), and the Transdiagnostic Model for Eating Disorders (Fairburn et al., 2003). However, as many eating disorder theories are diagnosis-specific (i.e. for anorexia nervosa, bulimia nervosa, or binge eating disorder independently), due to the transdiagnostic approach of the experiments within this thesis, Fairburn et al.'s (2003) Transdiagnostic Model for Eating Disorders may be most strongly supported.

Also, the opposite pattern was found in total reading times for body image-related materials in *Region 1* (e.g. *"Kade is very"*), where a *smaller* mismatch effect in body image-related scenarios predicted *higher* eating disorder levels. This may support literature of later processing avoidance of "threatening" information for those with eating disorders, called cognitive avoidance (e.g. Waller & Meyer, 1997). Although there are mixed results within the literature between attention towards negative disorder threatening related information and/or avoidance of negative disorder threatening related information, this may be because of automatic versus later processing, and the different methods used to examine these mechanisms. For instance, in an eye-tracking study to investigate the attentional bias or avoidance of food pictures between AN and HC's, Giel et al. (2011) found an initial automatic attention towards, followed by an avoidance of food with AN patients. Therefore, once the food pictures were encoded as food stimuli, those with AN (unlike HCs) avoided the eating disorder salient information. Therefore, this result in later measures, as also proposed for Experiment 1, may provide more evidence that once those with greater eating disorder tendencies processed the unexpected emotion response (*Region 2*; e.g. *"pleased"*) within the disease-salient body-related context, they may have avoided going back to re-read the beginning of the target sentence in Region 1 (; e.g. "*Kade is very*"). Therefore, unlike the Stroop task, using eye-tracking during reading, the temporal aspect between the initial fixation on information in earlier measures that was in contrast to individual's worldview and expectation of emotional response within context of disease-salient information, may automatically alert those with a disorder to an early mismatch effect. In addition, the shift to the cognitive-behavioural avoidance of the mismatch within context of threatening information in later measures and processing, may also be detected in these experiments, using eye-tracking during reading. Therefore, eye-

tracking may detect temporal differences within processing unexpected character response to the "threat" or situation, and this processing disturbance is able to predict the level of eating disorder tendencies.

As in the prior female studies (Experiment 1 and Experiment 2), with males in Experiment 3, it was also found that the size of the mismatch effect for perfectionism-related materials was key in predicting both eating disorder level and participants' measured BMI. Furthermore, *larger* mismatch effects in total reading times for perfectionism-related scenarios in Region 2 (e.g. *"pleased"*) predicted *smaller* measured BMI, which for males is again in the expected direction. Although males, unlike females, often indicate they would like a more muscular body, they also, similar to females, may prefer a leaner body which is toned and has little body fat (e.g. Pope et al., 2000a; Ridgeway & Tylka, 2005; Smolak & Murnen, 2008). In Experiment 3 males' actual muscle percentage was negatively related to actual BMI, and males' fat percentage was positively related to their actual BMI. This suggests that males with higher BMI were actually fatter rather than more muscular. However, those who fixated longer on the critical region (e.g. *"pleased"*) in mismatched perfectionism-related scenarios predicted thinner (less fat) BMI. To a lesser extent, those who had reading processing difficulty in scenarios that mismatched their expectations compared to match for perfectionism-related scenarios predicted larger BMI. Therefore, larger males (greater BMI) had processing difficulty of the target word detected in the spillover region (Region 3), whilst thinner males had processing difficulty on the emotion word (Region 2), showing that different information processing strategies for perfectionism-related context predicted different BMI level in males. Unlike females, the limited research available for males indicates that they typically would prefer to have a leaner but more muscular body, rather than merely a "skinnier" body (Dakanalis

et al., 2012; Leit et al., 2001; Pope et al., 1999). Therefore, these results may suggest that men may have different eating or behavioural habits associated with eating disorder tendencies than those behaviours that women with eating disorder tendencies exhibit (Bergeron & Tylka, 2007; Chittester & Hausenblas, 2009; McCreary et al., 2007; Olivardia et al., 2004; Tod et al., 2012). Although the perfectionism-related scenarios did not include body-, food-, or explicit or obvious "eating disorder-related" materials, these study results build evidence that processing general perfectionism-related materials with an emotional expectation aspect may be salient to females and males with higher levels of eating disorders.

As the materials in this current study were in third-person, about other male characters, it was uncertain whether the males were reading the materials and applying it to themselves, or if they were attempting to understand how the characters would feel in the given situations. Since internalisation is suggested to be related to eating disorder tendencies (Durso et al., 2012; Salmela-Aro et al., 2001; Vartanian, 2009), as with females, Experiment 3 was replicated in second-person with males. That is, the materials were directed at male participants, with male names replaced by the word "*you*", in order to influence participants to read the materials from their own perspective.

4.7. EXPERIMENT 4 - SECOND-PERSON EYE-TRACKING STUDY WITH MALES

4.8. METHOD

4.8.1. PARTICIPANTS

Ninety male native-English speakers aged between 18 and 35 years old (M = 20.50, SD = 2.22) with normal or corrected vision and no history of neurological illness or reading disability, and who had not participated in Experiment 3, were recruited from Nottinghamshire. As with the other experiments, the study was advertised as a general

reading study; without mention of health or eating disorders. They received an inconvenience allowance or course credit for participating.

4.8.2. STIMULUS MATERIALS AND DESIGN, AND PROCEDURE

In Experiment 4, the stimulus materials from Experiment 3 were used, but changed to second-person, which were directed at the male participants (see Table 21). Specifically, male names were changed to the word "*you*" (see Appendix B for full set of stimulus materials; see Appendix C for full set of filler items). Otherwise, the design, procedure, and eye-tracking analysis were all identical to Experiment 3.

TABLE 21
EXAMPLE MATERIAL FROM EXPERIMENT 4 WITH ANALYSIS REGIONS.

Scenario Type	**Example**
Food-related Match	You stop by the shop on your way home from work. You get a large tub of ice cream, and go home and eat a small portion./ You are very Region 1 / pleased Region 2 / to have done that. Region 3 /
Food-related Mismatch	You stop by the shop on your way home from work. You get a large tub of ice cream, and go home and eat the whole thing./ You are very Region 1 / pleased Region 2 / to have done that. Region 3 /
Body image-related Match	You go in for a regular check-up. Your doctor comments that you have lost quite a bit of fat since your last appointment./ You are very Region 1 / pleased Region 2 / to have done that. Region 3 /
Body image-related Mismatch	You go in for a regular check-up. Your doctor comments that you have gained quite a bit of fat since your last appointment./ You are very Region 1 / pleased Region 2 / to have done that. Region 3 /
Perfectionism-related Match	You work on creating music and sounds for a soundtrack. You listen to what you created and you notice that every note flows together perfectly./ You are very Region 1 / pleased Region 2 / to have done that. Region 3 /
Perfectionism-related Mismatch	You work on creating music and sounds for a soundtrack. You listen to what you created and you notice that not every note flows together perfectly./ You are very Region 1 / pleased Region 2 / to have done that. Region 3 /

As in the previous experiments, after the eye-tracking task, participants completed the Eating Disorder Examination Questionnaire (EDE-Q 6.0; Fairburn &

Beglin, 2008) to measure participants' eating disorder level, and participants' height and weight were measured in order to calculate their BMI. As in Experiment 3, a bioelectrical impendence scale was also used to measure males' body fat- and muscle-percentage to clarify the body composition of the BMI.

4.8.3. Eye-Tracking Data Analysis

Prior to analysis, all trials with zero first-pass reading times in two or more adjacent regions were removed, as this indicated that there was track loss or that this portion of text was not read. The trials with zero first-pass reading times in the region, which created the context for the match or mismatch (or the second sentence) were also removed. Following this procedure, 10.83% of the data were removed. Prior to analysis, all trials with zeros for each reading time measure in each region were also removed. Specifically, for first-pass, first fixation duration, and regression path, this procedure accounted for 23.96% of data in *Region 1*, 10.38% in *Region 2*, and 1.9% in *Region 3*. For total reading times, this procedure accounted for 6.27% of the data in *Region 1*, 6.99% in *Region 2*, and 1.87% in *Region 3*. An average accuracy rate for the comprehension questions of 92.29% (*SD* = .06) confirmed that the participants were engaged in the task.

4.9. Results Experiment 4

4.9.1. Eye-Tracking Data Results

Data for each of the three regions in the critical sentence were analyzed using two 3 *dimension* (food vs. perfectionism vs. body image) x 2 *match* (match vs. mismatch) ANOVAs, one considering participants ($F1$) and one considering items ($F2$) as random variables (see Figures 22-24a-d for descriptive statistics). Both dimension and match were treated as within-subjects factors in the $F1$ analyses, and both dimension and match were treated as within-items factors in the $F2$ analyses. If

sphericity could not be assumed, according to Mauchly's Test of Sphericity, then Greenhouse-Geisser was used.

Post-hoc bonferroni corrected (p = .05/6 = .008) paired t-tests were conducted on the average score independent of the match condition (match + mismatch/2) for any fully significant main effects of dimension.

4.9.1.1. REGION 1

As in Experiments 1, 2, and 3, in *Region 1* (e.g. "*You are very*") there were longer total reading times for mismatching than matching conditions, $F1$ (1, 89) = 20.47, $p < .001$; $F2$ (1, 35) = 11.54, $p = .002$. The main effect of dimension was significant by participants but not items in total reading times, $F1$ (2, 178) = 4.39, p = .01; $F2$ (2, 70) = 2.43, $p = .10$. There was an interaction between dimension and match significant by participants but not by items in first-fixation duration $F1$ (1.73, 153.98), 3.97, $p = .03$; $F2$ (2, 70) = 2.76, $p = .07$, and significant by items but not by participants in regression path $F1$ (1.87, 166.09) = 2.63, p = .08; $F2$ (1.66, 59.89) = 3.44, p = .047 (see Figures 22a-d for descriptive statistics for Region 1). As the interaction was not fully significant, there was no need to decompose. As there were no effects in early measures, significantly longer total reading times in mismatching than matching conditions indicated that participants spent more time re-reading the beginning of the target sentence in mismatched conditions. There were no other significant effects to report (Fs < 1.87, ps > .16).

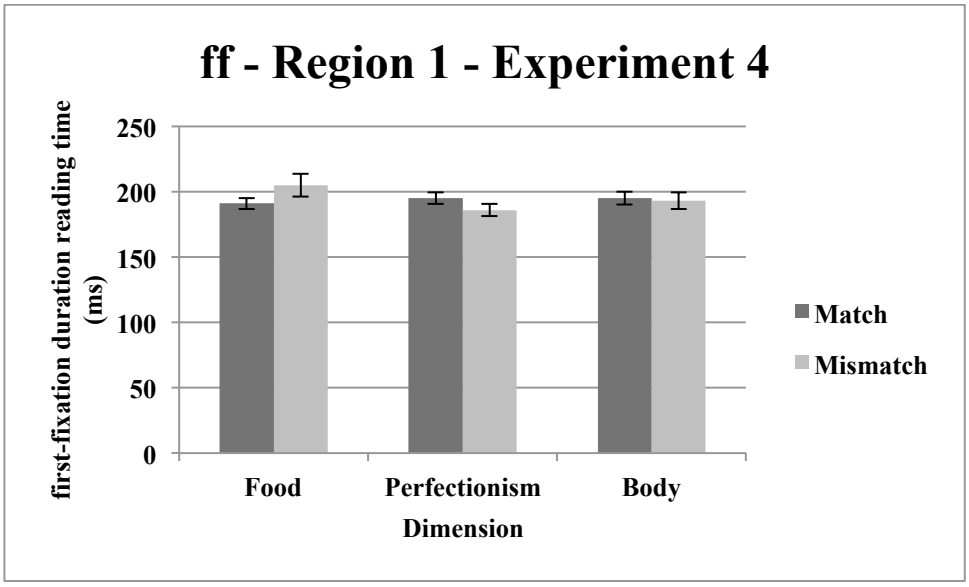


FIGURE 22.a. FIRST-FIXATION DURATION READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FF = FIRST-FIXATION DURATION.

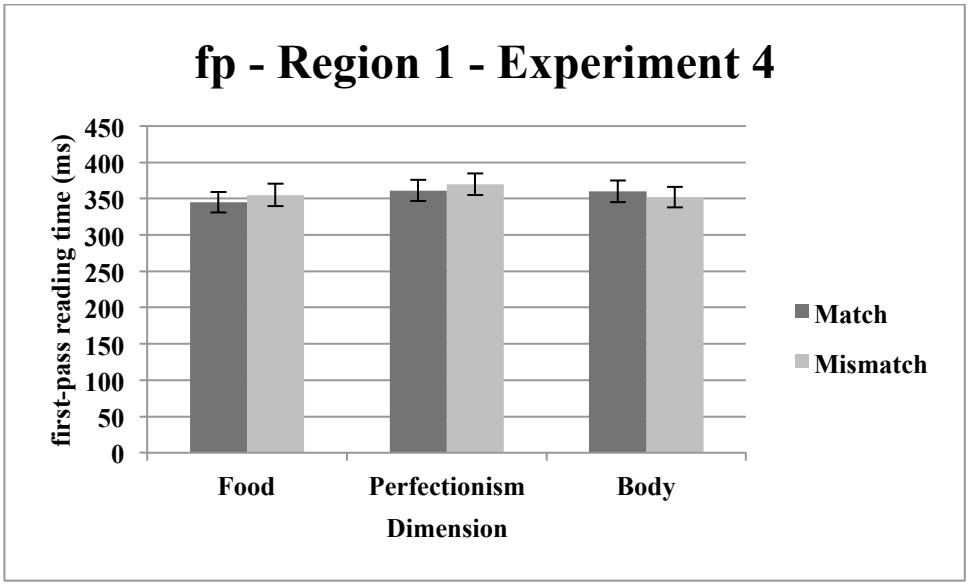


FIGURE 22.b. FIRST-PASS READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FP = FIRST-PASS.

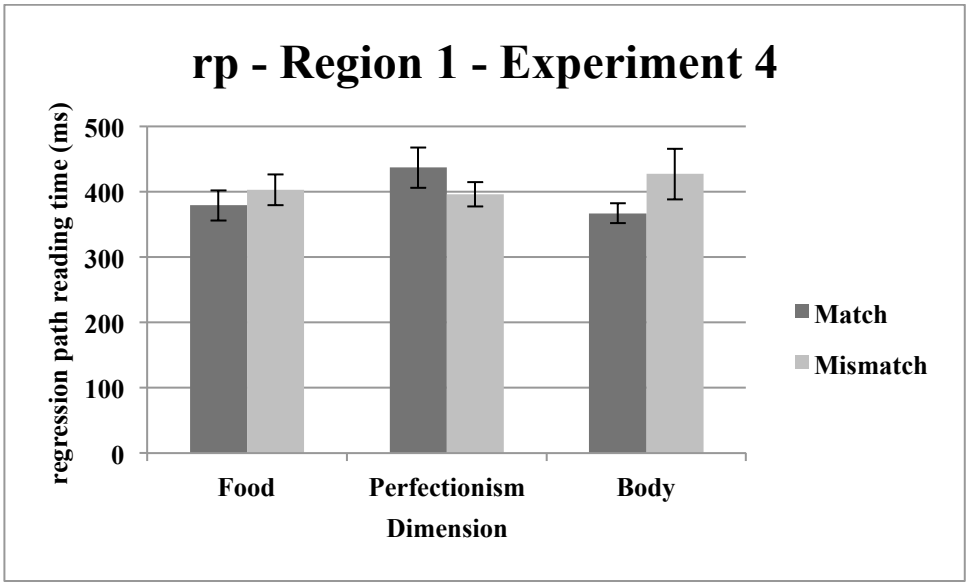


FIGURE 22.c. REGRESSION PATH READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. RP = REGRESSION PATH.

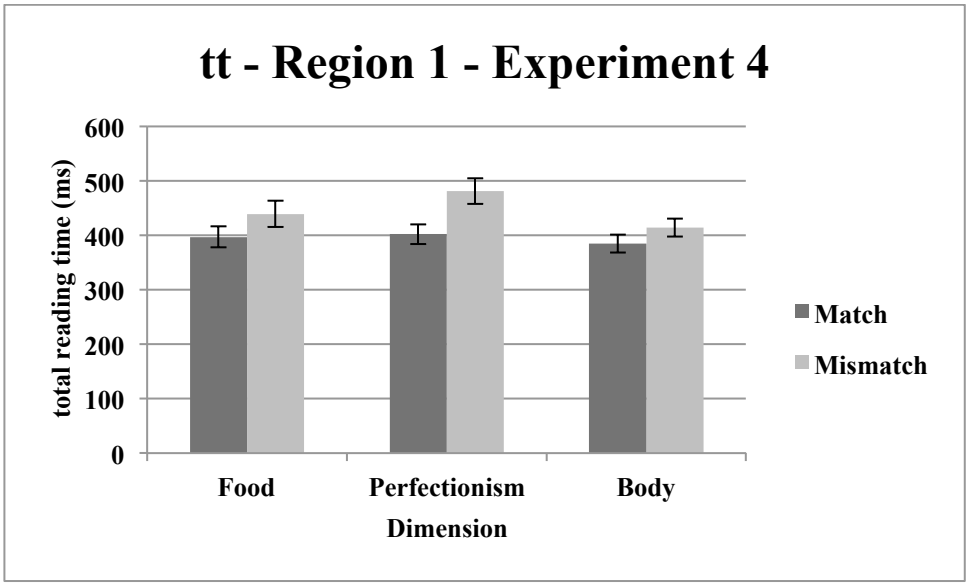


FIGURE 22.d. TOTAL READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. TT = TOTAL READING TIME.

4.9.1.2. REGION 2

As in *Region 1*, in *Region 2* (e.g. *"pleased"*) there were longer total reading times in mismatching than matching conditions, $F1\ (1, 89) = 26.90$, $p < .001$; $F2\ (1, 35) = 25.39$, $p < .001$. In first-past reading time there was a main effect of match by participants but not by items, $F1\ (1, 89) = 4.10$, $p = .046$; $F2\ (1, 35) = 2.04$, $p = .16$. There was an interaction between dimension and match by participants but not by items

in first-past reading time $F1$ (2, 178) = 3.23, p = .04; $F2$ (1.58, 55.26) = 2.71, p = .09, and significant by items but not by participants in first-fixation duration $F1$ (2, 178) = 1.23, p = .295; $F2$ (2, 70) = 3.78, p = .03 (see Figures 23a-d for descriptive statistics for Region 2). There were no other significant effects in this region (Fs < 2.90, ps > .07).

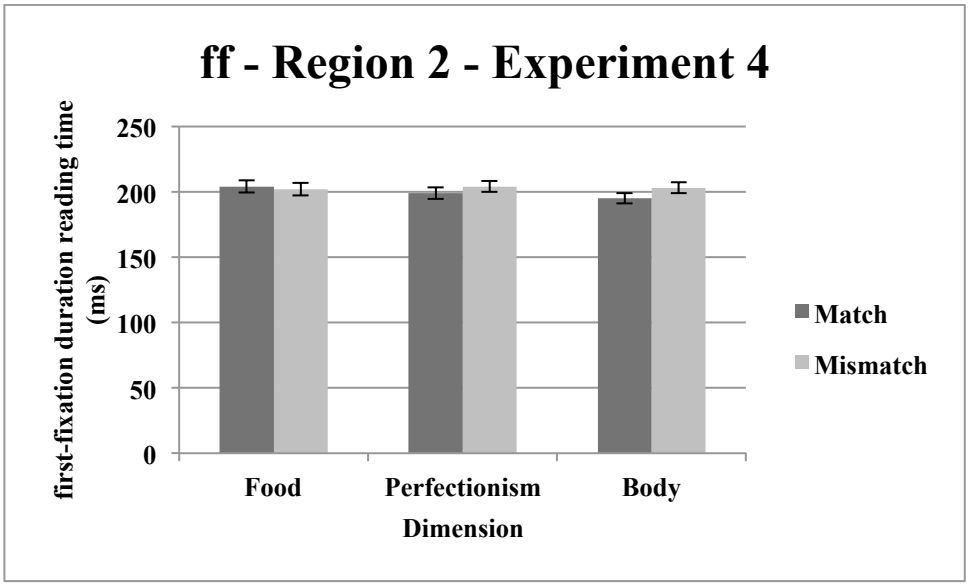


FIGURE 23.a. FIRST-FIXATION DURATION READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FF = FIRST-FIXATION DURATION.

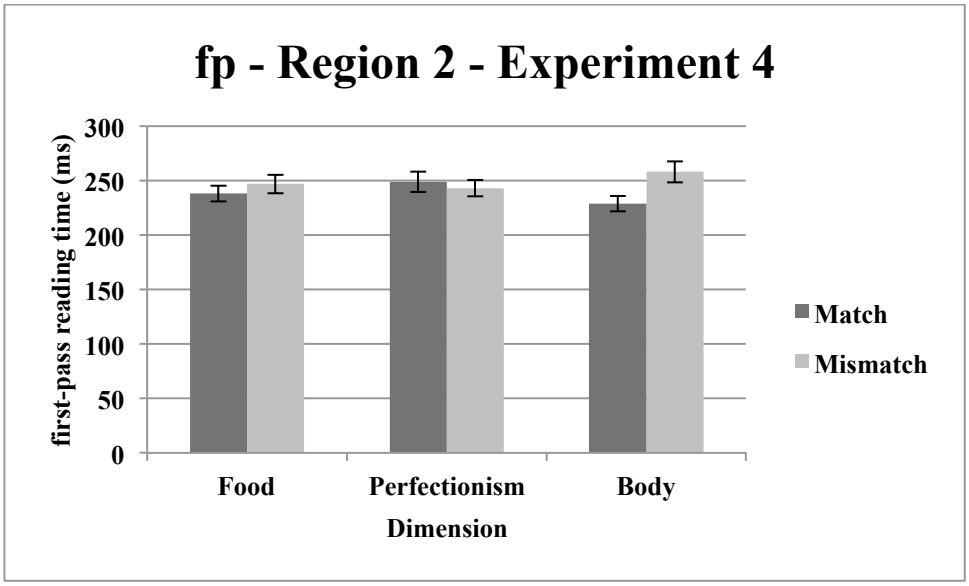


FIGURE 23.b. FIRST-PASS READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FP = FIRST-PASS.

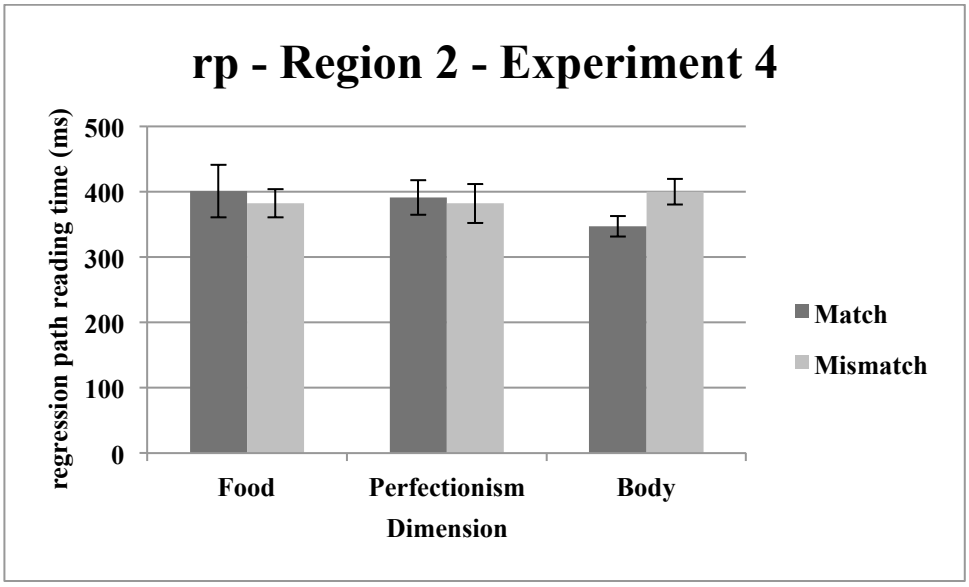


FIGURE 23.c. REGRESSION PATH READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. RP = REGRESSION PATH.

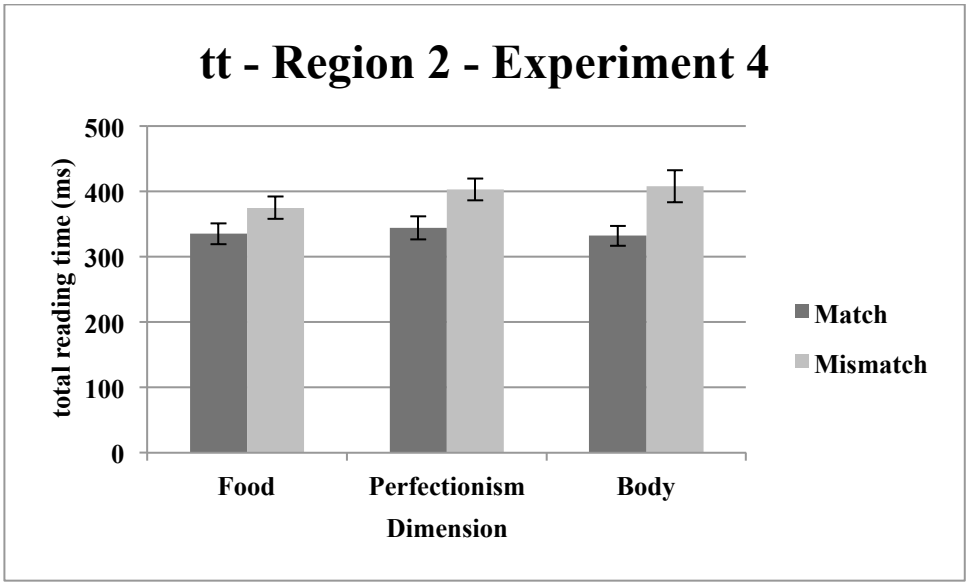


FIGURE 23.d. TOTAL READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. TT = TOTAL READING TIME.

4.9.1.3. REGION 3

As in both *Region 1* and *Region 2,* in *Region 3* (e.g. *"to have done that."*) there were longer total reading times in mismatching than matching conditions, $F1\ (1, 89) = 34.25$, $p < .001$; $F2\ (1, 35) = 26.97$, $p < .001$. There were main effects of match and dimension that were significant in regression path $F1\ (1, 89) = 48.82$, $p < .001$; $F2$ (1,

35) = 73.18, $p < .001$; $F1$ (1.79, 158.83) = 13.69, $p < .001$; $F2$ (2, 70) = 7.57, $p = .001$. Bonferroni corrected post-hoc paired t-tests ($p < .008$) indicated that the mean score for the perfectionism dimension ($M = 1440$, $SD = 889.0$) was significantly higher than the food dimension ($M = 1169$, $SD = 747.9$) $t1$ (89) = 4.92, $p < .001$; $t2$ (35) = 3.87, $p < .001$ and the body dimension ($M = 1189$, $SD = 710.4$) $t1$ (89) = 3.76, $p < .001$; $t2$ (35) = 2.90, $p = .006$ by participants and by items, whereas the food and body dimensions were not significantly different ($ts < .40$, $ps > .692$). There was a main effect of match that was significant by participants but not items in first-pass reading time, $F1$ (1, 89) = 5.55, $p = .02$; $F2$ (1, 35) = 3.58, $p = .07$. There was an interaction between dimension and match not significant by participants but significant by items in regression path $F1$ (2, 178) = 2.89, $p = .06$; $F2$ (2, 70) = 4.53, $p = .01$ (see Figures 24a-d for descriptive statistics for Region 3). As the interaction was not fully significant, there was no need to decompose. There were no other significant effects to report in *Region 3* ($Fs < 2.6$, $ps > .06$).

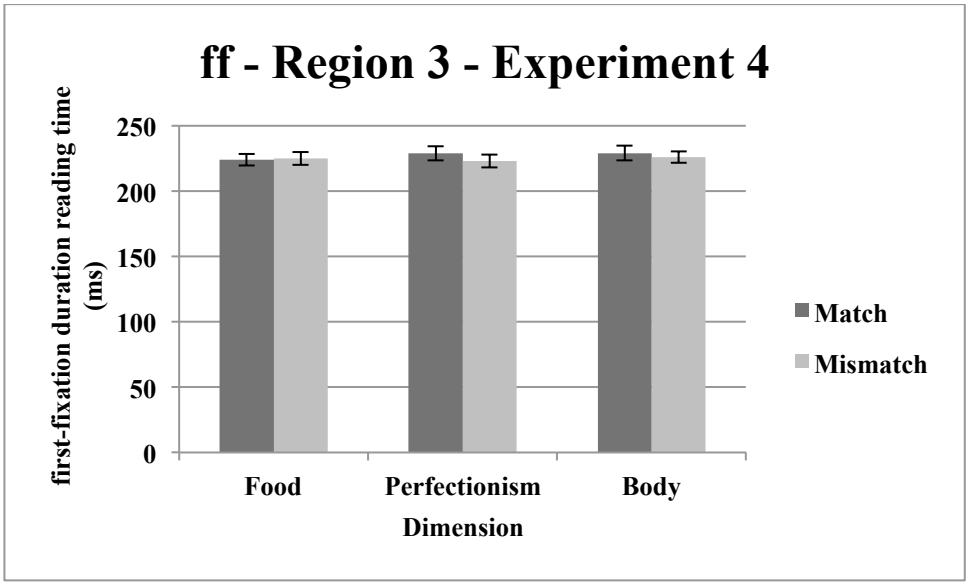


FIGURE 24.a. FIRST-FIXATION DURATION READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FF = FIRST-FIXATION DURATION.

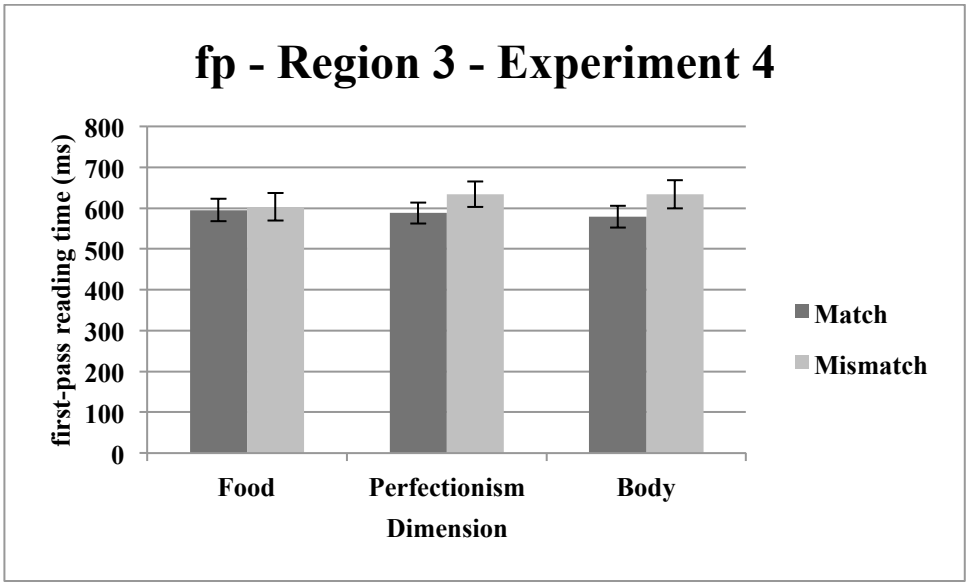


FIGURE 24.b. FIRST-PASS READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. FP = FIRST-PASS.

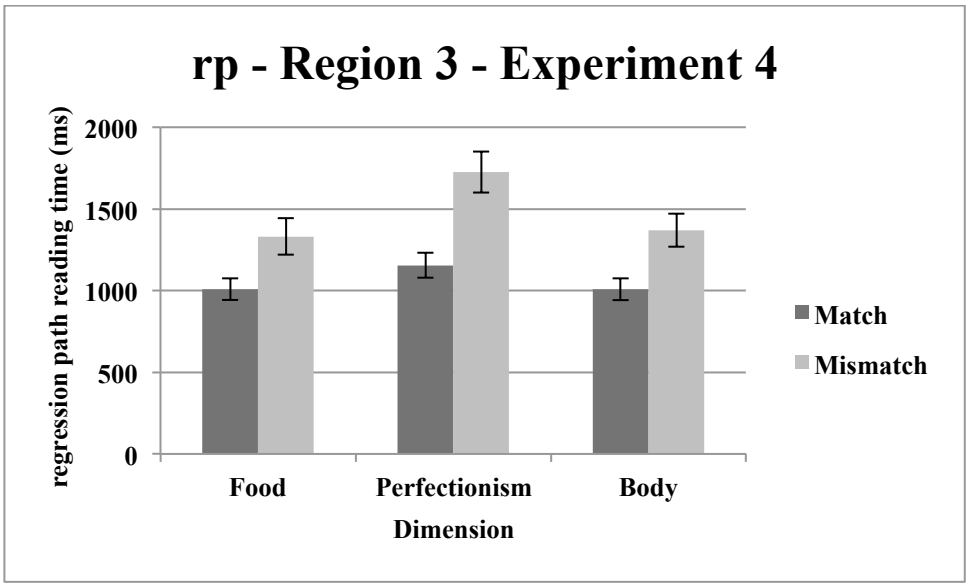


FIGURE 24.c. REGRESSION PATH READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. RP = REGRESSION PATH.

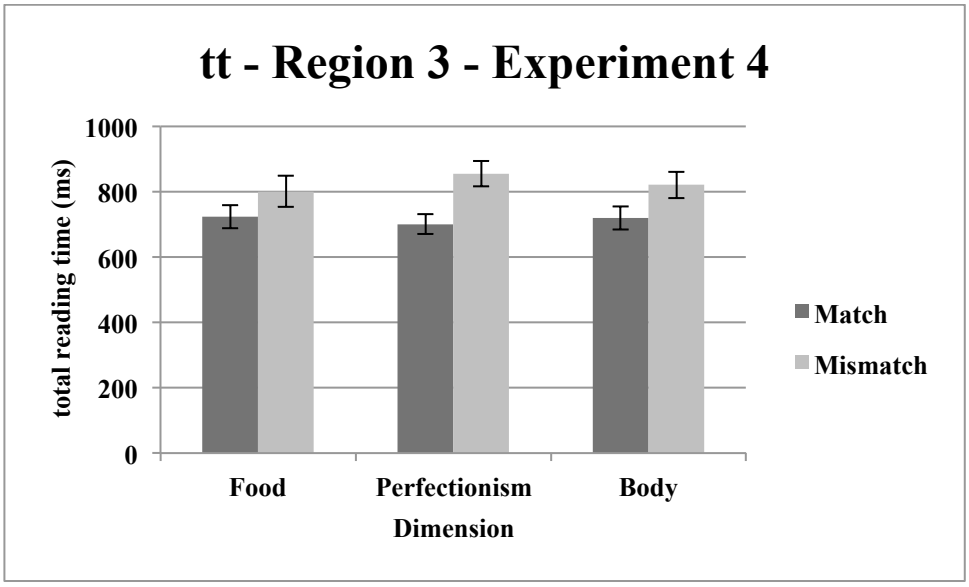


FIGURE 24.d. TOTAL READING TIME MATCH AND MISMATCH SCORES. ERROR BARS REPRESENT STANDARD ERRORS. TT = TOTAL READING TIME.

In sum, as expected, there were no significant mismatch effects in early measures of reading behaviour before the participant read the emotional target word (*Region 2*; *"pleased"*), and there were significantly longer total reading times for mismatching and matching dimensions across all three analysis regions, and for regression path in *Region 3*, which did not interact with dimension (e.g. food vs. perfectionism vs. body image).

4.9.2. DATA ANALYSIS FOR QUESTIONNAIRE MEASURES

4.9.2.1. BODY MASS INDEX (BMI) ANALYSIS

Body Mass Index (BMI) was calculated by dividing each participant's measured weight (in kilograms) by the square of his measured height (in metres) (BMI = Kg/M^2). Participants ranged from 15.60 (underweight) to 35.40 (obese) (M = 23.86, SD = 3.85; see prior Table 15 for British BMI health standards; Figure 25 for BMI Distribution of Participants).

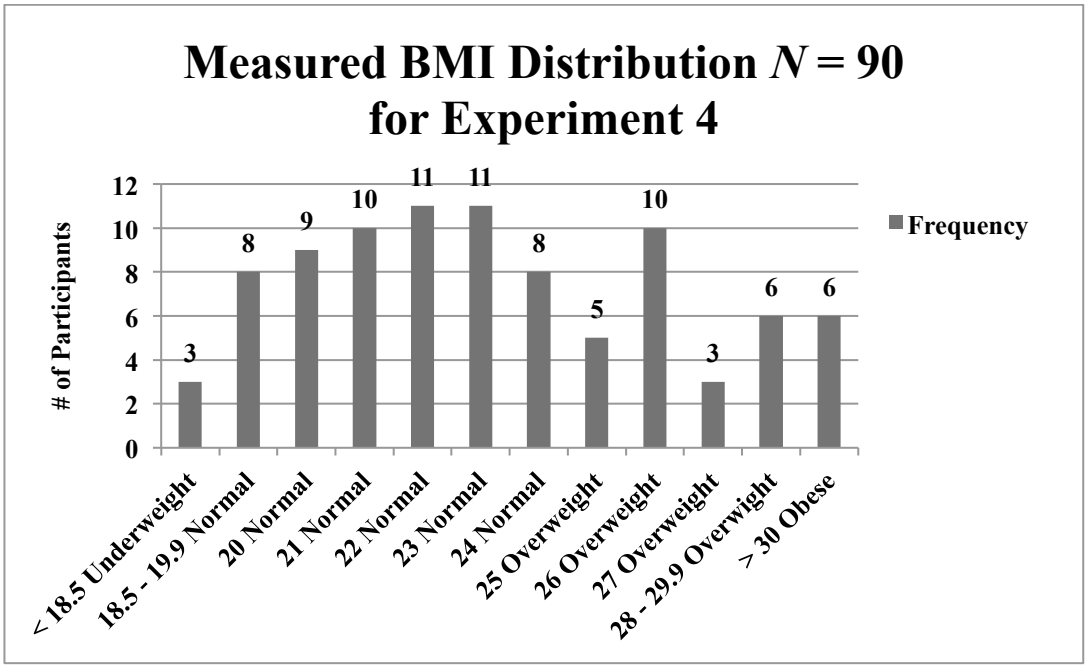


FIGURE 25. BMI DISTRIBUTION OF PARTICIPANTS FOR EXPERIMENT 4.

4.9.2.2. EDE-Q 6.0 ANALYSIS

All of the EDE-Q 6.0 facet scores for the participants were then calculated in SPSS by adding all of the items for each facet and then dividing the sum by the number of items in that facet. The final Global EDE-Q 6.0 was then calculated by dividing the sum of all of the EDE-Q 6.0 facet scores by the number of facets (four). The Global EDE-Q 6.0 Cronbach's alpha coefficient was reliable at .91.

The range for each of the EDE-Q- 6.0 facets (Restraint Concern (RC), Eating Concern (EC), Weight Concern (WC), Shape Concern (SC)), and Global EDE-Q 6.0 scores are from 0 (extremely low) to 6 (extremely high) levels of eating disorder tendency. Participants scored from 0 to 3.79 on the global EDE-Q 6.0 (M = 1.00, SD = .86; see Table 22 for mean scores, and Table 23 for percentile ranks for each subscale for the total sample). Participants' means scores for Shape Concern were comparable to community norms for young men, and the other scores (Restraint Concern, Eating Concern, Weight Concern, and Global) were slightly lower than community norms for young men (see Table 17; Lavender et al., 2010).

As with some prior EDE-Q norms studies, a cut-off of ≥ 4 was used to mark severe clinical significance (see Lavender et al., 2010). While none of the males' Global or Eating Concern scores exceeded this clinically severe threshold; 2.2% on Restraint, 4.4% on Weight Concern, and 6.7% on Shape Concern exceeded the clinical severity threshold.

TABLE 22
EDE-Q 6.0 SCORES AND MEANS OF MALES (N = 90) FOR EXPERIMENT 4.

Measure	**Mean**	***SD***	***N***	**Score Range (Possible)**	**Score Range (Actual)**
Global EDE-Q 6.0	1.00	0.86	90	0 (low) to 6 (extreme)	.00 to 3.79
Restraint Concern (RC) facet	0.91	1.19	90	0 (low) to 6 (extreme)	.00 to 4.60
Eating Concern (EC) facet	0.36	.55	90	0 (low) to 6 (extreme)	.00 to 2.60
Weight Concern (WC) facet	1.15	1.14	90	0 (low) to 6 (extreme)	.00 to 5.60
Shape Concern (SC) facet	1.60	1.30	90	0 (low) to 6 (extreme)	.00 to 5.88

TABLE 23

PERCENTILE RANKS FOR EDE-Q 6.0 SUBSCALE SCORES OF PARTICIPANTS FOR EXPERIMENT 4.

Percentile rank	Restraint	EC	WC	SC	Global Score
Mean (*SD*)	.91 (1.19)	.36 (.55)	1.15 (1.14)	1.60 (1.30)	1.00 (.86)
5	-	-	-	.13	.08
10	-	-	-	.14	.13
15	-	-	-	.33	.16
20	-	-	.20	.40	.22
25	-	-	.20	.59	.31
30	-	-	.40	.66	.38
35	-	-	.60	.86	.49
40	-	-	.60	1.00	.61
45	.20	.20	.80	1.13	.74
50	.40	.20	1.00	1.31	.81
55	.60	.20	1.00	1.38	.93
60	.80	.20	1.20	1.58	1.08
65	1.00	.40	1.20	2.00	1.11
70	1.20	.40	1.40	2.21	1.21
75	1.40	.40	1.80	2.41	1.44
80	2.00	.60	1.80	2.73	1.64
85	2.40	.60	2.20	2.88	1.90
90	2.78	.80	2.76	3.11	2.28
95	3.60	1.69	3.76	4.56	2.80
99	-	-	-	-	-

4.9.2.2.1. Eating Disorder Behaviour Results

As with Experiment 3, the proportion of males who reported engaging in disordered eating behaviours at all, and those who reported engaging in disordered behaviours as a regular occurrence is defined according to a prior male normative study (Lavender et al., 2010).

4.9.2.2.1.1. Dietary Restraint

12.2% of males reported restraining their diet for longer periods of time (≥ 8 hours) in order to influence their shape or weight, with 3.3% as a regular occurrence (≥ 13 days in the past 28 days).

4.9.2.2.1.2. Binge Eating

82.2% of males reported eating unusually large amounts of food given the circumstances (11.1% as a regular occurrence; ≥ 4 times in 28 days), and 23.3% of these binges included a sense of having lost control at the time (1.1% as a regular occurrence; ≥ 4 times in 28 days). 36.7% of males reported binge eating and having a sense of loss of control at the time (3.3% as a regular occurrence; ≥ 13 days).

4.9.2.2.1.3. Compensation & Purging

37.7% of males reported exercising in a way which was driven or compulsive, in order to control his weight, shape, amount of fat, or to burn off calories, 6.6% as a regular occurrence (≥ 20 times in 28 days). 1.1% of males reported self-inducing vomiting to control his shape or weight, and there were no reports of laxative use to control shape or weight.

4.9.2.3. Examining the relationship between reading & Eating Behaviour

4.9.2.3.1. EDE-Q 6.0 Scores and Mismatch Score Analysis

In order to evaluate the association between the processing of food-, perfectionism-, and body image-related materials and the participant's level of eating

disorder tendency, an enter multi-linear regression analyses with the size of the mismatch effect (mismatch – match) for each appropriate dimension as a predictor variable, and the participant's score on the EDE-Q 6.0 and BMI as the criterion variables was carried out. Tests indicated there were no influential outliers as Cook's Distance values were < 1, no correlated residual terms (Durbin-Watson values = 2.074; 2.610), and multicollinearity was not an issue. In relation to the EDE-Q 6.0, no mismatch scores significantly predicted the EDE-Q 6.0 Global Score (*p*s ≥ .08).

4.9.2.3.2. BMI SCORES AND MISMATCH SCORE ANALYSIS

Regarding the measured BMI, *higher* total reading time mismatch effect scores for body image-related materials in Region 3 predicted *higher* Measured BMI (see Table 24), which is not in the direction expected for males who have difficulty with negative body image-related information processing strategies.

TABLE 24
ENTER MULTIPLE REGRESSION MODEL: BMI EXPERIMENT 4 (N = 90).

Model	***b***	***SE b***	***ß***
Constant	23.42	.420	
Total Reading Time mm Region 3 Body	.004	.002	.29*

Notes. R^2 = .08, * p = .006

To clarify which aspect of body-composition was related to the increase in males' BMI measure (e.g. males' fat and/or muscle percentage), and relationship to reading behaviour, bivariate correlations results between males' actual body fat percentage, muscle percentage, BMI and Total Reading Time mismatch effect scores for body-image related materials were performed. As in Experiment 3, males' fat percentage was significantly positively related to actual BMI (r = .946, p < .001, N = 89), whilst males' muscle-percentage was significantly negatively related to fat percentage (r = -.875, p < .001, N = 89), and overall BMI (r = -.815, p < .001, N = 89).

Also, Total Reading Time mismatch effect scores for body-image related materials were significantly positively related to males' fat percentage (r = .271, p = .010, N = 89), and negatively related to males' muscle percentage (r = -.219, p = .006, N = 89). Therefore those who displayed more difficulty reading mismatched body-related scenarios in the spillover region predicted higher BMI, from fat percentage (not muscle).

4.10. EXPERIMENT 3 & 4 DISCUSSION

In sum, results from Experiments 3 and 4 revealed several findings in relation to the way in which males process information in text. Firstly, results displayed a mismatch effect from both a third-person (Experiment 3) and second-person (Experiment 4) perspective for all three dimensions (food, body image, and perfectionism) for male readers. This finding supports prior psycholinguistic studies, which suggest that readers detect unexpected emotional responses of characters when these responses do not conform with their worldview and world knowledge (e.g. de Vega et al., 1996; Filik, 2008; Filik & Leuthold, 2008; Filik & Leuthold, 2013; Filik et al., 2017a; Gernsbacher et al., 1992; Gernsbacher et al., 1998; Leuthold et al., 2012; Rayner et al., 2004; Warren & McConnell, 2007; Warren et al., 2008).

Regression analyses investigating the relationship between the size of the mismatch effect in each dimension and participants' EDE-Q 6.0 global scores, as well as their actual BMI, were performed to examine whether the way in which information relation to food, body image, and/or perfectionism is processed may predict eating disorder tendencies. Results from Experiment 3 revealed that the size of the total reading time mismatch effect for body image-related information predicted eating disorder tendencies. Specifically, once participants processed the entire text, *smaller* body-related mismatch effect scores predicted *greater* eating disorder tendencies (i.e. EDE-Q 6.0 scores). These results may provide some support for cognitive avoidance

later in the processing stage, as males may have avoided re-reading the beginning of target sentence within "threatening" body-related context that did not match their expected response (smaller total reading time mismatch effect scores).

Whilst most eating disorder cognitive theories point to perfectionism as directed toward the body or food, or as a trait, it is important to note that the perfectionism-related texts used in these eye-tracking experiments were not directly related to the body or food. In Experiment 3 in first fixation duration for *Region 3* (e.g. the words *"to have done that."* In the example given), higher perfectionism-related mismatch effect scores (mm) predicted higher eating disorder tendency (see Table 19), which is in the expected direction for difficulty processing the unexpected emotional responses in the "spillover" region, within threatening emotional context.

Whilst no reading measures predicted males' EDE-Q 6.0 scores in Experiment 4 (possibly due to slightly lower than normal EDE-Q 6.0 scores in this group), it was *larger* mismatch scores in *Region 3* (the "spillover" region) for body image-related stimuli that predicted *higher* BMI for males. These males who had more difficulty processing unexpected response to body-related materials had higher BMI's due to more fat instead of muscle. Accordingly, Experiment 3 (third-person male perspective) may support earlier processing with maintained attention just after unexpected emotional information (higher first fixation mismatch scores on the spill over region) within the context of perfectionism-related scenarios. Then, in later processing (total reading time reading measures), there was also attendance toward the emotion word (e.g. *"pleased"*) of this same information in males (in perfectionism-related texts), when the scenarios were more fully processed and about male characters' response (third-person). Also, males had information processing difficulty for body-related information only in later measures (total reading time), with avoidance of the region just

prior to the unexpected emotion response (smaller body-related mismatch scores in *Region 1*) in third-person perspective predicting higher EDE-Q 6.0 scores, whilst larger body-related mismatch scores in the spill-over region (Region 3) predicted larger BMI level for males in second-person. These results suggest both longer quick, initial attendance of (during earlier processing), and avoidance of (during later processing) related to eating disorder and BMI levels in males.

4.11. EXPERIMENT 3 & 4 CONCLUSION

In conclusion, the key factor, which predicted eating disorder tendencies (Global EDE-Q 6.0 score) and BMI level in third-person for males, was the processing of information relating to perfectionism (which was not directly eating disorder related). Also, processing difficulty of unexpected emotional response within body image-related context in third-person perspective (about male characters) also predicted males' EDE-Q 6.0 global scores. Body image-related processing also predicted male's BMI level when the scenarios were directed at the participant (e.g. "*you*"). Therefore, the results from Experiment 3 continue to provide some support for theories that point to perfectionism as a main underlying cognitive mechanism, and Experiment 3 and 4 provide some support for theories that also include body image-related processing involved in the development and maintenance of eating disorders, including the Joiner et al.'s (1997) Two Factor Vulnerability-Stress Model, Vohs et al.'s (1999) Three-Way Interactive Model for Bulimia Nervosa, Bardone et al.'s (2000) Three-Factor Interactive Model for Bulimia Nervosa, Heatherton and Baumeister's (1991) Escape from Self-Awareness Theory for bulimia nervosa, and the Cognitive-Interpersonal Model of Anorexia Nervosa (Schmidt & Treasure, 2006; Treasure & Schmidt, 2013). As previously noted, most eating disorder theories are diagnosis-specific (i.e. for anorexia nervosa, bulimia nervosa, or binge eating disorder distinctly), due to the transdiagnostic

approach of Experiments 1-4 Fairburn et al.'s (2003) Transdiagnostic Model for Eating Disorders may be most strongly supported.

To speculate, these eye-tracking results may also support that emotional, threatening or disorder-salient stimuli information processing difficulty may include several temporal processing phases, such as initial attendance towards, maintaining attention of, and/or avoidance during information processing (see Cisler & Koster, 2010). Firstly, there may be an immediate and automatic drawing towards unexpected emotional responses within context of "threatening" scenarios, or disorder-salient information, in which this information is detected early on (e.g. larger first fixation mismatch scores predicting EDE-Q 6.0 scores). Secondly, there may be difficulty shifting attention away from the unexpected emotional response information within these contexts, which may manifest as longer early processing (e.g. larger first fixation mismatch scores predicting EDE-Q 6.0 scores). Thirdly, once the information, or entire scenario, is processed and encoded, there may be an avoidance of the unexpected emotional response information within threatening context (e.g. smaller total reading time mismatch scores predicting EDE-Q scores). There seems to have been variant temporal processing aspects detecting the underlying mechanisms for eating disorders for males. For instance, in Experiment 3, longer initial fixations (i.e. larger first fixation mismatch scores) on the spillover region (Region 3) in perfectionism-related scenarios in conditions when the character responded in an unexpected way (e.g. pleased they made a small mistake) than those with lower levels of ED predicted higher levels of ED. Differently, in later reading measures (total reading time mismatch) once male readers were able to process body-related information, then males who appear to have avoided re-reading the beginning of the target sentence (*Region 1*) that contained the unexpected emotional response (pleased to negative body image-related scenarios) which did not

match the readers' expectations (i.e. smaller total reading time mismatch scores). This suggests that males who tended to avoid re-reading the beginning of the target sentence containing unexpected emotional responses to body image-related information (e.g. a pleased response that they had gained quite a bit of weight) once the scenario was more fully processed predicted higher EDE-Q 6.0 scores. Temporal processing differences within context of "threatening" information based on type of information, perspective, and gender for Experiments 1-4 will be discussed more in the final Discussion (see Chapter VI). Introduced earlier, males' body goals and ED behaviour may deviate from female body image-related goals and ED symptomology.

Finally, results may also subtly differ between males and females in the present studies (discussed in "The Final Picture and General Discussion" in Chapter VI), as well as differences between male and female eating disorder tendencies and goals that are reported within literature introduced next (Chapter V). Many current eating disorder and body image-related assessments within the field were initially developed for females, (for example to examine the "thin-ideal"), and then subsequently applied to male body dissatisfaction assessment. However, males may desire a more muscular-ideal body, or desire a lean-ideal body (low fat and larger muscles), rather than a skinny body. Consequently, there may be a large portion of the male population who are not properly assessed with many of the current assessment tools originally designed to detect female-related goals and eating disorder behaviours, and therefore overlooked.

With the desire to accurately and quickly assess male body dissatisfaction, two new scales (the Male Body Scale and Male Fit Body Scales) were developed, tested, and re-tested, as discussed in the following chapter. This will then be followed by a discussion of the overall picture and implications for all studies, which will be collectively examined in more detail in Chapter VI.

5. CHAPTER V: NEW BODY SCALES REVEAL BODY DISSATISFACTION, THIN-IDEAL, AND MUSCULARITY-IDEAL IN MALES

The aim of the current study was to develop, test, and re-test two new male body dissatisfaction scales: The *Male Body Scale* (MBS; consisting of emaciated to obese figures) and the *Male Fit Body Scale* (MFBS; consisting of emaciated to muscular figures). These scales were compared to the two most commonly used visually-based indices of body dissatisfaction (Stunkard Figure Rating Scale, SFRS; and Somatomorphic Matrix, SM). Male participants rated which body figure on each scale most represented their current figure, then their ideal figure, and then rated which one of the three scales (MBS, MFBS, and SFRS) best represented their current and ideal body overall. Finally, they completed the Drive for Muscularity Scale (DMS), the Eating Disorder Examination Questionnaire (EDE-Q 6.0), and their actual body composition was calculated. This was followed by a re-test and manipulation check two to six weeks later. Participants' actual body mass index, fat- and muscularity-percentage were all highly related to their current body figure choice, and both new scales were consistently valid and more reliable between test and re-test than the SFRS and SM body dissatisfaction scores. Importantly, each scale was sensitive to different types of body dissatisfaction within males. Specifically, the MBS revealed that males' desire for the thin-ideal significantly corresponded to higher eating disorder tendencies as identified by EDE-Q 6.0 scores, whilst the MFBS revealed much higher body dissatisfaction toward the larger, muscularity-ideal, predicting higher drive for muscularity as identified by DMS scores. Results validated the new scales, and inform male-focused eating disorder research.

5.1. INTRODUCTION

It is often suggested that males report substantially less body dissatisfaction than females both on questionnaires and during clinical diagnostic interviews, even when they have comparable eating disorder levels (Darcy et al., 2012; Micali et al., 2015; Ricciardelli & McCabe, 2015). At the same time, male body dissatisfaction and the prevalence of extreme body-shape and weight control behaviors are reported to be increasing (Mitchison, Hay, Slewa-Younan, & Mond, 2014; Murray, Griffiths, & Mond, 2016; Ricciardelli & McCabe, 2001). Reported low levels of male body dissatisfaction may be due to the majority of body dissatisfaction scales, such as the EDI-3 (Garner, 2004) or the Stunkard Figure Rating Scale (Stunkard, Sørensen, & Schulsinger, 1983) having been developed to focus on and measure fat-related concerns which are more commonly reported in females.

Figural rating scales are reported to be an accurate, robust method that quickly and effectively classifies males and females as thin or obese, and are highly correlated with self-reported BMI in very large, diverse populations (Bulik et al., 2001; Lo, Ho, Mak, & Lam, 2012). This method is also reported to accurately measure both attitudinal and perceptual aspects of body image distortions (Pallotti, Tubaro, Casilli, & Valente, 2017). Often, studies which investigate body-dissatisfaction or the influence of negative body image within a variety of research questions, use figure-rating scales within a battery of tests to quickly and robustly detect these body-related aspects (e.g. Schrimpf et al., 2017). In support of males' body concerns differing from those of females, Darcy and Lin (2012) reported that males with anorexia nervosa scored significantly lower on Weight Concern and Shape Concern subscales than females with anorexia nervosa during the clinical Eating Disorder Examination interview (EDE; Cooper & Fairburn, 1987). Another study reported that it was body fat dissatisfaction

but not muscularity dissatisfaction that predicted eating disorder tendencies in both heterosexual and homosexual men (Smith, Hawkeswood, Bodell, & Joiner, 2011).

The terms "thinness" and "leanness" have often been used interchangeably within the male body-related dissatisfaction literature (e.g. Brown, Forney, Pinner, & Keel, 2017; Smith et al., 2011). However, Smolak and Murnen (2008) reported the motivation to lose fat as two dimensions, the drive for thinness and the drive for leanness. The drive for thinness is reported as more focused on the fear of gaining any weight and determination to be thin, whereas the drive for leanness is focused on attitudes which are not directly pertaining to fat, but a desire to lose fat and gain a toned, muscular, and lean body. It may be that males tend to strive toward a lean, toned body (i.e. drive for leanness), rather than toward a larger more muscular body, or the thin-ideal (i.e. drive for thinness) that many females tend to strive towards (Ridgeway & Tylka, 2005).

For over three decades, the most commonly used figure scale has been the Stunkard Figure Rating Scale (SFRS; Stunkard et al., 1983). The SFRS is a quick and valid measure of body dissatisfaction in males and females with respect to thinness and obesity (Edman, Lynch, & Yates, 2014), and this nine-figure scale has been asserted to possess equal or better validity than dozens of other figure scales with respect to the relationship between the dissatisfaction score indicated by the scale, and the participant's BMI (Stunkard, 2000). There are a number of limitations to using the SFRS to measure male body dissatisfaction. The SFRS measures only the emaciated to obese-body dimension (i.e. drive for thinness), and therefore excludes muscularity or the drive for leanness (i.e. to be lean and toned), which may also be key dimensions of body dissatisfaction and eating disorder risk in males, along with the drive for thinness (Bergeron & Tylka, 2007; Mayo & George, 2014). Many of the body figures that make

up the male scales are cartoonish in appearance, and thus not very representative of the male figure (Thompson & Gray, 1995), which is also problematic of more current measures, such as Gruber, Pope, Borowiecki, & Cohane's (2000) Somatomorphic Matrix, and Hildebrandt, Langenbucher, and Schlundt's (2004) Body Builder Grid, which have incorporated indices of thinness-, fatness-, and muscularity-related body dissatisfaction simultaneously.

According to several papers, figure scales often do not provide sufficiently large obese body sizes (Cafri & Thompson, 2004; Stewart, Williamson, Smeets, & Greenway, 2001), and consist of unbalanced body size. The SFRS was not developed with precise incremental graduations between each body figure, and displays irregularities between body area sizes within each figure (such as lower and upper arm). The more current and detailed Male Body Matrices (Frederick & Peplau, 2007) only includes four levels of body fat variability, but seven levels of muscularity variability. The Somatomorphic Matrix (Gruber et al., 2000) possesses reduced lower body (i.e. legs) size variance compared with upper body (i.e. chest, biceps) size variance (Olivardia et al., 2004), and produced inconsistent results for males who have overestimated their body fat in several studies (Pope et al., 2000a). Although there has been concern relating to the Somatomorphic Matrix having low test-retest reliability, this tool is still the most frequently used muscularity scale, as it assesses fat and muscularity as a single dimension (Cafri, Roehrig, & Thompson, 2004).

Restored body weight and reduced (or even extinguished) drive for thinness (key anorexia nervosa recovery markers) have been reported to mask the development and maintenance of muscularity-drive disordered eating behaviors in males (Murray et al., 2017a). This highlights the importance of assessing two distinct facets of body dissatisfaction; fat-related dissatisfaction and/or muscularity-related dissatisfaction.

Incorporating Smolak and Murnen's (2008) report of the drive for thinness and the drive for leanness also as two separate dimensions, toward a thinner or a leaner, toned body, it may be important to assess fat-related dissatisfaction (i.e. thinness), and also muscularity-related (i.e. muscularity and/or leanness) body dissatisfaction. New evidence also points to fat-related and muscle-related body perception consisting of two independent neural mechanisms, as well as differing in psychological importance, making it essential to develop tools which address and assess these two features independently (Sturman, Stephen, Mond, Stevenson, & Brooks, 2017). Other key limitations of current figure scales are related to the figures, such as the size and complexity of the scales, which may consist of 32 to 100 cartoonish body drawings (e.g. Gruber et al., 2000; Hildebrandt et al., 2004), making them more time-consuming to complete. Further limitations include unnaturally positioned figures (i.e. flexing their bicep muscles which may cue males toward muscularity; Gruber et al., 2000), as well as headless figures (e.g. Frederick & Peplau, 2007), which may be disturbing (Minnebusch, Suchan, & Daum, 2009). Removing the head also excludes an important and frequent overall body shape concern, which is face fatness, such as: chubby cheeks, double chin, and neck rolls (Madsen, Bohon, & Feusner, 2013).

Taking everything into account, although the above tools may be useful in some aspects of research, there is still the need for new, brief, straightforward, holistic, visual, incrementally increasing male-specific body dissatisfaction measures which separately assess the muscularity-, and adipose-dimensions of body dissatisfaction. Unlike self-report questionnaires, figure-rating scales are not heavily reliant on the literacy level of the participant, and also provide a more homologous measure with the participants' perception of their physical appearance. Quick and accurate detection of the two distinct male-related dimensions of body dissatisfaction, (fat- and muscularity-related),

which significantly correspond to eating disorder level and/or drive for muscularity, would also provide important information to complement other collected self-reported information.

In response to this need, the new *Male Body Scale* (MBS; depicting a series of nine male bodies ranging from emaciated to obese) and *Male Fit Body Scale* (MFBS; depicting a series of nine male bodies ranging from emaciated, lean, to very muscular) were developed. These two image-based tools reduce the effect of wording in identifying male body dissatisfaction, and provide standardized measures for two contrasting assessments of holistic male body dissatisfaction. This allows the researcher or practitioner to identify whether the majority of male body dissatisfaction is toward the thin-ideal, lean-ideal, or muscular-ideal trend. These measures may be used together, or separately, in order to rapidly identify more specific aspects of male body dissatisfaction, and to answer different questions related to male body satisfaction.

The main aim of the current study is to test and re-test these two new male body dissatisfaction scales. Each scale was compared to the Stunkard Figure Rating Scale (SFRS), as even though issues have been noted with this scale, it is still the thinness-related figure scale which has been the most widely used since the early 80's. Each scale was also compared to the published test-retest Somatomorphic Matrix results, which is the most commonly used index for measuring both adipose- and muscularity-related body dissatisfaction. In contrast to most scales, which use self-reported body weight and height, construct validity was assessed in relation to participants' actual body measurements (i.e. their body mass index), and actual body composition (i.e. fat- and muscularity-percentage). Both scales were assessed compared to participants' drive for muscularity (as measured by the Drive for Muscularity Scale; DMS), and eating disorder tendency (as assessed by the Eating Disorder Examination Questionnaire;

EDE-Q 6.0). The aim was to assess whether the new scales are valid, reliable, and subjectively representative of males' current and ideal body physique, from which their two independent levels of body dissatisfaction (i.e. adiposity and muscularity) may be quickly assessed.

5.2. METHOD

5.2.1. PARTICIPANTS

This study was approved by the University of Nottingham School of Psychology Ethics Review Board. A local community sample of 103 native English-speaking males received a small inconvenience allowance for participating. Ages ranged from 18 to 50 years (M = 21.35, SD = 4.15), actual Body Mass Index (BMI = Kg/ M^2) ranged from 15.60 (Underweight) to 40.80 (Obese; M = 24.43, SD = 4.50), actual Body Fat Percentage ranged from 2.00% (Essential Fat) to 31.00% (Obese; M = 12.74%, SD = 6.12), and actual Body Muscle Percentage ranged from 35.10% to 50.80% (M = 44.43%, SD = 2.99).

5.2.2. SCALE DEVELOPMENT

The *Male Body Scale* and the *Male Fit Body Scale* were developed with help from a professional artist/graphic designer. Firstly, the professional artist/graphic designer modeled the most emaciated, most obese and most muscular figures (figures 1 and 9 in each scale) from photographs of anorexic, obese, and weight-lifting males. The professional artist/graphic designer then drew graduated sizes, which increased 10% in width between each body figure, while continuing to model each increasing body figure and growth to photographs of actual males. Once the figures for each scale were precisely drawn and contoured to match actual body figures in 10% graduating width size increments, the figures were scanned into a computer, and the uniform increase between figures from most emaciated to largest figure in each scale was checked using

Adobe Photoshop. By following this procedure, it was ensured that the figures accurately represent actual male body figures, which systematically increased in size across the nine different figures. The Male Body Scale was created to detect body dissatisfaction from the thin-ideal and adipose-related body dissatisfaction in males (emaciated to larger obese figures), whilst the Male Fit Body Scale was developed to detect the lean-ideal and muscle-related body dissatisfaction (emaciated to lean to larger muscular figures).

These male body figures for each scale then gave study participants the option to select their current body figure, and their ideal body figure, both in relation to their level of body fat (Male Body Scale) and their level of muscularity (Male Fit Body Scale) (see Figure 26 Male Body Scale and Figure 27 Male Fit Body Scale).

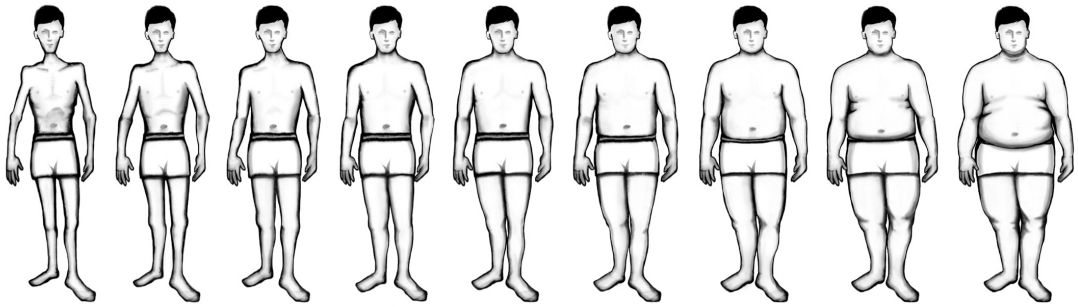


FIGURE 26. MALE BODY SCALE.

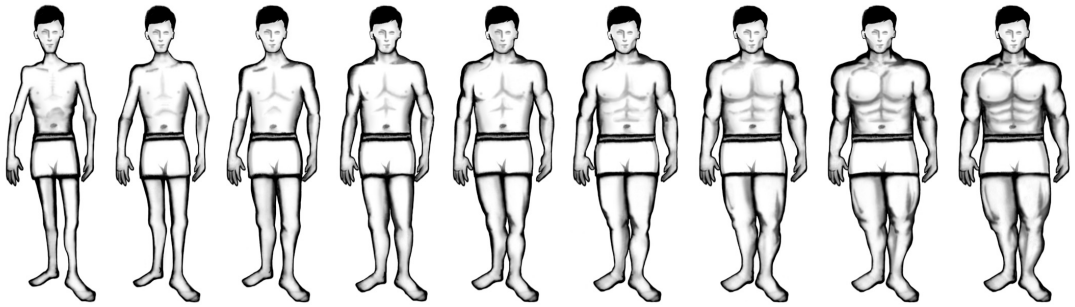


FIGURE 27. MALE FIT BODY SCALE.

5.2.3. Other Scales and Measurements

5.2.3.1. Actual Body Measurements

Participants were first asked to remove any heavy outer clothing layers, shoes, and socks. Actual height was measured using a Stabila 1607 Wooden Folding Rule. Body mass index was computed by measuring the actual height and weight (BMI = Kg/M^2). This information, along with the gender and age, was then used to measure the actual fat percentage and muscularity percentage of each participant via an Ozeri Touch Digital Bioelectrical Impedance Analyzer. Of the 103 males, one participant's fat- and muscularity-percentage did not register.

5.2.3.2. Drive for Muscularity

The Drive for Muscularity Scale (DMS; McCreary & Sasse, 2000) is a validated and reliable 15-item scale for determining drive for body muscularity, in which participants answer '1-Always' to '6-Never' (reverse scored) if they desire to perform behaviors geared toward muscularity (i.e. "I lift weights to build up muscle."), and desire for more muscularity (i.e. "I wish that I were more muscular."). Although there are two "lower order factors" which are reported for males but not females (called "Muscularity-Related Attitudes" and "Muscle-Enhancing Behaviors"), these two factors both load onto a single, global, higher-order "Drive for Muscularity" factor for males (McCreary, 2007). Therefore, a single, 15 items global score is the more common overall use of the Drive for Muscularity Scale, and was implemented in the current study (see Appendix D for full DMS items). Of the 103 males, four participants did not receive any of the DMS items, due to a technical problem. The DMS score was reliable as Cronbach's Alpha was .90 ($N = 99$), 95% CI [.87, .93], $p < .001$. Participants' DMS scores ranged from 17 (low levels of drive for muscularity) to 85 (high levels of drive

for muscularity; $M = 39.97$, $SD = 14.20$).

5.2.3.3. EATING DISORDER TENDENCY

The Eating Disorder Examination Questionnaire (EDE-Q 6.0; Fairburn & Beglin, 2008) is a self-report measure based on the gold standard interview measure Eating Disorder Examination Edition-D 16.0, which is often utilized by clinicians to diagnose an eating disorder. The EDE-Q 6.0 consists of a global eating disorder score made up of 23 of the items which assess eating disorder related behaviors and attitudes from the previous four weeks from 0 (Not at all) to 6 (Markedly), on a 7-point scale. The global score is the average of the sum of the four subscale scores; restraint behavior, preoccupation and negative feelings associated with eating, fear of gaining weight or concern over one's own body shape, and negative feelings associated with one's weight (see Appendix A for full EDE-Q 6.0 scale). The Global EDE-Q 6.0 score Cronbach's Alpha was reliable at .90 ($N = 103$), 95% CI [.87, .93], $p < .001$. Participants' scores ranged from .00 (no eating disorder tendency) to 3.79 (over the eating disorder threshold) out of 6.0 (see Table 25 EDE-Q 6.0 Male Scores).

Table 25
EDE-Q 6.0 Male Mean Scores.

Facet	Actual Range	Possible Range	Mean	*SD*
EDE-Q Global	.00 to 3.79	.00 to 6.0	1.00	0.83
WC Total	.00 to 5.60	.00 to 6.0	1.14	1.12
EC Total	.00 to 2.60	.00 to 6.0	.34	.54
SC Total	.00 to 5.88	.00 to 6.0	1.57	1.25
RC Total	.00 to 4.60	.00 to 6.0	.95	1.23

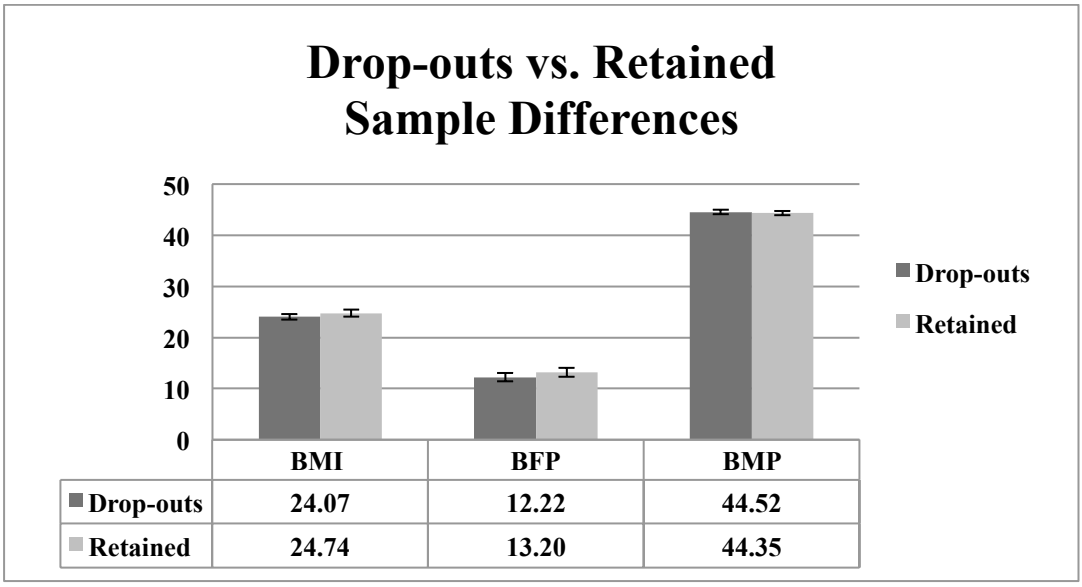
Notes. WC = Weight Concern; EC = Eating Concern; SC = Shape Concern; RC = Restraint Concern.

5.2.4. PROCEDURE

After written consent was given, three body scales (the Male Body Scale and Male Fit Body Scale along with the Stunkard Figure Rating Scale, for comparison) were presented to participants on a computer screen using Qualtrics software. Participants were asked to indicate which of the nine body figures on each scale best represented their current, and then their ideal body figure on a new screen. Participants were then asked to indicate which of the three scales best represented how they currently look, and why, and also which scale best represented how they would ideally like to look, and why. Participants then completed the Drive for Muscularity Scale (DMS), the Eating Disorder Examination Questionnaire (EDE-Q 6.0), and lastly their actual body mass index, body fat percentage, and body muscularity percentage were measured and calculated using biometric impedance analysis, taking into account age, gender, height, and weight. Participants were then debriefed, and given a list of online and community eating disorder and counseling resources, along with a small inconvenience allowance.

This Time 1 test was followed by a re-test and manipulation check in Time 2, two to six weeks later, in which all of the participants were emailed a link and original code to repeat the initial portion of the experiment. Of the 103 original participants, 55 also participated in Time 2, representing a response rate of 53.40%. These participants ranged from 18 to 36 years old (M = 21.27, SD = 3.55), BMI ranged from 15.60 to 40.80 (M = 24.74, SD = 4.95), Body Fat Percentage (BFP) ranged from 2.00% (Essential Fat) to 30.20% (Obese; M = 13.20%, SD = 6.43), and Body Muscle Percentage (BMP) ranged from 35.10% to 50.80% (M = 44.35%, SD = 3.16). Independent samples t-tests confirmed that there were no significant differences in terms of BMI, BFP, or BMP between drop-outs and retained sample, compared on

baseline scores (*t*s < .81, *ps* > .42 see Figure 28 BMI, BFP, BMP Dropout vs. Retained Differences).



	BMI	BFP	BMP
Drop-outs	24.07	12.22	44.52
Retained	24.74	13.20	44.35

Figure 28. BMI, BFP, BMP Drop-outs and Retained Sample Differences (compared on baseline scores). BMI = body mass index; BFP = body fat percentage; BMP = body muscularity percentage. Error bars represent Standard Errors.

As a manipulation check in Time 2, the order of the nine body figures on each of the two new body scales was randomized, and participants were instructed to correctly re-order them by clicking and dragging each of the figures up or down within the program in order to arrange them from thinnest to largest in each scale separately (Male Body Scale and Male Fit Body Scale).

5.3. ANALYSIS

The range and mean for each of the three body scales (Male Body Scale, Male Fit Body Scale, and Stunkard Figure Rating Scale) were calculated both in Time 1 and Time 2. Results from the manipulation check are reported in terms of percentage of correctly positioned body sizes (from 1 (emaciated figure) to 9 (obese figure); and 1 (emaciated figure) to 9 (largest muscular figure)).

Construct validity was then determined in three ways. The degree of

correspondence between participants' actual body measurements (i.e., their BMI, BFP, and BMP), and their current body rating in each of the three scales were examined. Construct validity pertaining to the desire for muscularity was measured by the degree of correspondence between each scale's body dissatisfaction ratings (calculated in terms of participants' ideal body figure choice minus their current body figure choice in each scale) and The Drive for Muscularity Scale (McCreary & Sasse, 2000). The degree of correspondence between each participant's current and ideal body figure choice and body dissatisfaction score (ideal score minus current score) on each scale, and their eating disorder tendencies, displayed by the EDE-Q 6.0 (Fairburn & Beglin, 2008) scores was examined. The test-retest reliability over a two to six week period was measured and calculated for all initial validated items above.[1] Bonferroni correction ($p < .008$) was used for all tests to correct for multiple comparisons.

5.4. Results and Discussion

5.4.1. Manipulation Check

Results from the manipulation check identified that 90.50% of participants ordered every one of the nine body figures in the correct order in the Male Body Scale and 87.88% ordered every one of the nine body figures in the correct order in the Male Fit Body Scale overall. Therefore, the order of the increase of body size in each scale was consistent.

5.4.2. CURRENT FIGURE CHOICES, IDEAL FIGURE CHOICES, AND BODY DISSATISFACTION SCORES

Males in both Time 1 ($N = 103$) and Time 2 ($N = 55$) chose a larger ideal body figure when given the option of a larger/muscular ideal choice on the Male Fit Body Scale, rather than larger/obese choice on the SFRS and MBS (see Table 26 Descriptive Statistics for Time 1 and Time 2 Self-rating Selections). This reveals that the male body ideal is often larger/more muscular, which would not be observable if using a scale that only depicts emaciated to obese figures.

Table 26
Descriptive Statistics for Time 1 and Time 2 Self-rating Selections.

			Time 1 $N = 103$			Time 2 $N = 55$		
Scale	Figure Choice	Possible Range	Actual Range	Mean	*SD*	Actual Range	Mean	*SD*
SFRS	Current	1 to 9	1 to 8	3.60	1.59	1 to 7	3.85	1.41
MBS	Current	1 to 9	1 to 8	4.09	1.58	2 to 7	4.31	1.35
MFBS	Current	1 to 9	1 to 8	3.71	1.38	2 to 7	4.00	1.20
SFRS	Ideal	1 to 9	2 to 6	3.72	,85	2 to 6	3.73	.91
MBS	Ideal	1 to 9	2 to 6	3.88	.83	2 to 6	4.22	.85
MFBS	Ideal	1 to 9	2 to 9	5.51	1.64	3 to 9	5.62	1.55
SFRS	BD Score	-8 to 8	-3 to 3	.12	1.60	2 to 5	3.65	.67
MBS	BD Score	-8 to 8	-3 to 3	-.20	1.31	-3 to 2	-.09	1.06
MFBS	BD Score	-8 to 8	-2 to 6	1.81	1.44	-1 to 5	1.62	1.27

Notes. BD Score = Body Dissatisfaction Score (ideal figure minus current figure); SFRS = Stunkard Fit Rating Scale; MBS = Male Body Scale; MFBS = Male Fit Body Scale, SD = Standard Deviations.

5.4.3. WHICH SCALE BEST REPRESENTS CURRENT AND IDEAL BODY SIZES OVERALL?

In both Time 1 and Time 2, males reported that the Male Fit Body Scale best represented their overall current body figure (52.40%; 49.10%), slightly more than the Male Body Scale (42.70%; 43.60%), but much more so than the Stunkard Figure Rating Scale (4.90%; 7.30%). Males reported that the Male Fit Body Scale best represented their overall ideal body figure (90.30%; 92.70%), rather than the Male Body Scale (8.70%; 5.50%) or the Stunkard Figure Rating Scale (1.00%; 1.80%). Paired samples t-tests revealed that the overall current scale preferred in Time 1 and Time 2, and the overall ideal scale preferred in Time 1 and Time 2 were not significantly different between test and re-test (ts < .44, ps > .66). As expected, the overall current and ideal preferred scale were different both in Time 1 t (102) = -7.94, p < .001 and Time 2 t (54) = -6.02, p < .001. These results point to consistency in selection of the overall most representative scale for both the current and the ideal male body type, but also that approximately half of males chose the MFBS (with most of the other half choosing the MBS) as their current body scale preference, in contrast to nearly all males choosing the MFBS as their ideal body scale preference overall in both Time 1 and Time 2. The MFBS, which has a scale from emaciated to very muscular is the most representative scale for males, with the MBS also being important as the current body selection that many males identified with.

5.4.4. CONSTRUCT VALIDITY IN RELATION TO ACTUAL BODY MEASURES

It is important to test the correspondence between the participants' perceived current body size that they indicated by choosing one of the nine figures on the three scales, and their actual size as measured. Results identified that there was a strong correlation between an individual's actual body mass index (BMI), body fat percentage

(BFP), and body muscle percentage (BMP) and current body size self-ratings for the total sample at both Time 1 and Time 2, on the Stunkard Figure Rating Scale, Male Body Scale, and Male Fit Body Scale (see Table 27 Time 1 & 2 Correlations Between Current Figure Body Scale Choice & Measures). Specifically, males with lower BMI or lower BFP chose thinner perceived current bodies on all scales at Time 1 and Time 2, whilst males with higher BMP also chose thinner perceived current bodies on all scales at Time 1 and Time 2.

Table 27

Time 1 & 2 Correlations Between Current Figure Body Scale Choice & Measures.

	TIME 1			TIME 2		
Body Scale	BMI *N* = 103	BFP *N* = 102	BMP *N* = 102	BMI *N* = 55	BFP *N* = 54	BMP *N* = 54
SFRS Current Figure	*r* = .63***	*r* = .72***	*r* = -.60***	*r* = .67***	*r* = .76***	*r* = -.77***
MBS Current Figure	*r* = .63***	*r* = .75***	*r* = -.63***	*r* = .69***	*r* = .79***	*r* = -.78***
MFBS Current Figure	*r* = .45***	*r* = .49***	*r* = -.35***	*r* = .58***	*r* = .62***	*r* = -.54***

Notes. *** = $p < .001$; BMI = body mass index; BFP = body fat percentage; BMP = body muscularity percentage; SFRS = Stunkard Figure Rating Scale; MBS = Male Body Scale; MFBS = Male Fit Body Scale.

5.4.1. CONSTRUCT VALIDITY IN RELATION TO DRIVE FOR MUSCULARITY

Construct validity was also examined by the degree of correspondence between the Drive for Muscularity Scale (DMS; McCreary & Sasse, 2000) and the ideal and body dissatisfaction score (ideal figure minus current figure) obtained on each of the three scales. Results from these bivariate correlations confirmed a significant relationship between an individual's DMS scores and ideal self-ratings for the total sample at Time 1 for ideal body figure choice with the Male Fit Body Scale ($r = .53$, $p < .001$, $N = 99$), but not for the Male Body Scale ($r = .21$, $p = .04$, $N = 99$), or the SFRS ($r = .20$, $p = .05$, $N = 99$). In terms of body dissatisfaction scores (ideal score minus current score), only the MFBS body dissatisfaction score had a strong significant correspondence with the DMS scores in Time 1 ($r = .41$, $p < .001$, $N = 99$), and in Time 2 ($r = .39$, $p = .003$, $N = 55$), unlike the SFRS or MBS ($rs < .14$, $ps > .16$). Therefore, these results suggest that the MFBS ideal and body dissatisfaction scores may accurately identify body dissatisfaction related to the desire for larger, more muscularity in males.

In support of the MFBS detecting muscularity-ideal-related body dissatisfaction in males, multiple regression was undertaken with the three scales' body dissatisfaction scores as the predictor variables, and the DMS as the dependent variable, which revealed that only the MFBS greater body dissatisfaction scores, in the more muscular-ideal direction, significantly predicted greater levels of drive for muscularity. This was identified by the DMS scores in both Time 1 ($R^2 = .17$, ß = .41, $sr^2 = .39$, $t = 4.18$, $p < .001$) and Time 2 ($R^2 = .17$, ß = .39, $sr^2 = .37$, $t = 2.88$, $p = .006$), unlike the SFRS and MBS ($ts < .84$, $sr^2s < .08$, $ps > .40$). Tests to see if the data met the assumption of collinearity indicated that multicollinearity was not a concern (VIFs < 5) in Time 1 or Time 2 (SFRS = 2.77/1.13; MBS = 2.71/1.12; MFBS = 1.08/1.10).

5.4.6. CONSTRUCT VALIDITY IN RELATION TO THE EDE-Q 6.0

Construct validity was examined by the degree of correspondence between participants' ideal figure choice and body dissatisfaction score (ideal minus current figure) on each scale and their eating disorder tendencies as indicated by scores on the EDE-Q 6.0 (Fairburn & Beglin, 2008). For ideal figure choices, only the MFBS ideal figure choice was significantly (positively) correlated with the EDE-Q 6.0 Score (r = .23, p = .020, N = 103; r = .49, p < .001, N = 55), which indicated that the larger, more muscular ideal body figure that was chosen, the higher the male's eating disorder symptomology, (for the other two scales, rs < .10, ps > .33). It is important to note that although Time 1 was statistically significant, the more conservative correction for multiple comparisons Bonferroni p value (p < .008) was not achieved. For body dissatisfaction scores, the MBS body dissatisfaction score (r = -.47, p < .001, N = 103; r = -.39, p = .004, N = 55), as well as the SFRS score only in Time 1 (r = -.49, p < .001, N = 103; r = -.01, p = .93, N = 55), significantly negatively correlated with the EDE-Q global score in Time 1 and Time 2, but the MFBS body dissatisfaction scores did not (r = .05, p = .61, N = 103; r = .22, p = .11, N = 55). These results indicate that those males who chose thinner ideal body figures than their current body figure choice (rather than fatter ideal body figures than their perceived current body size) in both the MBS and SFRS indicated higher levels of eating disorder behavior as measured on the EDE-Q 6.0, such as "desire to lose weight" and "fear of weight".

5.4.7. FURTHER TEST-RETEST RELIABILITIES

Test-retest reliabilities for each scale were further confirmed by examining the bivariate correlations between current and ideal body size ratings, and body dissatisfaction scores between Time 1 and Time 2 (two to six weeks later). Importantly, all correlations were moderate to strong for current body size, ideal body size, and body

dissatisfaction scores between the Time 1 and Time 2 for the *Male Body Scale*, the *Male Fit Body Scale*, and the SFRS, except for SFRS body dissatisfaction scores (see left column of Table 28). Therefore, both MBS and MFBS were more reliable in assessing body dissatisfaction than the SFRS in the two to six week test-retest.

As the Somatomorphic Matrix measures both muscularity and fatness and has been proposed as a current common visual method used to assess male body image (Cafri & Thompson, 2004), the test-re-test correlations of the MBS and MFBS were compared with the published Somatomorphic Matrix muscularity and body fat test-retest correlations. Although the two to six weeks period of time between the MFBS and MBS test and the re-test was substantially longer than the seven to ten day Somatomorphic Matrix test-retest, and the MFBS dissatisfaction test-retest correlation was moderate (on the verge of strong at .49; Cohen, 1988), the overall dissatisfaction scores still exceeded the Somatomorphic Matrix's published test-retest correlations (Cafri et al., 2004) both for measuring muscularity and fatness body ratings. Table 28 compares the MFBS (muscularity), MBS (fatness), and SFRS (fatness) two to six week test-retest correlations individually to the seven to ten day test-retest correlations Somatomorphic Matrix.

Table 28
Test-retest Correlations Between MFBS, MBS, and Somatomorphic Matrix (Cafri et al., 2004).

Muscularity	**MFBS 2-6 weeks**	**Somatomorphic Matrix 7-10 days**
Current	*r* = .76***	*r* = .78
Ideal	*r* = .69***	*r* = .55
Dissatisfaction	*r* = .49***	*r* = .35
Fatness	**MBS 2-6 weeks**	**Somatomorphic Matrix 7-10 days**
Current	*r* = .77***	*r* = .64
Ideal	*r* = .54***	*r* = .78
Dissatisfaction	*r* = .62***	*r* = .57
Fatness	**SFRS 2-6 weeks**	**Somatomorphic Matrix 7-10 days**
Current	*r* = .69***	*r* = .64
Ideal	*r* = .48***	*r* = .78
Dissatisfaction	*r* = -.26	*r* = .57

Note. MFBS = Male Fit Body Scale; MBS = Male Body Scale; SFRS = Stunkard Figure Rating Scale, *** = $p < .001$ (the *p*-values for Cafri et al.'s 2004 data are not known).

Together, these results suggest that both new scales; the MFBS and the MBS, were more reliable than both the SFRS and Somatomorphic Matrix concerning body dissatisfaction scores, each scale assessing a distinct dimension of male body dissatisfaction (adipose and muscularity).

5.5. Scale Development Conclusion

In conclusion, both the new Male Body Scale and Male Fit Body Scale were valid and reliable, as well as being the scales that males indicated they would choose to best represent their current and ideal body figure. Each of these scales asks different questions pertaining to male body ideals, and male body dissatisfaction. With each providing a proportionally systematically increasing figure scale, the MFBS measured the lean-ideal and muscularity-related body dissatisfaction, whereas the MBS measured the thin-ideal and fat-related body dissatisfaction in males. Results identified that the two newly developed scales are complementary. These scales may be utilized together or separately, depending on the investigation, to make a very quick assessment of body dissatisfaction in males. Whilst other technological or computerized measures of body dissatisfaction are currently being developed and fill a need for particular aspects of investigation, it is important to consider that in many settings there is also a need to reduce test-duration, such as in clinical assessments, where often many assessments are given at one time. Within a very brief duration of testing, these new visually-based scales are able to identify and predict specific dimensions of body dissatisfaction, which is imperative according to recent male-related ED findings (Murray et al., 2017b; Sturman et al., 2017). The new scales were both identified to be more reliable in the test-retest than the body dissatisfaction score correlations for the SFRS and also the Somatomorphic Matrix, even though the time gap between Time 1 and Time 2 was substantially longer for MBS and MFBS than for the Somatomorphic Matrix. As there are many more images that participants would need to choose from (100 images for Somatomorphic Matrix; 32 images for the Body Matrices, versus 18 for both MBS and MFBS scales combined), it is logical that these new assessments would be faster to assess two independent aspects of body dissatisfaction. Also, the head, and therefore

body size factors important to clinical populations, such as cheek-, chin-, and neck-fat or size, were included in MBS and MFBS, unlike those scales which exclude the head (such as the Body Matrices; Frederick & Peplau, 2007).

As predicted, only the MFBS body dissatisfaction scores strongly predicted the drive for muscularity in males, as identified on the DMS, and also revealed body dissatisfaction that was not identified on the SFRS or MBS. Of the two new scales only the MBS body dissatisfaction scores (toward the thin-ideal) displayed a strong relationship with greater levels of eating disorder tendencies identified on the EDE-Q 6.0 global scores in both Time 1 and Time 2. This may be because the majority of eating disorder tendencies which are measured on the EDE-Q 6.0 may focus more on the fear of fat and the avoidance of food and weight gain (i.e. "food avoidance", "fear of weight gain", "avoidance of eating", "desire to lose weight", "eating in secret", etc.), detecting a drive for thinness, rather than on the drive for muscularity and desire for a larger, more muscular body. The MFBS revealed much higher body dissatisfaction than the scales with larger, obese figures (i.e. MBS or SFRS) indicated, with most males desiring to have a larger, more muscular body than their current perceived body figure, detecting a drive for muscularity. Interestingly, males who had a higher actual body-muscle percentage still perceived their body as toward the leaner/muscular body figures rather than the larger more bulky muscular body figures. Males with a higher body muscle percentage still desired to be larger and more muscular than their currently perceived body, instead of the drive for thinness or drive for leanness. These assessments, which independently measure male body dissatisfaction in two-dimensions (adipose versus muscularity), are likely more quickly assessed and less complex than the existing measures which combine adipose and muscularity dimensions.

Some limitations include the need for scales which may appeal to more ethnically diverse populations, as well as the minor detail of the facial features (i.e. eyes, nose, lips, and hair), which are not important to the assessment of the overall body-size dissatisfaction. It is also important to note that even though the MBS and MFBS scales were identified to have more reliable body dissatisfaction scores in the test-retest correlations than the two most commonly used figure rating scales (i.e. the SFRS and the Somatomorphic Matrix), some of the correlations were moderate rather than strong. It may be that body image and dissatisfaction fluctuates quite frequently, and therefore had changed within the time that participants were assessed for the second time. More testing would need to be performed in order to determine what an appropriate or expected level of reliability should be for visual scales. Although the most commonly utilized visually- and linguistically-based scales were used as comparison and for construct validity for this study, with the aim of examining whether these scales may be valid and reliable, in the future the MBS and MFBS could also be directly compared with many of the various visually-based scales. One such study could use eye-tracking to evaluate whether extremely detailed computerized images, the removal of the head from the body, or the lack of body-size balance in many of the current scales may promote even more hyper-detailed focus and greater processing difficulty in clinical populations compared with the overall body representation of the MBS and MFBS. The current results point to the importance of investigating male body dissatisfaction and eating disorder tendencies. This under-examined line of investigation is crucially important, since muscle dissatisfaction in males has been reported to be related to overall low levels of well-being, including: depression, life dissatisfaction, and poor self-esteem (Cafri, Strauss, & Thompson, 2002).

The current study provides evidence to suggest that both the MBS and MFBS

are online, visually-driven, valid and reliable measures that straightforwardly and quickly assess male body dissatisfaction more reliably than the most commonly used visual tools for males at this time (SFRS and Somatomorphic Matrix). Unlike some of the current scales, the MBS and MFBS scales were created in a way that precisely graduate in size incrementally, in a balanced and proportional manner by a professional designer (both in overall size between figures and overall size within each figure), and were developed with actual male bodies as templates. Both scales corresponded to the actual body composition of the males (i.e. BMI, Fat-, and Muscularity percentage). In the current study, the MBS detected larger, more adipose-related body dissatisfaction (i.e. the drive for thinness), related to EDE-Q 6.0 level, whereas the MFBS revealed muscularity-ideal male body dissatisfaction (i.e. the drive for muscularity) predicting their Drive for Muscularity level in the normal male population. Used together, these scales quickly and robustly identify thin-, lean-, and/or muscularity-ideal in males, importantly measuring distinct adipose- and muscularity-related body dissatisfaction independently.

6. CHAPTER VI: THE FINAL PICTURE AND GENERAL DISCUSSION

6.1. SUMMARY OF FINDINGS

The main research questions of this thesis were:

(i) Does the way in which people read characters' expected and unexpected emotional responses within food-, body-, and/or perfectionism-related written texts predict eating disorder tendencies and/or BMI in the non-clinical population?

(ii) Which are the key underlying mechanisms (food-, body-, and/or perfectionism-related) of eating disorders in the non-clinical population?

(iii) Are the newly developed male body-dissatisfaction visual scales reliable and valid to measure the two independent dimensions of male body-dissatisfaction (adipose and muscularity)?

In Experiment 1 (Chapter III) the way in which females process "matching" or "mismatching" emotional responses from a third-person perspective (i.e. about a female character) within food-, body-, and perfectionism-related context scenarios was examined using eye-tracking. Reading behaviour was examined within these contexts to investigate the underlying mechanisms of eating disorder tendencies (i.e. EDE-Q 6.0 scores and BMI).

Overall, the findings from Experiment 1 suggest that females' perfectionism-related mismatch scores in early measures (larger first-pass mismatch scores) on the emotional response word (e.g. "*pleased*") predicted higher eating disorder levels (i.e. EDE-Q 6.0 scores). Also, the reading behaviour of individuals with lower perfectionism-related mismatch scores in total reading time predicted higher levels of eating disorder (i.e. EDE-Q 6.0 scores). Specifically, those who avoided going back to re-read the beginning of the target sentence (*"She was very"*) in later measures when

the characters' response within the scenario did not 'match' the expectations of the reader, for instance responded as *"pleased"* when the reader would expect her to be displeased. Also, higher perfectionism-related mismatch scores in total reading time at the beginning of the target sentence predicted lower BMI. Lastly, greater mismatch scores in later measures (regression path) on the emotional response word (e.g. *"pleased"*) within body-related context also predicted higher levels of disordered eating behaviour (i.e. EDE-Q 6.0 scores). Therefore, the females' expectations regarding the emotional responses of characters in perfectionism-, and to a lesser extent body-related scenarios, predicted eating disorder tendencies (i.e. EDE-Q 6.0 scores) when the scenarios were about other female characters. Experiment 1 results seemed to support those eating disorder theories that suggest perfectionism and body factors are key underlying mechanisms for the development and maintenance of an eating disorder. However, since perspective-taking has been shown to affect reading behaviour (Filik et al., 2017a), and it was uncertain whether participants read and applied the scenarios about female characters to themself, this was investigated in second-perspective by slightly changing the texts to be about the reader.

In Experiment 2 (Chapter III), eye movements were measured to investigate the way in which females' process "matching" or "mismatching" emotional responses from a second-person perspective (i.e. about the reader) within food-, body-, and perfectionism-related context scenarios. It was investigated how reading behaviour predicted eating disorder level (i.e. EDE-Q 6.0 scores) and BMI.

Overall, the findings from Experiment 2 indicated that females' perfectionism-related mismatch scores in early measures (larger first fixation mismatch scores) in scenarios when their emotional response did not correspond with the context of the perfectionism-related situation (e.g. *"pleased"* about making a mistake) just after

reading the emotional response (e.g. "pleased") predicted higher EDE-Q 6.0 scores. Also, *larger* early measures (first fixation mismatched scores) were detected, at the emotional response word (*Region 2*, e.g. *"pleased"*) in body-related scenarios, which predicted females' *lower* measured BMI's. Therefore, thinner females quickly detected and fixated on the unexpected emotional response (e.g. *"pleased"*) when the scenario was about their own body (e.g. stated they were pleased that they had gained quite a bit of weight). In later reading measures (i.e. total reading time) in scenarios about the female readers, those with *higher* mismatch scores in perfectionism-related scenarios (just following the emotional response *"pleased"*), predicted *lower* measured BMI's. Thinner females tended to avoid the end of the target sentence (e.g. *"to have done that."*) just after the unexpected emotional response (e.g. *"pleased"*), when the scenario stated they were pleased that they had made a small mistake. Therefore, perspective-taking did seem to make some difference in the way in which females with higher levels of eating disorder and lower levels of BMI read the scenarios, but still the results seemed to support those theories that include both perfectionism-related, and to a lesser extent, body-related underlying mechanisms of eating disorders.

In Experiment 3 (Chapter IV) male reading behaviour was examined utilising eye-tracking, to examine how males processed expected and unexpected emotional responses of other males from a third-person perspective to food-, body-, and perfectionism-related scenarios, and how this may predict their eating disorder level (i.e. EDE-Q 6.0) and BMI.

Overall, the findings from Experiment 3 indicated that males with higher mismatch scores for perfectionism-related scenarios predicted their levels of disordered eating behaviour (i.e. EDE-Q 6.0 scores) and lower BMI, and lower mismatch scores in later measures predicted males higher EDE-Q 6.0 scores. Male readers had higher first

fixation mismatch scores in the region of text immediately following the unexpected emotional response (e.g. *"pleased"*) for perfectionism-related scenarios, which predicted higher eating disorder levels (i.e. EDE-Q 6.0 scores). Also, those who tended to attend to the unexpected emotional response (*"pleased"*) in these scenarios in later reading measures (i.e. *higher* total reading time perfectionism- related mismatch scores) predicted *lower* measured BMI. However, to a lesser extent, *larger* regression path mismatch scores within the "spill-over" region just after the emotion word ("*pleased"*) in perfectionism-related context unexpectedly predicted *higher* BMI. Additionally, males who tended to avoid re-reading the beginning of the target sentence (*"He was very"*) of body-related scenarios in which the male character's response did not match the readers expectations (i.e. *lower* total reading time body-related mismatch scores) were predicted to have higher eating disorder levels (i.e. EDE-Q 6.0 scores). Therefore, these results also appear to support the theories that indicate perfectionism- and to a lesser extent body-related underlying mechanisms of eating disorder tendency, and specifically the Transdiagnostic Model of Eating Disorders (Fairburn et al., 2003) which focusses on the common underlying and maintaining features of all eating disorders (Fairburn & Cooper, 2011). However, as alluded to with the female studies, perspective-taking may subtly influence the way in which people process information, and therefore materials were slightly altered to investigate males reading second-perspective food-, body-, and perfectionism-related information.

In Experiment 4 (Chapter IV) eye-movements were recorded to examine how males process second-person (i.e. scenarios about "you") scenarios with "matching" or "mismatching" emotional responses to food-, body-, and perfectionism-related texts. It was investigated how reading behaviour regarding these factors may predict eating disorder level (i.e. EDE-Q 6.0 scores) and BMI.

Overall the findings from Experiment 4 indicated that higher body-related mismatch scores predicted males' higher BMI. There were no mismatch scores that predicted males' EDE-Q scores. Both of these results were unexpected, and may be due to the lower average global EDE-Q scores in this sample (M = 1.00, SD = .86) compared to male norms (M = 1.09, SD = 1.00; Lavender et al., 2010). Nevertheless, the results in this study appeared to support theories that include body-related underlying mechanisms for eating disorders in males, such as the cognitive model of eating disorders (Vitousek & Hollon, 1990). This points to distorted body schemata leading to processing difficulty (selective attention) related to negative body-related information. Also, the Cognitive Behavioural Theory of Bulimia Nervosa and Anorexia Nervosa (Fairburn, 1981; Fairburn, 1984; Fairburn et al., 1999a), which both point to processing difficulty (hyper-focus) within the context of disliked body-related information. However, these results may also provide some support toward the Transdiagnostic Theory of Eating Disorders (Fairburn et al., 2003) related to males. In a study investigating the validity of the Transdiagnostic Theory of Eating Disorders in males, body and weight concerns were shown to be related to BMI level, which then was reported to lead to disordered eating and compulsive exercise behaviour in males (Dakanalis, Timko, Clerici, Zanetti, & Riva, 2014). This study suggested that (if replicated in clinical samples) body-related concerns (along with emotional regulation) were the two main factors to be focused on within male-related eating disorder treatment.

The lack of males involved in the systematic review (Chapter II) showed that males are often excluded from eating disorder research. Furthermore, current literature results suggest that males may strive toward different body-related goals compared with females (muscularity-driven rather than the "thin-ideal"), which may lead to different

eating disorder-related behaviours. To address these needs, new male body dissatisfaction scales were developed and reported in this present thesis to provide male body-related assessment tools.

In Chapter V two visually-based male scales (Male Body Scale and Male Fit Body Scale) were developed, tested, and re-tested to provide a quick and visual method that is able to measure two dimensions of male body-dissatisfaction independently (adipose vs. muscularity). Body dissatisfaction on both new male scales showed greater test/re-test reliability compared to the two most utilised male visual scales (Stunkard Figure Rating Scale and Somatomorphic Matrix). Both new male scales were found to be reliable, valid scales, which importantly each measure a distinct aspect of two-dimensional male body dissatisfaction. Specifically the Male Body Scale measured body dissatisfaction related to obesity, whilst the Male Fit Body Scale measured body dissatisfaction related to muscularity.

6.2. Contributions To The Literature

6.2.1. The Relationship Between Reading Behaviour and Eating Disorder Tendencies (ED Theories)

In this thesis, eye-tracking during reading was utilised to assess whether the processing of characters' emotional responses to food-, body-, and/or perfectionism-related information could reveal underlying mechanisms that predict eating disorder tendencies (measured by the EDE-Q scores and BMI). Consistently across Experiments 1, 2, and 3, primarily the way in which participants read perfectionism-related information predicted their eating disorder tendencies. This was evident in both females whilst reading third- and second-person texts, and also males whilst reading third-person texts. In these same experiments, the body-related mismatch scores predicted their eating disorder tendencies, and this reading behaviour also predicted BMI in Experiment 4 (males reading second-person texts).

Collectively, the female and male eye-tracking studies may support several aspects related to theories of eating disoders. Firstly, Experiments 1-4 results may most strongly support theories, which include perfectionism- and body-related mechanisms and maintainers underlying eating disorders in general, such as the Transdiagnostic Model of Eating Disorders (Fairburn et al., 2003), as perfectionism was detected as the main predictor of eating disorder level. The Transdiagnostic Model of Eating Disorders (Fairburn et al., 2003) suggests that eating disorders are primarily cognitive difficulties with basic core psychopathologies that similarly underly all eating disorders (i.e. anorexia nervosa, bulimia nervosa, binge eating disorder, etc.), as well as additional maintaining mechanisms in some patients.

A main core factor for *some* individuals is to establish their self-worth on the ability to achieve extreme self-expectations and rules (clinical perfectionism). These rigid rules may be focused on general life (e.g. achievements), and also turned toward the body, with self-worth based on weight, body-size, and body-fat. Therefore, these individuals may find it particularly difficult to process unexpected emotional responses within a perfectionism- and/or body-related context (e.g. pleased to make a small mistake or have gained some weight), as detected in the eye-tracking studies within this present thesis. However, not only the control and over-evaluation of body-related aspects are considered to be core psychopathologies, but this theory includes the over-evaluation and control of eating, along with body-related core maintainers (e.g. body shape and weight), which then lead to the disordered eating behaviour.

The present eye-tracking studies did not detect food-related underlying mechanisms of eating disorders. Also, clinical perfectionism within the Transdiagnostic Theory of Eating Disorders (Fairburn et al., 2003) only pertains to *some* individuals with eating disorders, whereas the present eye-tracking study results suggest that mainly

general perfectionism- and to a lesser degree, body-related underlying mechanisms of eating disorder level and also BMI levels in both males and females. To speculate, it may be that perfectionism is an underlying cognitive mechanism in general, that then is applied toward the body, which then leads to disordered eating behaviours.

Also, the present results seem to support those studies which have shown that those with higher levels of ED will initially fixate upon what may be threatening stimuli (failure-related and body-related), followed by disengagement of these stimuli later in processing for those with greater levels of ED. These results may provide some support for theories that include processing difficulty within a threatening ego-related context, such as Heatherton and Baumeister's (1991) theory Escape from Awareness, which suggests an initial cognitive focus on high standards and expectations (in general or body-related), which leads to negative self-image and viewing oneself as a failure in comparison. This leads to avoidance of ego-related threats, or perceived failure, and an escape from awareness related to disordered eating (binge eating behaviour).

As it has been found that perceived failures, even in non-body-related spheres (e.g. making a mistake), may cause more negative self-body-image in those with ED (Striegel-Moore, McAvay, & Rodin, 1986), it may be that perfectionism-related materials in which the character did not respond as expected (e.g. pleased that they made a mistake) may be indirectly related to oneself in those with higher levels of ED. Therefore, the emotional response to perfectionism-related stimuli that "mismatches" the participants with higher levels of ED, may be initially processed with more difficulty by becoming fixated on or just after the key emotional word in the spill-over processing area (e.g. *"pleased"* or *"to have done that."*). Those with higher levels of eating disorder may quickly find this unexpected information within the context of threatening perfectionism-related information (e.g. pleased of what is perceived as

failure) in early measures (e.g. larger first fixation mismatch scores), which then induces self-awareness as there is time to further process the texts, leading to an avoidance of re-reading the beginning of the target sentence in later reading measures (e.g. smaller total reading time mismatch scores).

Taken together these studies displayed initial fixations (i.e. first fixation duration mismatch scores) on the unexpected emotional word (e.g. *"pleased"*) and just after this response (called the spillover effect), indicating processing difficulty of an unexpected response. This then was often followed by an avoidance of re-reading the target sentence that contained the unexpected emotional response within the context of mainly perfectionism and also body-related context, but to a lesser extent. These earlier processing results (i.e. larger first fixation mismatch scores predicting greater eating disorder tendencies) may provide further support for prior studies that point to individuals with eating disorders finding it difficult to shift their cognitive focus (lower cognitive flexibility) during the initial phases of information processing strategy (for example Holliday, Tchanturia, Landau, Collier, & Treasure, 2005; Lang, Lopez, Stahl, Tchanturia, & Treasure, 2014; Roberts, Tchanturia, Stahl, Southgate, & Treasure, 2007). However, larger mismatch effect scores only predicted EDE-Q 6.0 in earlier measures (e.g. larger first fixation and first-pass mismatch scores) for perfectionism-related scenarios within this thesis (Experiments 1-3). These larger mismatch effect scores in early processing (e.g. larger first fixation mismatch scores) also predicted lower measured BMI within body-related context for materials directed at the reader for females (Experiment 2). Therefore, as this effect was not detected generally, or for food-related stimuli, lower cognitive flexibility or difficulty shifting attention for those with eating disorders during early processing may be factor-dependent and not a general disturbance. Alternatively, cognitive inflexibility may broaden to general cognitive

processing inflexibility as eating disorder severity progresses, making it more difficult to shift focus within clinical populations.

The studies in this thesis took the transdiagnostic approach to eating disorders, as many people migrate between eating disorder diagnoses (Agras et al., 2000; Sullivan et al., 1998). These migrations between eating disorder diagnoses occur so frequently that longitudinal researchers have suggested that anorexia nervosa is one stage within the progression of stages within an eating disorder, with shared underlying core mechanisms, rather than an independent disorder with independent mechanisms (Eddy et al., 2002). Fairburn et al. (2003) developed the evidence-based Transdiagnostic Model of Eating Disorders, pointing to shared distinctive clinical features between anorexia nervosa, bulimia nervosa, and EDNOS (including binge eating disorder). Within this theory, clinical perfectionism (i.e. the over-importance of achieving self-imposed, demanding standards) is viewed as a key maintaining factor of an eating disorder for some individuals, and recovery was found to be supported when this component was diminished. Fairburn et al.'s (2003) theory includes perfectionism as a key factor for an eating disorder for some individuals (inclusive of anorexia nervosa, bulimia nervosa, and binge eating disorder transdiagnostically). This theory places body-related (as well as food-related) dysfunctional schemata for self-evaluation as core mechanisms for eating disorders in general, unlike many of the other theories, which are diagnosis-specific. Other more commonly referred to theories are designed specifically for bulimia nervosa and binge eating disorder, or anorexia nervosa individually.

The eye-tracking studies in this thesis may support the view that a perfectionistic information processing style is both a risk and maintenance factor for eating disorders as the Cognitive-Interpersonal Model of Anorexia Nervosa includes (Schmidt & Treasure, 2006; Treasure & Schmidt, 2013). However, this type of processing style was

not found to predict eating disorder level for unexpected responses within all conditions (i.e. not for food-related text), but only perfectionism- and also body-related text, to a lesser extent. Still, the main underlying mechanism that was detected to predict eating disorder level and BMI was perfectionism-related. In addition, the eye-tracking studies in this thesis (Experiments 1-4) broaden these findings to include eating disorders in general (transdiagnostically), providing evidence for perfectionism related information processing style as a transdiagnostic eating disorder mechanism and maintenance. Also, these eye-tracking studies explicitly include body-related cognitive mechanisms, but to a lesser extent than perfectionism-related information processing strategies. Therefore, Fairburn et al.'s (2003) Transdiagnostic Model of Eating Disorders, which includes perfectionism- and body-related global eating disorder underlying mechanisms, may be most strongly supported by the eye-tracking experiments in this thesis. The present eye-tracking results may extend the Transdiagnostic Model to elevate general perfectionism cognitive mechanisms as a principal core underlying mechanism for eating disorder level, along with body-related cognitive mechanisms, to a slightly lesser extent.

6.2.2. The Relationship Between Eye-tracking Experiment Results and Previous Empirical Literature on Eating Disorders and Cognitive Processing

Unlike many implicit studies, tracking eye-movements during reading provided a natural task, and as participants came in for a "reading" study, it was not obvious to participants what the study was investigating until they were debriefed. In this way, participants were not primed or biased prior to the study, and reading behaviour and information processing style was able to be identified that predicted eating disorder level and also BMI within the normal population for females and males.

Whilst many clinical studies have found food-related, or combined food- and body-related word and/or image processing difficulty for those with eating disorders

utilising the modified Stroop task (e.g. Ben-Tovim & Morton, 1989; Ben-Tovim & Walker, 1991; Channon et al., 1988; Cooper et al., 1992; Cooper & Fairburn, 1992; Cooper & Todd, 1997; Green et al., 1998; Johansson et al., 2008; Jones-Chesters et al., 1998; Long et al., 1994; Perpina et al., 1993; Sackville et al., 1998; Stormark & Torkildsen, 2004); the modified dot-probe task (Shafran et al., 2007); fMRI (Brooks et al., 2011a; Brooks et al., 2012; Geliebter et al., 2016; Gordon et al., 2001; Uher et al., 2003; Uher et al., 2004); go/no-go task (Mobbs et al., 2008); ERPs (Blechert et al., 2011); the startle response task (Friederich et al., 2006); the visual search task (Smeets et al., 2008); the word association test (Berry et al., 1998); and eye-tracking (Giel et al., 2011), the results from all four eye-tracking studies in this present thesis did not find any significant relationship between the processing of character response to food-related scenarios (food mismatch scores) and eating disorder tendencies (i.e. EDE-Q 6.0 scores) or BMI in females or males.

The consistent food-related results reported in this thesis (i.e. lack of significant food-related processing difficulties in relation to eating disorder tendencies) may support other clinical studies that also report no significant food-related results. For example Black et al.'s (1997) modified Stroop task reported that individuals with BN, restrained, and unrestrained healthy controls processed food-related words similarly. Also, Mobbs et al. (2011) reported that BED and non-BED obese controls reacted similarly in a go/no-go with food-related words. However, unlike the results of Experiments 1-4 reported here, this study also reported no body-related processing differences. Whilst no food mismatch scores predicted any eating disorder level (i.e. EDE-Q 6.0) or BMI level in the four eye-tracking studies in this present thesis, there were body-related mechanisms detected in all four Experiments. Van den Eynde et al.'s (2013) fMRI study also found no processing differences toward food-related stimuli

related to eating disorder level, but did find differences in processing body-related simuli (i.e. increased insular activation toward body-related images) related to eating disorder. Also, none of the present eye-tracking results (Experiment 1-4) support other non-clinical eye-tracking studies investigating the relationship between BMI and processing strategies of food-related stimuli (Nijs et al., 2010; Werthmann et al., 2011), in which initial but not maintained attention for food-related images related to those who were overweight or obese.

Generally, Experiments 1-4 support studies that have reported significant processing difficulty for body-related stimuli in clinical eating disorder participants utilising the modified Stroop task (e.g. Fassino et al., 2002; Green et al., 1994; Green et al., 1999); the modified dot-probe task (Blechert et al., 2010) fMRI (e.g. Castellini et al., 2013; Friederich et al., 2010; Mohr et al., 2010; Miyake et al., 2010a; Sachdev et al., 2008; Suchan et al., 2013; Vocks et al., 2010); fMRI and Stroop combined (e.g. Redgrave et al., 2008); and eye-tracking (e.g. Blechert et al., 2009; George et al., 2011; Phillipou et al., 2016; von Wietersheim et al., 2012).

Previous fMRI studies presenting body-related stimuli to clinically diagnosed eating disorder participants have shown strong emotional brain activity response (such as fear) toward body-related stimuli (e.g. Castellini et al., 2013; Miyake et al., 2010b; Mohr et al., 2010; Redgrave et al., 2008; Sachdev et al., 2008; Spangler & Allen, 2012; Uher et al., 2005; Vocks et al., 2010). To speculate, it may be that the early measures (higher first fixation mismatch scores) for unexpected responses within body-related scenarios, as well as the avoidance of regions within the target sentence containing the emotional response of the character in later reading mismatch scores, may provide some support for these emotion-processing differences related to eating disorder level in the general population.

The eye-tracking results of Experiments 1-4 also may provide support to clinical studies that have reported information processing differences between self- versus other-body-related stimuli, such as Blechert et al.'s (2010) modified dot-probe task which reported that those with anorexia nervosa displayed significantly faster saccades toward self-body photos compared to other-body photos. Extending these results, the present eye-tracking studies (Experiments 1-4) detected difficulty processing unexpected responses to body-related information (e.g. pleased to have gained quite a bit of fat) predicted the transdiagnostic eating disorder level (i.e. EDE-Q 6.0 scores) of both female and male readers when the scenario was about a character's response to the character's body (i.e. third-person perspective). However, when the scenarios were about the readers' own unexpected response to their own body (i.e. second-person perspective), body-related mismatch scores predicted both female and male readers' BMI level.

6.2.3. Mismatch effect, Perspective Taking, Worldview/Individual Differences and Reading Behaviour (Psycholinguistics Literature)

This thesis (i.e. Experiments 1-4) investigated food-, body-, and perfectionism 'matched' and 'mismatched' emotional responses of same-gendered characters (third-person experiments), and also emotional responses from the reader's perspective (e.g. "*you*"). Results seem to support a number of findings within the psycholinguistics literature.

As there was an overall mismatch effect (i.e., longer reading times for mismatch than match scenarios) in all three factors in all four experiments, and therefore both female and male readers detected unexpected emotional responses which were about characters of the same gender as the reader (i.e. third-person perspective), and also the reader (i.e. second-person perspective). This general 'mismatch effect' supports studies

from the psycholinguistics literature showing that that readers are able to infer emotional states for fictional characters, and that this knowledge about human emotions is automatically accessed (see Gernsbacher et al., 1998), and that eye-tracking is able to reveal expectations and more detailed information processing difficulty when the emotional response does not correspond to the reader's world knowledge (see Filik, 2008; Filik & Leuthold, 2013, Experiment 2).

It is interesting that there was an overall mismatch effect for food-, body-, and perfectionism-related scenarios across all four eye-tracking studies (i.e. Experiments 1-4). These overall mismatch effects seem to suggest that the general perception for both males and females is that it is "bad" to put on weight, to eat a lot, and to make minor mistakes, and that individuals make these judgments even during a more implicit test which was detected by tracking eye movements. These results support several concepts, such an implicit anti-fat bias attitudes and stereotypes, which has not only been reported in eating disorder samples, but in children as young as 5 years of age (e.g. Rodgers, Wertheim, Damiano, Gregg, & Paxton, 2015), and even in obesity-focused healthcare professionals. For example, Teachman and Brownell (2001) reported that of 84 health professionals who treat those with obesity, that a significant implicit anti-fat attitude (i.e. fat was related to "bad") and and anti-fat stereotype (i.e. fat people are lazy), although less than for the general population. Rodgers et al. (2015) reported that 4.2% of 3-year-olds and 28% of 5-year-olds recognised the use of dietary restriction to lose weight, and more than 15% of children were familiar with or participated in the stigmatisation of overweight people. Therefore, these dichotomous "good" and "bad" associations and attitudes towards body size and foods may be learned early in life. The perfectionism-related stimuli in Experiments 1-4 may be considered "ego-threats", as the small mistakes or lack of perfection may be perceived by the reader as a "threat" to

the character's or reader's self-image. Therefore, the readers may have generally expected a negative response to "mismatch" perfectionism-related materials. Self-image has been reported to significantly reduce when an individual's self-image is threatened, such as Vohs and Heatherton's (2001) study that reported a reduction in view of oneself in relation to poor academic performance.

More recent findings (see Filik et al., 2017a) show that an individual's expectation of the emotional-response is impacted by the reader's perspective. Within the four eye-tracking studies in this thesis (i.e. Experiments 1-4), subtle processing difficulty was detected in both third- and second-perspective for male and female readers, with the same key underlying mechanism of eating disorder tendencies emerging (i.e. perfectionism- and body-related dimensions). Both males (in third-person perspective) and females (in third- and second-person perspective) with greater processing difficulty of unexpected emotional responses within perfectionism-related scenarios (i.e. mismatch scores) predicted higher levels of eating disorder (i.e. EDE-Q 6.0 scores). Also, males and females with greater processing difficulty of unexpected emotional responses (i.e. mismatch scores) within body-related scenarios (e.g. pleased to have gained quite a bit of weight) predicted higher levels of eating disorder (i.e. EDE-Q 6.0 scores) whilst reading in third-perspective (i.e. about a character), and actual BMI levels in second-perspective (i.e. about the reader).

Finally, eye-tracking during a natural reading task was able to not only detect subtle processing difficulties in general (i.e. general 'mismatch effect'), but also predict eating disorder level and BMI of individuals. These studies revealed key underlying cognitive processing difficulty predictive of eating disorder tendencies and BMI in both females and males in the general population. Experiments 1-4 results extend the current psycholinguists research, which suggest that inter-individual differences influence

information processing style (Kos et al., 2012; Van den Brink et al., 2012). For example, Filik et al. (2017b, *in review*) reported that those who use malicious humour (a subscale of the indirect aggression scale) more often in everyday life read critical texts differently (as more sarcastic rather than literally) compared those who do not use malicious humour as often. Likewise, the eye-tracking results within this thesis extend the suggestion that inter-individual differences may alter how an individual processes and interprets texts. The expectations of characters' responses of those with higher levels of eating disorder may differ to those with lower levels of eating disorder, and therefore appeared to alter the way in which disease-salient information was processed. Therefore, Experiments 1-4 supported and extended psycholinguistic studies, showing that eye-tracking detects the expectations of the reader, subtle information processing strategy differences depending on perspective, individual differences, that may be utilised to predict eating disorder tendencies and BMI.

6.2.4. Development, Test, Re-Test of New Male Body Scales

In this thesis, the review of prior cognitive processing literature in relation to eating disorder tendencies, indicated a lack of male eating- and body-related studies, which the eye-tracking has now contributed to. Examining the history of eating disorders revealed that eating disorder diagnosis criteria, as well as assessments, and treatments have been focused primarily on females and female symptomology (e.g. such as including the lack of menstrual period as a primary criteria for the diagnosis of anorexia nervosa until the most current DSM-V). Therefore, many males have not sought help, have not been assessed or diagnosed properly, and are therefore overlooked regarding eating disorder and body dissatisfaction. Chapter V detailed the development, testing, and re-testing of two new visual-based male body dissatisfaction scales. This chapter explored the two-dimensional body dissatisfaction of males (adipose versus

muscularity), which has been shown to differ from female-related body dissatisfaction (desire to be 'skinny'). The results suggested that these scales may provide a quick, more robust assessment of male body dissatisfaction than the two most commonly utilised visually-based assessments (SFRS and somatomorphic matrix) for research within this area.

As these scales are visually-based, incrementally graduated in size, and precisely created based on actual male body figures (avoiding cartoon-like male figures), many of the aspects that hinder the detection of two distinct male body-dissatisfaction dimensions are avoided, such as the wording of scales and female goal-oriented assessments (i.e. focused on the fear of fat rather than the desire to be lean and muscular). Also, unlike during the development of many other figure-based scales, males' actual body composition (BMI, Fat-, and Muscularity-percentages) was measured, and found to correspond to each of the new male body scales. Differing results of body-dissatisfaction with the same individuals on the two scales supported current research that fat-related and muscle-related body perception are two independent mechanisms in males, with differing psychological importance (Sturman et al., 2017). Since a diminished drive for thinness has shown to at times mask the development of the drive for muscularity in males, it is important to be able to assess these two dimensions separately (Murray et al., 2016), which these two new scales were able to distinguish between. In sum, this Chapter contributes two valid and reliable scales for other researchers and clinicians to utilise, which focus on the assessment of male body-dissatisfaction in two independent dimensions.

6.3. Limitations and Future Directions

All of the experiments in this present thesis were performed with participants from the general population, who were native English-speaking individuals. Although the EDE-Q 6.0 is the only measure to monitor and evaluate eating disorder pathology currently recommended by the NIMHE (2008), and created specifically as a transdiagnostic assessment, there may be some limitations using this as a transdiagnostic measure of eating disorders. Firstly, as a self-report measure, the EDE-Q 6.0 may be subject to biases, such as response bias. Additionally, EDE-Q 6.0 levels may be lower for individuals with AN, and higher for individuals with BN and BED. Further research focused on the processing of general perfectionism, body-related and food-related information as distinct factors within a clinically diagnosed population utilising the current eye-tracking materials and methods, and also clarifying the role of food in clinical populations is needed.

There may also be limitations using BMI as a proxy measure of eating disorder symptomology for a couple of reasons. Firstly, in Experiment 1 only reported BMI was collected and reported, whereas Experiment 2-5 included measured BMI. The BMI in Experiment 1 is oddly distributed, so it is important to consider that the self-reported BMI may not be as accurate as the actual BMI when making conclusions. Secondly, as only AN diagnosis includes an intense fear of fat, and low BMI, it was greater mismatch scores that were hypothesised to predict lower BMI in the eye-tracking studies, even though these studies mainly investigated eating disorders transdiagnostically. However, it is important to note that there is a wide range of weight (and therefore BMI) across eating disorders, and the high prevalence of BED may point to reading measures predicting high or low BMI.

The expectations of character response may also be culturally influenced. Some cultures (e.g. western cultures) may associate body fatness with laziness, whilst other cultures (e.g. areas with higher levels of poverty) may associate body fatness with wealth and prestige. Therefore, this research may set an initial strong foundation to be extended within the clinically diagnosed population, as well as extended into other cultures and languages. For instance, eye-tracking during the natural task of reading may be utilised to detect the development of eating disorders, pick up eating disorder risk, and as a tool within attentional bias re-training programs, to attempt to reduce the cognitive processing related to eating disorder symptomology.

6.4. Overall Conclusion

This thesis has demonstrated, through four large-scale eye-tracking studies detecting information processing strategies, that the expectations of the reader influences the processing of food-, body-, and perfectionism-related information, (i.e. general mismatch effect), which predicts eating disorder tendencies (i.e. EDE-Q 6.0 scores) and BMI level in the general population. Overall, participants displayed a "mismatch effect" (difficulty processing information) when the emotional response of the character within the text did not "match" the expectation of the reader in all three dimensions (food, body, and perfectionism). Furthermore, for the first time this method was used to investigate the underlying mechanisms of eating disorders, and was able to predict participants' eating disorder tendencies (larger EDEQ scores) and BMI, mainly through reading times in relation to perfectionism-related scenarios, and to a lesser extent for body-related scenarios. Although food and eating-related aspects are central difficulties related to disordered eating behaviour, and may be a relevant eating disorder mechanism, this relationship could not be established here in the normal population, as no food-related mismatch effect scores were related to participants' level of eating

disorder behaviour (i.e. EDE-Q 6.0 scores) or BMI. These results support theories that incorporate both perfectionism- and body-related key mechanisms in the development and maintenance of eating disorders such as Joiner et al.'s (1997) Two Factor Vulnerability-Stress Model, Vohs et al.'s (1999) Three-Way Interactive Model for Bulimia Nervosa, Bardone et al.'s (2000) Three-Factor Interactive Model for Bulimia Nervosa, Heatherton and Baumeister's (1991) Escape from Self-Awareness Theory for bulimia nervosa, and the Cognitive-Interpersonal Model of Anorexia Nervosa (Schmidt & Treasure, 2006; Treasure & Schmidt, 2013). However, since many eating disorder theories are diagnosis-specific (i.e. for anorexia nervosa, bulimia nervosa, or binge eating disorder distinctly), due to the transdiagnostic approach of the experiments within this thesis, Fairburn et al.'s (2003) Transdiagnostic Model for Eating Disorders may be most strongly supported.

The results of these eye-tracking studies (Experiment 1-4) may inform the further development of eating disorder theory. Many of the current theories emphasise perfectionism as a trait or related to body perception and/or food intake. Therefore, the main perfectionistic goals are often related to or work with regulating the body (negative or distorted body self-image) or food. In contrast, in this thesis most eye-tracking evidence pointed to the processing of unexpected emotional responses to general perfectionism (not related to the body or food) that appeared as a key mechanism for eating disorder tendencies at times independently of body-related mechanisms and consistently independent from food-related mechanisms in the normal population in these novel studies. These results may point to the literature that supports information processing difficulties with "ego-threats". It may be that the unexpected emotional response to perfectionism-related information is internalised, and therefore as making a small mistake is processed as a failure as a person, these scenarios are quite

robust at detecting those with higher levels of eating disorder. Also, until more recently many studies investigating the processing of information related to eating disorders have often merged body and food stimuli together in a single category, making it difficult to distinguish the underlying mechanisms. As none of the studies in this thesis indicated any food-related information processing difficulty are related to eating disorder level or BMI, it is important to continue investigating body-, and food-related stimuli independently.

This thesis also demonstrated the need for new, expeditious visual assessments, and especially for males. Two new visual tools to assess the two dimensions of body dissatisfaction in males were developed, tested, and re-tested, and shown to be valid and reliable. Importantly, each visual scale was able to assess two distinct dimensions of body dissatisfaction in males (adipose and muscularity) in the normal population. The results may inform eating disorder-related assessment in males, and further testing of these scales within the clinical population may also prove to be useful as an expeditious, relevant method to assess two independent dimensions of body dissatisfaction.

This evidence-based research brings more clarity to the cognitive mechanisms underlying the development and maintenance of eating pathologies, to provide much needed understanding of these cognitive biases and information processing, in order to enhance current literature, and also to be implemented into clinical execution in the future through preventative strategies and eating disorder treatments.

FOOTNOTES

1. Bivariate correlations were performed between difference in body dissatisfaction scores between Time 1 and Time 2 for each scale, and the number of days between the Time 1 and Time 2. Results indicated that there were no significant relationships between the difference in time between Time 1 and Time 2 and the difference in body dissatisfaction score (rs < .20, ps > .15, N = 55).

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Appendix A
EDE-Q 6.0 Scale

EATING QUESTIONNAIRE

Instructions: The following questions are concerned with the past four weeks (28 days) only. Please read each question carefully. Please answer all the questions. Thank you.

Questions 1 to 12: Please circle the appropriate number on the right. Remember that the questions only refer to the past four weeks (28 days) only.

	On how many of the past 28 days …..	No days	1-5 days	6-12 days	13-15 days	16-22 days	23-27 days	Every day
1	Have you been deliberately trying to limit the amount of food you eat to influence your shape or weight (whether or not you have succeeded)?	0	1	2	3	4	5	6
2	Have you gone for long periods of time (8 waking hours or more) without eating anything at all in order to influence your shape or weight?	0	1	2	3	4	5	6
3	Have you tried to exclude from your diet any foods that you like in order to influence your shape or weight (whether or not you have succeeded)?	0	1	2	3	4	5	6
4	Have you tried to follow definite rules regarding your eating (for example, a calorie limit) in order to influence your shape or weight (whether or not you have succeeded)?	0	1	2	3	4	5	6
5	Have you had a definite desire to have an empty stomach with the aim of influencing your shape or weight?	0	1	2	3	4	5	6
6	Have you had a definite desire to have a totally flat stomach?	0	1	2	3	4	5	6
7	Has thinking about food, eating or calories made it very difficult to concentrate on things you are interested in (for example, working, following a conversation, or reading)?	0	1	2	3	4	5	6
8	Has thinking about shape or weight made it very difficult to concentrate on things you are interested in (for example, working, following a conversation, or reading)?	0	1	2	3	4	5	6
9	Have you had a definite fear of losing control over eating?	0	1	2	3	4	5	6
10	Have you had a definite fear that you might gain weight?	0	1	2	3	4	5	6
11	Have you felt fat?	0	1	2	3	4	5	6
12	Have you had a strong desire to lose weight?	0	1	2	3	4	5	6

EDE-Q 6.0 Scale
(Continued)

Questions 13-18: Please fill in the appropriate number in the boxes on the right. Remember that the questions only refer to the past four weeks (28 days).

Over the past four weeks (28 days) ……

13 Over the past 28 days, how many times have you eaten what other people would regard as an unusually large amount of food (given the circumstances)?	…….
14 ….. On how many of these times did you have a sense of having lost control over your eating (at the time that you were eating)?	…….
15 Over the past 28 days, on how many **DAYS** have such episodes of overeating occurred (i.e., you have eaten an unusually large amount of food and have had a sense of loss of control at the time)?	…….
16 Over the past 28 days, how many times have you made yourself sick (vomit) as a means of controlling your shape or weight?	…….
17 Over the past 28 days, how many times have you taken laxatives as a means of controlling your shape or weight?	…….
18 Over the past 28 days, how many times have you exercised in a "driven" or "compulsive" way as a means of controlling your weight, shape or amount of fat, or to burn off calories?	…….

Questions 19 to 21: Please circle the appropriate number. Please note that for these questions the term "binge eating" means eating what others would regard as an unusually large amount of food for the circumstances, accompanied by a sense of having lost control over eating.

19 Over the past 28 days, on how many days have you eaten in secret (ie, furtively)? ….. Do not count episodes of binge eating	No days	1-5 days	6-12 days	13-15 days	16-22 days	23-27 days	Every day
	0	1	2	3	4	5	6
20 On what proportion of the times that you have eaten have you felt guilty (felt that you've done wrong) because of its effect on your shape or weight? ….. Do not count episodes of binge eating	None of the times	A few of the times	Less than half	Half of the times	More than half	Most of the time	Every time
	0	1	2	3	4	5	6
21 Over the past 28 days, how concerned have you been about other people seeing you eat? ….. Do not count episodes of binge eating	Not at all		Slightly		Moderately		Markedly
	0	1	2	3	4	5	6

EDE-Q 6.0 Scale
(Continued)

Questions 22 to 28: Please circle the appropriate number on the right. Remember that the questions only refer to the past four weeks (28 days).

	Over the past 28 days …..	Not at all		Slightly		Moderate -ly		Markedly
22	Has your weight influenced how you think about (judge) yourself as a person?	0	1	2	3	4	5	6
23	Has your shape influenced how you think about (judge) yourself as a person?	0	1	2	3	4	5	6
24	How much would it have upset you if you had been asked to weigh yourself once a week (no more, or less, often) for the next four weeks?	0	1	2	3	4	5	6
25	How dissatisfied have you been with your weight?	0	1	2	3	4	5	6
26	How dissatisfied have you been with your shape?	0	1	2	3	4	5	6
27	How uncomfortable have you felt seeing your body (for example, seeing your shape in the mirror, in a shop window reflection, while undressing or taking a bath or shower)?	0	1	2	3	4	5	6
28	How uncomfortable have you felt about others seeing your shape or figure (for example, in communal changing rooms, when swimming, or wearing tight clothes)?	0	1	2	3	4	5	6

What is your weight at present? (Please give your best estimate.) .....

What is your height? (Please give your best estimate.) .....

If female: Over the past three-to-four months have you missed any menstrual periods? .....

If so, how many? .....

Have you been taking the "pill"? .....

THANK YOU

Appendix B
Experiment 1 & 3 (Third-person female & male) & 2 & 4 (Second-person)
Stimulus Materials Full Set

1.

Scenario Type	Example
Food-related Match	Margaret/You/Adam go(es) to the fair with her/your/his friends. There, she/you/he manage(s) to keep from eating too much candyfloss. She/You/He feel(s) really happy that this happened.
Food-related Mismatch	Margaret/You/Adam go(es) to the fair with her/your/his friends. There, she/you/his end(s) up eating way too much candyfloss. She/You/He feel(s) really happy that this happened.
Body image-related Match	Margaret/You/Adam start(s) a new workout plan. She/You/He no longer feel(s) her/your/his thighs rubbing together every time she/you/he walk(s). She/You/He feel(s) really happy that this happened.
Body image-related Mismatch	Margaret/You/Adam start(s) a new workout plan. She/You/He can feel her/your/his thighs rubbing together every time she/you/he walk(s). She/You/He feel(s) really happy that this happened.
Perfectionism-related Match	Margaret/You/Adam go(es) to the fair with her/your/his friends. After one of the rides she/you/he notice(s) her/your clothes are in perfect order. She/You/He feel(s) really happy that this happened.
Perfectionism-related Mismatch	Margaret/You/Adam go(es) to the fair with her/your/his friends. After one of the rides she/you/he notice(s) her/your/his clothes are a mess. She/You/He feel(s) really happy that this happened.

Is the main character Margaret/you/Adam? **1. Yes** 2. No

2.

Scenario Type	Example
Food-related Match	Leanne/You/George go(es) to a friend's pool party where there is an array of snacks. She/You/He end(s) up eating lots of crisps. She/You/He feel(s) ashamed about the entire situation.
Food-related Mismatch	Leanne/You/George go(es) to a friend's pool party where there is an array of snacks. She/You/He end(s) up refraining from eating the crisps. She/You/He feel(s) ashamed about the entire situation.
Body image-related Match	Leanne/You/George decide(s) to go out with her/your/his friends to a movie. She/You/He find(s) the seats really comfortable, but too tight for her/your/his body size. She/You/He feel(s) ashamed about the entire situation.
Body image-related Mismatch	Leanne/You/George decide(s) to go out with her/your/his friends to a movie. She/You/His find(s) the seats really comfortable, and spacious for

	her/your/his body size. She/You/He feel(s) ashamed about the entire situation.
Perfectionism-related Match	Leanne/You/George go(es) out with her/your/his friends to a movie that she/you/he chose. After the movie she/you/he think(s) that she/you/he made a bad choice. She/You/He feel(s) ashamed about the entire situation.
Perfectionism-related Mismatch	Leanne/You/George go(es) out with her/your/his friends to a movie that she/you/he chose. After the movie she/you/he think(s) that she/you/he made a great choice. She/You/He feel(s) ashamed about the entire situation.

3.

Scenario Type	**Example**
Food-related Match	Hilary/You/Harry is/are sick in bed. Her/Your/His friend comes by with a big container of rich, thick soup, and she/you/he manage(s) to eat some of it. Afterwards, she/you/he felt very successful to have done that.
Food-related Mismatch	Hilary/You/Harry is/are sick in bed. Her/Your/His friend comes by with a big container of rich, thick soup, and she/you/he eat(s) far too much of it. Afterwards, she/you/he felt very successful to have done that.
Body image-related Match	Hilary/You/Harry is/are trying to lose weight. She/You/He weigh(s) herself/yourself/himself and see(s) that she/you/he is/are actually a few pounds lighter than her/your goal. Afterwards, she/you/he felt very successful to have done that.
Body image-related Mismatch	Hilary/You/Harry is/are trying to lose weight. She/You/He weigh(s) herself/yourself/himself and see(s) that she/you/he is/are still much heavier than her/your/his goal. Afterwards, she/you/he felt very successful to have done that.
Perfectionism-related Match	Hilary/You/Harry was/were working hard to get everything done. She/You/He was/were able to cross everything off her/your 'to-do' list for the week. Afterwards, she/you/he felt very successful to have done that.
Perfectionism-related Mismatch	Hilary/You/Harry was/were working hard to get everything done. She/You/He was/were not able to cross everything off her/your/his 'to-do' list for the week. Afterwards, she/you/he felt very successful to have done that.

4.

Scenario Type	**Example**
Food-related Match	Kimberly/You/Isaac often feel(s) like having a snack. On this occasion she/you eat(s) too much again. Afterwards she/you/he is/are very annoyed with the whole thing.
Food-related	Kimberly/You/Isaac often feel(s) like having a

Mismatch	snack. On this occasion she/you/he is/are able to resist. Afterwards she/you/he feel(s) very annoyed with the whole thing.
Body image-related Match	Kimberly/You/Isaac goes into the bathroom to take a shower. As she/you/he bathe(s) she/you/he notice(s) her/your/his body feels rather slender/chubby. Afterwards she/you/he is/are very annoyed with the whole thing.
Body image-related Mismatch	Kimberly/You/Isaac go(es) into the bathroom to take a shower. As she/you/he bathe(s) she/you/he notice(s) her/your/his body feels very slender/tonned. Afterwards she/you/he is/are very annoyed with the whole thing.
Perfectionism-related Match	Kimberly/You/Isaac hung up new pictures in her/your/his home. Later she/you/he go(es) back and look(s) to make sure ever single one is perfectly straight, and they are all straight. Afterwar she/you/he is/are very annoyed with the whole thing.
Perfectionism-related Mismatch	Kimberly/You/Isaac hung up new pictures in her/your/his home. Later she/you/he go(es) back and look(s) to make sure every single one is perfectly straight, but one is tilted. Afterwards she/you/he is/are very annoyed with the whole thing.

5.

Scenario Type	**Example**
Food-related Match	Beth/You/Bob win(s) a special award. Her/Your/His good friends take her/you/him out for chips and beer, and she/you/he manage(s) not to overeat. Beth/You/Bob feel(s) peaceful about the whole situation.
Food-related Mismatch	Beth/You/Bob win(s) a special award. Her/Your/His good friends take her/you/him out for chips and beer, and she/you/he end(s) up overeating. Beth/You/Bob feel(s) peaceful about the whole situation.
Body image-related Match	Beth/You/Bob go(es) to the doctor's office for a weight check-up. The nurse notes that Beth's/your hips/waistline have/has decreased in size from her/your/his last appointment. Beth/You/Bob feel(s) peaceful about the whole situation.
Body image-related Mismatch	Beth/You/Bob go(es) to the doctor's office for a weight check-up. The nurse notes that Beth's/your/Bob's hips/waistline have/has increased in size from her/your/his last appointment. Beth/You/Bob feel(s) peaceful about the whole situation.
Perfectionism-related Match	Beth/You/Bob was/were answering questions in a pop quiz. She/You/Bob overheard someone agree with her/your/his answers. Beth/You/Bob feel(s) peaceful about the whole situation.
Perfectionism-related Mismatch	Beth/You/Bob was/were answering questions in a pop quiz. She/You/Bob overheard someone mock one of her/your/his answers. Beth/You/Bob feel(s) peaceful about the whole situation.

Did Beth/you/Bob stay at home in the scenario? 1. Yes **2. No**

6.

Scenario Type	Example
Food-related Match	Jilly/You/Jack go(es) to a workshop to learn to make cakes. There she/you/he end(s) up eating all of the ones she/you/he made for her/your/his family. She/You/He is/are very discouraged thinking about it all.
Food-related Mismatch	Jilly/You/Jack go(es) to a workshop to learn to make cakes. There she/you/he end(s) up keeping herself/yourself/himself from eating the ones she/you/he made for her/your/his family. She/You/He is/are very discouraged thinking about it all.
Body image-related Match	Jilly/You/Jack go(es) to a workshop that she/you heard about. There they measure her/you/him and tell her/you/him that she/you/he is /are way overweight for her/your/his body type. She/You/He is/are very discouraged thinking about it all.
Body image-related Mismatch	Jilly/You/Jack go(es) to a workshop that she/you heard about. There they measure her/you/him and tell her/you/him that she/you/he is/are a little slimmer/more fit than her/your/his body type. She/You/He is/are very discouraged thinking about it all.
Perfectionism-related Match	Jilly/You/Jack go(es) to a workshop that she/you/he heard about. There she/you/he crop(s) pictures into different shapes, and later she/you/he see(s) not all of them are perfectly cropped. She/You/He is/are very discouraged thinking about it all.
Perfectionism-related Mismatch	Jilly/You/Jack go(es) to a workshop that she/you/he heard about. There she/you/he crop(s) pictures into different shapes, and later she/you/he see(s) that all of them are perfectly cropped. She/You/He is/are very discouraged thinking about it all.

7.

Scenario Type	Example
Food-related Match	Barb/You/Kade stop(s) by the shop on her/your/his way home from work. She/You/He get(s) a large tub of ice cream, and go(es) home and eat(s) a small portion. She/You/He is/are very pleased to have done that.
Food-related Mismatch	Barb/You/Kade stop(s) by the shop on her/your/his way home from work. She/You/He get(s) a large tub of ice cream, and go(es) home and eat(s) the whole thing. She/You/He is/are very pleased to have done that.
Body image-related Match	Barb/You/Kade go(es) in for a regular check-up. Her/Your/His doctor comments that she/you/he has/have lost quite a bit of weight/fat since her/your/his last appointment. She/You/He is/are very pleased to have done that.
Body image-related Mismatch	Barb/You/Kade go(es) in for a regular check-up. Her/Your/His doctor comments that she/you/he has/have gained quite a bit of weight/fat since her/your/his last appointment. She/You/He is/are very pleased to have done that.

Perfectionism-related Match	Barb/You/Kade work(s) on creating music and sounds for a soundtrack. She/You/He listen(s) to what she/you/he created and hear(s) every note flows together perfectly. She/You/He is/are very pleased to have done that.
Perfectionism-related Mismatch	Barb/You/Kade work(s) on creating music and sounds for a soundtrack. She/You/He listen(s) to what she/you/he created and hear(s) not every note flows together perfectly. She/You/He is/are very pleased to have done that.

8.

Scenario Type	**Example**
Food-related Match	Victoria/You/Lucas went to the park to have a picnic. She/You/He hear(s) someone comment that her/your/his food looks really unhealthy. She/You/He felt really terrible to have heard that.
Food-related Mismatch	Victoria/You/Lucas went to the park to have a picnic. She/You/He hear(s) someone comment that her/your/his food looks really healthy. She/You/He felt really terrible to have heard that.
Body image-related Match	Victoria/You/Lucas was/were waiting for the bus. A woman/Someone next to her/you/him commented that Victoria's/your/his shirt looked way too tight on her/you/him. She/You/He felt really terrible to have heard that.
Body image-related Mismatch	Victoria/You/Lucas was/were waiting for the bus. A woman/Someone next to her/you/him commented that Victoria's/your/his shirt looked nice on her/you/him. She/You/He felt really terrible to have heard that.
Perfectionism-related Match	Victoria/You/Lucas spent the day making a dress/suit. A lady/man saw the dress/suit and commented that the seams were a little off. She/You/He felt really terrible to have heard that.
Perfectionism-related Mismatch	Victoria/You/Lucas spent the day making a dress/suit. A lady/man saw the dress/suit and commented that the seams were perfect. She/You/He felt really terrible to have heard that.

9.

Scenario Type	**Example**
Food-related Match	Jordan/You/Frank noticed her/your niece's/nephew's Halloween candy sitting there in her/his room. She/You/He end(s) up not having any of the sweets in the bowl. She/You/He was/were overjoyed with herself/yourself/himself about that.
Food-related Mismatch	Jordan/You/Frank noticed her/your niece's/nephew's Halloween candy sitting there in her/his room. She/You/He end(s) up eating quite a few of the sweets in the bowl. She/You/He was/were overjoyed with herself/yourself/himself about that.

Body image-related Match	In an exercise class Jordan/you/Frank do(es) jumping jacks. She/You/He cannot feel her/your chest/firm chest bounce at all with every jump. She/You/He was/were overjoyed with herself/yourself/himself about that.
Body image-related Mismatch	In an exercise class Jordan/you/Frank do(es) jumping jacks. She/You/He can feel her/your/his chest/flabby chest bouncing with every jump. She/You/He was/were overjoyed with herself/yourself/himself about that.
Perfectionism-related Match	Jordan/You/Frank had spent the day tidying her/your/his room. One of her/your/his friends came over and pointed out that nothing was out of order. She/You/He was/were overjoyed with herself/yourself/himself about that.
Perfectionism-related Mismatch	Jordan/You/Frank had spent the day tidying her/your/his room. One of her/your/his friends came over and pointed out that something was out of order. She/You/He was/were overjoyed with herself/yourself/himself about that.

Was/Were Jordan/you/Frank happy with herself/yourself in this scenario? **1. Yes** 2. No

10.

Scenario Type	**Example**
Food-related Match	The doorbell rings and the pizza delivery drops off an extra-large pizza for Emily/you/Mark. She/You/He eat(s) the entire pizza. She/You/He feel(s) very bad about the entire situation.
Food-related Mismatch	The doorbell rings and the pizza delivery drops off an extra-large pizza for Emily/you/Mark. She/You/He eat(s) a sliver of pizza. She/You/He feel(s) very bad about the entire situation.
Body image-related Match	Emily/You/Mark go(es) to the gym to walk on the treadmill. She/You/He decide(s) to measure herself/yourself/himself before she/you/he work(s) out and she/you/he gained 3 inches on her/your hips/his belly in a month. She/You/He feel(s) very bad about the entire situation.
Body image-related Mismatch	Emily/You/Mark go(es) to the gym to walk on the treadmill. She/You/he decide(s) to measure herself/yourself/himself before she/you/he work(s) out and she/you/he lost 3 inches on her/your/his hips in a month. She/You/He feel(s) very bad about the entire situation.
Perfectionism-related Match	Emily/You/Mark spend(s) quite a long time doing laundry. She/You/He finish(es) and everything is perfectly in its place, but she/you/he missed a piece of clothing. She/You/He feel(s) very bad about the entire situation.
Perfectionism-related Mismatch	Emily/You/Mark spend(s) quite a long time doing laundry. She/You/He finish(es) and everything is perfectly in its place, and she/you/he got every piece of clothing. She/You/He feel(s) very bad about the entire situation.

11.

Scenario Type	Example
Food-related Match	At her/your/his friend's house Jane/you/Nate ate a piece of cake. She/You/He knew that the piece of cake that she/you/he had just eaten contained very few calories. She/You/He was/were delighted to have known that.
Food-related Mismatch	At her/your friend's house Jane/you/Nate ate a piece of cake. She/You/He knew that the piece of cake that she/you/he had just eaten contained a thousand calories. She/You/He was/were delighted to have known that.
Body image-related Match	Jane/You/Nate walked in the room and chatted with a few people. Then, someone walked up and told her/you/him that she/you/he looked slim that day. She/You/He was/were delighted to have known that.
Body image-related Mismatch	Jane/You/Nate walked in the room and chatted with a few people. Then, someone walked up and told her/you/him that she/you/he looked fat that day. She/You/He was/were delighted to have known that.
Perfectionism-related Match	Jane/You/Nate worked hard on her/your/his assignment. When the marks came back, she/you/he knew that she/you/he had made no mistakes on her/your/his essay. She/You/He was/were delighted to have known that.
Perfectionism-related Mismatch	Jane/You/Nate worked hard on her/your/his assignment. When the marks came back, she/you/he knew that she/you/he had made many mistakes on her/your/his essay. She/You/He was/were delighted to have known that.

12.

Scenario Type	Example
Food-related Match	Patty/You/Pete talks/talk with her/your/his friend as she/they/he makes dinner for them/you both. She/You/He see(s) that her/your/his friend puts only light ingredients into the sauce. Patty/You/Pete is/are very satisfied to have noticed that.
Food-related Mismatch	Patty/You/Pete talks/talk with her/your/his friend as she/they/he makes dinner for them/you both. She/You/He see(s) that her/your/his friend puts lots of fatting cream into the sauce. Patty/You/Pete is/are very satisfied to have noticed that.
Body image-related Match	Patty/You/Pete notice(s) her/your/his mum's broad hips/dad's beer belly. Then her/your/his sister/brother makes a comment that Patty/you/Pete and her mum/his dad do not have the same body shape at all. Patty/You/Pete is/are very satisfied to have

	noticed that.
Body image-related Mismatch	Patty/You/Pete notice(s) her/your/his mum's broad hips/dad's beer belly. Then her/your/his sister/brother makes a comment that Patty/you/Pete and her mum/his dad have the exact same body shape. Patty/You/Pete is/are very satisfied to have noticed that.
Perfectionism-related Match	Patty/You/Pete move(s) into a new house. She/You/He notice(s) that the paint on the trim is flawless and even. Patty/You/Pete is/are very satisfied to have noticed that.
Perfectionism-related Mismatch	Patty/You/Pete move(s) into a new house. She/You/He notice(s) that the paint on the trim is flawed and uneven. Patty/You/Pete is/are very satisfied to have noticed that.

13.

Scenario Type	**Example**
Food-related Match	Anna/You/Charlie go(es) out with her/your/his friends for milkshakes. Once she/you/he is/are there Anna/you/Charlie decide(s) to have two of them. She/You/He feel(s) awful about the whole thing.
Food-related Mismatch	Anna/You/Charlie go(es) out with her/your/his friends for milkshakes. Once she/you/he is/are there Anna/you/Charlie decide(s) to have tea. She/You/He feel(s) awful about the whole thing.
Body image-related Match	Anna/You/Charlie put(s) on some body cream. As she/you/he smooth(s) the cream into her/your/his skin she/you/he see(s) lots of new cellulite/flab on her/your/his thighs from not exercising all winter. She/You/He feel(s) awful about the whole thing.
Body image-related Mismatch	Anna/You/Charlie put(s) on some body cream. As she/you/he smooth(s) the cream into her/your/his skin she/you/he see(s) no new cellulite/flab on her/your/his thighs from not exercising all winter. She/You/He feel(s) awful about the whole thing.
Perfectionism-related Match	Anna/You/Charlie is/are learning Spanish. She/You/He tries/try to speak with a native Spanish-speaker for the first time, and she/you/he realize(s) she/you/he is/are speaking with lots of mistakes. She/You/He feel(s) awful about the whole thing.
Perfectionism-related Mismatch	Anna/You/Charlie is/are learning Spanish. She/You/He tries/try to speak with a native Spanish-speaker for the first time, and she/you/he realize(s) she/you/he is/are speaking without mistakes. She/You/He feel(s) awful about the whole thing.

Is the main character Beth in the scenario? 1. Yes **2. No**
Is/Are Charlie/you out with his parents in the scenario? 1. Yes **2. No**

14.

Scenario Type	Example
Food-related Match	Julia/You/Robert is/are making a big dinner. Once everyone is there she/you/he serve(s) the plates and she/you/he eat(s) too much. She/You/He feel(s) upset about the situation.
Food-related Mismatch	Julia/You/Robert is/are making a big dinner. Once everyone is there she/you/he serve(s) the plates and she/you/he manage(s) not to eat too much. She/You/He feel(s) upset about the situation.
Body image-related Match	Julia/You/Robert is/are sitting on a bench in the park. A child walks by with his mother/father, and she/you/he hear(s) her/him say she/you/he is/are a fatty. She/You/He feel(s) upset about the situation.
Body image-related Mismatch	Julia/You/Robert is/are sitting on a bench in the park. A child walks by with mother/father, and she/you/he hear(s) her/him say she/you/he is/are in good shape. She/You/He feel(s) upset about the situation.
Perfectionism-related Match	Julia/You/Robert is/are organising a big event, and she/you/he work(s) hard to decorate all of the tables. Afterwards, someone makes a snide comment about the event. She/You/He feel(s) upset about the situation.
Perfectionism-related Mismatch	Julia/You/Robert is/are organising a big event, and she/you/he work(s) hard to decorate all of the tables. Afterwards, someone makes a complimentary comment about the event. She/You/He feel(s) upset about the situation.

15.

Scenario Type	Example
Food-related Match	Joy/You/Steve is/are at Christmas dinner. There are all sorts of sugary foods and desserts, and she/you/he eats quite a lot. She/You/He is/are really perturbed to have done that.
Food-related Mismatch	Joy/You/Steve is/are at Christmas dinner. There are all sorts of sugary foods and desserts, and she/you/he does/do not eat too much. She/You/He is/are really perturbed to have done that.
Body image-related Match	Joy/You/Steve go(es) to her/your favourite clothing shop. She/You/He decide(s) to get the boots/jeans she/you liked in the catalogue, but her/your/his calves will not fit into them. She/You/He is/are really perturbed to have done that.
Body image-related Mismatch	Joy/You/Steve go(es) to her/your favourite clothing shop. She/You/He decide(s) to get the boots/jeans she/you/he liked in the catalogue, and her/your/his calves fit perfectly into them. She/You/He is/are really perturbed to have done that.
Perfectionism-related Match	Joy/You/Steve is/are making Christmas ornaments. She/You/He put(s) the glue on and as she/you/he sprinkle(s) the glitter on them she/you/he see(s) that it goes on

	unevenly. She/You/He is/are really perturbed to have done that.
Perfectionism-related Mismatch	Joy/You/Steve is/are making Christmas ornaments. She/You/He put(s) the glue on and as she/you/he sprinkle(s) the glitter on them she/you/he see(s) that it goes on perfectly even. She/You/He is/are really perturbed to have done that.

16.

Scenario Type	**Example**
Food-related Match	Dina/You/Thomas has/have worked out a healthy diet plan with a nutritionist. She/You/He decide(s) to eat a bit less than what was recommended. She/You/He feel(s) very self-disciplined with what she/you/he decide(s).
Food-related Mismatch	Dina/You/Thomas has/have worked out a healthy diet plan with a nutritionist. She/You/He decide(s) to eat much more than what was recommended. She/You/He feel(s) very self-disciplined with what she/you/he decide(s).
Body image-related Match	Dina/You/Thomas has/have worked out a healthy workout plan with a certified trainer to get fit. She/You/He decide(s) to work out a bit ahead of schedule/more than his trainer scheduled. She/You/He feel(s) very self-disciplined with what she/you/he decide(s).
Body image-related Mismatch	Dina/You/Thomas has/have worked out a healthy workout plan with a certified trainer to get fit. She/You/He decide(s) to work out behind schedule/less than his trainer scheduled. She/You/He feel(s) very self-disciplined with what she/you/he decide(s).
Perfectionism-related Match	Dina/You/Thomas has/have an important job due at the end of the week. She/You/He realise(s) she/you might make mistakes but she/you start(s) working. She/You/He feel(s) very self-disciplined with what she/you/he decide(s).
Perfectionism-related Mismatch	Dina/You/Thomas has/have an important job due at the end of the week. She/You/He realise(s) she/you might make mistakes so she/you procrastinate(s). She/You/He feel(s) very self-disciplined with what she/you/he decide(s).

17.

Scenario Type	**Example**
Food-related Match	Mary/You/Edward is/are at a buffet that is all-you-can-eat for one price. She/You/He notice(s) that her/your/his whole table is eating, but she/you/he decide(s) to eat less than the others. She/You/He feel(s) very virtuous reflecting on it all.

Food-related Mismatch	Mary/You/Edward is/are at a buffet that is all-you-can-eat for one price. She/You/He notice(s) that her/your whole table is eating, so she/you/he decide(s) to eat a lot more than the other. She/You/He feel(s) very virtuous reflecting on it all.
Body image-related Match	Mary/You/Edward is/are at a fitness workshop. She/You/He is/are placed in the advanced group because she/you/he is/are very tonned. She/You/He feel(s) very virtuous reflecting on it all.
Body image-related Mismatch	Mary/You/Edward is/are at a fitness workshop. She/You/He is/are placed in the starter-beginner group because she/you/he is/are not very tonned. She/You/He feel(s) very virtuous reflecting on it all.
Perfectionism-related Match	Mary/You/Edward is/are organising everything on her/your/his shelf. Later she/you/he admire(s) her/your/his organisation and she/you/he notice(s) that everything is straight. She/You/He feel(s) very virtuous reflecting on it all.
Perfectionism-related Mismatch	Mary/You/Edward is/are organising everything on her/your/his shelf. Later she/you/he admire(s) her/your/his organisation until she/you/he notice(s) that nothing is straight. She/You/He feel(s) very virtuous reflecting on it all.

Does/Did Mary/you/Edward feel virtuous? **1. Yes** 2. No

18.

Scenario Type	**Example**
Food-related Match	After the big game Gail/you/Victor go(es) out to celebrate with her/your/his teammates. She/You/He end(s) up stuffing herself /yourself/himself on food there. She/You/He is/are very disappointed to have done that.
Food-related Mismatch	After the big game Gail/you/Victor go(es) out to celebrate with her/your/his teammates. She/You/He refrain(s) from stuffing herself/yourself/himself on food there. She/You/He is/are very disappointed to have done that.
Body image-related Match	Gail/You/Victor is/are a bridesmaid/groomsman at her/your/his best friend's wedding. She/You/He notice(s) her/your/his dress/trousers fits too snug over her/your/his hips/buttocks and thighs when she/you/he sit(s) down. She/You/He is/are very disappointed to have done that.
Body image-related Mismatch	Gail/You/Victor is/are a bridesmaid/groomsman at her/your/his best friend's wedding. She/You/He notice(s) her/your/his dress/trousers is/are not too snug over her/your/his hips and thighs when she/you/he sit(s) down. She/You/He is/are very disappointed to have done that.
Perfectionism-related	After the big game Gail/you/Victor go(es) out to celebrate with her/your/his teammates. She/You/He cannot stop thinking about

Match	how she/you/he missed one goal. She/You/He is/are very disappointed to have done that.
Perfectionism-related Mismatch	After the big game Gail/you/Victor go(es) out to celebrate with her/your/his teammates. She/You/He cannot stop thinking about how she/you/he scored every goal. She/You/He is/are very disappointed to have done that.

19.

Scenario Type	Example
Food-related Match	Louise/You/Walter get(s) to work and someone is offering around cake in the common room. She/You/He politely decline(s) and refrain(s). She/You/He feel(s) thrilled with herself/yourself/himself about that.
Food-related Mismatch	Louise/You/Walter get(s) to work and someone is offering around cake in the common room. She/You/He end(s) up eating several large pieces of it. She/You/He feel(s) thrilled with herself/yourself/himself about that.
Body image-related Match	Louise/You/Walter quickly take(s) a shower at the gym and gets dressed for work. She/You/He is/are new at working out and feel(s) like her/your/his body is already slim/trim. She/You/He feel(s) thrilled with herself/yourself/himself about that.
Body image-related Mismatch	Louise/You/Walter quickly take(s) a shower at the gym and get(s) dressed for work. She/You/He is/are new at working out and feels like her/your/his body is chubby. She/You/He feel(s) thrilled with herself/yourself/himself about that.
Perfectionism-related Match	Louise/You/Walter take(s) a shower and get(s) dressed for work. As she/you/He opens her/your/his bag to get out her/your/his things, she/you/he realise(s) that her/your/his work papers are perfectly placed. She/You/He feel(s) thrilled with herself/yourself/himself about that.
Perfectionism-related Mismatch	Louise/You/Walter take(s) a shower and get(s) dressed for work. As she/you/he open(s) her/your/his bag to get out her/your/his things, she/you/he realise(s) that her/your/his work papers are a bit wrinkled. She/You/He feel(s) thrilled with herself/yourself/himself about that.

20.

Scenario Type	Example
Food-related Match	Linda/You/Zach has/have a special dinner date planned. There she/you/he end(s) up eating tons as she/you/he and her/your/his date talk. Later, she/you/he feel(s) really troubled to think about that.
Food-related Mismatch	Linda/You/Zach has/have a special dinner date planned. There she/you refrain(s) from eating too much as she/you/he and her/your/his date talk. Later, she/you/he feel(s) really troubled to think about that.

Body image-related Match	Linda/You/Zach has/have a special date planned. She/You/He overhear(s) a conversation and realise(s) that the people next to her/you/him think that her/your/his dress/outfit makes her/you/him look plump. Later, she/you/he feel(s) really troubled to think about that.
Body image-related Mismatch	Linda/You/Zach has/have a special date planned. She/You/He overhear(s) a conversation and realise(s) that the people next to her/you/him think that her/your/his dress/outfit makes her/you/him look slim/trim. Later, she/you/he feel(s) really troubled to think about that.
Perfectionism-related Match	Linda/You/Zach has/have a special dinner date planned. There she/you/he realise(s) that her/your/his necklace/necktie does not match her/your/his outfit. Later, she/you/he feel(s) really troubled to think about that.
Perfectionism-related Mismatch	Linda/You/Zach has/have a special dinner date planned. There she/you/he realise(s) that her/you/his necklace/necktie perfectly matches her/your/his outfit. Later, she/you/he feel(s) really troubled to think about that.

21.

Scenario Type	**Example**
Food-related Match	Gina/You/Darren go(es) to the spa for her/your/his birthday. During her/your/his time there, she/you/he has/have some of the healthy food that they served. She/You/He is/are very soothed to have experienced that.
Food-related Mismatch	Gina/You/Darren go(es) to the spa for her/your/his birthday. During her/your/his time there, she/you/he has/have a lot of the unhealthy food that they served. She/You/He is/are very soothed to have experienced that.
Body image-related Match	Gina/You/Darren go(es) to get a massage that her/your/his friend purchased for her/your/his birthday. She/You/He feel(s) the muscles on her/your/his back move under the massage therapist's hands. She/You/He is/are very soothed to have experienced that.
Body image-related Mismatch	Gina/You/Darren go(es) to get a massage that her/your/his friend purchased for her/your/his birthday. She/You/He feel(s) the fat on her/your/his back move under the massage therapist's hands. She/You/He is/are very soothed to have experienced that.
Perfectionism-related Match	Gina/You/Darren go(es) to get a massage that her/your/his friend purchased for her/your birthday. Later, she/you/he open(s) her/your/his locker to find that she/you/he left everything in order. She/You/He is/are very soothed to have experienced that.
Perfectionism-related Mismatch	Gina/You/Darren go(es) to get a massage that her/your/his friend purchased for her/your/his birthday. Later, she/you/he open(s) her/your/his locker to find that she/you/he left nothing in order. She/You/He is/are very

	soothed to have experienced that.

Does Gina/you/Darren go to the beach in the scenario? 1. Yes **2. No**

22.

Scenario Type	**Example**
Food-related Match	Jennifer/You/Adam is/are invited to a friend's summer barbeque. All of the food is really dripping with oil, and her/your/his friend gives her/you/him a plate to get food. She/You/He feel(s) really flustered about all of this.
Food-related Mismatch	Jennifer/You/Adam is/are invited to a friend's summer barbeque. All of the food is very healthy, and her/your/his friend gives her/you/him a plate to get food. She/You/He feel(s) really flustered about all of this
Body image-related Match	Jennifer/You/Adam went to a meeting. While she/you/he was there she/you/he realised she/you/he could not breathe very well because her/you/his outfit was so tight over her chest and stomach. She/You/He feel(s) really flustered about all of this
Body image-related Mismatch	Jennifer/You/Adam went to a meeting. While she/you/he was there she/you/he realised she/you/he could breathe freely because her/your/his outfit was so loose over her/your/his chest and stomach. She/You/He feel(s) really flustered about all of this
Perfectionism-related Match	Jennifer/You/Adam is/are invited to a friend's summer party. She/You/He bring(s) chairs so people may enjoy the sunshine, but she/you/he may not have brought enough. She/You/He feel(s) really flustered about all of this
Perfectionism-related Mismatch	J Jennifer/You/Adam is/are invited to a friend's summer party. She/You/He bring(s) chairs so people may enjoy the sunshine, and she/you/he brought plenty. She/You/He feel(s) really flustered about all of this

23.

Scenario Type	**Example**
Food-related Match	Suzi/You/Bradley get(s) a birthday cake for her/your/his best friend. She/You/He decide(s) to exercise self-control and only have a sliver of the cake at the party. Later, she/you/he feel(s) radiant thinking of it all.
Food-related Mismatch	Suzi/You/Bradley get(s)a birthday cake for her/your/his best friend. She/You/He decide(s) not to exercise self-control and have several very large pieces at the party. Later, she/you/he feel(s) radiant thinking of it all.
Body image-related Match	Suzi/You/Bradley go(es) to her/your/his best friend's birthday party. There she/you/he hears someone say that her/your/his bum is sexy. Later, she/you/he feel(s) radiant thinking of it all.
Body image-related	Suzi/You/Bradley go(es) to her/your/his best friend's

Mismatch	birthday party. There she/you/he hear(s) someone say that her/your/his bum is fat. Later, she/you/he feel(s) radiant thinking of it all.
Perfectionism-related Match	Suzi/You/Bradley decorate(s) for her/your/his best friend's birthday party. At the party she/you/he hear(s) someone compliment the balloons she/you/he chose. Later, she/you/he feel(s) radiant thinking of it all.
Perfectionism-related Mismatch	Suzi/You/Bradley decorate(s) for her/your/his best friend's birthday party. At the party she/you/he hear(s) someone criticise the balloons she /you/he chose. Later, she/you/he feel(s) radiant thinking of it all.

24.

Scenario Type	Example
Food-related Match	Lucy/You/Chris love(s) to cook and bake for friends. She/You/He decide(s) to make some brownies one evening and ends up eating them all. She/You/He feel(s) rotten because of that situation.
Food-related Mismatch	Lucy/You/Chris love(s) to cook and bake for friends. She/You/He decide(s) to make some brownies one evening and decides to refrain from eating them. She/You/He feel(s) rotten because of that situation.
Body image-related Match	Lucy/You/Chris head(s) to a conference. Right before she/you/he walk(s) into the conference, she/you/he realise(s) that she/you/he is going to be quite late. She/You/He feel(s) rotten because of that situation.
Body image-related Mismatch	Lucy/You/Chris heads to a conference. Right before she/you/he walk(s) into the conference, she/you/he realise(s) that she/you/he is/are going to be a bit early. She/You/He feel(s) rotten because of that situation.
Perfectionism-related Match	Lucy/You/Chris is/are spending time with her/your/his friend. Lucy/You/Chris can feel the rolls of her/your/his sides hanging out over her/your/his trousers. She/You/He feel(s) rotten because of that situation.
Perfectionism-related Mismatch	Lucy/You/Chris is/are spending time with her/your/his friend. Lucy/You/Chris can feel her fit sides inside her nicely loose trousers. She/You/He feel(s) rotten because of that situation.

25.

Scenario Type	Example
Food-related Match	Jessica/You/Ian go(es) to her/your/his friend's lively party. There, they have bowls of crisps, and she/you/he choose(s) not to have any of them. She/You/He is/are extra proud of herself/yourself/himself about that.
Food-related Mismatch	Jessica/You/Ian go(es) to her/your/his friend's lively party. There, they have bowls of crisps, and she/you/he eat(s) an entire

	bowl of them. She/You/He is/are extra proud of herself/yourself/himself about that.
Body image-related Match	Jessica/You/Ian is/are going to a meeting on a beautiful day. She/You/He feel(s) her/your/his slender/tonned arms pumping back and forth across her/your/his sides as she/you/he walks. She/You/He is/are extra proud of herself/yourself/himself about that.
Body image-related Mismatch	Jessica/You/Ian is/are going to a meeting on a beautiful day. She/You/He feel(s) her/your/his chubby arms pumping back and forth across her/your/his sides as she/you/he walk(s). She/You/He is/are extra proud of herself/yourself/himself about that.
Perfectionism-related Match	Jessica/You/Ian submit(s) her/your/his paper to be published. Once it comes out in the journal, she/you/he notice(s) that it has not one mistake. She/You/He is/are extra proud of herself/yourself/himself about that.
Perfectionism-related Mismatch	Jessica/You/Ian submit(s) her/your/his paper to be published. Once it comes out in the journal, she/you/he notice(s) that it has a small typo. She/You/He is/are extra proud of herself/yourself/himself about that.

Is main character's name Jessica/you/Ian in the scenario? **1. Yes** 2. No

26.

Scenario Type	**Example**
Food-related Match	At her/your/his friend's house Charlotte/you/David is/are asked if she/you/he would like something to eat. She/You/He decide(s) to accept the offer and eat(s) the fried chicken. She/You/He feel(s) defeated because of what happened.
Food-related Mismatch	At her/your/his friend's house Charlotte/you/David is/are asked if she/you/he would like something to eat. She/You/He decide(s) to accept the offer and eats the salad. She/You/He feel(s) defeated because of what happened.
Body image-related Match	The trainer measures Charlotte's/your/David's body at the gym. She/You/He gained an inch since last month on her/your/his waist, because she/you/he has/have not been to the gym much. She/You/He feel(s) defeated because of what happened.
Body image-related Mismatch	The trainer measures Charlotte's/your/David's body at the gym. She/You/He lost an inch since last month on her/your/his waist, although she/you/he has/have not been to the gym much. She/You/He feel(s) defeated because of what happened.
Perfectionism-related Match	Charlotte/You/David quickly tidies up before her/your/his guest comes. Later that evening she/you/he see(s) that the towels that she/your/he hung for her/your/his friend are not perfectly in line. She/You/He feel(s) defeated because of what happened.
Perfectionism-related	Charlotte/You/David quickly tidies up before her/your/his guest comes. Later that evening

Mismatch	she/you/he see(s) that the towels that she/you/he hung for her/your/his friend are perfectly in line. She/You/He feel(s) defeated because of what happened.

27.

Scenario Type	Example
Food-related Match	Laura/You/Evan work(s) hard on her/your/his computer. She/You/He has/have a big bowl of sweets next to her/you/him, and later she/you/he notice(s) that she/you/he has/have managed to avoid eating them. She/You/He is/are really joyful when she/you/he realise(s) that.
Food-related Mismatch	Laura/You/Evan work(s) hard on her/your/his computer. She/You/He has/have a big bowl of sweets next to her/you/him, but later she/you/he notice(s) that she/you/he has/have unconsciously eaten all of them. She/You/He is/are really joyful when she/you/he realise(s) that.
Body image-related Match	Laura/You/Evan is in a hurry. She/You/He has/have to run up the steps, and feels her/your/his lean sides get taut as she/you/he jump(s) up the steps. She/You/He is/are really joyful when she/you/he realise(s) that.
Body image-related Mismatch	Laura/You/Evan is in a hurry. She/You/He has/have to run up the steps, and feels the fat on her sides sides shake as she/you/he jump(s) up the steps. She/You/He is/are really joyful when she/you/he realise(s) that.
Perfectionism-related Match	Laura/You/Evan strive(s) to do things perfectly. She/You/He find(s) out at work that she/you/he is/are getting a promotion. She/You/He is/are really joyful when she/you/he realise(s) that.
Perfectionism-related Mismatch	Laura/You/Evan strive(s) to do things perfectly. She/You/He find(s) out at work that she/you/he is/are not getting a promotion. She/You/He is/are really joyful when she/you/he realise(s) that.

28.

Scenario Type	Example
Food-related Match	Judy/You/Fred went to watch a great football game. While she/you/he was/were there she/you/he decided to eat a large, greasy hot-dog. She/You/He was/were then depressed continually thinking about it.
Food-related Mismatch	Judy/You/Fred went to watch a great football game. While she/you/he was/were there she/you/he decided to eat a small fruit salad. She/You/He was/were then depressed continually thinking about it.
Body image-related Match	Judy/You/Fred look(s) through her/your/his favourite fashion magazine. She/You/He realise(s) that she/you/he do(es) not have the same body type as the model in the magazine. She/You/He

	was/were then depressed continually thinking about it.
Body image-related Mismatch	Judy/You/Fred look(s) through her/your/his favourite fashion magazine. She/You/He realise(s) that she/you/he has the same body type as the model in the magazine. She/You/He was/were then depressed continually thinking about it.
Perfectionism-related Match	Judy/You/Fred decided to organise her/your/his notes. Once she/you/he finished she/you/he realised that one was missing. She/You/He was/were then depressed continually thinking about it.
Perfectionism-related Mismatch	Judy/You/Fred decided to organise her/your/his notes. Once she/you/he finished she/you/he realised that none was missing. She/You/He was/were then depressed continually thinking about it.

29.

Scenario Type	**Example**
Food-related Match	Jackie/You/Hank ordered some food and took it home. Then she /you/he ate a portion and made her/your/his enormous take away into two meals. She/You/He felt really satisfied to have done that.
Food-related Mismatch	Jackie/You/Hank ordered some food and took it home. Then she /you/he ate a portion and did not make her/your/his enormous take away into two meals. She/You/He felt really satisfied to have done that.
Body image-related Match	Jackie/You/Hank and her/your/his friends took pictures in the photo booth. She/You/He saw how her/your/his cheeks looked nice and slim in the pictures. She/You/He felt really satisfied to have done that.
Body image-related Mismatch	Jackie/You/Hank and her/your/his friends took pictures in the photo booth. She/You/He saw how her/your/his cheeks looked round and chubby in the pictures. She/You/He felt really satisfied to have done that.
Perfectionism-related Match	Jackie/You/Hank washed her/your/his car on a sunny day. When her/your/his car was completely dry she/you/he saw it was all shiny. She/You/He felt really satisfied to have done that.
Perfectionism-related Mismatch	Jackie/You/Hank washed her/your/his car on a sunny day. When her/your/his car was completely dry she/you/he saw it had dirt spots. She/You/He felt really satisfied to have done that.

Is/Are Jackie/You/Hank with her/your/his grandparents in the scenario? 1. Yes **2. No**

30.

Scenario Type	**Example**
Food-related Match	Lauren/You/Gary is/are invited on a hike in the mountains. During their hike her/your/his friend stops to eat and offers her/you/him chocolate bars, and Lauren/you/Gary eats them

	all. She/You/He feel(s) deflated to have done that.
Food-related Mismatch	Lauren/You/Gary is/are invited on a hike in the mountains. During their hike her/your/his friend stops to eat and offers her/you/him chocolate bars, but Lauren/you/Gary resists eats them. She/You/He feel(s) deflated to have done that.
Body image-related Match	Lauren/You/Gary has/have her/your/his friend measure her/your/his with a measuring tape to see if her/your/his exercise routine is paying off. She/You/He had/have gained many inches in a short time. She/You/He feel(s) deflated to have done that.
Body image-related Mismatch	Lauren/You/Gary has/have her/your/his friend measure her/your/him with a measuring tape to see if her/your/his exercise routine is paying off. She/You/He had lost many inches in a short time. She/You/He feel(s) deflated to have done that.
Perfectionism-related Match	Lauren/You/Gary practiced her/your/his response to an emotionally difficult situation before she/you/he met with her/you mum/his dad. When she is there she/you/he is/are not able to respond optimally. She/You/He feel(s) deflated to have done that.
Perfectionism-related Mismatch	Lauren/You/Gary practiced her/your/his response to an emotionally difficult situation before she/you/he met with her/you mum/his dad. When she is there she/you/he is/are able to respond optimally. She/You/He feel(s) deflated to have done that.

31.

Scenario Type	**Example**
Food-related Match	Lindy/You/James is/are at happy hour and everyone is having fried appetisers. She/You/He resist(s) from eating loads of the fried ones. She/You/He is/are very contented concerning the entire thing.
Food-related Mismatch	Lindy/You/James is/are at happy hour and everyone is having fried appetisers. She/You/He indulges in eating loads of the fried ones. She/You/He is/are very contented concerning the entire thing.
Body image-related Match	Lindy/You/James shave(s) her/your legs/his face in the shower. She/You/He notice(s) that her legs are much less bulky/cheeks are much less chubby than last month. She/You/He is/are very contented concerning the entire thing.
Body image-related Mismatch	Lindy/You/James shave(s) her/your legs/his face in the shower. She/You/He notice(s) that her legs are much less bulky/cheeks are much more chubby than last month. She/You/He is/are very contented concerning the entire thing.
Perfectionism-related Match	Lindy/You/James has/have to give a speech. While she/you/he is/are practicing, every word comes out fluidly. She/You/He is/are very contented

	concerning the entire thing.
Perfectionism-related Mismatch	Lindy/You/James has/have to give a speech. While she/you/he is/are practicing, not one word comes out fluidly. She/You/He is/are very contented concerning the entire thing.

32.

Scenario Type	Example
Food-related Match	Betsy/You/Larry go(es) home for the holidays to visit her/your/his family. During her/your/his entire visit for every family meal, she/you/he choose(s) to eat tons. She/You/He is/are very distressed by what she/you/he did.
Food-related Mismatch	Betsy/You/Larry go(es) home for the holidays to visit her/your/his family. During her/your/his entire visit for every family meal, she/you/he refrain(s) from eating tons. She/You/He is/are very distressed by what she/you/he did.
Body image-related Match	Betsy/You/Larry go(es) home to visit her/your/his family. During her/your/his visit she/you/he end(s) up gaining quite a lot of weight and inches on her/your/his stomach. She/You/He is/are very distressed by what she/you/he did.
Body image-related Mismatch	Betsy/You/Larry go(es) home to visit her/your/his family. During her/your/his visit she/you/he end(s) up losing some weight and inches off of her/your/his stomach. She/You/He is/are very distressed by what she/you/he did.
Perfectionism-related Match	Betsy/You/Larry go(es) home for the holidays to visit her/your/his family with gifts in her/your/his bag that she/you/he has/have chosen to wrap in advance. When she/you/he take(s) them out of her bag she/you/he see(s) that all of them but one look beautifully wrapped. She/You/He is/are very distressed by what she/you/he did.
Perfectionism-related Mismatch	Betsy/You/Larry go(es) home for the holidays to visit her/your/his family with gifts in her/your/his bag that she/you/he has/have chosen to wrap in advance. When she/you/he take(s) them out of her/your/his bag she/you/he see(s) that all of them look beautifully wrapped. She/You/He is/are very distressed by what she/you/he did.

33.

Scenario Type	Example
Food-related Match	The waiter is coming Jean's/your/Ken's way. She/You/He see(s) that all the dishes on the menu are light and healthy. She/You/He feel(s) really elated to have seen that.
Food-related Mismatch	The waiter is coming Jean's/your/Ken's way. She/You/He see(s) that all the dishes on the menu are large and greasy. She/You/He feel(s) really elated to have seen that.

Body image-related Match	Jean/You/Ken is/are washing her/your/his hands in the sink. She/You/He look(s) up and see(s) from her/your/his reflection in the window that she/you/he has/have a nice chin. She/You/He feel(s) really elated to have seen that.
Body image-related Mismatch	Jean/You/Ken is/are washing her/your/his hands in the sink. She/You/He look(s) up and see(s) from her/your/his reflection in the window that she/you/he has/have a double chin. She/You/He feel(s) really elated to have seen that.
Perfectionism-related Match	Jean/You/Ken has/have to drop a note off at her/your/his boss' office, but they are not there. She/You/He look(s) over and sees an employee of the month list with her/your/his name selected. She/You/He feel(s) really elated to have seen that.
Perfectionism-related Mismatch	Jean/You/Ken has/have to drop a note off at her/your/his boss' office, but they are not there. She/You/He look(s) over and sees an employee of the month list with her/your/his name not selected. She/You/He feel(s) really elated to have seen that.

Is the main character Jean/Ken in the scenario? **1. Yes** 2. No
Do you notice something in the scenarios? **1. Yes** 2. No

34.

Scenario Type	**Example**
Food-related Match	At a little get together there are appetisers. Sharon/You/Martin overindulge(s) eating the fried starters. She/You/He is/are quite bothered with this whole situation.
Food-related Mismatch	At a little get together there are appetisers. Sharon/You/Martin decides to avoid eating the fried starters. She/You/He is/are quite bothered with this whole situation.
Body image-related Match	Sharon/You/Martin is/are in a gymnastics/wrestling competition. She/You/He is/are new in the field and overhear(s) someone she/you/he is attracted to say that she/you/he has bulky/skinny thighs. She/You/He is/are quite bothered with this whole situation.
Body image-related Mismatch	Sharon/You/Martin is/are in a gymnastics/wrestling competition. She/You/He is/are new in the field and overhear(s) someone she/you/he is attracted to say that she/you/he has nice thighs. She/You/He is/are quite bothered with this whole situation.
Perfectionism-related Match	Sharon/You/Martin work(s) hard at her/your/his job. Once she/you/he completes it she/you/he hears someone say it was not exactly what they liked. She/You/He is/are quite bothered with this whole situation.
Perfectionism-related Mismatch	Sharon/You/Martin work(s) hard at her/your/his job. Once she/you/he completes it she/you/he hears someone say it was exactly what they liked. She/You/He is/are quite bothered with this whole situation.

35.

Scenario Type	Example
Food-related Match	Betty/You/Ned go(es) to a friend's house/a cafeteria for dinner. The table is filled with loads of food, and she/you/he eat(s) just a little of it. She/You/He feel(s) marvelous to have realised that.
Food-related Mismatch	Betty/You/Ned go(es) to a friend's house/a cafeteria for dinner. The table is filled with loads of food, and she/you/he eat(s) quite a lot of it. She/You/He feel(s) marvelous to have realised that.
Body image-related Match	Betty/You/Ned stroll(s) down the street as she/you/he window shops. In one of the windows she/you/he catch(es) a reflection of her/your/his backside and sees that she/you/he look(s) fit. She/You/He feel(s) marvelous to have realised that.
Body image-related Mismatch	Betty/You/Ned stroll(s) down the street as she/you/he window shops. In one of the windows she/you/he catch(es) a reflection of her/your/his backside and sees that that a fat roll is exposed. She/You/He feel(s) marvelous to have realised that.
Perfectionism-related Match	Betty/You/Ned spend(s) hours putting in all the birthdays of friends and family in her/your/his calendar for the year. Later, she/you/he realise(s) she/you/he put in every single one. She/You/He feel(s) marvelous to have realised that.
Perfectionism-related Mismatch	Betty/You/Ned spend(s) hours putting in all the birthdays of friends and family in her/your/his calendar for the year. Later, she/you/he realise(s) she/you/he forgot one. She/You/He feel(s) marvelous to have realised that.

36.

Scenario Type	Example
Food-related Match	Sandy/You/Pierce go(es) to the beach with her/your/his friends. She/You/He end(s) up eating a lot of crisps, cakes, and junk food that people brought. She/You/He is/are very remorseful because she/you/he did that.
Food-related Mismatch	Sandy/You/Pierce go(es) to the beach with her/your/his friends. She/You/He end(s) up eating none of crisps, cakes, and junk food that people brought. She/You/He is/are very remorseful because she/you/he did that.
Body image-related Match	Sandy/You/Pierce put(s) on her/your/his bathing suit/trunks to go to the beach with her/your/his friends. She/You/He has gained weight on her/your/his bum over the winter from lack of exercise. She/You/He is/are very remorseful because she/you/he did that.
Body image-related Mismatch	Sandy/You/Pierce put(s) on her/your/his bathing suit/trunks to go to the beach with her/your/his friends. She/You/He has lost weight on her/your/his bum over the winter despite lack of exercise. She/You/He is/are very remorseful because she/you/he did that.
Perfectionism-related Match	Sandy/You/Pierce go(es) to the beach with her/your/his friends. Once at the beach she/you/he realise(s) her/your/his beach chair fabric has a new snag from how she/you/he stored it. She/You/He is/are very remorseful because she/you/he did that.
Perfectionism-related Mismatch	Sandy/You/Pierce go(es) to the beach with her/your/his friends. Once at the beach she/you/he realise(s) her/your/his beach chair fabric looks brand new from how she/you/he stored it. She/You/He is/are very remorseful because she/you/he did that.

APPENDIX C: EXPERIMENT 1 - 4
FILLER ITEMS

Kara/You/Sean went to the shops. There she/you/he bought
a few products, and then she/you/he headed home.
She/You/He was lighthearted the entire day.
Did Kara/you/Sean stay home all day long in the scenario? 1. Yes **2. No**

Lilian/You/Richard went to the library.
There she/you/he hung out and read a few magazines.
She/You/He felt relaxed as it was such a quiet place.

Amy/You/Travis went and played basketball.
There she/you/he dribbled the ball with her/your/his friends.
She/You/He played for the whole afternoon.

Kate/You/Vernon knew the clocks were changing.
The next day she/you/he got to sleep longer.
She/You/He felt good to be able to do that.

Fran/You/Wayne took her/your/his exam. When she/you/he was/were finished she/you/he handed it in. She/You/He went to the shop after that was complete to buy something nice to reward herself/yourself/himself.
Did Fran/you/Wayne take an exam in the scenario? **1. Yes** 2. No

Becca/You/Bernard looked over and saw someone dressed in an 80's outfit.
The costume was very authentic, and the person was dancing.
She/You/He thought it was quite hilarious to have seen that.

Laura/You/Carsen noticed that all the leaves were changing colour on the trees. It is officially autumn. She/You/He felt cheerful to have noticed that.

Sarah/You/Dan look(s) outside to see the snowflakes falling down.
They are sticking on the ground. She/You/He decide(s) to go out
and walk in the snow.

Megan's/Your/John's friend asks her/you/him what time it is. She/You/He look(s) at her/your/his watch and lets her/you/him know that it is ten thirty in the morning. She/You/He then gets back to her/your/his work.
Was it nighttime in the scenario? 1. Yes **2. No**

At a party Esther/you/Edmond is/are asked if she/you/he has/have any music on her/your/his phone that she/you/he can play. She/You/He put(s) on her/your/his favourite songs. She/You/He feel(s) elated to have shared them.

After a day of skiing Amanda/you/Francis sit(s) in the chalet.
It is nice and warm and she/you/he thaw(s) out.
She/You/He unwinds as she/you/he sit(s) there.

Wendy's/Your/Gregory's friend went traveling to many places.
She/They/He send(s) her/your/him some pictures of her/their/his trips.
Wendy/You/Gregory look(s) at every single one of them.

Rachel/You/Allan receive(s) a postcard in the mail from her/your/his good friend.
Her/Your/His friend lets her/you/him know that she/they/he is/are thinking of
her/you/him. Rachel/You/Allan is/are very touched to have received that.
Did Rachel/You/Allan receive something in the scenario? **1. Yes** 2. No

Tiffany/You/Hugo goes to a costume party.
She/You/Hugo has/have a really fun time.
She/You/He is/are exhilarated to have gone there.

The Christmas market is open.
Nicole/You/Isaac decide(s) to go and shop for gifts.
She/You/He end(s) up shopping all day.

Hayley/You/Sean walk by a shop and sees a beautiful pair of shoes.
She/You decide(s) to go inside and buy them.
She/You is/are really overjoyed to have found them.

Emma/You/Jace and her/your/his flat mates decide to paint her/your/his walls a new colour. She/You/He go(es) to the shop to pick out the colours. She/You/He is/are mesmerized by all the different colours to choose from.
Was Emma/You/Jace painting a picture at her/your/his artist studio? 1. Yes **2. No**

Tracey/You/Matt go(es) ice-skating at an outdoor rink.
It is a very beautiful night.
She/You/H is/are beaming from ear-to-ear.

Shannon/You/Neil is/are waiting for a text from a friend.
Her/Your/His phone buzzes and she/you/he think(s) it may have come in.
She/You/He has butterflies to have felt that.

Chrissy/You/Oliver got a new car and decide(s) to go and visit a friend.
On her/your/his way there she/you/he stop(s) and get(s) petrol.
She/You/He is/are looking forward to seeing her/your/his friend.

Katy/You/Kent goes to the cinema to see a movie.
It is all in 3D and really engaging. Afterward
she/you/he cannot stop thinking about how brilliant it was.
Did Katy/you/Kent like the movie in the scenario? **1. Yes** 2. No

Joan/you/Ram go(es) on a trip to London. The tube is
massively crowded. She/You/He feel(s) like a
mouse in a maze as she/you/he tries/try to get around.

Vickie/You/Sam look(s) outside and it is pouring with rain.
She/You/He do(es) not have an umbrella, but needs to go and meet a friend.
She/You/He is/are soaking wet by the time she/you/he get(s) there.

Honey/You/Ted run(s) to catch the bus. She/You/He end(s) up tripping,
and the bus drives straight past her/you/him. She/You/He would love to start the day all over again.

Abigail/You/Parker decide(s) to take a bike ride. During her/your/his ride her/your/his bike gets a puncture. She/You/He end(s) up having to push it all the way back home.
Did Abigail/You/Parker go ice skating in the scenario? 1. Yes **2. No**

Susan/You/Jerry and some friends go and play tennis.
She/You/He test(s) out her/your/his new racket.
She/You/He decide(s) that she/you/he does not really enjoy playing.

Holly/You/Charles woke up to a loud noise. She/You/He realised
that they were doing construction on her/your/his day off.
She/You/He is/are exhausted and irritated to have had this happen.

Petra/You/Darwin start(s) to feel poorly. By the afternoon
she/you/he realises she/you/he need(s) to go to the clinic.
She/You/He drag(s) herself to have a check up.

Paula/You/Quinn wanted to get a new guitar. At the shop she/you/he
see(s) that the one that she/you/he wanted is much too expensive.
She/You/He end(s) up going home without one.
Did Paula/you/Quinn end up not buying the guitar? **1. Yes** 2. No

Kelly's/Your/Ernie's friend offers to drive her/you/him to an event.
She/They/He comes by to get her/you/him. The two of them/you have
nothing to talk about for the whole journey.

Violet/You/Benson is/are working on an online survey.
She/You/He puts all the data into the survey.
Sadly, the program will not function.

Darcy/You/Fletcher purchase(s) a new pillow. She/You/He is/are looking forward
to a good night's sleep. The next morning she/you/he
notices that the pillow is already falling apart.

Pipa/You/Uriah need(s) new pictures for her/your/his work profile.
The photographer is confirmed. However,
on the day of the shoot she/they/he do(es) not show up.
Does Pipa/you/Uriah get her picture taken in the scenario? 1. Yes **2. No**

Diana/You/Gilbert go(es) to an event. Once she/you/he is/are there
she/you/he realize(s) that she/you/he do(es) not know anyone.
The first person she/you/he approach(es) is very rude.

Samantha/You/Haiden has/have planted a garden.
The plants are coming up. It freezes in the night and
all of her/your/his plants look wilted.

Gigi/You/Ivan decide(s) to go for a walk. As she/you/he walk(s) around the lake she/you/he see(s) big black clouds coming her/your/his way. Then some thunder and lightning starts, so she/you/he run(s) for shelter.

Kerry/You/Vaughn reads the news for the day.
There are a lot of terrible things happening.
She/You/He feel(s) quite deflated to read it all.
Did Kerry/you/Vaughn read the news in the scenario? **1. Yes** 2. No

Scanning through emails Ashley/you/Jackson see(s) one from someone she/you/he has/have not seen in a while. Once she/you/he click(s) on it she/you/he find(s) that it is a virus. She/You/He wonders if she/you/he has/have been affected.

A friend asks Filly/you/Jeremiah what her/your/his opinion is about something on a phone call. She/You/He tell(s) her/you/him what she/you/he really thinks.
The friend gets silent at the other end of the phone.

Rebecca/You/Noel and a friend want to make jewelry/go-carts.
They go to the shop to get supplies together.
There is not much to choose from.

Running out of the door Theresa/you/Wade feel(s) that it is cold outside. She/You/He dart(s) back in and grabs her/your/his winter coat.
Halfway there she/you/he feel(s) she/you/he also could have used a scarf.
Is it really hot outside in the scenario? 1. Yes **2. No**

Kellan/You/Oscar turns the light on to read something. Then she/you/he hear(s) a strange sound. The light had burned out.

Allie/You/Tray leave(s) work early. When she/you/he come(s) back the next day, her/your/his things have been moved. She/You/He cannot find her/your/his notepad.

Yolanda/You/Zain sees her/your/his friend has posted up a new picture on her/their/his blog. She/You/He click(s) to see what it is.
She/You/He see(s) that it is a really disturbing picture.
Do(es) Yolanda/You/He have a blog in the scenario? **1. Yes** 2. No

Walking down the street Georgia/You/Tim looks over to see a baby bird. She/You/He is/are not sure if she/you/he should touch it or leave it. The next day it is gone, and she/you/he wonders what happened to it.

Ruby/You/Philip get(s) a call from a number she/you/he do(es) not recognise.
They leave a message. Once she/you/he check(s) her/your/his messages she/you/he become(s) aware that it is the important call she/you/he has/have been waiting for.

Nic/You/Andy walk(s) into her/your/his home, and the sun has gone down.
It is really dark inside. All of the electricity is out for some reason.
Is it sunny out in the scenario? 1. Yes **2. No**

APPENDIX D
DRIVE FOR MUSCULARITY SCALE

Please read each item carefully then, for each one, circle the number that best applies to you.

1	2	3	4	5	6
ALWAYS	VERY OFTEN	OFTEN	SOMETIMES	RARELY	NEVER

1. I wish that I were more muscular.	1	2	3	4	5	6
2. I lift weights to build up muscle.	1	2	3	4	5	6
3. I use protein of energy supplements.	1	2	3	4	5	6
4. I drink weight gain or protein shakes.	1	2	3	4	5	6
5. I try to consume as many calories as I can in a day.	1	2	3	4	5	6
6. I feel guilty if I miss a weight training sesson.	1	2	3	4	5	6
7. I think I would feel more confident if I had more muscle mass.	1	2	3	4	5	6
8. Other people think I work out with weights too often.	1	2	3	4	5	6
10. I think that I would look better if I gained 10 pounds in bulk.	1	2	3	4	5	6
10. I think about taking anabolic steroids.	1	2	3	4	5	6
11. I think that I would feel stronger if I gained 10 pounds in bulk.	1	2	3	4	5	6
12. I think that my weight training schedule intereferes with other aspects of my life.	1	2	3	4	5	6
13. I think that my arms are not muscular enough.	1	2	3	4	5	6
14. I think that my chest is not muscular enough.	1	2	3	4	5	6
15. I think that my legs are not muscular enough.	1	2	3	4	5	6