

# **The Modified Stroop Effect and Eating Disorders**

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I declare that this report is my own original work and that contributions  
of others have been duly acknowledged

*W. H. H.*

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Literature Review

**The Modified Stroop Task and Eating Disorders: A Review  
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## **The Modified Stroop Effect and Eating Disorders: A Review of the Research**

### **Abstract**

The use of the Modified Stroop task in assessing attentional bias and cognitive processing underlying psychopathology is reviewed, with particular focus on eating disorders. It is argued that the modified Stroop effect obtained with food or body related stimuli is not specific to individuals with eating disorders but also occurs in individuals high on dietary restraint. The relationship between the Stroop effect and recovery from eating disorders is examined addressing the issue of whether the Stroop effect is concomitant with current symptomatology or reflects an underlying vulnerability trait that remains after recovery. Methodological issues such as varying approaches to statistical analyses; stimuli word choice and control words are considered. The influences of participant characteristics such as eating disordered symptomatology and general psychopathology as well as hunger state on the Stroop effect are evaluated. Further directions for increasing knowledge of the conditions under which the effect occurs are indicated. The Stroop effect is considered as evidence for the existence of schematic processing of food and body shape related information and implications of this for understanding of disordered eating behavior and treatment are considered.

In recent years principles of cognitive psychology have increasingly been applied to research on psychopathology. Cognitive accounts have pointed out that many psychological disorders share the common feature of sensitivity to and preoccupation with stimuli in the environment that represent the focus of their concern. Central to these cognitive theories is the notion that this preoccupation arises from biases in attention (Williams, Mathews, & MacLeod, 1996). Cognitive models assume that such attentional biases are important factors in the aetiology and maintenance of psychological disorders. One of the most frequently used measures for attentional bias in psychological disorders is the modified Stroop task. The focus of this literature review is the application of the Stroop methodology to the understanding of attentional bias and cognitive processing underlying eating disorders.

The first section outlines the information processing approach and Stroop methodology. The second section discusses research on the Stroop effect and eating disorders and is followed by a discussion of the specificity of the effect and the role of dietary restraint, arguing that the effect is not specific to individuals with eating disorders. The issue of the Stroop effect and recovery from eating disorders is then discussed.

Methodological problems in the research and their contribution to difficulties in reconciling findings are considered. The role of specific and general features of eating disordered psychopathology and their relationship to the colour naming effect are discussed as is the contribution of hunger to our understanding of the Stroop effect. The meaning of the Stroop effect and the concept of schema will be



considered. Finally, the utility of the Stroop task as a measure of eating disordered psychopathology and clinical change is also discussed.

## **Investigation of Psychopathology using an Information Processing Approach**

The information processing approach proposes that human behaviour can be explained in terms of the operation of fundamental cognitive processing mechanisms that act upon the flow of information (Williams, Watts, Macleod, & Mathews, 1997). These mechanisms include attention, encoding, rehearsal and transformation of information and forgetting (Solso, 1995). As argued by Williams et al. (1997) within the framework of this approach the development and maintenance of certain psychological disorders may be due to idiosyncrasies in the operation of these cognitive processes. Thus, the identification of idiosyncrasies in the information processing of individuals with psychological disorders may provide insight into the cognitive processing underlying their psychopathology.

Individuals with psychological disorders have been shown to have a preoccupation with stimuli in the environment that represent the focus of their concern. For example, clinical observations of depressed individuals might suggest that they are particularly likely to notice things that are consistent with their depressed mood (Kovacs & Beck, 1978). Although these individuals have often had more negative experiences than non-depressed individuals, their preoccupation seems to exceed what is explicable on such a basis. Several explanations for this excessive preoccupation have been proposed; an increase in the extent to which people notice stressful events, an increase in the effect of these events on cognitive functioning, or an increase in the frequency with which these events are recalled (Williams et al.,

1997). These authors also point out that from a clinical point of view, all these explanations are plausible.

### *The modified Stroop effect in psychological disorders*

This literature review focuses on one of the explanations for this preoccupation, attentional bias. An attentional bias for certain stimuli can impair or facilitate performance on certain tasks (Williams et al., 1997). One of the most frequently used tests of attentional bias is the modified Stroop task. The original Stroop task developed by J. R. Stroop (1935), presents a list of colour names or a string of Xs and requires the respondent to name the colour of the ink in which the colour name is written. It is commonly found that an individual requires longer to name the ink colours when the items are colour names than when they are rows of meaningless stimuli (Lezak, 1995). Furthermore, when the colour of the ink and the colour name are inconsistent the participant takes longer to name the colour than when they are consistent. The difference between the time taken to respond to the meaningless stimuli and the time taken to colour name the colour words is referred to as the 'Stroop effect' (Ben-Tovim, Walker, Fok, & Yap, 1989).

One explanation of the Stroop effect has been provided by the parallel distributed processing model (Cohen, Dunbar, & McClelland, 1990). According to this model, the Stroop task involves the activation of two cortical pathways, one for colour naming and one for word reading. To enable a response to occur the relevant pathways must be sufficiently activated. Cohen et al. (1990) propose that the word reading pathway interferes with the activation of the colour naming pathway because it is more highly practised. This results in increased time to gather the required

strength of activation to produce the colour naming response than the word reading response.

In the modified Stroop task, also known as the emotional Stroop task, respondents are required to name the ink colour of different sorts of words. These words are usually varied in their relation to the individual's psychopathology (or have particular salience for them) and response latencies for these words are compared with the response latencies for neutral words. Dalgleish (1995) found that keen ornithologists show colour naming interference for the names of rare birds, indicating that the effect is not restricted to emotionally provoking stimuli but also occurs to salient stimuli. Findings consistently show that individuals with a psychological disorder exhibit longer latencies for colour naming of disorder salient words than for matched words unrelated in meaning to their psychopathology. This has been illustrated in relation to a range of problems including; spider phobia (Watts, McKenna, Sharrock, & Trezise, 1986), generalised anxiety disorder (Mathews & Macleod, 1985), depression (Gotlib & McCann, 1984) and eating disorders (Cooper & Fairburn, 1992).

According to the Cohen et al. (1990) parallel distributed processing model, the modified Stroop effect can be explained by higher resting activation levels of cortical pathways for emotionally salient words than resting activation levels of neutral words. When the pathway is activated by a salient word there is a higher activation output than when it is activated by a neutral word, due to their respective resting activation levels. The presentation of a salient word increases the activation level

through the pathway, absorbing processing resources, and thus there is greater interference with colour naming at the response level (Williams et al., 1997).

Another important conceptual model explaining the preoccupation with stimuli in certain psychological disorders and of relevance to performance on the emotional Stroop task is the concept of the self-schema. Individuals are said to have organised cognitive structures or schemas around emotionally salient issues (Williams et al., 1996). A self-schema comprises self descriptive traits or attributes which are represented in an organised way in semantic memory such that activation or exposure to one attribute will automatically lead to activation of the others (Segal & Vella, 1990). This stored body of knowledge or schema is known to interact with incoming information by shaping selective attention and memory search (Williams et al., 1997). Research has shown that individuals are more likely to direct their attention to information that is consistent with an established self-schema, process information more quickly and have greater recall for schema congruent than incongruent information (Bargh, 1982; Markus, 1977). Thus the individual with a self-schema for a particular stimulus is likely to selectively attend to information consistent with that schema. In the case of the emotional Stroop task, if stimuli are presented that activate a schema, then information processing resources are absorbed by processing the meaning of the stimuli and there is greater interference with colour naming.

The schematic processing explanation is consistent with the Cohen et al. (1990) model. If an individual has highly elaborated self-schema for a particular domain these concepts would have higher resting levels of activation and be more accessible.

Thus when a word is presented that activates self-schemas there would be greater interference with colour naming at the response level.

The modified Stroop task has been used to measure attentional bias in the processing of information in several psychological disorders such as; obsessive compulsive disorder (Lavy, Van Oppen, & Van den Hout, 1994), generalised anxiety disorder (Mathews & MacLeod, 1985; Mathews, Mogg, Kentish, & Eysenck, 1995), depression (Gotlib & McCann, 1984), post traumatic stress disorder (Cassiday, McNally, & Zeitlan, 1992) specific phobias (Watts, McKenna, Sharrock, & Trezise, 1986), social phobia (Mattia, Heimberg, & Hope, 1993), panic disorder (McNally, Amir, Louro, Lukach, Riemann, & Calamari, 1994) and eating disorders (Cooper & Fairburn, 1992).

### ***The modified Stroop effect in eating disordered individuals***

The Modified Stroop effect in relation to food and/or body shape related words has been demonstrated in individuals with eating disorders. The rationale given for this effect is that overvalued ideas relating to food, body, weight and shape in these individuals manifest themselves as an attentional bias. Several researchers have found an attentional bias in bulimic individuals towards the combined presentation of food and body shape related words (Cooper, Anastasiades, & Fairburn, 1992; Cooper & Fairburn, 1992; Cooper & Fairburn, 1993; Cooper & Fairburn, 1994; Fairburn, Cooper, Cooper, McKenna, & Anastasiades, 1991) and in anorexics (Cooper & Fairburn, 1992; Cooper & Todd, 1997; Green, McKenna, & DeSilva 1994).

However, combined presentation confounds possible differences in response to the specific stimulus categories of food and body shape.

The picture becomes more complex when the modified Stroop effect to separate presentation of food and body shape related words is examined. Cooper and Todd (1997) found that bulimics demonstrated an interference effect greater than that observed in control participants on weight and eating related words but not on shape related words. Moreover, other research has found bulimics show greater interference to both shape and food related words (Ben-Tovim, Walker, Fok, & Yap 1989). However, Black, Wilson, Labouvie, and Heffernan (1997) failed to find a greater interference effect to body or food related words in bulimics relative to control participants.

Similarly, research investigating anorexics has reported the Stroop effect for food and body shape related words (Cooper & Todd, 1997; Green, McKenna, & DeSilva 1994). However, some studies have failed to find delayed colour naming of body shape words, finding the effect only for food related words (Ben-Tovim, Walker, Fok, & Yap, 1989; Channon, Hemsley, & Desilva 1988; Perpiña, Hemsley, Treasure & Desilva, 1993) and some research has found the effect for body shape but not food related words (Green, Wakeling, Elliman, & Rogers, 1998). Furthermore, Cooper and Todd (1997) found retarded colour naming for the separate presentation of weight related as well as food and body shape related words.

It is hard to compare differences between the attentional bias to various word categories from published studies of anorexics or bulimics because the studies themselves have used a range of stimulus words and word types.

Some investigators have conducted within-study comparisons comparing attentional bias in bulimics and anorexics to the same set of words. However, findings have

been inconsistent. While some researchers such as Perpiña et al. (1993) have reported impaired colour naming of food words in anorexics and body related words in bulimics, others, such as Ben-Tovim et al. (1989) and Cooper and Todd (1997) report impaired naming of food words in both anorexics and bulimics. Ben-Tovim et al. found impaired colour naming of shape words in bulimics, whereas Cooper and Todd demonstrated impaired naming of shape related words in anorexics. Jones-Chesters, Monsell, and Cooper (1998) found that both patients with bulimia nervosa and patients with anorexia nervosa showed increased reaction time for colour naming words related to eating, food, weight and shape. Overall, however, it appears that impaired colour naming to food words may be a more robust finding in both bulimia and anorexia.

### *The modified Stroop effect in non-eating disordered individuals*

Early enthusiasm for the Stroop as a diagnostic tool for eating disorders has been moderated somewhat by findings of the same effect in non-clinical individuals high on dietary restraint, however these findings lack consistency. Restrained eaters are those individuals who resist food in order to control weight gain or encourage weight loss (Pirke & Laessle, 1993; Ruderman, 1986). A number of researchers have demonstrated a colour naming impairment in highly restrained individuals to food-related words as compared to low or unrestrained eaters (Green & Rogers, 1993; Overduin, Jansen, & Louwerse, 1995; Stewart & Samoluk, 1997). Conversely, many investigations have failed to find colour naming differences between individuals high and low on dietary restraint (Mahemedi & Heatherington, 1993; Ogden & Greville, 1993). Findings for body related words are also unclear. Most investigations have failed to find selective interference for body shape/weight related words in highly



restrained eaters (Ben-Tovim & Walker, 1991; Channon et al., 1988; Cooper & Fairburn, 1992; Huon & Brown, 1996; Jansen, Huygens, & Tenney, 1998; Mahemedi & Heatherington, 1993; Overduin, Jansen, & Louwerse, 1995; Perpiña et al., 1993). However Green and Rogers (1993) found a difference between restrained and unrestrained eaters on colour naming body related words. Furthermore, research by Mahemedi and Heatherington, (1993), Overduin et al. (1995) and Ogden and Greville, (1993) found differential responding on the Stroop task has emerged after exposure to a food preload.

Findings relating to the colour naming performance of normal unrestrained eaters at certain stages of development further raise questions regarding the specificity of the attentional bias. Green and McKenna (1993) found that the Stroop effect to body and/or food related words was demonstrated in 14-year-old females, but not in 14-year-old males and that there was a small effect in 11-year-old girls but not 9-year-old males or females.

At least one investigation by Black, Wilson, Labouvie and Heffernan (1997) has found a Stroop effect for food and body shape related words that did not differ significantly between bulimic, restrained eater and non-restrained eating groups. Furthermore, several studies have found the effect in normal participants (Fairburn, Cooper, Cooper, McKenna, & Anastasiades, 1991; Jones-Chesters et al., 1998) although it has been reported to be a smaller than in comparison clinical groups.

*Changes in the Stroop effect with treatment and recovery from eating disorders*

The link between the Stroop effect and psychopathology has also been supported by researchers examining the Stroop effect over the course of treatment. Cooper and Fairburn (1994) found that the Stroop interference effect to the combined presentation of food and body related words diminished as symptomatology improved in a bulimic group after 19 weeks of psychotherapy. Colour naming impairment to food and body related words has also been examined in anorexics, on initial admission, after one week of therapy and after 12 weeks of therapy (Green et al., 1998). Anorexics demonstrated an interference effect for both food and body words on initial hospital admission, an interference effect for only body words one week after admission, and on final testing there was no interference effect for either word type. Furthermore, body dissatisfaction scores on the Eating Disorder Inventory (Garner, Olmstead, & Polivy, 1983), both at initial testing and after 12 weeks of therapy, correlated significantly with body colour naming at each of these times. Green et al. (1998) concluded that colour naming performance for body shape rather than food words provides a clearer indication of improvement in psychopathological status in anorexia nervosa.

Between-subjects designs have also investigated the relationship between clinical change and the Stroop effect. Lovell, Williams, and Hill (1997) compared anorexics, recovered anorexics, bulimics, recovered bulimics and non-eating disordered women, and found that women currently suffering from bulimia and those women who had recovered from anorexia were more distracted by words reflecting shape concerns than were women who had never suffered eating disorders or women who had recovered from bulimia. No difference was observed between groups for responses

to food words or words related to adolescent concerns. Lovell et al. (1997) speculated that for bulimia nervosa sufferers who have never suffered from anorexia, shape concern may be a state effect, being high while the individual is suffering from bulimia but dissipating with recovery. For women with anorexia who engage in extreme self starvation and for whom recovery involves weight gain, the Stroop effect may indicate the presence of an enduring cognitive characteristic which functions relatively automatically. This finding is consistent with Green et al. (1998) finding that the Stroop effect to body words disappears more slowly than to food words.

In summary it seems that the emotional Stroop effect is a more robust finding in eating disordered participants than in non-eating disordered individuals with varying levels of dietary restraint. However, the effect is not restricted to individuals with eating disorders. Furthermore, the effect seems to diminish with treatment. Importantly, there is a lack of consistency between findings that requires clarification before the meaning and utility of the Stroop effect in eating disorders can be understood.

Some of the inconsistencies may be due to methodological variations, such as differences between words used, heterogeneity of control words and differences in statistical analyses, that more recent research is beginning to address. In addition, some of the differences may be related to underlying factors that determine the colour naming effect. It has been argued that the Stroop test may be related to specific features of bulimic psychopathology and therefore its existence will be determined by the different characteristics of the groups tested. Furthermore, the role

of hunger in the production of the Stroop effect has yet to be understood. These methodological and sampling issues will be discussed in the following sections.

## **Methodological Issues**

### ***Varying approaches to statistical analysis***

Comparison between studies is made difficult by the wide range of approaches to statistical analysis of the data. Some studies conservatively check for overall main effects and interactions and follow these by post hoc tests (Cooper & Fairburn, 1992). Other studies only report one-way and post hoc analyses making it impossible to determine whether the highly relevant interaction between word type and group is statistically significant (Ben-Tovim et al., 1989; Long, Hinton, & Gillespie, 1994). In these analyses a significant interaction between control/threat word type and subject group would be used as overarching evidence for the existence of a Stroop effect. Other research employs as the dependent variable an interference index calculated from the reaction time to threat words minus the reaction time to control words, with participant group allocation as the between-subjects factor. Due to findings of differences between threat and control words in non-clinical groups it is crucially important that the analyses determine whether the difference between responses to threat and control words is significantly greater in the experimental than the control groups, in addition to whether there is a significant difference in response to control and threat words in the control group. Jones-Chesters et al. (1998) provided an example of a more appropriate analyses. They conducted a preliminary one-way analysis of variance limited to the control participants on the reaction time to threat

and control words, followed by an analysis of variance of the interference index of all the data, allowing for a more thorough examination of the Stroop effect.

### *Variations in stimulus word choice*

Some inconsistencies in findings, most particularly noted in relation to body shape related words, may be attributable to the choice of words. Most researchers have used a mixture of trait adjectives with negative emotional valence already attached (eg 'fat' or 'flabby') and nouns referring to parts of the body, (eg 'hips'). Analyses have masked any differences between response latencies to nouns and adjectives that may exist (for example Channon et al., 1988; Perpiña et al., 1993).

Words with negative valence already attached may be more likely to be perceived as negative for most of the population whereas the body parts may have a positive/negative/neutral valence and may be perceived as negative only for particular types of individuals, such as those with eating disorders. Thus, the adjectives may be more likely to produce interference: nouns require an interpretation, but adjectives are already negative. It is conceivable that most individuals have schemas around words connoting negative body image such as 'fat, flabby, podgy' so adjectives may activate a schema in most women. On the other hand, schemas may be less likely to be activated using words such as hips, thighs, unless these concepts have particularly elaborated knowledge structures or are important elements of their self-schema around body image. Furthermore, the adjectives may activate anxiety which has been shown to increase colour naming interference (Mathews & Macleod, 1985). Accordingly, research into the possible differential effects of parts of speech would be useful; the choice of nouns or

adjectives may be a factor that effects the strength of activation of eating disordered related cognitions.

Similar issues exist with food words, where there has been little discussion of word choice. Most researchers have combined different types of food words (Channon et al., 1988; Fairburn et al., 1991) or used words with a presumed negative affective valence for individuals with eating disorders or those on diets, for example high fat foods, 'forbidden foods', or words typically associated with bulimic binges (Formea & Burns, 1996; Green, McKenna, & Desilva, 1994 ). Some authors have included words related to meals eg 'dinner' 'diet' (Channon et al., 1988). Most of these studies have found colour naming impairments for food related words in clinical participants but the findings from non-clinical groups have been inconsistent. Some of the research that finds a Stroop effect for food words in restrained eaters uses forbidden food words (Green & Rogers, 1993; Overduin et al., 1995; Stewart & Samoluk, 1997). Similarly, researchers such as Mahemedi and Heatherington, (1993) who have failed to find differences between those high and low on dietary restraint, used more neutral or more general selections of food words, including such words as 'baker', 'dinner', 'sandwich'. Thus the activation of schemas related to food may be more strongly associated with those foods to which we are more likely to have attributed an affective valence or which are more salient to the individual.

Most studies investigating the Stroop effect to food and body related words have neglected colour naming of more positively valenced words such as 'slim, carrots, and slender'. This may limit understanding of information processing and eating disorders (Vitousek & Hollon, 1990). Resistance to counterschematic information

may be an important feature in eating disorders (Rieger, Schotte, Touyz, Griffiths, Russell, & Beumont, 1998). Individuals with eating disorders, restrained eaters and unrestrained eaters may respond differently to positively and negatively valenced stimuli. Francis, Stewart and Hounsell (1997) investigated colour naming of restrained and unrestrained eaters to forbidden and non forbidden food types and found that restrained eaters demonstrated impaired colour naming to both types of words, despite rating only the forbidden words as more forbidden than control participants.

In another study which attempted to explore valence effects by including positively and negatively valenced emotional words, Sackville, Schotte, Touyz, Griffiths, and Beumont (1998) investigated colour naming to words connoting fatness, words connoting thinness, low caloric density food words, high caloric density food words, and neutral control words. They found that patients with anorexia nervosa but not unrestrained or restrained eaters had delayed colour naming latencies for both thin and fat word categories and to a lesser extent for high caloric density food words. The inclusion of categorically related neutral control words and emotional words suggest the findings were not due to semantic homogeneity (see below) or emotional valence. This was interpreted as evidence of a specific attentional bias in individuals with anorexia towards body shape related information and high caloric food words. Taken together, these findings of Sackville et al. (1998) and Francis et al. (1997) indicate that the influence of more specific word types on Stroop interference remains an open question worthy of further investigation.

### *Variations in control words*

Difficulties are also evident in the choice of control words. While many researchers have controlled for important factors such as frequency of use, grammatical category and word length, many have failed to use control words that for sets that are homogenous. It is well established that greater interference with colour naming is observed for a word semantically related to the previous word (Green, Corr, & DeSilva, unpublished). Delayed colour naming therefore may simply be a result of differences in processing times due to differences in word homogeneity and all of the interference in colour naming to a block of food words could be due to the semantic relation between each word and the prior context, not to the disorder related salience of the words (Jones-Chester et al., 1998). Many studies have failed to control for homogeneity of control words (Channon et al., 1988; Cooper & Fairburn, 1992; Cooper & Fairburn, 1993; Cooper & Fairburn, 1994; Cooper & Todd, 1997; Fairburn et al., 1991; Huon & Brown, 1996; Mahemedi & Heatherington, 1993; Ogden & Greville, 1993; Perpiña et al., 1993,). However some more recent research has found modified Stroop effect after controlling for homogeneity (Jones-Chester et al., 1998; Green et al., 1996; Lovell et al., 1997; Overduin et al., 1998; Stewart & Sornoluk, 1997) supporting the notion that the Stroop effect is more than a mere product of the priming effects of a homogeneous category of words.

Green, Corr, and DeSilva (unpublished) hypothesised that the Stroop interference effect demonstrated by anorexics should vary as a function of associative strength of the neutral words. Presenting non-clinical individuals and anorexics with a set of body shape words and three sets of neutral words, varying in associative strength, he found that colour naming times of non-clinical subjects reflected the associative



strength of the words within each category. Anorexics colour named body shape related words as slowly as the highly inter-associated neutral words. This finding was interpreted as reflecting the highly interconnected nature of body related schemas in anorexia rather than affective valence. However, one criticism that Green acknowledged is that his choice of control word sets, the use of groups of animals 'cows, slugs;' and clothes 'skirt' 'shorts' 'outfit' may have primed schema related to food and body image. Nevertheless, whilst using such words as control words, the interference effect was still greater in body shape and food related words.

### **The Influence of Participant Characteristics on Stroop Effects**

#### ***Variations in eating disorder symptoms and Stroop effects***

It is conceivable that some inconsistencies between studies may be due to quantitative differences in the symptomatology of the groups tested. Researchers have therefore examined correlations between colour naming indices and measures of symptomatology, attempting to determine the aspects of eating disordered psychopathology that relate to the attentional bias.

Cooper, Anastasiades, and Fairburn (1992), found a correlation between bulimics' colour naming of food and body related words and symptom severity as measured by the Eating Attitudes Test (EAT) (Garner & Garfinkel, 1979)- a self-report measure of the specific psychopathology of eating disorders. Individuals with more severe symptoms showed greater selective processing. However, interference was also significantly correlated with depression and when the effects of depression were controlled for, the Stroop effect was reduced to below significance. Thus, it was

unclear whether the relationship between the colour naming and symptom severity was merely mediated by depression. In an attempt to clarify this finding Cooper and Fairburn (1992) investigated the contribution of general psychopathology and the specific features of eating disorders in a much larger sample of 75 patients with Bulimia Nervosa. They found that colour naming to mixed presentation of food and body shape related words was related to the overall level of psychiatric symptoms and frequency of purging. Using multiple regression analysis, frequency of purging was found to be the best predictor of interference, so interference with colour naming appeared to be more closely related to the severity of symptoms specific to the disorder than to general psychopathology.

Further evidence of the relationship between the Stroop effect and specific psychopathology comes from Formea and Burns (1996) who investigated colour naming of food, body and weight in a group of non-patients with a score on the Bulimia Test Revised (BULIT-R) (Thelen, Farmer, Wonderlich, & Smith, 1991)- a self report measure of bulimic behaviors, consistent with those of bulimia nervosa. These authors found a correlation between scores on the BULIT and colour naming in both their bulimic and non bulimic groups. Green et al. (1998), also found that the Stroop effect to body related words correlates with body dissatisfaction as measured by the Eating Disorder Inventory (EDI) (Garner et al., 1983) in anorexics at initial testing and again after 12 weeks of therapy.

There is also research to suggest that the Stroop effect may be related to the dimensions of dietary restraint and drive for thinness as measured by the EDI. Non-clinical, high drive for thinness, high dietary restrained individuals have been shown

not to differ significantly from eating disordered individuals in colour naming for food and body related words (Perpiña et al., 1993). High drive for thinness was associated with a slower processing of body related but not food related terms whereas high restraint was associated with slower colour naming of both terms. This finding suggests that drive for thinness and dietary restraint may be the factors that are related to attentional bias. Further support for this suggestion comes from Long et al.'s (1994) findings on obese restrained eaters who exhibit colour naming impairments compared with unrestrained controls on colour naming of food and body size words.

Thus, there is evidence to suggest that specific features of eating disordered psychopathology such as severity of symptoms, or underlying dimensions of eating disordered psychopathology that exist on a continuum from restrained eating to eating disorders may be related to the Stroop effect. More research is required to clarify the specific aspects of eating disordered psychopathology tapped by the Stroop task.

### ***The effect of general psychopathology on Stroop responses***

Certain studies have failed to find a relationship between the specific features of eating disorders and colour naming, finding relationships instead with more general measures of psychopathology such as depression. Cooper and Fairburn (1992) suggest a possible explanation for the selective information processing found in patients with bulimia nervosa is that they view food and body shape related words as more negative than do normal controls. Studies of selective information processing in depression have found that interference with colour naming for negative words is

increased in those who have depressive features (Gotlib & McCann, 1984), and in depressed psychiatric patients (Gotlib & Cane, 1987). Jones-Chester et al. (1998) failed to find any correlation between colour naming and the specific psychopathology of eating disordered individuals (body dissatisfaction, restraint and disordered eating patterns) in anorexics, bulimics and non-patients. They combined anorexic and bulimic groups and found colour naming correlated significantly with HAD-D (Hospital anxiety and depression scale-depression) and DEBQ (Dutch eating behaviour questionnaire) scores. However multiple regression analysis revealed that only HAD-D accounted for significant variance in colour naming interference.

Other researchers have also found a relationship between depression and colour naming impairment in individuals with eating disorders. Lovell et al. (1997) collapsed across groups of bulimics, anorexics, recovered bulimics, recovered anorexics and controls and found that scores on the BDI correlated significantly ( $r = .29$ ) with colour naming. Cooper, Anastasiades, and Fairburn (1992) also found a correlation between the Beck Depression Inventory and colour naming ( $r = .34$ ) in their bulimic group. Formea and Burns (1996) suggest that an investigation is needed which uses a non-bulimic control group with depression scores that equate with the bulimic group to further clarify these issues.

In summary, the research to date casts doubt on any assertion that the Stroop test may be a simple instrument for defining clinical psychopathology. Instead it raises the issue that the Stroop task may be tapping into an underlying dimension of eating disordered psychopathology such as dietary restraint or drive for thinness. The Stroop effect may provide a measure of clinical severity, rather than identify a

qualitative difference in cognitive processing between eating disordered individuals and non-eating disordered individuals. Moreover, the utility of the Stroop test as a measure of the specific psychopathology of eating disorders is questioned by research suggesting a role for depression in mediating Stroop effects.

### *The influence of hunger state on Stroop effects*

Another variable whose role in mediating the Stroop effect requires clarification is hunger. Several studies have demonstrated that unrestrained eaters who are deprived of food also exhibit colour naming impairment to food words (Channon & Hayward, 1990; Green, Elliman, & Rogers, 1996) and that the colour naming impairment increases as food deprivation increases in highly restrained individuals. This raises the question of whether the Stroop effect is merely a function of food deprivation. Food deprivation has been shown to increase preoccupation with food in normal weight individuals without any history of eating disorders (Channon & Hayward, 1990). Thus the Stroop effect may be activated by increasing food preoccupation and activating food related schemas in non-clinical participants who are food deprived.

The effect of food deprivation on colour naming in eating disordered individuals is unclear. It has been suggested that delayed colour naming in anorexics is related to the starvation process. Delayed colour naming of food related words has been observed to be greater at the more extreme end of the anorexic weight range (Channon et al., 1988) and the size of colour naming impairment for body related words has been shown to decrease as a function of weight gain and improvement in psychopathology (Green et al., 1998). However, Green et al. (1996) demonstrated that impairments in food related colour naming varied as a function of anorexics' self

reported hunger level with the most hungry subjects displaying the smallest Stroop effect for colour naming food words. The finding was interpreted as indicating that it is subjective feeling of hunger that is the mediating variable between anorexia and colour naming. However, these findings are in the opposite direction to what would be expected.

Notwithstanding the methodological and participant related problems reviewed research to date generally supports the notion that the modified Stroop effect exists in individuals with eating disorders, but the effect is less clear in individuals with varying levels of dietary restraint. The food-related word colour naming effect seems to be a more robust finding than the effect for body related words in eating disordered individuals. Importantly the effect for food related words is also seen in non-clinical participants and thus it does not differentiate individuals with clinical eating disorders and normals.

### **Attentional Bias and the Concept of Schema**

The attentional bias to food and body shape related words demonstrated by eating disordered individuals on the emotional Stroop task is evidence for the existence of schematic processing of body shape and food related information. Studies have shown that individuals are more likely to direct their attention to information that is consistent with an established self-schema and to process that information more quickly (Markus, 1977). It has been posited that eating disordered individuals develop schemas around issues of body shape and weight and their implications for

the self, that influence their perceptions, thoughts, affect and behaviour. This schematic processing has been thought to play a role in supporting the maladaptive behaviours associated with bulimia and anorexia in a relatively automatic way (Vitousek & Hollon, 1990).

It has been argued that all individuals develop some organisation of knowledge pertaining to body weight or body image, comprising thoughts and feelings about their bodies (universalistic schema) (Markus, Hamill, & Sentis, 1987). However, there is individual variation in the degree of activation of their knowledge structures in this domain. Individuals range from extremely concerned with their body weight and everything connected with it, to completely unconcerned. Those actively concerned are said to have a particularistic schema and be schematic, while those who possess only a universalistic schema are said to be aschematic (Markus et al., 1987). Markus et al. posit that due to a lack of an integrated knowledge structure for body weight and shape aschematic individuals do not differentially attend to these stimuli. Thus it would be expected that only schematic individuals would demonstrate attentional bias on the Stroop task. This distinction may help to explain the findings that individuals with clinical eating disorders demonstrate the Stroop effect to body related words whereas there are only a limited number of studies reporting a Stroop effect for body related words in individuals without a clinical eating disorder.

However the distinction is less useful in relation to processing of food related information. It would be expected that individuals with eating disorders would have particularistic schemas related to food as well as body image. However if the Stroop

task is providing a measure of the degree to which an individual is schematic for a particular stimulus then this suggests individuals across the continuum of eating behaviour and especially those high on dietary restraint have particularistic schemas around food. Thus, it is suggested that the degree to which an individual is schematic for a particular domain of stimuli exists on a continuum and the extent to which an individual displays an attentional bias towards this domain of stimuli is closely related to this schematic processing.

This schematic processing explanation for the emotional Stroop effect in eating disorders is consistent with Cohen et al.'s (1990) model. Differences in colour naming interference for salient stimuli can be explained by the premise that individuals with a self-schema for a particular domain have more integrated knowledge structures and thus higher resting levels of activation.

### **Conclusion**

While caution must be adopted in developing conclusions, due to methodological problems in the research and inconsistent findings, some general conclusions can be made. There appears to be a colour naming decrement for food words across the continuum of eating behaviour. The colour naming impairment is sometimes observed in normal eaters but this is a less robust finding than in individuals high on dietary restraint. Individuals with eating disorders demonstrate a greater Stroop effect to food related words than restrained eaters and the effect is demonstrated more consistently. Whether this is related to underlying dimensions of restraint, drive for thinness or the specific psychopathology of eating disorders requires further



exploration. As symptomatology improves, the Stroop effect diminishes suggesting that it is not merely increased exposure to food related information and concern that results in the attentional bias. The research supports the notion that food is a universalistic schema and that the degree to which individuals are schematic towards food varies between the groups covered in this review.

Most research reveals impaired colour naming to body shape related stimuli in individuals with eating disorders. This is taken to be evidence for an attentional bias towards body shape related information in eating disorders and self-schema related to body shape. Decreases in the Stroop effect to body shape related words have been shown to be related to improvements in symptomatology, and the Stroop technique provides a potentially useful measure of clinical change, especially if research can further clarify the specific features of eating disordered symptomatology that are most closely associated with the attentional bias. Information about the specific symptomatology and participant characteristics such as treatment status needs to be collected and examined in relation to colour naming times.

Research into both the Stroop effect to body related words and the Stroop effect to food related words has been complicated by methodological shortcomings and different methodological approaches. Different approaches to statistical analyses have made comparison between research studies difficult. Furthermore the failure in some research to control for semantic homogeneity may have contributed to different findings between studies. Further research needs to control for semantic homogeneity and develop consistency of approach to statistical analyses.

The choice of stimuli words is also an important factor that needs further consideration, with future research examining colour naming to more specific types of words to further clarify the nature of schematic processing underlying disordered eating behaviour. Factors such as the time since the participants have eaten and hunger state also need to be considered.

Cognitive psychology has introduced many new possibilities into research on the psychopathology of eating disorders and researchers are constantly developing new tools which clinical researchers need to evaluate and adopt wherever appropriate. The modified Stroop methodology proves useful especially if these methodological shortcomings in its use are rectified.

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Empirical Study

**The Modified Stroop Task and Eating Disorders:  
An Investigation of the Cognitive processing of Body, Food  
and Self-threat related information in Bulimics, Recovered  
Bulimics, Restrained Eaters and Unrestrained Eaters**

**The Modified Stroop Effect and Eating Disorders: An Investigation of the Cognitive Processing of Food, Body shape and Self-threat related words in Bulimics, Recovered Bulimics, Restrained Eaters and Unrestrained Eaters**

**Abstract**

Schematic processing underlying eating disordered symptomatology was examined using the modified Stroop task. In three separate experiments 16 women with bulimia, 13 recovered bulimics, 15 restrained eaters and 15 unrestrained eaters completed the modified Stroop task for food, body shape and self-threat related words. It was expected that bulimics would demonstrate a Stroop effect to food, body shape and self-threat related words greater than restrained eaters and unrestrained eaters. Consistent with the notion that the Stroop effect is concomitant with current symptomatology rather than a measure of an underlying trait vulnerability factor it was hypothesised that the recovered bulimics would not demonstrate the Stroop effect. Individuals with bulimia and recovered bulimics showed greater Stroop interference to food related words than restrained eaters and unrestrained eaters. Further, bulimics and recovered bulimics showed delayed colour naming to unhealthy food words whereas restrained eaters' colour naming was delayed for healthy food words. These results suggest that the Stroop effect to food related information is not unique to individuals with eating disorders, but exists across the continuum of eating behaviour, and that models of eating behaviour may need to differentiate between schematic processing of healthy and unhealthy foods. No Stroop effects were demonstrated with body shape related words, providing no support for schematic processing of body shape related information in bulimia.

Neither was evidence found that uncontrolled mixing of nouns and adjectives in previous research has generated inconsistent findings. Recovered bulimics, restrained eaters and unrestrained eaters all demonstrated delayed colour naming to self-threat words, specifically to autonomy and sociotropy related self-threat words whereas the bulimics failed to demonstrate any such effect, which may have been due to their high anxiety. The implications of these findings in clarifying previous research and for understanding of eating disordered behaviour are discussed.

Dysfunctional cognitions or attitudes about the meaning of body, weight and shape, body fat, food and eating behaviour have been implicated in the development and maintenance of eating disorders (Fairburn, 1985). The influential cognitive behavioural model (Fairburn, 1985) posits that bulimic individuals ascribe extreme significance to body shape and weight and attempt to compensate for deficits in self-esteem by defining and evaluating themselves exclusively in terms of body shape and weight. Accordingly, pursuit of thinness becomes the central organising principle for the eating disordered individual, whose sense of self is dominated by attitudes, beliefs and assumptions that overvalue the meaning of appearance. These beliefs, organised as schemas, simplify the individual's world, influencing thoughts, affect and behaviour. The operation of these schema can help to account for the persistence of eating disordered symptomatology. According to the cognitive-behavioural model, these attitudes and beliefs trigger dietary restraint. However dietary restraint is not sustainable either physiologically or psychologically and triggers binge eating. In an attempt to compensate for bingeing the individual employs compensatory mechanisms such as purging, laxative use and excessive exercise.

There is growing evidence that factors other than dietary restraint can also trigger binge eating. Negative affect has been shown to do so (Agras & Telch, 1998), and dysphoric mood has been found to precede food craving (Cooper & Bowskill, 1986) and binge eating in bulimics (Davis, Freeman, & Solyom, 1985). Researchers have postulated that binge eating is associated with a reduction of awareness of negative emotions and many models have been proposed to explain the link between emotions and bingeing. For example, Lacey (1986) proposes that bingeing serves the direct

function of moderating affective states, while Heatherington and Baumeister (1991) propose that bingeing is a consequence of cognitive narrowing used to escape from awareness of negative emotional states.

The importance of emotional precipitants emphasised in these models has led to the proposition that individuals with bulimia also have highly developed schemas for threatening material (Waller & Meyer, 1997). Thus it could be argued binge eating may be precipitated by both dietary restraint and/or negative affect and individuals with bulimia nervosa have schemas around issues of threat as well as body shape and food.

Investigation of cognitions underlying eating disorders historically has focussed on the use of self-report instruments, subjective self-report, thought sampling and monitoring techniques. These methods are limited by their subjective nature, relying on accurate reports by participants. However, the last decade has brought methods from the field of cognitive psychology to the investigation of psychopathology allowing for the study of information processing and cognitive structures underlying psychological disorders.

One of the most frequently employed methods is the emotional Stroop task. In this task, participants are required to name the ink colour in which each of a series of words is printed. Individuals are slower to colour name familiar words than a string of visually equivalent letters such as X and it seems that activation of the word's

name and/or meaning competes with retrieval or production of the colour name, so the interference effect can be used as a measure of this word activation. Individuals with psychological disorders consistently show impaired colour naming of words that are salient to the disorder as compared with matched words semantically unrelated to the disorder. This interference effect has been interpreted as indicating an attentional bias towards stimuli that are salient (Williams, Watts, MacLeod, Mathews, 1997). This effect has been illustrated in a range of psychopathologies including spider phobia (Watts, McKenna, Sharrock, & Trezise, 1986), generalised anxiety disorder (Mathews & Macleod, 1985), depression (Gotlib & McCann, 1984) and eating disorders (Cooper & Fairburn, 1992). This attentional bias has been hypothesised as evidence for the existence of disorder-related schemas.

Using the emotional Stroop task several researchers have demonstrated an attentional bias towards the combined presentation of food and body shape related words in bulimic individuals (Cooper, Anastasiades, & Fairburn, 1992; Cooper & Fairburn, 1992; Cooper & Fairburn, 1993; Cooper & Fairburn, 1994; Fairburn, Cooper, Cooper, McKenna, & Anastasiades, 1991) and also in anorexic individuals (Cooper & Fairburn, 1992; Cooper & Todd, 1997; Green, McKenna, & DeSilva, 1994).

Colour naming effects for separate presentation of these word types have been less clear. Some researchers have reported a Stroop effect for the separate presentation of both food and body shape related words in anorexia (Cooper & Todd, 1997; Green, McKenna, & DeSilva, 1994) and/or bulimia (Ben-Tovim, Walker, Fok, & Yap, 1989). Others have demonstrated the effect only for food words and not body shape

related words, in anorexia (Ben-Tovim, Walker, Fok, & Yap, 1989; Channon, Hemsley, & Desilva, 1988; Perpiña, Hemsley, Treasure, & Desilva, 1993) and/or bulimia, (Cooper & Todd, 1997) and yet others for body words, and not food related words, in anorexia (Green et al., 1998).

Some evidence suggests that the interference effect is related to specific aspects of bulimic psychopathology. Positive correlations have been demonstrated between the interference effect and the frequency of purging (Cooper & Fairburn, 1993) and severity of symptoms as measured by the Eating Attitudes Test (EAT) (Cooper & Fairburn, 1992; Cooper & Fairburn, 1993).

The specificity of the effect has been questioned by findings in individuals not diagnosed with eating disorders such as restrained eaters. Restrained eaters are those individuals who resist food in order to control weight gain or encourage weight loss (Pirke & Laessle, 1993; Ruderman, 1986). Some researchers report a colour naming impairment for food related words (Green & Rogers, 1993; Overduin, Jansen, & Louwerse, 1995; Stewart & Samoluk, 1997) and body shape related words (Green & Rogers, 1993) in high dietary restrained individuals. However, most investigations have failed to find colour naming impairment for body shape and weight related words (Ben-Tovim & Walker, 1991; Cooper & Fairburn, 1992; Huon & Brown, 1995; Jansen, Huygens, & Tenney, 1998; Mahemedi & Heatherington, 1993; Overduin et al., 1995; Perpiña et al., 1993). In some investigations, a Stroop effect has emerged in restrained eaters after exposure to a food preload (Mahemedi & Heatherington, 1993; Ogden & Greville, 1993; Overduin et al., 1995). A limited



number of studies has even demonstrated an attentional bias to food related words in normal individuals, but the effect is smaller than that observed in individuals with eating disorders. Unfortunately differences in statistical analyses make comparison between studies difficult.

Understanding of the specificity of the emotional Stroop effect has been limited by the tendency to use words with a presumed negative valence. Typically word lists have comprised food words associated with binges or of high caloric value that eating disordered individuals consider 'forbidden'. Such research fails to consider possible attentional biases to positively valenced healthy/low caloric foods. For example, Sackville, Schotte, Touyz, Griffiths, & Beumont (1998) found that anorexics demonstrated delayed colour naming for names of high caloric density foods but not for names of foods of low caloric density, though this difference was not found in unrestrained or restrained eaters. Restrained and unrestrained eaters have been shown to demonstrate a Stroop effect for both 'forbidden' and 'non-forbidden' food words (Francis, Stewart, & Hounsell, 1997). Some further exploration of responses of bulimic individuals to negative and positively valenced food words is indicated.

Inconsistencies between investigations may be related to differences in methodology such as those involving word type. In the case of attentional bias to body shape related words most researchers use a combination of trait adjectives and nouns. The adjectives commonly used are inherently negative (eg. flabby) whereas the nouns simply refer to different parts of the body (eg. hips) requiring an interpretation to give

them positive or negative valence. No study to date has examined the differential effects of nouns and adjectives on colour naming in bulimics to determine whether these word type differences contribute to any of the inconsistencies in findings.

Many investigations also have failed to control for the semantic homogeneity of disorder salient and comparison word types, possibly confounding the emotional Stroop effect with priming effects (Green, Corr, & De Silva, unpublished). Despite such failures to control for homogeneity in some investigations and difficulties reconciling findings due to the differences between studies such as the use of different words, Stroop methodology provides potentially useful information about food and body shape preoccupation and about the underlying schemas related to body-shape and food in eating disorders.

While the Stroop effect may be a useful indicator of schemas underlying eating disorders, it may also increase understanding of the information processing underlying clinical change and recovery from bulimia nervosa. Research tracking Stroop task performance and recovery has attempted to address the question of whether Stroop interference is concomitant with current symptomatology and provides a useful measure of clinical change, or whether it persists after the behavioural features of the disorder disappear and is related to an underlying vulnerability factor.

Stroop interference for many psychological disorders, including spider phobia (Watts et al., 1986), generalised anxiety disorder (Mathews, Mogg, Kentish, & Eysenck, 1995) and depression (Segal & Vella, 1990) has been shown to decrease with improvement in symptomatology. Individuals with depressive disorders, have shown the Stroop effect to depressive words while clinically depressed, only for it to disappear on recovery, despite the underlying increased chance of further depressive episodes (Segal et al., 1990). Similarly, in individuals with generalised anxiety disorder, there is correlational evidence that attentional bias decreases as anxious thoughts decrease (Mathews et al., 1995). This evidence suggests that the Stroop effect is related to current symptomatology rather than an enduring vulnerability schema.

In eating disorders a similar picture is apparent. Reduction of the emotional Stroop effect with the elimination of eating disordered behaviour suggests that the effect is linked to symptomatology and is not underpinned by an enduring cognitive schema. A limited number of studies have in fact, investigated the Stroop effect and recovery from eating disorders. Cooper and Fairburn (1994) found that 25 bulimic patients showed the Stroop effect to food and body shape related words, but significantly less so after 19 sessions of treatment. In a group of anorexics, Green et al. (1998) found a colour naming interference for food and body shape related words on initial admission, to body shape related words only after one week of therapy, and no effect at all after 12 weeks of therapy. Interference in body, but not food, colour naming correlated with scores on the EDI body dissatisfaction scale at each of these times. Green et al. (1998) concluded that colour naming performance for body shape, rather

than food words, provides a clearer indication of improvement in psychopathological status in anorexia nervosa.

In a study which attempts to address longer term effects Lovell, Williams and Hill (1997) compared anorexics, recovered anorexics (two years after anorexia), bulimics and recovered bulimics (two years after bulimia) with non-eating disordered women, both dieters and non-dieters, on colour naming for food and body shape related words. Current bulimics and recovered anorexics showed a greater Stroop effect to shape words than recovered bulimics and women who had never suffered eating disorders. There was no difference between dieters and non-dieters. All groups demonstrated longer colour naming latencies to food words than control words. Lovell et al. (1997) suggested that for bulimics, shape concern may be a state effect that is high while the woman is suffering from bulimia, but dissipates with recovery. Recovery from anorexia on the other hand involves substantial weight gain and the Stroop task may indicate the presence of an enduring cognitive characteristic which functions relatively automatically. Individuals with anorexia may make an effort to overcome eating disorders and change their attitudes but at an automatic level continue to selectively process shape related information. To date, Lovell et al.'s study is the sole study using a between-subjects design investigating the Stroop effect in recovered bulimics and these important findings require replication.

Interestingly, bulimic psychopathology is associated with Stroop interference when stimulus words related to more general types of threat are used, especially threat to self-esteem. Bulimics demonstrate a greater interference index to threats to personal

control (autonomy), threats to physical integrity and to self-directed threats to self-esteem than do non-eating disordered controls (McManus, Waller, & Chadwick, 1996). However no reliable differences have been observed for words involving a perceived danger of social isolation and rejection (sociotropy threat words) although colour naming for self-esteem threat words perceived to come from others (ego-other threats) approached significance. Colour naming for autonomy related words was also positively correlated with frequency of bingeing, and ego-self-threat words was correlated with frequency of both bingeing and purging.

Waller, Watkins, Shuck, and McManus, (1996) demonstrated that bulimic attitudes in non-bulimic individuals are associated with an attentional bias towards self-esteem threat words, specifically to ego-self-threats words rather than ego-other threat words. Thus bulimic attitudes and behaviours are associated with highly developed schemas for ego threats. However, Waller and Meyer (1997) have suggested that the Stroop effect may be related to other features of the bulimic individuals such as anxiety and depression which were not measured in either of these investigations.

The current investigation addressed several issues. The main aim was investigate colour naming in recovered bulimics, to determine whether the underlying schemas demonstrated by the Stroop effect are associated with current symptomatology. The second aim was to further clarify the nature of the schema underlying bulimia by investigating the types of words eliciting the effect. The third aim was to further clarify the specificity of the effect by investigating individuals who were high in dietary restraint comparing them with both bulimic individuals and unrestrained

eaters. Restrained eating often precedes the development of an eating disorder and restrained eaters are highly concerned with body shape and food but do not engage in eating disordered behaviour.

The first experiment investigated colour naming of self-threat related words while controlling for semantic homogeneity, an omission in existing studies on this issue. It was expected that individuals with bulimia would demonstrate an interference effect to self-threat words related to autonomy, physical integrity and self-esteem (ego-other) greater than that observed in restrained eaters, unrestrained eaters or recovered bulimics.

The second experiment investigated colour naming of healthy and unhealthy food words. It was expected that individuals with bulimia nervosa would demonstrate a greater interference index to both types of food words than recovered bulimics, restrained eaters and unrestrained eaters.

The third experiment investigated colour naming for body shape related words. It aimed to clarify inconsistencies in findings between different types of words by investigating colour naming for body adjectives separately from body nouns and comparing colour naming with person nouns and person adjectives as well as control nouns and control adjectives. It was expected that individuals with bulimia would demonstrate an interference index to both body adjectives and nouns that was greater than that observed in recovered bulimics, restrained eaters and unrestrained eaters. It

was expected that any difference between the interference effect for bulimics and the other groups would be greater in the noun condition. Recovered bulimics, restrained eaters and unrestrained eaters are unlikely to have attached affective valence or meaning to the nouns in the same way as bulimic individuals. Bulimics have highly interconnected schemas for body shape and body nouns may be expected to activate these schema and thus demonstrate a greater Stroop effect.

## Method

### Participants

The participants were 16 females with Bulimia Nervosa, 13 females who had previously had bulimia nervosa and recovered, 15 females without a history of an eating disorder who were low on dietary restraint and 15 females without a history of an eating disorder who were high on dietary restraint.

Current and recovered bulimic individuals were recruited through public notices, advertisements in local newspapers and contact with community mental health services. In classifying the clinical participants, the Diagnostic and Statistical Manual for Mental Disorders Edition 4 (DSM-IV) (American Psychiatric Association, 1994) criteria for bulimia were applied. Individuals who had met the criteria for bulimia nervosa and still engaged in binge eating were included in the bulimic group. Recovery was operationally defined as no longer engaging in binge eating or purging behaviours and having not done so for at least three months.

University undergraduate students were screened using the Revised Restraint Scale (Herman & Polivy, 1980). Suitable individuals were invited to participate in a study on the effects of food on mental functioning. Participants with scores of 15 and above were selected as restrained eaters; those with 12 and below were selected as unrestrained eaters. Restrained and unrestrained eaters were screened for eating disordered psychopathology, using the Eating Disorder Examination Questionnaire (Fairburn & Beglin, 1992) and participants who currently engaged in, or had



previously engaged in, binge eating or inappropriate compensatory mechanisms to prevent weight gain were excluded.

## **Materials and apparatus**

### *Revised Restraint Scale (Herman & Polivy, 1980)*

The Revised Restraint Scale was used to screen and classify participants (Appendix 1). This scale is a 10 item questionnaire assessing dietary restraint. The scale assesses the extent to which individuals exhibit behaviours relating to two distinct factors, weight fluctuation (extent of previously experienced weight gain and loss) and concern for dieting (heightened attention and emotional association with eating). A score of 15 or above is commonly used as the criterion for high restraint status in females (Mahemedi & Heatherington, 1993). The Revised Restraint Scale is considered to be a valid and reliable measure of restraint in normal weight individuals (Ruderman, 1986).

### *The Eating Disorders Examination Questionnaire (EDE-Q) (Fairburn & Beglin, 1992)*

The EDE-Q was used to identify the presence of eating disorder symptoms. This questionnaire focuses on eating disordered symptomatology during the preceding four weeks. Participants were given an additional information page with a definition of a binge (American Psychiatric Association, 1994).

The EDE-Q provided a measure of current symptomatology. This enabled the identification of bulimic behaviour in any participants who had been recruited as control participants or recovered bulimics and allowed their reclassification or exclusion. If participants indicated the presence of symptoms of an eating disorder this was clarified at interview. An additional question was added to determine whether the behaviour over the past 4 weeks was representative of the past 12 weeks. This aided in diagnosis in terms of DSM-IV criteria (American Psychiatric Association, 1994). Additional questions were asked during the interview to clarify diagnostic status.

### *Semi Structured Clinical Interview*

A semi-structured clinical interview based on DSM-IV diagnostic criteria was conducted. The interview focussed on the life span in order to identify past history of eating disordered symptomatology an issue not addressed by the EDE-Q. In the case of recovered bulimics it was important to ascertain whether they had in the past met DSM-IV criteria for bulimia nervosa and that they no longer engaged in these behaviours. For control participants it was important to determine that they had never engaged in eating disordered behaviours and for the bulimic group the interview provided confirmation of their diagnosis (American Psychiatric Association, 1994) (Appendix 2).

*The Eating Disorders Inventory -2 (EDI-2) (Garner, 1991)*

The EDI-2 was used to ascertain the severity of eating disordered psychopathology.

The EDI-2 is a 64-item multi-scale self-report measure focussing on symptoms commonly associated with eating disorders. It was administered to provide additional information on the symptomatology of participant groups. It contains three sub-scales assessing attitudes and behaviours concerning eating, weight and shape (drive for thinness, bulimia, and body dissatisfaction), and five sub-scales tapping more general psychological traits clinically relevant to eating disorders (ineffectiveness, perfectionism, interpersonal distrust, interoceptive awareness, maturity fears). It also contains three provisional sub-scales (asceticism, impulse regulation, and social insecurity). It is considered to provide reliable information about clinical status and is a reliable and valid measure of eating disorder symptomatology (Garner, 1991). The complete scale was administered, but only the first three scales specifically related to the attitudes and behaviours concerning eating, weight and shape were involved in the analysis.

*The Beck Depression Inventory-2 (BDI-2) (Beck, Steer, & Brown, 1996).*

The Beck Depression Inventory-2 was administered to provide an indication of the individual's severity of depression. It is a 21-item self-report inventory of the underlying symptoms of depression experienced in the past two weeks. The scale yields a score between 0 and 63 which provides an indication of the individual's severity of depression and is a widely used measure. Its reliability and validity are well established (Beck, Steere, & Brown, 1996).

*The State-Trait Anxiety Inventory (Spielberger, 1983).*

Anxiety was assessed using the State-Trait Anxiety Inventory, a 40 item self-report inventory, which yields two scores, trait anxiety and state anxiety. The trait anxiety scale asks the participant to rate how they 'generally feel', and the state anxiety section how they 'feel right now' on a variety of anxiety related symptoms.

Participants are required to select a rating ranging from 1 'not at all' to 4 'very much so'. The scale's reliability and validity is well established (Spielberger, 1983).

*The Self Descriptive Questionnaire III (SDQ-3) (Marsh, 1990).*

The global sub-scale of the Marsh (1990) Self Descriptive Questionnaire III was selected to provide a measure of global self-esteem. The participant is required to indicate how well each of 12 self-descriptive statements relates to them on a scale of 1 'definitely false' to 8 'definitely true'. Satisfactory psychometric information is reported (Marsh, 1990).

*The Stroop task*

The Modified Stroop task was run using a Pentium 90 computer with an attached four-key response pad. The stimuli consisted of words displayed in either red, green, blue or yellow which appeared one at a time on the monitor. Each word was displayed in lower case letters, in 48 point font, and for a maximum duration of 2400 milliseconds, with a zero inter-stimulus interval. The participant was required to press a button on a keypad that corresponded to the colour in which each word was written. An array of coloured squares below the stimulus indicated the positions of

the colours on the keypad. The participant was instructed to respond as quickly and accurately as possible to each stimulus.

Participants completed a practice task prior to the first experimental task, comprising a non word ("XXXX") repeated at random in the four colours for 100 trials, to familiarise participants with the task and, in particular, with the positions of the colours on the key pad. This allowed participants to reach optimal performance so that experimental findings were less likely to be artefacts of task familiarity.

Three separate experiments involving the Stroop task were undertaken. In these experiments food, body shape and self-threat related words were matched with their respective control words for word length, frequency of occurrence, and part of speech (noun or adjective) using the Kucera and Francis (1967) word list. In addition, the neutral control word lists were composed of words belonging to a single semantic category for each list. The word sets were presented in block order as recommended by Holle, Neely, and Heimberg (1977) and the presentation order of blocks was randomised across participants for Experiments 1 (self-esteem) and 3 (body) and counterbalanced for Experiment 2 (food). The words within each block were presented in a fixed randomised order and there was a short break (10 seconds) between successive blocks.

The words used in each experiment are shown in Tables 1, 2 and 3. In Experiment 1 the words were organised into 10 groups each containing 8 words repeated 12 times

in randomised order (96 words). The self-threat words were those used by McManus, Waller, and Chadwick (1996).

Table 1

*Self-threat words and matched control words (Experiment 1)*

Sociotropy Threat	Sociotropy Control	Autonomy Threat	Autonomy Control	Physical Threat
alone	scrap	blocked	pinned	pain
lonely	listed	restrain	arranged	kill
isolated	answered	deterred	drafting	hurt
rejected	recorded	powerless	scheduled	blood
helpless	computed	dependent	organised	agony
deprived	outlined	restricted	negotiable	maimed
abandoned	accounted	controlled	calculated	wounded
friendless	catalogued	manipulated	perforated	collapse
Physical Control	Ego-other Threat	Ego Others Control	Ego self- threat	Ego self Control
file	mocked	manual	bad	cut
tape	jeered	carbon	ugly	copy
tray	derided	stapled	stupid	locked
paper	insulted	refilled	failure	project
diary	sniggered	productive	inferior	adhesive
erased	ridiculed	duplicate	defeated	expanded
printed	criticised	summarised	worthless	delegated
lamine	humiliated	illustrated	inadequate	documented

In Experiment 2 the stimulus words were organised into three sets containing six words each presented sixteen times (96 words).

Table 2.

*Healthy, unhealthy and control words (Experiment 2)*

Food - 'healthy'	Food 'unhealthy'	Control
celery	sweets	tables
carrot	cream	lamps
lettuce	chocolate	ornament
beans	chips	desks
apple	cakes	shelf
spinach	bread	lounge

*\* The term unhealthy reflects bulimics' and dieters' common misperception of the food stuffs which are commonly included in bulimic binges, rather than their nutritional content*

In the third experiment the words were organised into six sets each containing seven words presented fourteen times in randomised order (98 words).

Table 3.

*Body shape words, person words and control words (Experiment 3)*

Body adjectives	Control adjectives	Body nouns	Control nouns	Person nouns	Person adjectives
large	moist	hips	lawn	habit	angry
bulky	leafy	shape	trees	style	irate
fat	dry	thighs	shrubs	outlook	mad
stocky	floral	waist	roses	trait	horrid
chubby	herbal	figure	garden	nature	vulgar
plump	mossy	stomach	grounds	feature	nasty
massive	fertile	buttocks	lavender	aptitude	hateful

### *The Hunger scale*

A hunger scale was constructed for this project to assess subjective feelings of hunger and to provide information on the time since the participant had eaten. Hunger has been shown to affect colour naming to food related words (Channon & Hayward, 1990; Green, Elliman & Rogers, 1996). Participants were asked to rate their hunger on a rating scale of 1 to 10 with 1 'being most hungry' and 10 'not hungry at all'. They were also asked when they ate their last meal and to record the current time. This enabled calculation of the time since the participant had eaten (Appendix 3).

### *Medication use*

On a medication self report form participants were asked to specify any medication they were currently taking and its dose to enable determination of possible medication effects on colour naming times.

### *Emotionality questionnaire*

An emotionality questionnaire was constructed to determine the emotionality ratings of control and target words. Participants were asked to rate the emotionality of the words presented on a rating scale of 0 to 10, with 0 being 'extremely negative' and 10 'extremely positive' (Appendix 4).



### *Semantic Homogeneity questionnaire*

A semantic homogeneity questionnaire was constructed in order to determine whether the sets of control and experimental words were equivalent in their relationship to each other. Participants were asked to rate the degree to which words in each block were related to each other on a rating scale, ranging from 0 'not at all related' to 5 'strongly related' (Appendix 5).

### **Procedure**

On initial telephone contact, participants were given a brief outline of the experimental procedure and were told that the procedure would involve answering some questions, completing a computer task and completing some self-report questionnaires. On arrival they were given an information sheet (Appendix 6), invited to ask any questions and then completed a consent form (Appendix 7). All participants believed the study was about information processing and eating patterns. However, because of the manner of recruitment the bulimic and recovered bulimic groups were aware that their bulimic eating patterns were also of interest.

After completion of the consent form, participants completed a series of self-report questionnaires. The first questionnaires concerned general psychopathology; the subsequent questionnaires were more specifically related to the psychopathology of eating disorders. They first completed the Hunger Questionnaire, followed by the BDI-2, State-Trait Anxiety Inventory and the SDQ-3. They were then given the EDE-Q to determine the presence or absence of eating disordered symptomatology. After

completion of the EDE-Q the experimenter briefly examined the answers, asking any questions necessary to clarify eating behaviour. The clinical interview was then conducted to gain information on eating disordered behaviour throughout the lifespan. The author conducted the interview and a registered clinical psychologist reviewed uncertain classifications. The interview was aided by questions that had been constructed based on DSM-IV criteria (Appendix 2). The participants were then asked to complete the EDI-2 to provide further information on the characteristics of the participants relevant to eating patterns and attitudes.

Participants then carried out the practice Stroop task followed by Experiment 1- (self-threat words), Experiment 2- (food words) and Experiment 3- (body shape words).

After each experiment participants were given a break and on completion of Experiment 3 they were administered the emotionality and homogeneity rating scales.

At the completion of all experimental procedures and rating scales, participants were fully debriefed as to the purpose of the study and provided with an opportunity to ask any questions. If requested participants received appropriate referral information.

## Results

An alpha level of .05 was adopted for all analyses and post hoc LSD tests were conducted when indicated. Analyses excluding participants currently on medication yielded the same pattern of significant results as analyses with participants included, so all participants were included in the analyses presented below.

### Participant Characteristics

The groups differed significantly on age,  $F(3,54) = 9.28, p < .001$ . Post hoc tests revealed that the bulimics were significantly older than the restrained eaters and unrestrained eaters. The recovered bulimics were also significantly older than the restrained eaters and controls.

The groups differed significantly on BMI,  $F(3,48) = 2.72, p < .05$ . Post hoc tests revealed a significant difference between bulimics and restrained eaters. Restrained eaters had the highest BMI followed by the unrestrained eaters, recovered bulimics and bulimics. All means, however, were within the normal range.

The groups differed significantly on restraint score,  $F(3,46) = 29.33, p < .001$ . Post hoc analyses revealed that all the groups differed significantly from each other.

Bulimics had the highest restraint scores followed by the restrained eaters, recovered bulimics and then the unrestrained eaters. The mean scores for the bulimics and the restrained eaters were in the restrained eating range and the recovered bulimics just outside.

The groups differed significantly on state anxiety,  $F(3,58) = 7.98, p < .001$  and trait anxiety,  $F(3,58) = 13.52, p < .001$ . The bulimics were significantly higher on state anxiety than restrained eaters, recovered bulimics and unrestrained eaters. On trait anxiety bulimics were also significantly higher than all other groups. The restrained eaters, recovered bulimics and unrestrained eaters did not differ significantly from each other on either scale.

The groups differed significantly on the global self-esteem scale,

$F(3,58) = 8.17, p < .001$ . The scores of restrained eaters, unrestrained eaters, and recovered bulimics were significantly higher than those of the bulimic group.

The groups differed significantly on the BDI-2,  $F(3, 56) = 14.38, p < .001$ . Post hoc analyses revealed that the bulimics scored significantly higher on depression than all the other groups at the .01 level. The bulimic group scored within the moderate depression range but other groups scored in the normal range.

On EDI-2 Drive for Thinness bulimics' scores were significantly higher than those of all other groups,  $F(3,58) = 15.38, p < .000$ . The scores of the unrestrained eaters were significantly lower than those of all the other groups. On EDI-2 Body Dissatisfaction scale the scores of the bulimics were significantly higher than the scores of the recovered bulimics and unrestrained eaters, but not restrained eaters,

$F(3, 58) = 4.31, p = .008$ . The scores of the recovered bulimics were significantly higher than those of the unrestrained eaters. On EDI-2 scale of Bulimia the scores of the bulimics were significantly higher than all other groups  $F(3,58) = 16.23, p < .000$ .

The groups did not differ significantly on hunger ratings,  $F(3,55) = .364, p = .77$ , or on the time since they had eaten,  $F(3,54) = 1.32, p = .27$ , or on the time of day that they were tested  $F(3,54) = .732, p = .53$ .

Table 5 shows the characteristics of the participants on measures of general and specific psychopathology.

Table 5

*Characteristics of the Bulimics, Recovered Bulimics, Restrained eaters and Unrestrained eaters on Measures of General and Specific Psychopathology, Age and Body Mass Index*

Measure	Bulimics		Recovered Bulimics		Restrained Eaters		Unrestrained Eaters	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
BMI	21.3	2.31	22.36	2.58	24.98	2.95	23.08	5.04
Restraint Score	25.31	3.88	14.7	7.72	18	2.39	8.2	2.53
Age	29.4	10.5	32.92	9.24	22.07	3.06	20.07	4.76
BDI-2	24.44	13.47	6.82	4.58	7.67	4.84	10.33	5.89
State anxiety	49.13	9.95	35.08	10.98	35.93	12.27	33.2	6.85
Trait anxiety	59	11.58	43.46	11.74	39.33	8.66	40.07	6.95
SEI	46.88	18.66	66.46	19.62	72.4	12.36	68.07	10.53
EDI-DT	12.56	5.32	5.77	6.98	4.87	4.69	0.73	1.28
EDI-B	6.75	5.07	1.54	1.61	1	1.2	0.467	0.92
EDI-BD	16.88	7.76	10.69	8.48	15.4	5.46	8.73	6.88

Note: SEI = Self Esteem Inventory, EDI-DT = Eating Disorder Inventory Drive for Thinness, EDI-B = Eating Disorder Inventory Bulimia, EDI-BD = Eating Disorder Inventory Body Dissatisfaction

In summary, the bulimics and recovered bulimics were older than the other groups. The bulimics demonstrated higher scores on depression, state and trait anxiety and lower self-esteem scores. Despite differences between groups, all groups scored within the normal range on BMI. All groups differed on restraint scores with bulimics having the highest scores, followed by restrained eaters, recovered bulimics and controls. The groups did not differ on hunger ratings, the time since they had eaten or the time of day they were tested. The bulimics' scores were higher than the other groups on the Drive for Thinness and Bulimia subscales of the EDI-2 and on the Body Dissatisfaction scale scored higher than recovered bulimics and unrestrained eaters

### **Overview of Data Analysis**

For each experiment Stroop interference scores were calculated. As detailed below, for each individual the median response latency for the control word list was subtracted from that for the threat list to calculate an interference index.

Differences in interference indices were initially explored using repeated measures ANCOVAs, with age as a covariate due to the significant age differences between groups. The covariate effect was non-significant in each experiment so analysis of variance was used:

The data met the assumption of homogeneity of variance (Levene's test) and was therefore not transformed.

## **Experiment 1: Self-threat words**

Experiment 1 investigated colour naming for five groups of self-threat and control words. The experiment can be viewed overall as having a mixed factorial design: 4 (group; bulimic, recovered bulimic, restrained eater, unrestrained eater) x 5 (threat type; sociotropy, autonomy, physical, ego-others, ego-self) x 2 (word type; threat, control). However for purposes of analysis, the following approach was adopted.

First, ANOVAs were conducted for each of the interference indices with group as the between subjects factor and the interference index as the dependent variable. Second, separately for each group and using reaction time itself as the dependent variable with word type as a factor a repeated measures analysis was conducted.

Analyses of variance were also conducted with the number of correct responses as the dependent variable and group and word type as independent variables.

### *Interference indices for self-threat words*

Interference indices were calculated, using the difference between the median reaction times for each set of self-threat words and the matched neutral words. In addition, an overall interference index was calculated from the reaction-times to all self-threat and all control words. Separate One-way ANOVAs were conducted to compare participant groups on each interference index, with post hoc tests when indicated.



Groups differed significantly on the overall interference index to threat words,  $F(3,54) = 4.05, p < .01$ , the bulimic group having the lowest interference index (Figure 1), and post hoc tests revealed significant differences between the bulimic group ( $M = -53.97, SD = 176.46$ ) and each of the other groups: recovered bulimics ( $M = 126.62, SD = 145.13$ ) restrained eaters ( $M = 102.03, SD = 157.41$ ) and unrestrained eaters ( $M = 73.39, SD = 136.52$ ). Separate ANOVAs were then conducted on each type of self-threat word interference index.

For the interference index for autonomy words there was a significant difference between groups  $F(3,53) = 2.19, p = .04$ , with bulimics having a negative interference index ( $M = -32.37, SD = 89.24$ ) and differing significantly on post hoc tests from the recovered bulimics ( $M = 25.08, SD = 70.47$ ), restrained eaters ( $M = 24, SD = 62.43$ ), and unrestrained eaters ( $M = 35.32, SD = 44.94$ ).

The difference between groups on the interference index for sociotropy words approached significance  $F(3,53) = 2.35, p = .083$ . Bulimics ( $M = -15.47, SD = 66.63$ ) demonstrated significantly smaller interference indices than the recovered bulimics ( $M = 33.46, SD = 43.32$ ), and unrestrained eaters ( $M = 29.32, SD = 44.94$ ) but not restrained eaters ( $M = 9.03, SD = 38.40$ ).

On the ego self, ego-other, and physical threat interference indices, group differences failed to reach significance.

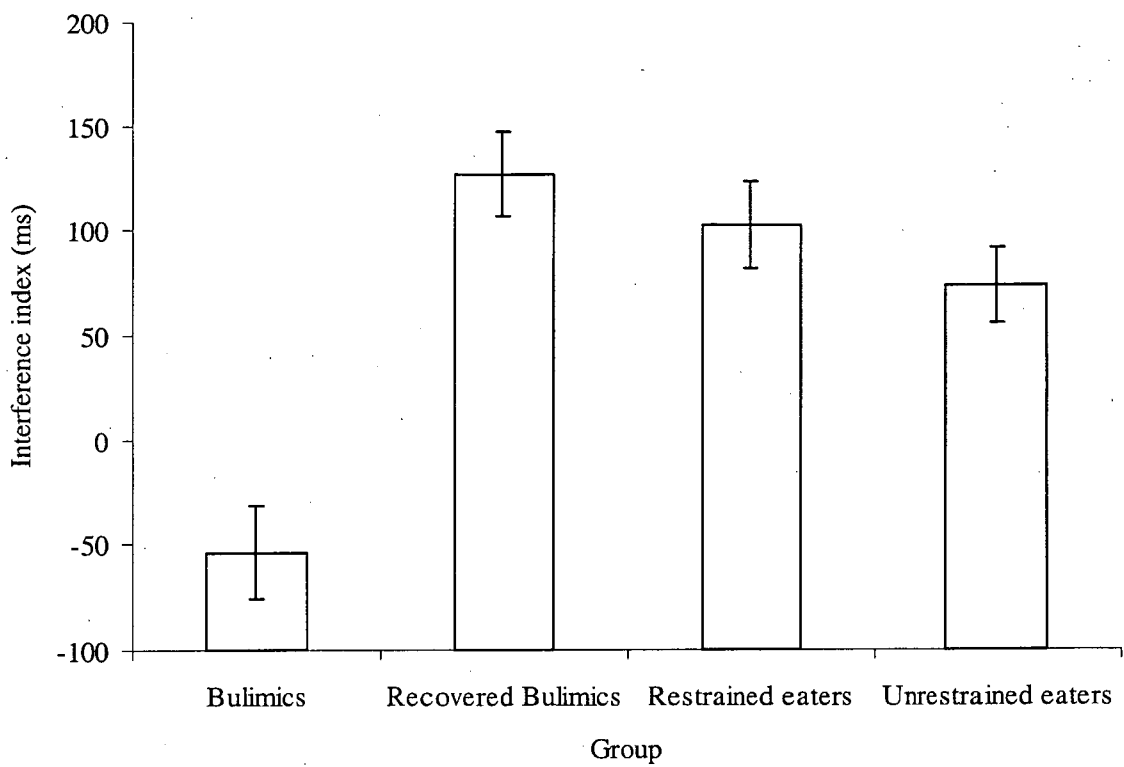


Figure 1. *Interference index for self-threat words for bulimics, recovered bulimics, restrained eaters and unrestrained eaters.*

*\* Vertical lines depict standard error of the means*

*Colour naming reaction times for self-threat words*

Using reaction time itself as the dependent variable, a 5 (self-threat type: sociotropy, autonomy, ego self, ego other, physical) x 2 (word type: control, threat) repeated measures ANOVAs were also conducted on each of the groups separately to determine whether each group demonstrated significant differences between responses to control and threat words (Figure 2).

In the bulimic group there was no significant effect for word type. For the recovered bulimics there was a significant difference between reaction time to control and threat words  $F(1, 12) = 9.89, p = .008$ , with the reaction time to threat words greater than the reaction time to control words. The reaction times of restrained eaters to control and threat words differed significantly  $F(1,12) = 6.30, p = .025$ , the reaction time for threat words being greater than for control words. Unrestrained eaters responded more quickly to control than to threat words, but the difference only approached significance  $F(1,13) = 4.05, p = .065$ .

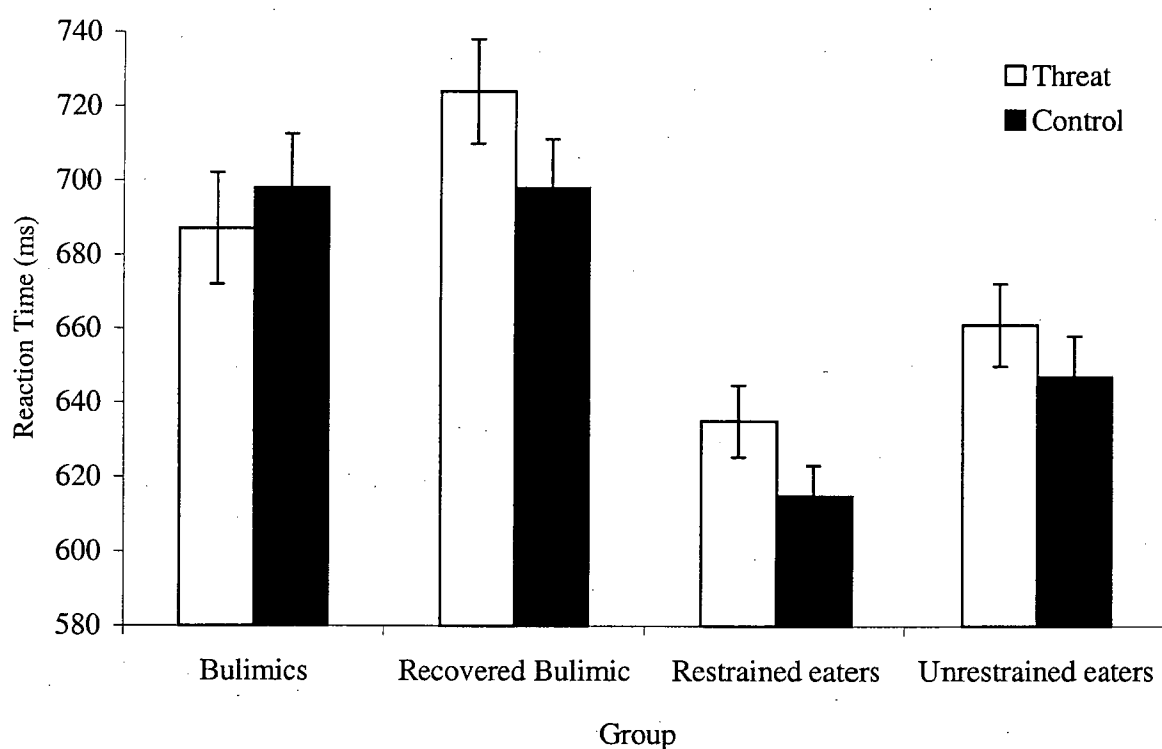


Figure 2. Reaction times to overall self-threat words and control words for bulimics, recovered bulimics, restrained eaters and unrestrained eaters

\* Vertical lines depict standard error of the means

### *Accuracy of colour naming*

Analyses of variance were conducted on the number of correct responses in each block of words with groups as the between subjects factor and word type (control, threat) as the repeated measures factor. There were no significant main effects or interactions. This indicates that participant responses to both types of words were equally accurate and the different groups of participant responded similarly, so that the significant differences in reaction time could not be attributed to any speed-accuracy trade off.

### *Correlations between interference indices and self-report measures*

Correlations between interference indices and self-report measures were calculated. The overall interference index for self-threat words had a moderate negative correlation with BDI score ( $r = -.41$ ) and with EDI- DT ( $r = -.49.$ ). There were also small negative correlations with the EDI-B ( $r = -.39$ ), EDI-BD ( $r = -.33$ ). There was a moderate negative correlation of the sociotropy interference index with EDI-DT ( $r = -.46$ ) and a small negative correlation with EDI-B ( $r = -.26$ ). There was a small negative correlation of the autonomy interference index with BDI-2, ( $r = -.33$ ). There were small negative correlations with EDI-DT ( $r = -.28$ ), EDI-B, ( $r = -.27$ ), and EDI-BD ( $r = -.32$ ).

### *Emotionality ratings for self-threat words*

A mean rating of emotionality for each block of words was derived for each subject. These ratings were entered into a 4 (group: bulimic, recovered bulimic, restrained

eaters, unrestrained eaters) x 5 (threat type: sociotropy, autonomy, physical, ego-self, ego others) x 2 (word type: threat, control) repeated measures ANOVA. There was a main effect for threat type,  $F(4, 12) = 5.56, p < .001$ , a main effect for word type  $F(1, 1) = 90.34, p < .001$ , and an interaction between word type and threat type  $F(4, 1) = 7.03, p < .001$ , but no other significant effects. Pair-wise comparisons revealed that the self-threat words were all rated as more negative than the corresponding control words at the .01 level. Mean rating, on a scale from 0 (extremely negative) to 10 (extremely positive), was 2.78 for the threat words and 4.79 for the control words (Figure 3).

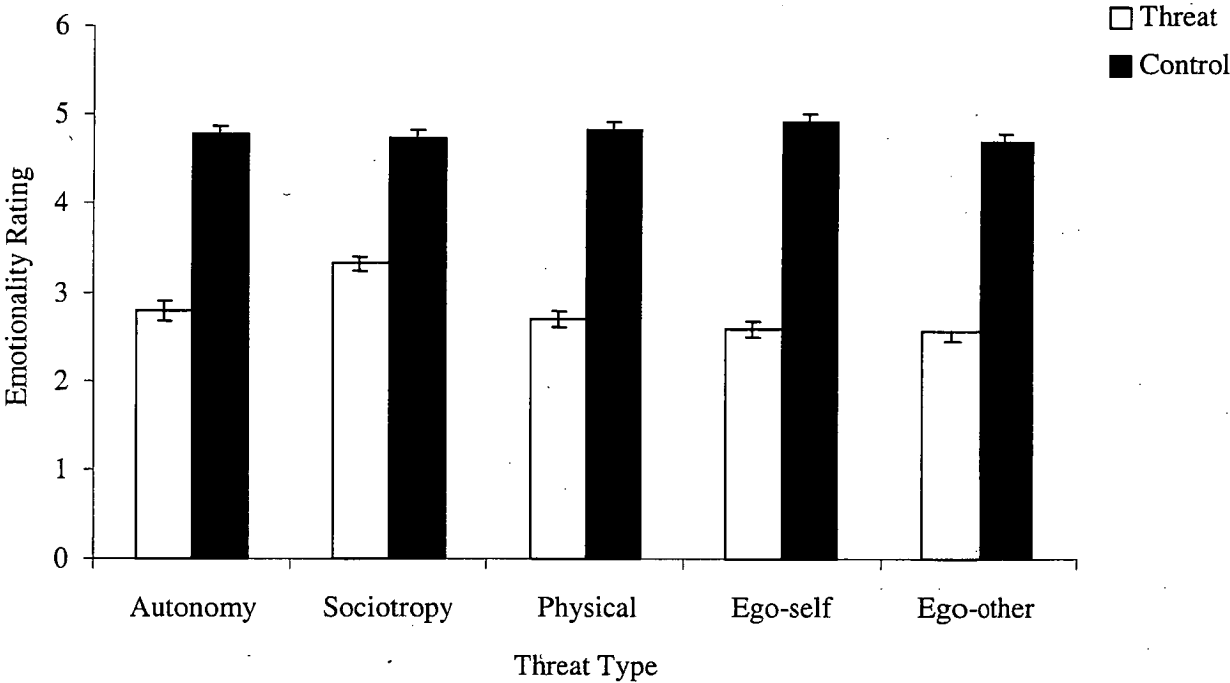


Figure 3. *Emotionality ratings for control and self-threat words across word types (ranging from 0 ‘negative’ to 10 ‘positive’)*

\* *Vertical lines depict standard error of the means*

### *Homogeneity ratings for self-threat words*

Homogeneity ratings were entered into a 4 (group: bulimic, recovered bulimic, restrained eaters, unrestrained eaters) x 5 (threat type: sociotropy, autonomy, physical, ego-self, ego others) x 2 (word type: threat, control) repeated measures ANOVA. There was a significant main effect for threat type,  $F(4, 1) = 23.31, p < .001$ , no significant main effect for word type and a significant interaction between word type and threat type  $F(4, 1) = 25.55, p < .001$ . There was no significant group main effect or interaction. Paired samples  $t$  tests revealed that sociotropy and autonomy threat words were rated as significantly more homogeneous than their respective control words. For ego-other and ego-self words the control words were rated as significantly more homogeneous than threat words (Figure 4). Mean rating, on a scale from 0 'not at all related' to 5 'strongly related' was 3.94 for threat words and 4.03 for the control words.

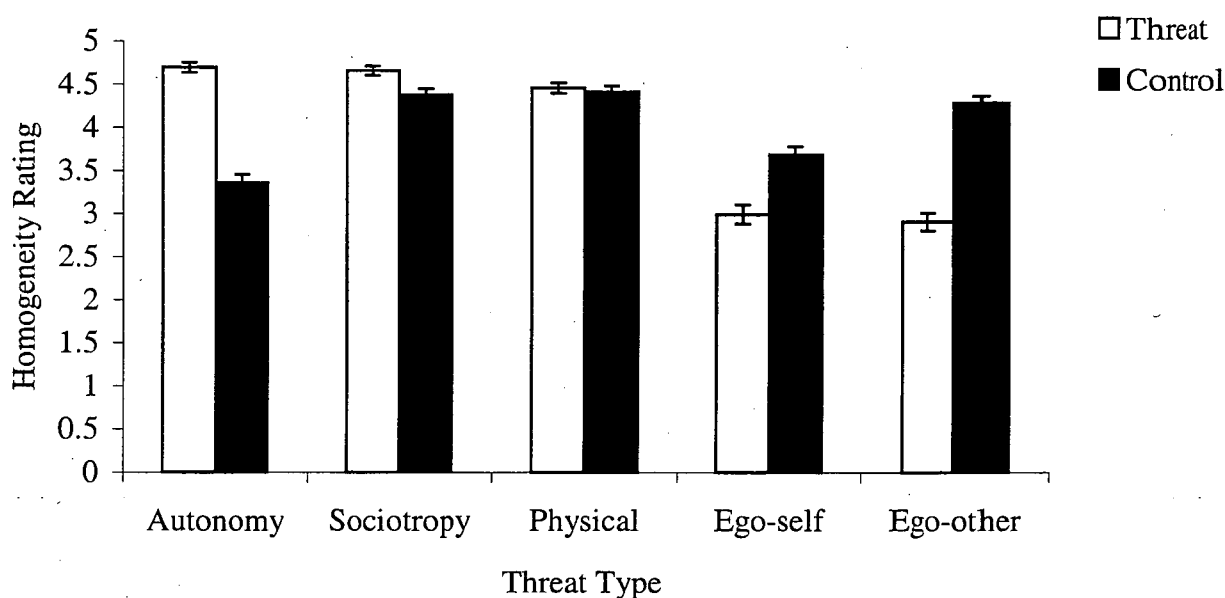


Figure 4. *Homogeneity ratings for control and self-threat words across word types (ranging 0 'not at all related' to 5 'strongly related')*

\* Vertical lines depict standard error of the means

## **Experiment 2: Food words**

Experiment Two investigated colour naming to food related words including healthy, unhealthy and control words. The design of Experiment 2 was a 4 (group: bulimic, recovered bulimic, restrained eater, unrestrained eater) x 3 (word type: unhealthy food, healthy food, control words) mixed design. For purposes of analysis, the following approach was adopted. First, ANOVAs were conducted for the interference indices (unhealthy - control, healthy - control) with group as the between subjects factor and the interference index as the dependent variable. Second, separately for each group and using reaction time itself as the dependent variable, a repeated measures analysis was conducted to determine whether each group differed on their responses to unhealthy, healthy and control words. Correlations between interference indices and self-report measures were also calculated.

Three participants were excluded from the analyses because the time since they had eaten was 2.5 standard deviations or more from the mean and judged to be excessive, given the nature of the stimuli in this experiment and evidence about the effects of hunger (Channon & Hayward, 1990; Green et al., 1996).

### *Interference indices for food related words*

Two different interference indices were calculated using the reaction times for healthy food minus control words and unhealthy food minus control words. One-way ANOVAs were conducted on each of the two interference indices to investigate between group differences

There was a significant main effect of group on interference index based on unhealthy to control words  $F(3, 55) = 2.96, p = .04$ . There was a significant difference between bulimics and unrestrained eaters. Differences between bulimics and restrained eaters and between recovered bulimics and unrestrained eaters ( $p = .078$ ) approached significance. The bulimics demonstrated the greatest interference index followed by the recovered bulimics, restrained eaters and unrestrained eaters (Figure 5).

The differences between groups based on the interference index for healthy and control words was non-significant,  $F(3,55) = .30, p = .843$ .

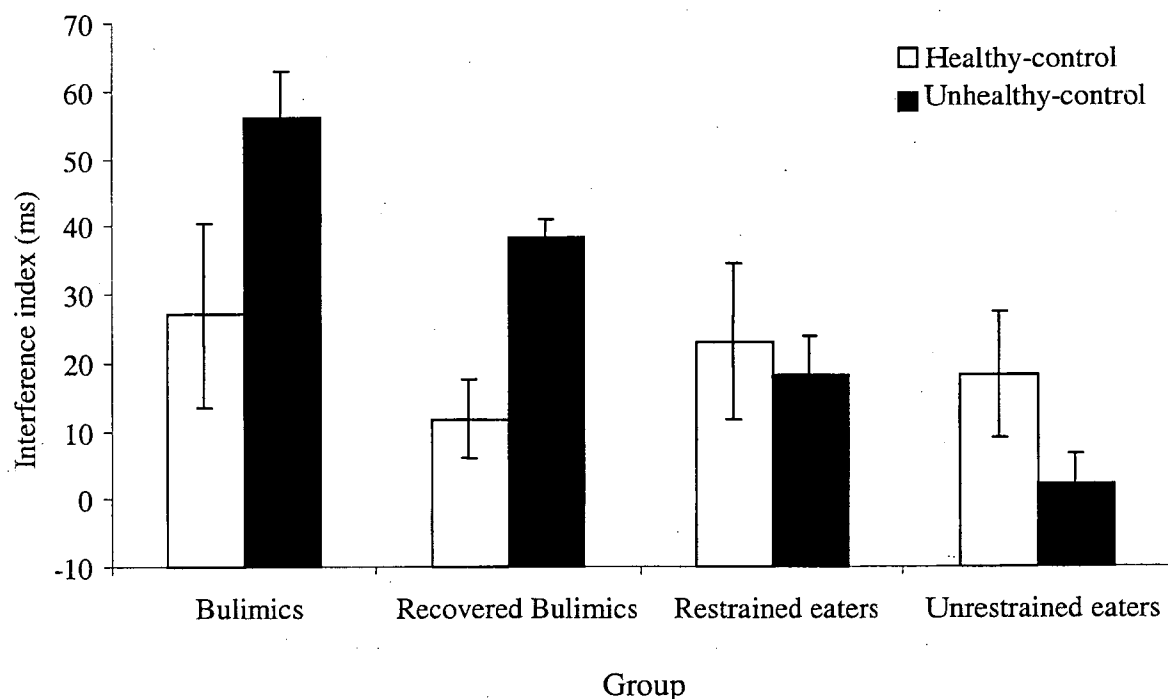


Figure 5. *Interference index based on reaction time to healthy-control words and unhealthy-control words for bulimics, recovered bulimics, restrained eaters and unrestrained eaters on the modified Stroop task*

\* Vertical lines depict standard error of the means



*Colour naming times for food related words*

Repeated measures analysis of variance was conducted on each group independently to determine whether the median reaction time to healthy, unhealthy and control words differed significantly (Figure 6). For the bulimic group there was a main effect for word type  $F(2, 26) = 5.21, p = .013$ . Pairwise comparisons revealed reaction time to unhealthy words was significantly greater than reaction time to control words, but not greater than the reaction time to healthy words. For recovered bulimics there was a main effect for word type  $F(2, 22) = 5.38, p = .013$ . Unhealthy words elicited a significantly larger reaction time than control words. The difference between unhealthy and healthy words approached significance ( $p = .058$ ) with unhealthy words demonstrating the longest reaction time. Although for restrained eaters the main effect for word type only approached significance  $F(2, 28) = 3.02, p = .068$ , it was considered appropriate to perform post hoc tests. The reaction time for healthy words was significantly larger than the reaction time for control words. The difference between reaction time to unhealthy and control words was not significant ( $p = .143$ ). There were no significant main effects for the unrestrained eaters.

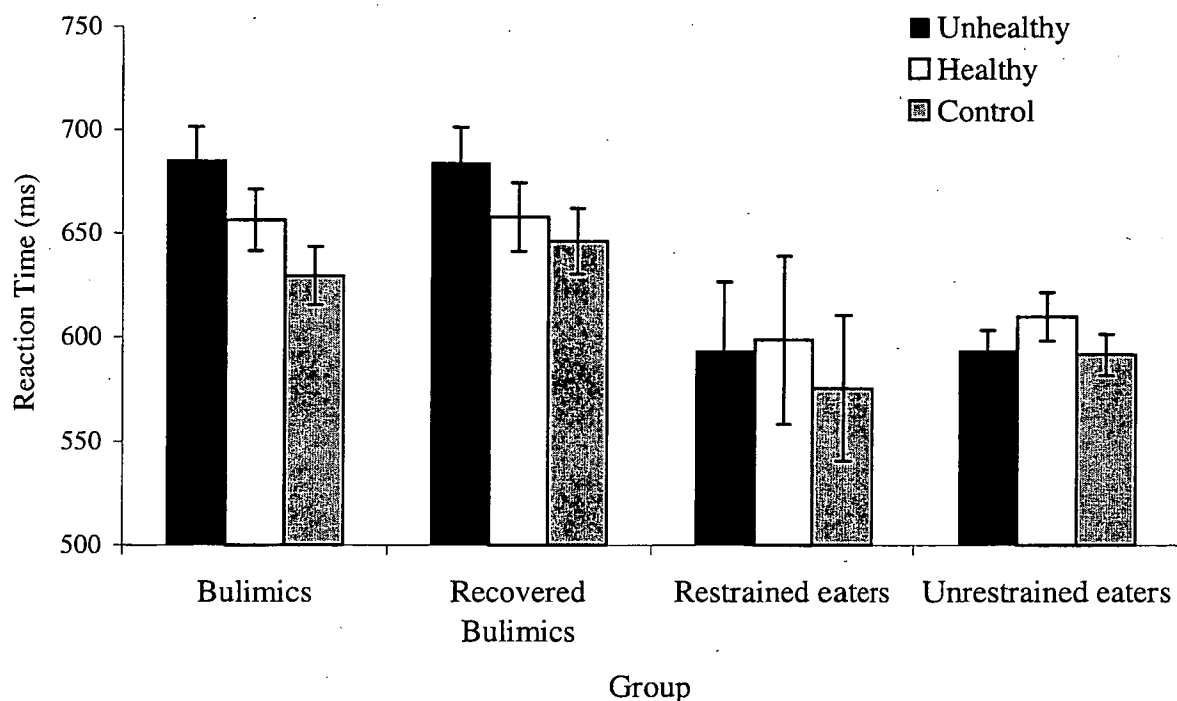


Figure 6. Reaction times for healthy, unhealthy and control words for bulimics, recovered bulimics, restrained eaters and unrestrained eaters on the modified Stroop task

\* Vertical lines depict standard error of the means

#### *Accuracy of colour naming*

An ANOVA was conducted on number of responses correct, with group as a between subjects factor and word type (unhealthy, healthy, control) as the repeated measures factor. No significant main effects or interactions were found. This finding indicates participants' responses to the three types of words were equally accurate and the different groups of participants responded similarly, so that the significant differences in reaction time could not be attributed to any speed-accuracy trade off.

### *Correlations between interference indices and self-report measures*

Correlations between the interference indices and self report measures were calculated. There was a moderate significant positive correlation of unhealthy - control interference index with EDI-DT ( $r = .49$ ). There was a small significant positive correlation with restraint score ( $r = .34$ ), and EDI-BD ( $r = .34$ ). There was a small positive correlation of healthy - control interference index with BDI-2 ( $r = .32$ ), EDI-DT ( $r = .29$ ), EDI-BD ( $r = .39$ ).

### *Emotionality ratings for food related words*

Mean ratings on the emotionality questionnaire were entered into a 4 (group: bulimic, recovered bulimic, restrained eater, unrestrained eater) x 3 (word type: unhealthy, healthy, control) repeated measures ANOVA. There was a significant main effect for word type  $F(2,1) = 6.89, p < .01$ . Healthy words were rated significantly more positive ( $M = 5.43$ ) than unhealthy words ( $M = 4.66$ ) or control words ( $M = 4.89$ ), where 0 was 'extremely negative' and 10 'extremely positive'. The interaction between word type and group approached significance  $F(6,3) = 2.1, p = .06$  (Figure 7). For bulimics, the healthy words were rated as more positive than both the unhealthy and control words, for recovered bulimics the healthy words were rated as more positive than the unhealthy words and for unrestrained eaters the unhealthy words were rated as significantly more positive than the control words.

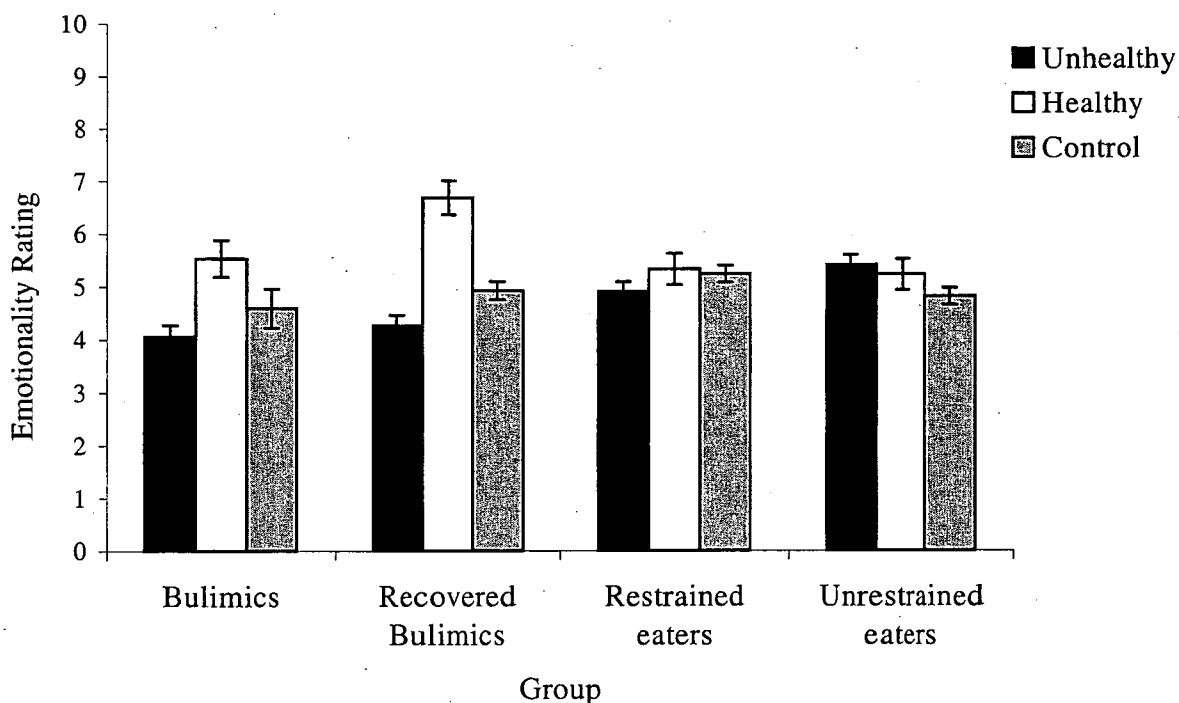


Figure 7. *Emotionality ratings for healthy, unhealthy and control words for bulimics, recovered bulimics, restrained eaters and unrestrained eaters (ranging from 0 'negative' to 10 'positive').*

*\* Vertical lines depict standard error of the means*

#### *Homogeneity ratings for food related words*

Mean ratings on the homogeneity questionnaire were entered into a 4 (group: bulimic, recovered bulimic, restrained eater, unrestrained eater) x 3 (word type: unhealthy, healthy, control) repeated measures ANOVA. There was a significant main effect for word type  $F(2, 1) = 7.67, p < .001$  and a significant interaction between word type and group  $F(6, 3) = 2.26, p < .05$ . For the bulimic group the difference between word types approached significance with unhealthy words rated as more related than control words. The restrained eaters rated the healthy words as more closely related than the unhealthy and control words and the unrestrained eaters rated the healthy words as more closely related than the unhealthy words (Figure 8).

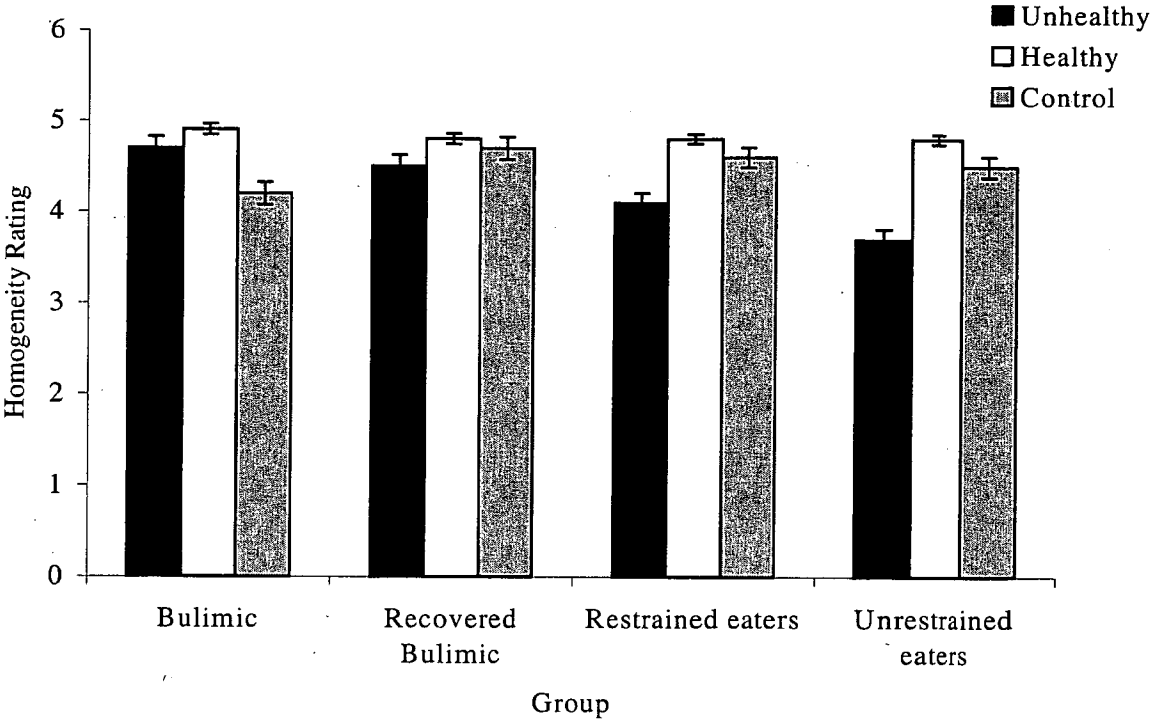


Figure 8. *Relatedness ratings for healthy, unhealthy and control words for bulimics, recovered bulimics, restrained eaters and unrestrained eaters (ranging 0 'not at all related' to 5 'strongly related')*

*\* Vertical lines depict standard error of the means*

### Experiment 3: Body shape words

Experiment 3 investigated colour naming for body shape related words and differentiated between colour naming body nouns and body adjectives, comparing them with colour naming to control nouns and adjectives and person nouns and adjectives. This experiment employed a 4 (group: bulimic, recovered bulimic, restrained eater, unrestrained eater) x 3 (word type: body, control, person) x 2 (part of speech: adjectives, nouns) mixed design. ANOVAs were conducted for the interference indices (body nouns - control nouns, body nouns - person nouns, body adjectives - control adjectives and body adjectives - person adjectives) with group as the between subjects factor and the interference index as the dependent variable.

Second, separately for each group using reaction time itself as the dependent variable a series of repeated measures analysis was conducted. Correlations between interference indices and self-report measures were calculated.

#### *Interference indices for body shape related words*

Analysis of the body shape words revealed no significant group effects on interference indices calculated for body nouns - control nouns  $F(3,58) = 1.01, p = .39$ , body adjectives - control adjectives  $F(3,58) = .037, p = .99$ , body nouns - person nouns,  $F(3,58) = .56, p = .65$  or body adjectives - person adjectives,  $F(3,55) = .52, p = .67$ .

### *Reaction times for body shape related words*

Repeated measures analysis of variance with two repeated measures factors: word type (body, garden, person) and part of speech (noun or adjective), and group as the between subjects factor (bulimic, recovered bulimic, restrained eaters, unrestrained eaters) was conducted on the overall data. There was a main effect for word type,  $F(2,1) = 3.61, p = .03$ . Participants took longer to respond to both body shape ( $M = 635.6, SD = 89.65$ ) and garden words ( $M = 633.23, SD = 89.57$ ) than person words ( $M = 623.35, SD = 90.43$ ). There was no main effect for part of speech or interactions. The main effect for group approached significance,  $F(3,55) = 2.63, p = .059$ . The recovered bulimics ( $M = 669.6, SD = 84.38$ ) demonstrated longer latencies followed by bulimics ( $M = 655.23, SD = 85.04$ ), unrestrained eaters ( $M = 606.03, SD = 84.85$ ) and restrained eaters ( $M = 592, SD = 84.85$ ).

A 3 (word type: body, control, person) x 2 (part of speech: noun, adjective) repeated measures ANOVA was also conducted independently on each of the groups using reaction time as the dependent variable. For the bulimic group the effect of part of speech approached significance  $F(1, 15) = 3.57, p = .08$ . Response latencies were longer for adjectives ( $M = 646.24, SD = 97.35$ ) than nouns ( $M = 664.22, SD = 114.04$ ). The recovered bulimic group demonstrated a significant main effect for word type  $F(2, 24) = 4.40, p = .02$ . Recovered bulimics took longer to respond to garden words ( $M = 679.42, SD = 91.62$ ) followed by body words ( $M = 672, SD = 94.27$ ) and person words ( $M = 657.37, SD = 96.53$ ). For both restrained and unrestrained eaters there were no significant main effects.

### *Accuracy of colour naming*

An ANOVA was conducted on the number of words correct, with group as a between subjects factor and word type as the repeated measures factor. No significant main effects or interactions were found. This indicates that participants' responses to the types of words were equally accurate and the different groups of participants responded similarly  $F(3, 53) = .50, p = .68$ .

### *Correlations between interference indices and self report measures*

Correlations between the interference indices and self report measures were calculated. There was a positive correlation between the interference index body nouns-control nouns and state anxiety ( $r = .34$ ), and EDI-BD ( $r = .26$ ). There were no significant correlations with any of the other interference indices.

### *Emotionality ratings for body shape related words*

Mean ratings on the emotionality questionnaire were entered into a 4 (group: bulimic, recovered bulimic, restrained eater, unrestrained eater) x 3 (word type: body, person, control) x 2 (part of speech: noun, adjective) repeated measures ANOVA. There was a significant main effect for word type  $F(2, 50) = 50.03, p < .001$ , and a significant main effect for part of speech  $F(1, 50) = 26.23, p < .001$ . There was also a significant interaction between part of speech and word type  $F(2, 50) = 72.83, p < .001$ . In the body and control conditions the nouns were rated as more positive than adjectives whereas in the person condition the adjectives were rated as more positive. There were no other significant main effects or interactions (Figure 9).



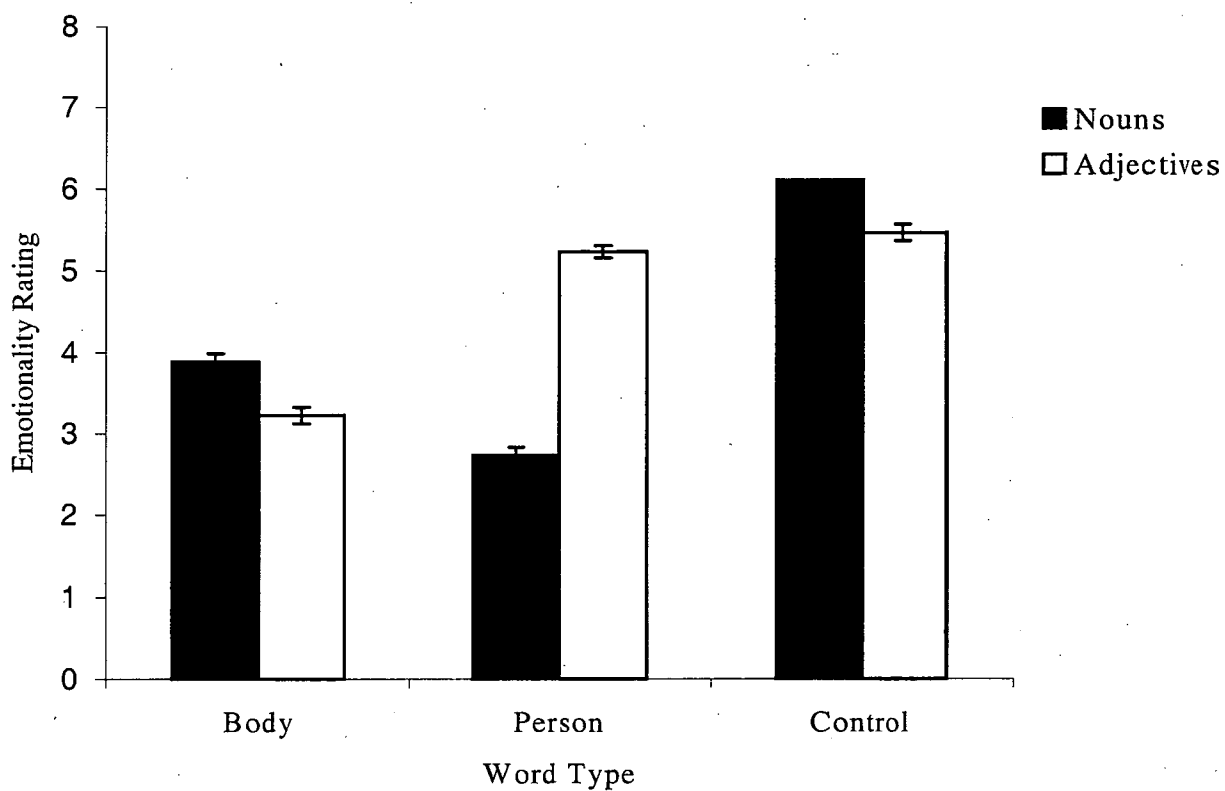


Figure 9. *Emotionality ratings for nouns and adjectives in the body, person and control word type conditions (ranging from 0 'negative' to 10 'positive')*

*\* Vertical lines depict standard error of the means*

*Homogeneity Ratings for body shape related words*

Mean ratings on the homogeneity questionnaire were entered into a 4 (group: bulimic, recovered bulimic, restrained eater, unrestrained eater) x 3 (word type: body, person, control) x 2 (part of speech: noun, adjective) repeated measures ANOVA.

There was a significant main effect for word type  $F(2, 1) = 24.73, p < .001$ , a significant main effect for part of speech  $F(1, 1) = 24.52, p < .001$  and a significant

interaction between word type and part of speech  $F(2, 1) = 14.3, p < .001$  (Figure 10). In the body word and control word condition there was no significant difference between nouns and adjectives, but for person words the groups of adjectives were rated as more related than the nouns. All means were above 4 (0 'unrelated', 5 'strongly related') except for person nouns ( $M = 3.36$ ).

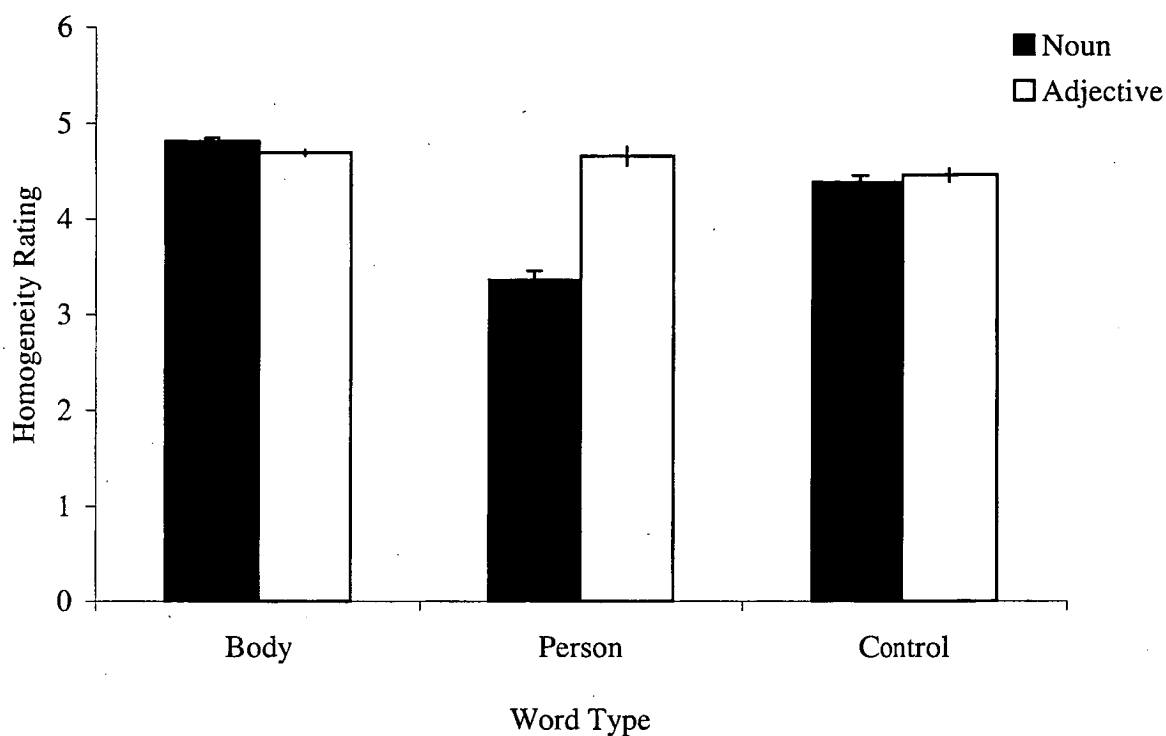


Figure 10. *Homogeneity ratings for nouns and adjectives in the body, person and control word type conditions (ranging 0 'not at all related' to 5 'strongly related')*

\* *Vertical lines depict standard error of the means*

## **Discussion**

The findings of the three experiments concerned with food, body shape and self-threat related effects on the Stroop have been presented so far in this paper in their order of administration, which was determined in order to minimise priming and fatigue effects. It is more appropriate to discuss these findings in order of the relationship to core and more general symptomatology associated with eating disorders, beginning with Experiment 2, concerned with food related words.

### **Colour naming for food related words (Experiment 2)**

The purpose of this experiment was to examine the specificity of the Stroop effect in relation to bulimia, word-type and the persistence of the effect on recovery.

Accordingly, the differences between bulimics, recovered bulimics, individuals high on dietary restraint and individuals low on dietary restraint were examined on Stroop interference to food related words of two types: 'healthy' and 'unhealthy'. It was predicted that individuals with bulimia nervosa would take longer to respond to food related than to control words due to the accessibility of an underlying schema related to food. This difference was expected to be greater than that observed in the recovered bulimics, restrained eaters and unrestrained eaters. It was also predicted that it would be observed for both types of food words due to the highly interconnected nature of schemas for food in bulimics.

The hypothesis that the bulimic group would demonstrate a greater interference index to unhealthy food words than the other groups was confirmed for restrained eaters

and unrestrained eaters, however the recovered bulimic group did not differ from the bulimics. The groups did not differ on the interference index to healthy words. Furthermore, the hypothesis that the bulimic group would demonstrate a delayed colour naming effect for food related, relative to neutral words was supported for unhealthy food words but not for healthy food words.

The Stroop effect demonstrated by both the bulimic and recovered bulimic group for unhealthy food words suggests that the underlying schema related to food in recovered bulimic individuals remains unchanged. This is consistent with the findings for recovered bulimics and anorexic individuals where a divergence between cognition and behaviour has been reported. Various studies report that between one- and two-thirds of treated patients no longer demonstrating the behavioural symptoms of anorexia or bulimia nevertheless still worried about their physical appearance (Rosen, 1996). Further women with bulimia nervosa rate dealing with the desire to be thin as the hardest part of recovery (Rorty, Yager, & Rosotto, 1993). However, the current investigation could have primed latent schemas in recovered bulimics by the process of recruitment on the basis of former bulimic status and interview responses about bulimic symptomatology. Thus, food related schemas in recovered bulimics may normally be less accessible than evidenced in the current investigation. Further research examining Stroop effects in individuals who have recovered from bulimia but who are unaware of the reason for recruitment would clarify this.

In the only other between subjects analyses examining Stroop interference and recovery from bulimia Lovell et al. (1997) found an overall effect with slower colour

naming for a heterogeneous block of food related words (high caloric, low caloric, food preparation and food intake) compared with control words, in dieters, non-dieters, bulimics, anorexics, recovered bulimics and recovered anorexics (Lovell et al., 1997). Heterogeneous presentation of food related words may have confounded differences between groups on colour naming specific types of food related words. In anorexia, on the other hand, Green et al. (1998) found colour naming impairment which diminished with treatment, specifically for binge-related food words similar to the words used in the current investigation.

Despite the interference index being greater for bulimics and recovered bulimics than for controls, the Stroop effect was not limited to these groups. Restrained, but not unrestrained eaters also demonstrated delayed colour naming for food related words as compared to neutral words. This is consistent with research findings of delayed colour naming in restrained eaters compared with unrestrained eaters for food related words (Green & Rogers, 1993; Overduin et al., 1995; Stewart & Samoluk, 1997).

The current investigation aimed to examine colour naming latencies for more distinct categories of words. When the analysis was conducted on each word group separately, it was found that restrained eaters demonstrated impaired colour naming for healthy rather than unhealthy food words, whereas the bulimics and recovered bulimics showed delayed colour naming for unhealthy words.

Other recent research which has attempted to clarify differences between responses to different types of words in restrained and unrestrained eaters has reported conflicting results. Sackville et al. (1998) failed to demonstrate an interference effect in either restrained or unrestrained eaters to the separate presentation of high and low caloric food words. Contrary to this, Francis et al. (1997) reported an interference effect in restrained eaters to the separate presentation of both 'forbidden' and 'non-forbidden food' words. Thus word type did not seem to be a critical factor in either case in contrast to the present results.

The differences between these earlier findings and those of the current study could possibly be due to non-exclusion of individuals with eating disordered symptomatology or eating disorders from the restrained eating group in the Francis et al. (1997) experiment. Individuals with subclinical eating disorders have demonstrated Stroop effects for combined presentation of body shape and food related words greater than that observed in dieters (Cooper & Fairburn, 1992). In the Francis et al. (1997) study the restrained eaters had a higher mean restraint score than in the current study, and high restraint was associated with subclinical eating disorder psychopathology. Nonetheless, consistent with the findings of the present investigation, Francis et al. (1997) found no interference effect in unrestrained eaters.

It is argued that the current findings provide support for the contention that the schemas operating in individuals with bulimia and recovered bulimics may be distinguished from those operating in individuals high on dietary restraint. The delayed colour naming of foods in both restrained eaters and bulimics reflects an

increasing preoccupation with food and eating (Channon et al., 1988). Behaviourally, restrained eaters are limiting their dietary intake but still may be consuming a wide range of foods. Bulimic individuals, however are consuming a smaller range of foods episodically in large amounts within the context of ongoing dietary restraint. For bulimic individuals binge foods may have a greater salience or emotional association, schematic processing in bulimics may be organised around binge food concepts whereas those of restrained eaters are associated with healthy foods.

The emotional associations of words may also contribute to the word type response differences between bulimic and restrained eaters. Unhealthy foods may not only have an increased salience but also an emotional association in individuals with bulimia and those individuals who have recovered from bulimia because they are foods commonly associated with bulimic binges. Such foods, however, may have no special significance for restrained eaters. This contention is supported by the findings for the emotionality ratings, since both bulimics and recovered bulimics rated unhealthy words as significantly more negative than the healthy words, whereas the ratings did not significantly differ in the restrained eating group and unrestrained eaters rated the unhealthy words as more positive.

Thus the results suggest that individuals across the continuum of eating behaviour have schemas for food, but the exact nature of these schemas varies. The correlations observed in this study between Stroop colour naming for food related words suggests that colour naming may be related to underlying dimensions such as Drive for Thinness, and Body Dissatisfaction which exist across the continuum of eating

behaviour. Based on this interpretation, the Stroop effect for food related words is a measure that is correlated with underlying attitudinal and cognitive factors rather than external behaviours.

### **Colour naming for body shape related words (Experiment 3)**

None of the four groups in the study demonstrated a Stroop interference effect for body shape related words. Reference to the relevant literature indicates that empirical findings are divided on this issue with both reports of an effect for body shape related words in bulimics (Ben-Tovim & Walker, 1991; Ben Tovim et al., 1989; Jones-Chesters, Monsell, & Cooper, 1988; Lovell, Williams, & Hill, 1997; Perpiña et al., 1993) and reports of no such effect (Black, Wilson, Labouvie, & Heffernan, 1997; Cooper & Todd, 1997; Perpiña, Leonard, Treasure, Bond, & Banos, 1998). Several researchers who report body shape related effects in individuals with anorexia have found that they are smaller than for food words (Green & Rogers, 1993) or absent altogether (Green et al., 1996). One interpretation of the findings in the present study is that individuals with bulimia may not have schemas associated with body shape in the same way as they do for food.

However a number of interpretations are possible. It is possible that the responsiveness to body shape words by bulimic individuals may be influenced by the salience of the body concept as determined by the stage of active treatment. Many investigations have recruited only participants who are currently in treatment for eating disorders (eg. Ben Tovim, Walker, Fok & Yap, 1989; Cooper & Todd, 1997). This methodology may increase the salience of body shape information, especially if



those individuals are experiencing food normalisation, a process which may itself increase the salience of body shape information. The bulimics in the current investigation were in fact a fairly heterogeneous sample, including individuals actually engaged in treatment, others who had been experiencing bulimia for a short period of time and many who had been living with bulimia for many years.

It is conceivable also that methodological constraints may have minimised Stroop effects in the current study. One possibility is the choice of control words. Garden words are words frequently associated with colours (for example, grass) and words associated with colours can produce a colour-naming latency (Scheibe, Shavert, & Carrier, 1967).

Finally, colour naming latencies were longer for body shape words and control words than for person words. Part of speech had no significant effect on colour naming latencies. Thus there is no evidence that colour naming latencies to body shape words vary according to part of speech or that previous inconsistencies in research are attributable to choice of nouns and/or adjectives. This suggests that in this investigation the assumed degree of affective processing did not affect colour naming times.

Examination of the correlations reveals that colour naming to body nouns-control nouns has a small association with body dissatisfaction and state anxiety. Thus, there

seems to be less of a relationship between Stroop effect for body shape related words and the underlying features of eating disorders than is demonstrated by Experiment 2.

### **Colour Naming for self-threat related words (Experiment 1)**

The findings for colour naming of self-threat related words were contrary to expectations. Recovered bulimics, restrained eaters, and unrestrained eaters showed a Stroop effect to self-threat words, specifically autonomy and sociotropy words, but bulimics failed to show any Stroop effect. This failure to demonstrate the effect in bulimics is inconsistent with previous reports of an interference index for autonomy, discomfort anxiety, and ego self-threat words in bulimics greater than that observed in controls (McManus et al., 1996).

However, the finding of a Stroop effect in the non-clinical groups has precedents. Waller et al. (1996) demonstrated slower colour naming of sociotropy, physical, self directed ego threat words than matched neutral words in 80 non-eating-disordered women. Further, in the McManus et al. (1996) study, control participants displayed delayed colour naming of self directed ego threats and sociotropy words albeit to a smaller degree than in bulimic individuals.

Waller et al. (1996) investigated the relationship between bulimic characteristics and attentional bias in non-eating-disordered individuals. Attentional bias to self-directed ego threats was found to correlate with the bulimia, social insecurity and ineffectiveness scales of the EDI. When the women were divided into high and low

bulimic groups based on EDI scores, the groups differed on the Stroop effect to self-directed ego threats. Thus, there is evidence supporting the finding of impaired colour naming for different types of self-threat related words in non-clinical participants.

The present investigation aimed to replicate the findings of McManus et al. (1996) and to investigate colour naming for self-threat words in recovered bulimics. One possible explanation for the absence of the effect in bulimic individuals in the current experiment is that individuals with bulimia measure their self-esteem exclusively in terms of food and body image, so that other self-threat words may fail to elicit threat or activate any schemas. Furthermore, there is evidence to suggest that the Stroop effect is specific to current concerns, and it may be that self-threat words are simply not related sufficiently closely to current concerns. Investigations of anxiety disorders have found that the Stroop effect is specific to the domain of worry rather than related to more general concerns. For example, disruption in spider phobics does not generalise to generally negative words (Watts et al., 1986). In individuals with panic disorder, colour naming to panic related words has been shown to be a more robust effect than to interpersonal threat words (Lundt, Wikstrom, Westerlund, & Ost, 1999). Persons with bulimia may not possess a schema for self-threat related words as such, and so the effect demonstrated by Waller et al. (1996) and McManus et al. (1996) may possibly have been an artefact of semantic priming.

On the other hand, the absence of a colour naming effect in this experiment might be attributable to the high anxiety of the bulimic group. Previous studies have not

reported the anxiety levels of the bulimic participants. However, the individuals with bulimia in the current study were higher than the other groups on both state and trait anxiety. Trait emotion is usually associated with increased colour naming interference for emotional stimuli related to current concerns (Martin, Williams, & Clarke, 1991; Mogg, Kentish, & Bradley, 1993). However, there is evidence that anxious participants may in some circumstances override this (eg. Williams et al., 1996). This phenomenon seems to occur as a result of state anxiety and does not occur without conscious awareness of the stimuli.

Evidence for an overriding effect comes from several studies. By increasing state anxiety in high and low trait anxious participants using mood induction procedures, colour naming effects for words related to anxiety have been shown to disappear (Macleod & Rutherford, 1992; Mogg, Kentish, & Bradley, 1993). The colour naming effect for social threat words demonstrated in social phobics has also been shown to disappear under conditions of high but not low anxiety (Amir, McNally, Riemann, Burns, Lorenz, & Mullen, 1996). Researchers such as Mogg, Kentish, and Bradley, have suggested that participants in whom an anxious mood has been induced adopt a cognitive strategy which inhibits further processing of threat. As Parrot and Sabini (1990) have indicated this strategy may serve as an adaptive mood regulatory process.

In the present study, the bulimic group while experiencing self-threat words as threatening, may nevertheless have been able to consciously override the threat by, as Williams, Mathews, and Macleod (1996) would argue, increased effort to meet task

demand (see Williams, Mathews, and Macleod for a review). Previous investigations into anxiety and the Stroop effect have found that in the high anxious condition individuals demonstrate increased colour naming latencies to all stimuli, which has been interpreted as evidence of increased effort to meet task demand and thus override the Stroop effect. However, the current investigation did not manipulate anxiety so this comparison can not be made. An examination in bulimics of the subliminal processing of self-threat related threat words where conscious overriding would not be possible could provide further clarification of these issues.

The correlations between the Stroop effect to self-threat related words and the measures of general and specific psychopathology indicated that as Depression, Drive for Thinness, Bulimia as measured by the EDI-2 and Body Dissatisfaction increased the interference index to self-threat words decreased. This finding suggests that the Stroop effect to self-threat words has a negative relationship with depression and these eating disordered attitudes and behaviours. Against the argument that this finding could be due to high depression in the bulimic group it might be counted that the four groups in this experiment provide a spread of subjects across a range of eating behaviours so correlations are not necessarily inflated substantially by inter-group differences.

The different findings across the three experiments in this study may be reconciled by the proposition that different cognitive processes were operating over the course of the experimental session. The effect of high trait anxiety may have been specific to the self-threat experiment because the types of the words in that experiment were

more closely associated with general anxiety symptomatology than were food related words which are more specific to the core of the eating disordered symptomatology. Therefore the failure to find the Stroop effect in the bulimic group for self-threat related words may have been due to anxiety rather than bulimic symptomatology. Additional supporting evidence is provided by the emotionality ratings which indicated that the self-threat words were rated as more negative than the food words.

In this study a considered decision was made to run the three experiments in a constant rather than counterbalanced order, for two reasons. First, these were distinct experiments and there was no intention of comparing data from one with data from another. Second, to counterbalance their administration would cause error variance estimates within the three experiments to be inflated by any order-related effects. The decision, nonetheless created the possibility that the self-threat experiment may have been more difficult thus increasing task demand and resulting in increased effort. Further, as the self-threat experiment was first, anxiety may have been highest. Participants' anxiety may have decreased over the course of the session.

### **Methodological issues**

Despite methodological improvements from previous studies by using categorically related control words the results from the homogeneity ratings illustrated the difficulties in controlling for semantic homogeneity. However, despite the finding that ratings for the control words differed from the experimental words in the three experiments all the control words for each experiment belonged to a single semantic category and were mostly rated as related. On a five point scale, with 0 being 'not at

all related' and 5 being 'strongly related', all groups of words in Experiments 2 and 3 were rated as above 4.3 with the exception of person nouns (3.4). The self-threat words were rated as less homogenous (ranging from 2.8 to 4.7), the self-threat words being rated as more homogenous than the control words.

### **Conclusion**

The present investigation found a Stroop interference effect for food related words that was greater in bulimics and recovered bulimics than in restrained and unrestrained eaters. This provides evidence for the existence of food-related schemas in individuals with bulimia and suggests that attentional bias to food related words is not concomitant with current symptomatology but persists after bingeing and purging cease. This persistence of food related schematic processing could be indicative of an underlying vulnerability factor, which may contribute to the cyclical nature of the disorder and its high relapse rate.

The Stroop effect for food related words observed in restrained eaters extends previous evidence for a Stroop interference gradient across the continuum of eating behaviour. This limits the utility of Stroop interference as a diagnostic measure, but it may nevertheless provide a quantitative measure predictive of eating disordered psychopathology.

The finding that both bulimics and recovered bulimics displayed Stroop interference to unhealthy, but the restrained eaters to healthy, food words provides more specific

information about schemas underlying different types of eating behaviour.

Theoretical explanations of the development of eating disorders such as Fairburn's cognitive model (Fairburn, 1985) or the dietary restraint model (Herman & Polivy, 1984), may need to more clearly articulate notions of schematic processing of particular food types.

The present investigation found no Stroop effect for body-related words, suggesting that the bulimic participants were aschematic for body shape, replicating Black et al. (1997), and Cooper and Todd (1997), and contrasting with the findings of Ben-Tovim et al. (1989), Perpiña et al. (1993), and Jones-Chesters et al. (1998). Bulimic individuals experience a wide variety of symptoms varying in frequency and intensity. Specific symptomatology or underlying cognitions rather than diagnostic category may be associated with the Stroop effect to body shape related words. The varying correlations between indices of Stroop interference and scores on measures such as the EDI-2 reported in the study suggest that further investigations might explore specific factors that are associated with Stroop interference effects

The absence of any difference in colour naming times for body nouns and adjectives indicates that the mixing of these grammatical classes in some previous research has probably not led to artefactual results, thus removing one source of methodological concern. Thus there is no evidence from this study that the amount of affective processing of the word affects the Stroop colour naming times.



Recovered bulimics, restrained eaters and unrestrained eaters, but not the bulimic group, demonstrated a Stroop effect for self-threat related words. This is consistent with previous findings in non-clinical groups (Waller et al., 1996) and most individuals would be expected to find these words threatening. More surprising is the failure to find the effect in the bulimic groups, which may have been due to their high anxiety which has been shown to override the Stroop effect (Amir et al., 1996). Further research using mood induction procedures to enable demonstration of the Stroop effect under conditions of high and low anxiety in bulimic and comparison groups may clarify the contribution of high anxiety. Examination of colour naming for the subliminal presentation of self-threat words, where conscious override is not possible would also help to clarify this.

In summary, the present research has provided further evidence for the utility of the Stroop effect and the importance of research investigating schematic processing underlying eating disordered symptomatology. The Stroop effect for food related words was found in restrained eaters, although it was smaller than the effect in bulimics and recovered bulimics. Further, the effect in restrained eaters was towards healthy words whereas bulimics and recovered bulimics demonstrated the effect for unhealthy words. Further development of models of aetiology, maintenance and treatment could incorporate underlying cognitions related to different types of food. The present investigation did not find a Stroop effect for body shape related words in either nouns or adjective condition and supports previous research which has not demonstrated the Stroop effect to body shape related words. The findings of an attentional bias towards self-threat words in unrestrained eaters, restrained eaters and

recovered bulimics was consistent with previous research findings, however the failure to demonstrate the effect in bulimics was unexpected, and may have been due to high anxiety.

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## Appendix

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## Appendix 1: Revised Restraint Scale

1. How often are you dieting?

Never                  rarely                  sometimes                  often                  always

2. What is the maximum amount of weight (in kilos) that you have ever lost within one month?

0-1                  2-4                  5-7                  8-10                  11+

3. What is your maximum weight gain within one week?

0-0.5                  0.6-1.0                  1.1-1.5                  1.6-2.5                  2.6+

4. In a typical week how much does your weight fluctuate?

0-0.5                  0.6-1.0                  1.1-1.5                  1.6-2.5                  2.6+

5. Would a weight fluctuation of 2.5kilos affect the way you live your life?

Not at all                  slightly                  moderately                  very much

6. Do you eat sensibly in front of others and splurge alone?

Never                  rarely                  often                  always

7. Do you give too much time and thought to food?

Never                  rarely                  often                  always

8. Do you have feelings of guilt and overeating?

Never                  rarely                  often                  always

9. How conscious are you of what are you are eating?

Not at all                  slightly                  moderately                  extremely

10. How many kilos over your desired weight were you at your maximum weight?

0-0.5                  0.6-2.5                  2.6-4.5                  4.6-9.0                  9.1

11. Could you estimate your current:

Weight: in kilos..... Height: in cm..... or feet and inches.....

## Appendix 2: Semi-structured clinical interview

### Important

#### **Bulimics**

- Determine whether they have met criteria for bulimia past three months
- Whether they have had another eating disorder
- How long have they been Bulimic

#### **Recovered Bulimics**

- Did they ever have Bulimia?
- Have they recovered?
- For how long have they recovered?
- How long did they have it for?
- Have they had another eating disorder?

#### **Restrained and Unrestrained eaters**

- Have they ever had an eating disorder?
- Which one?
- Do they have one now?
- Do they have an EDNOS?

#### **1. Binge Eating**

- Have you ever engaged in binge eating? **Yes/No** ( if no skip to next question)

- Could you describe what you would typically eat during a  
binge? \_\_\_\_\_  
\_\_\_\_\_

- For what period did you engage in binge eating?

- How frequently? How many times a day? \_\_\_\_ How many days a week? \_\_\_\_ How  
long did that go on for?  
\_\_\_\_\_  
\_\_\_\_\_

- Have you felt out of control when bingeing? **Yes/No**

- Did you feel like you could stop eating once a  
binge had started? **Yes/No**

- Did you feel like you could stop a binge from starting in the first place **Yes/No**

- Did you feel like you could control how much you were eating? **Yes/No**

- Did you feel distressed by your bingeing? **Yes/No**

*NB. DSMIV*

- A. Recurrent episodes of binge eating. An episode characterised by both of the following:
1. Eating in a discrete amount of time (eg within any two hour period) an amount of food that is definitely larger than most people would eat during a similar period of time and under similar circumstances
  2. A sense of lack of control over eating during that episode ( eg a feeling that one cannot stop eating or control what or how much one is eating)

**3. Dieting**

- Have you ever restricted your food intake (been on a diet) due to concerns about your body size and weight? **Yes/No**
- Have you ever gone for long periods of time without eating to control your body size and weight? **Yes/No?** ( if no go to the next question)
- How long?
- Do you miss meals

**4. Weight loss**

- Have you ever lost a large amount of weight? **Yes/No**
- How much?
- In what period of time?
- How much did you weigh before?
- How much did you weigh after?

*( Anorexia- weight loss leading to 85% of what is expected)*

## 5. Diagnosis and Treatment

### Bulimia

- Have you been diagnosed as Bulimic? **Yes/No**
- When?
- By whom?
- Have you been treated for Bulimia? **Yes/No**
- When?
- By whom?
- For how long ?

### Anorexia

- Have you ever been diagnosed with Anorexia? **Yes/No**
- When?
- By whom?
- Have you been treated for Anorexia **Yes/No**
- When?
- By whom?

### Other

- Have you been treated for any other eating related problem? **Yes/No**

## 5. Purgeing

- Have you ever tried to vomit after eating to get rid of the food eaten to prevent weight gain? **Yes/No** ( if no go to next question)
- If so, when did you do this?
- Did it occur regularly?
- How often?
- At the worst of times what would you estimate was your average number of vomiting episodes a week?
- How long did that go on for?
- For what period of time did you regularly vomit to get rid of food?



**6. Laxatives**

- Have you ever used laxatives to control your weight or get rid of food? **Yes /No** ( if no go to next question)
- Did it occur regularly?
- How often?
- How long did that go on for?
- When did this occur?

**7. Diet Pills**

- Have you ever taken diet pills? **Yes/ No** ( if no go to next question)
- How often?
- For how long?
- When did this occur?
- At the worst of times what would you estimate was your average number of diet pills per week?
- How long did that go on for?

**8. Diuretics**

- Have you ever taken diuretics **Yes/ No** ( if no go to next question)
- How long ago?
- How often did you take them?
- At the worst of times what was the average number of diuretics that you were taking per week?
- How long ago was that?
- How long did that go on for?

**9. Exercise**

- Has there been a time in your life when you have exercised more that three times a week? **Yes/No**

- How often did you exercise?
- What percentage of this exercise was aimed at controlling your weight?

#### **10. Frequency and Severity**

- If you were regularly engaging in binge eating and vomiting, using laxatives, diuretics, fasting, diet pills or excessive exercise how long did this behaviour go on for?

*( at least twice a week for three months)*

#### **11. Menstruation ( Anorexia only)**

- Have you ever had a period of time when you did not menstruate? ( excluding pregnancy)
- For how long did you fail to menstruate?
- Pill?

#### **12. Lifestyle**

- Would you consider that your concerns with food and body shape have significantly impacted on your life?

#### **13. Self evaluation**

- Has your body size and weight ever determined how you feel about yourself? **Yes/No**

*Refer back to EDE-Q*

- To what extent?

### Appendix 3: Hunger Scale

Please rate how hungry you are feeling right now

extremely  
hungry

not at all  
hungry

0    1    2    3    4    5    6    7    8    9    10

--	--	--	--	--	--	--	--	--	--	--

What was the last meal you ate?( eg breakfast) \_\_\_\_\_

What time did you eat it? \_\_\_\_\_

Could you please record the current time \_\_\_\_\_(am/pm)

#### Medication

Are you presently taking any medication? \_\_\_\_\_

What are you taking?


When was the last time you took


### Appendix 4: Emotionality Questionnaire

Please rate the emotionality of the following words from 0 to 10 with 0 being extremely negative and 10 extremely positive :

extremely negative											extremely positive
0	1	2	3	4	5	6	7	8	9	10	

1	habit	0	1	2	3	4	5	6	7	8	9	10
2	restricted	0	1	2	3	4	5	6	7	8	9	10
3	lawn	0	1	2	3	4	5	6	7	8	9	10
4	plump	0	1	2	3	4	5	6	7	8	9	10
5	stapled	0	1	2	3	4	5	6	7	8	9	10
6	drafting	0	1	2	3	4	5	6	7	8	9	10
7	blocked	0	1	2	3	4	5	6	7	8	9	10
8	deprived	0	1	2	3	4	5	6	7	8	9	10
9	garden	0	1	2	3	4	5	6	7	8	9	10
10	copy	0	1	2	3	4	5	6	7	8	9	10
11	trees	0	1	2	3	4	5	6	7	8	9	10
12	nasty	0	1	2	3	4	5	6	7	8	9	10
13	deterred	0	1	2	3	4	5	6	7	8	9	10
14	aptitude	0	1	2	3	4	5	6	7	8	9	10
15	illustrated	0	1	2	3	4	5	6	7	8	9	10
16	stomach	0	1	2	3	4	5	6	7	8	9	10
17	shelf	0	1	2	3	4	5	6	7	8	9	10
18	bread	0	1	2	3	4	5	6	7	8	9	10
19	powerless	0	1	2	3	4	5	6	7	8	9	10
20	delegated	0	1	2	3	4	5	6	7	8	9	10
21	expanded	0	1	2	3	4	5	6	7	8	9	10
22	desks	0	1	2	3	4	5	6	7	8	9	10
23	herbal	0	1	2	3	4	5	6	7	8	9	10
24	outlook	0	1	2	3	4	5	6	7	8	9	10
25	hateful	0	1	2	3	4	5	6	7	8	9	10
26	cakes	0	1	2	3	4	5	6	7	8	9	10
27	grounds	0	1	2	3	4	5	6	7	8	9	10
28	style	0	1	2	3	4	5	6	7	8	9	10
29	carrot	0	1	2	3	4	5	6	7	8	9	10
30	mossy	0	1	2	3	4	5	6	7	8	9	10
31	stocky	0	1	2	3	4	5	6	7	8	9	10
32	sweets	0	1	2	3	4	5	6	7	8	9	10
33	project	0	1	2	3	4	5	6	7	8	9	10
34	isolated	0	1	2	3	4	5	6	7	8	9	10
35	sniggered	0	1	2	3	4	5	6	7	8	9	10
36	erased	0	1	2	3	4	5	6	7	8	9	10
37	floral	0	1	2	3	4	5	6	7	8	9	10
38	humiliated	0	1	2	3	4	5	6	7	8	9	10
39	large	0	1	2	3	4	5	6	7	8	9	10
40	helpless	0	1	2	3	4	5	6	7	8	9	10
41	maimed	0	1	2	3	4	5	6	7	8	9	10

42	shape	0	1	2	3	4	5	6	7	8	9	10
43	rejected	0	1	2	3	4	5	6	7	8	9	10
44	cream	0	1	2	3	4	5	6	7	8	9	10
45	derided	0	1	2	3	4	5	6	7	8	9	10
46	hips	0	1	2	3	4	5	6	7	8	9	10
47	vulgar	0	1	2	3	4	5	6	7	8	9	10
48	computed	0	1	2	3	4	5	6	7	8	9	10
49	lounge	0	1	2	3	4	5	6	7	8	9	10
50	documented	0	1	2	3	4	5	6	7	8	9	10
51	buttocks	0	1	2	3	4	5	6	7	8	9	10
52	negotiable	0	1	2	3	4	5	6	7	8	9	10
53	ugly	0	1	2	3	4	5	6	7	8	9	10
54	figure	0	1	2	3	4	5	6	7	8	9	10
55	lamps	0	1	2	3	4	5	6	7	8	9	10
56	friendless	0	1	2	3	4	5	6	7	8	9	10
57	angry	0	1	2	3	4	5	6	7	8	9	10
58	diary	0	1	2	3	4	5	6	7	8	9	10
59	bulky	0	1	2	3	4	5	6	7	8	9	10
60	inferior	0	1	2	3	4	5	6	7	8	9	10
61	lettuce	0	1	2	3	4	5	6	7	8	9	10
62	summarised	0	1	2	3	4	5	6	7	8	9	10
63	spinach	0	1	2	3	4	5	6	7	8	9	10
64	controlled	0	1	2	3	4	5	6	7	8	9	10
65	pinned	0	1	2	3	4	5	6	7	8	9	10
66	calculated	0	1	2	3	4	5	6	7	8	9	10
67	massive	0	1	2	3	4	5	6	7	8	9	10
68	listed	0	1	2	3	4	5	6	7	8	9	10
69	trait	0	1	2	3	4	5	6	7	8	9	10
70	lonely	0	1	2	3	4	5	6	7	8	9	10
71	printed	0	1	2	3	4	5	6	7	8	9	10
72	catalogued	0	1	2	3	4	5	6	7	8	9	10
73	accounted	0	1	2	3	4	5	6	7	8	9	10
74	inadequate	0	1	2	3	4	5	6	7	8	9	10
75	feature	0	1	2	3	4	5	6	7	8	9	10
76	refilled	0	1	2	3	4	5	6	7	8	9	10
77	duplicate	0	1	2	3	4	5	6	7	8	9	10
78	productive	0	1	2	3	4	5	6	7	8	9	10
79	cut	0	1	2	3	4	5	6	7	8	9	10
80	file	0	1	2	3	4	5	6	7	8	9	10
81	fat	0	1	2	3	4	5	6	7	8	9	10
82	chocolate	0	1	2	3	4	5	6	7	8	9	10
83	ornaments	0	1	2	3	4	5	6	7	8	9	10
84	laminate	0	1	2	3	4	5	6	7	8	9	10
85	roses	0	1	2	3	4	5	6	7	8	9	10
86	paper	0	1	2	3	4	5	6	7	8	9	10
87	perforated	0	1	2	3	4	5	6	7	8	9	10
88	kill	0	1	2	3	4	5	6	7	8	9	10
89	celery	0	1	2	3	4	5	6	7	8	9	10
90	manipulated	0	1	2	3	4	5	6	7	8	9	10
91	collapse	0	1	2	3	4	5	6	7	8	9	10
92	apple	0	1	2	3	4	5	6	7	8	9	10
93	tape	0	1	2	3	4	5	6	7	8	9	10
94	chips	0	1	2	3	4	5	6	7	8	9	10
95	dependent	0	1	2	3	4	5	6	7	8	9	10
96	irate	0	1	2	3	4	5	6	7	8	9	10
97	locked	0	1	2	3	4	5	6	7	8	9	10

98	tables	0	1	2	3	4	5	6	7	8	9	10
99	alone	0	1	2	3	4	5	6	7	8	9	10
100	shrubs	0	1	2	3	4	5	6	7	8	9	10
101	agony	0	1	2	3	4	5	6	7	8	9	10
102	carbon	0	1	2	3	4	5	6	7	8	9	10
103	tray	0	1	2	3	4	5	6	7	8	9	10
104	failure	0	1	2	3	4	5	6	7	8	9	10
105	bad	0	1	2	3	4	5	6	7	8	9	10
106	defeated	0	1	2	3	4	5	6	7	8	9	10
107	scheduled	0	1	2	3	4	5	6	7	8	9	10
108	chubby	0	1	2	3	4	5	6	7	8	9	10
109	answered	0	1	2	3	4	5	6	7	8	9	10
110	horrid	0	1	2	3	4	5	6	7	8	9	10
111	arranged	0	1	2	3	4	5	6	7	8	9	10
112	moist	0	1	2	3	4	5	6	7	8	9	10
113	abandoned	0	1	2	3	4	5	6	7	8	9	10
114	beans	0	1	2	3	4	5	6	7	8	9	10
115	outlined	0	1	2	3	4	5	6	7	8	9	10
116	manual	0	1	2	3	4	5	6	7	8	9	10
117	mad	0	1	2	3	4	5	6	7	8	9	10
118	worthless	0	1	2	3	4	5	6	7	8	9	10
119	blood	0	1	2	3	4	5	6	7	8	9	10
120	fertile	0	1	2	3	4	5	6	7	8	9	10
121	scrap	0	1	2	3	4	5	6	7	8	9	10
122	jeered	0	1	2	3	4	5	6	7	8	9	10
123	hurt	0	1	2	3	4	5	6	7	8	9	10
124	insulted	0	1	2	3	4	5	6	7	8	9	10
125	dry	0	1	2	3	4	5	6	7	8	9	10
126	pain	0	1	2	3	4	5	6	7	8	9	10
127	nature	0	1	2	3	4	5	6	7	8	9	10
128	restrain	0	1	2	3	4	5	6	7	8	9	10
129	leafy	0	1	2	3	4	5	6	7	8	9	10
130	stupid	0	1	2	3	4	5	6	7	8	9	10
131	recorded	0	1	2	3	4	5	6	7	8	9	10
132	ridiculed	0	1	2	3	4	5	6	7	8	9	10
133	criticised	0	1	2	3	4	5	6	7	8	9	10
134	mocked	0	1	2	3	4	5	6	7	8	9	10
135	thighs	0	1	2	3	4	5	6	7	8	9	10
136	wounded	0	1	2	3	4	5	6	7	8	9	10
137	waist	0	1	2	3	4	5	6	7	8	9	10
138	organised	0	1	2	3	4	5	6	7	8	9	10
139	lavender	0	1	2	3	4	5	6	7	8	9	10
140	adhesive	0	1	2	3	4	5	6	7	8	9	10

Appendix 5: Homogeneity Questionnaire

Please rate how related you think the following groups of words are:

1. cakes, chips, cream, sweets, chocolate, bread

not at all related						strongly related
0	1	2	3	4	5	

2. apple, beans, carrot, celery, lettuce, spinach

not at all related						strongly related
0	1	2	3	4	5	

3. shelf, desks, lamps, tables, ornaments, lounge

not at all related						strongly related
0	1	2	3	4	5	

4.hips, shape, thighs, waist, figure, stomach, buttocks

not at all related						strongly related
0	1	2	3	4	5	

5. lawn, trees, shrubs, roses, garden, grounds, lavender

not at all related						strongly related
0	1	2	3	4	5	

6. habit, style, outlook, trait, nature, feature, aptitude

not at all related						strongly related
0	1	2	3	4	5	

7. large, bulky, fat, stocky, chubby, plump, massive

not at all related						strongly related
0	1	2	3	4	5	

**8. moist, leafy, dry, floral, herbal, mossy, fertile**

not at all related                      strongly related

0            1            2            3            4            5

**9. angry, irate, mad, horrid, vulgar, nasty, hateful**

not at all related                      strongly related

0            1            2            3            4            5

**10. alone, lonely, isolated, rejected, helpless, deprived, abandoned, friendless**

not at all related                      strongly related

0            1            2            3            4            5

**11. scrap, listed, answered, recorded, computed, outlined, accounted, catalogued**

not at all related                      strongly related

0                      1                      2                      3                      4                      5

**12. blocked, restrain, deterred, powerless, dependent, restricted, controlled, manipulated**

not at all related                      strongly related

0            1            2            3            4            5

**13. pinned, arranged, drafting, scheduled, organised, negotiable, calculated, perforated**

n not at all related                      strongly related

0                  1                  2                  3                  4                  5

|                  |                  |                  |                  |                  |

**14. pain, kill, hurt, blood, agony, maimed, wounded, collapse,**

not at all related                      strongly related

0          1          2          3          4          5

|-----|-----|-----|-----|-----|

**15. file, tape, tray, paper, diary, erased, laminate**

not at all related                      strongly  
related

0          1          2          3          4          5

|         |         |         |         |         |



**16. mocked, jeered, derided, insulted, sniggered, ridiculed, criticised, humiliated**

not at all related                      strongly related

0            1            2            3            4            5

**17. manual, carbon, stapled, refilled, productive, duplicate, summarised, illustrated**

not at all related                      strongly related

0            1            2            3            4            5

**18. bad, ugly, stupid, failure, inferior, defeated, worthless, inadequate**

not at all related                      strongly related

0                  1                  2                  3                  4                  5

19. cut, copy, locked , project, adhesive, expanded, delegated, documented

not at all related                      strongly related

0            1            2            3            4            5

## Appendix 6: Information Sheet

### Thinking processes and eating patterns

Mr Peter Ball  
Head of Department  
Psychology Department

Dr. Elaine Hart  
Lecturer  
Psychology Department

Belinda Read  
Masters Student  
Psychology Department

The purpose of this study is to investigate the relationship between thinking processes and eating patterns. The project is being undertaken as part of the requirements for a masters degree in clinical psychology.

Participants will not be placed at any risk during the procedure. All information will be kept confidential, and participants will have an opportunity to ask questions prior to, during and on completion of the experiment.

Participants may withdraw from the experiment at any time without penalty or prejudice. The study has received ethical approval from the University Ethics Committee (Human Experimentation).

#### Procedure:

1. Participants will be required to answer questions regarding their eating habits and general psychological well being.
2. Participants will complete some computer administered reaction time tasks. These tasks will require participants to respond to a list of words presented on the screen.
3. Participants will be required to complete a series of self report measures concerning: anxiety, depression, self esteem, and eating patterns.
4. The procedure should take approximately 90 minutes
5. Participants will be debriefed fully and given an opportunity to ask any questions about the experiment.

For more information subjects should contact Mr Peter Ball (pH. 6226 7462), Dr Elaine Hart (pH.6226 2936) or Belinda Read (pH. 6226 2807)

If subjects have any concerns of an ethical nature or complaints about the manner in which the project is conducted, they may contact the Chair or Executive Officer of the University Ethics Committee (Human Experimentation). The Chair is Dr Margaret Otlowski, (03) 62 267569 and the Executive Officer is Ms Chris Hooper, (03) 62 262763.

Participants may also discuss any concerns confidentially with a University Student Counsellor.

All participants will be debriefed on completion of the experiment or on withdrawal, and may ask to see their results on the experimental tasks if they wish.

Participants will be given a copy of this information sheet and consent form to retain.

## Appendix 7: Consent Form

### THE STATEMENT OF INFORMED CONSENT FOR RESEARCH PURPOSES

#### Thinking processes and eating patterns

##### Participant

I have read and understood the 'Information Sheet' for this study. I understand the nature and possible effects of the study. I understand that the study involves answering questions, completing computer administered reaction time tasks and completing self report questionnaires. I understand that all research data will be treated as confidential. Any questions that I have asked have been answered to my satisfaction. I agree to participate in this investigation and understand that I may withdraw at any time without prejudice. I agree that research data gathered for the study may be published provided that I cannot be identified as a participant

Name of subject .....

Signature of subject ..... Date .....

---

I have explained this project and the implications of participation in it to this volunteer and I believe that the consent is informed and that he/she understands the implications of participation.

Name of investigator .....

Signature of investigator ..... Date .....

---

## Appendix 8: Raw Data Experiment 1

No	group	socio- T	socioC	auto T	auto C	phy-T	phy-C
1	1	604.00	558.00	603.00	575.50	603.00	604.00
2	1	601.00	706.00	602.00	657.00	767.00	712.00
3	1	775.00	805.00	752.00	801.50	864.50	861.00
4	1	822.00	877.00	822.00	932.00	877.00	821.00
5	1	657.00	712.00	657.00	821.00	657.00	877.00
6	1	972.00	972.00	860.00	971.50	973.00	807.50
7	1	766.00	767.00	822.00	712.00	794.00	689.00
8	1	641.50	697.00	643.00	614.00	697.00	642.00
9	1	766.00	738.00	656.50	875.00	711.00	767.00
10	1	580.50	586.00	587.00	532.00	532.00	533.00
11	1	600.50	602.00	655.50	602.00	600.50	655.00
12	1	658.00	767.00	712.00	711.00	711.50	712.00
13	1	657.00	655.00	657.00	655.00	655.00	655.00
14	1	656.00	710.50	656.50	711.00	712.00	657.00
15	1	547.00	547.00	602.00	819.50	712.00	822.00
16	1	765.00	601.00	818.50	819.00	710.00	876.00
17	2	819.00	711.00	710.00	684.50	792.50	711.00
18	2	766.00	712.00	712.00	657.00	767.00	711.00
19	2	822.00	739.00	712.00	767.00	767.00	712.00
20	2	532.00	532.00	581.00	533.00	587.00	587.00
21	2	711.00	712.00	681.00	712.00	712.00	822.00
22	2	793.50	767.00	820.00	930.00	820.00	712.00
23	2	712.00	712.00	767.00	657.00	764.00	712.00
24	2	860.00	751.00	916.00	910.00	861.00	887.50
25	2	602.00	547.00	546.00	546.00	547.00	547.00
26	2	875.00	875.50	875.00	822.00	820.00	820.00
27	2	549.00	548.00	548.00	548.00	658.00	548.00
28	2	696.00	696.00	751.50	692.00	862.00	697.00
29	2	655.00	655.00	767.00	602.00	656.00	703.00
30	3	641.00	587.00	641.00	641.50	641.00	587.00
31	3	534.00	533.00	533.00	557.50	644.00	534.00
32	3	642.00	643.00	695.00	586.00	588.00	697.00
33	3	643.00	588.00	698.00	587.50	589.00	643.00
34	3	696.00	691.00	697.00	642.00	697.00	642.00
35	3	805.00	696.00	696.00	695.00	751.00	808.00
36	3	475.50	532.00	531.00	477.00	478.00	477.00
37	3	656.50	655.50	657.00	712.00	761.00	602.00
38	3	546.00	545.00	655.00	547.00	546.00	547.00
39	3	532.00	532.00	586.00	531.00	532.00	583.00
40	3	573.50	602.00	547.00	655.00	602.00	602.00
41	3	600.00	601.50	657.00	600.50	655.50	601.00
42	3	710.00	712.00	710.00	711.00	658.00	767.00
43	3	600.00	602.00	602.00	601.00	602.00	602.00
44	3	657.00	656.00	601.00	602.00	656.00	656.00
45	4	875.00	710.00	767.00	712.00	877.00	765.00
46	4	655.00	655.00	656.00	655.00	602.00	657.00
47	4	710.00	657.00	710.00	656.00	765.00	657.50
48	4	711.00	601.50	657.00	602.00	655.00	602.00
49	4	657.00	712.00	822.00	683.50	822.00	765.00
50	4	555.00	531.00	587.00	530.50	587.00	480.50
51	4	602.00	595.50	600.00	601.50	547.00	547.00
52	4	655.00	602.00	602.00	599.00	656.00	602.00
53	4	820.00	767.00	710.00	765.00	765.00	767.00
54	4	602.00	602.00	655.00	603.00	602.50	766.00
55	4	602.00	546.00	600.00	546.00	656.00	655.00
56	4	640.50	642.00	696.00	668.50	807.00	751.00
57	4	587.00	532.00	586.50	532.00	587.00	640.00
58	4	547.00	655.00	600.00	600.00	547.00	652.00

egoo-T	548.00	603.00	603.00	603.00	17.50	93.00	95.00	nc SC	92.00
egoo-C	602.00	657.00	602.00	602.00	-214.50	94.00	96.00	95.00	88.00
egoo-T	805.00	862.00	917.50	862.00	-77.50	94.00	96.00	95.00	91.00
egoo-T	822.00	877.00	877.00	822.00	-109.00	96.00	95.00	95.00	96.00
egoo-T	916.00	862.00	777.00	971.50	-86.50	94.00	92.00	95.00	95.00
egoo-T	711.00	716.00	767.00	767.00	209.00	91.00	91.00	95.00	91.00
egoo-T	643.00	641.00	637.00	642.00	25.50	92.00	95.00	95.00	89.00
egoo-T	712.00	712.00	765.00	712.00	-193.50	93.00	92.00	95.00	88.00
egoo-T	638.00	532.00	586.00	558.50	182.00	94.00	96.00	96.00	92.00
egoo-T	600.50	602.00	655.00	655.00	-4.00	92.00	90.00	90.00	90.00
egoo-T	657.00	657.00	657.00	657.00	-108.50	95.00	96.00	96.00	94.00
egoo-T	656.00	657.00	656.50	602.00	57.50	93.00	94.00	94.00	94.00
egoo-T	656.00	656.00	658.00	656.00	-52.00	94.00	92.00	92.00	92.00
egoo-T	51.00	65.00	59.00	85.00	-367.50	44.00	94.00	94.00	88.00
egoo-T	820.00	710.00	765.00	657.00	215.50	95.00	92.00	92.00	94.00
egoo-T	821.00	764.00	822.00	656.00	438.00	96.00	94.00	94.00	92.00
egoo-T	766.00	710.00	764.00	710.00	275.00	95.00	95.00	95.00	87.00
egoo-T	711.00	712.00	711.00	767.00	26.00	95.00	94.00	94.00	92.00
egoo-T	558.50	585.00	532.00	586.00	-32.50	94.00	92.00	92.00	95.00
egoo-T	712.00	712.00	821.00	767.00	-88.00	95.00	96.00	96.00	94.00
egoo-T	711.00	820.00	710.00	683.00	-57.50	88.00	93.00	93.00	91.00
egoo-T	767.00	712.00	657.00	712.00	162.00	95.00	94.00	94.00	95.00
egoo-T	861.00	807.00	862.00	807.00	197.50	91.00	94.00	94.00	96.00
egoo-T	546.50	547.00	547.00	547.00	54.50	91.00	93.00	93.00	92.00
egoo-T	929.00	822.00	820.50	822.00	158.00	88.00	88.00	88.00	86.00
egoo-T	549.00	603.00	658.00	548.00	167.00	93.00	94.00	94.00	94.00
egoo-T	697.00	696.00	696.50	747.00	175.00	95.00	94.00	94.00	96.00
egoo-T	710.00	657.00	711.00	711.00	171.00	91.00	94.00	94.00	95.00
egoo-T	587.00	532.00	586.00	586.00	162.50	94.00	94.00	94.00	92.00
egoo-T	534.00	640.00	587.00	533.00	141.50	91.00	95.00	95.00	93.00
egoo-T	666.50	636.00	642.50	639.00	22.50	88.00	92.00	92.00	95.00
egoo-T	752.00	696.00	696.00	695.00	231.00	93.00	93.00	93.00	96.00
egoo-T	751.50	696.00	970.00	642.00	546.00	95.00	90.00	90.00	92.00
egoo-T	526.00	530.50	531.00	477.00	48.00	90.00	90.00	90.00	86.00
egoo-T	711.00	710.00	766.00	712.00	160.00	92.00	90.00	90.00	95.00
egoo-T	600.00	546.50	547.00	602.00	106.50	93.00	95.00	95.00	96.00
egoo-T	531.00	532.00	532.00	532.50	2.50	93.00	91.00	91.00	89.00
egoo-T	600.00	600.00	710.50	655.50	-81.50	92.00	91.00	91.00	90.00
egoo-T	602.00	601.00	601.00	655.00	56.50	93.00	92.00	92.00	92.00
egoo-T	679.50	600.50	712.00	710.50	-143.00	93.00	91.00	91.00	90.00
egoo-T	655.00	600.50	656.00	655.00	54.50	91.00	92.00	92.00	92.00
egoo-T	655.00	602.00	601.00	602.00	52.00	95.00	96.00	96.00	95.00
egoo-T	820.00	986.00	766.50	820.00	112.50	95.00	96.00	96.00	96.00
egoo-T	656.50	710.00	602.00	657.00	-162.50	95.00	93.00	93.00	95.00
egoo-T	660.00	712.00	657.00	657.00	162.50	93.00	93.00	93.00	88.00
egoo-T	602.00	547.00	655.00	602.00	325.50	93.00	90.00	90.00	93.00
egoo-T	820.00	876.00	822.00	767.00	139.50	95.00	93.00	93.00	95.00
egoo-T	532.00	532.00	532.00	532.00	187.00	92.00	89.00	89.00	92.00
egoo-T	600.00	547.00	600.00	601.00	57.00	95.00	92.00	92.00	95.00
egoo-T	602.00	602.00	547.50	602.00	55.50	89.00	94.00	94.00	95.00
egoo-T	766.50	767.00	767.00	766.00	-3.50	95.00	95.00	95.00	95.00
egoo-T	602.00	547.00	711.50	602.00	53.00	91.00	93.00	93.00	94.00
egoo-T	549.50	600.00	656.00	600.50	116.00	95.00	92.00	92.00	94.00
egoo-T	697.50	695.00	587.50	696.00	140.50	92.00	90.00	90.00	95.00
egoo-T	586.00	586.00	585.00	585.00	59.00	91.00	93.00	93.00	86.00
egoo-T	600.50	601.00	600.00	601.00	-214.50	91.00	92.00	92.00	88.00



intmdaut	intmdphy	intmddegoo	intmddegos	ncc	ttnc	overall T	overallIC
27.50	-1.00	0.00	0.00	473.00	467.00	592.20	588.70
-55.00	55.00	55.00	-54.50	475.00	475.00	634.80	677.70
-49.50	3.50	-55.50	55.50	466.00	451.00	822.80	838.30
-110.00	56.00	0.00	55.00	467.00	478.00	844.00	865.80
-164.00	-220.00	-136.50	26.50	476.00	477.00	673.30	744.80
-111.50	165.50	85.00	-194.50	468.00	469.00	899.60	916.90
110.00	105.00	-51.00	0.00	454.00	454.00	772.00	730.20
29.00	55.00	4.00	-5.00	468.00	464.00	652.30	647.20
-218.50	-56.00	-53.00	53.00	465.00	448.00	722.10	760.80
55.00	-1.00	-54.00	27.50	464.00	467.00	584.70	548.30
53.50	-54.50	-53.00	0.00	458.00	458.00	622.40	623.20
1.00	-0.50	0.00	0.00	463.00	473.00	679.10	700.80
2.00	0.00	0.50	54.50	473.00	469.00	656.30	644.80
-54.50	55.00	-2.00	2.00	433.00	463.00	667.70	678.10
						394.20	467.70
-0.50	-166.00	-55.00	108.00	469.00	471.00	775.70	732.60
25.50	81.50	-58.00	166.00	433.00	468.00	792.90	705.30
55.00	56.00	-54.00	54.00	467.00	468.00	755.00	700.00
-55.00	55.00	1.00	-56.00	465.00	466.00	744.60	739.40
48.00	0.00	53.00	-54.00	465.00	472.00	558.10	564.60
-31.00	-110.00	-109.00	54.00	480.00	473.00	727.40	745.00
-110.00	108.00	110.00	27.00	453.00	457.00	770.90	782.40
110.00	52.00	55.00	-55.00	469.00	475.00	733.40	701.00
6.00	-26.50	-55.00	55.00	473.00	468.00	872.00	832.50
0.00	0.00	0.00	0.00	459.00	459.00	557.70	546.80
53.00	0.00	1.50	-1.50	442.00	434.00	863.90	832.30
0.00	110.00	-55.00	110.00	468.00	473.00	592.40	559.00
59.50	165.00	-0.50	-50.50	476.00	472.00	740.60	705.60
165.00	-47.00	-54.00	0.00	469.00	463.00	699.80	665.60
-0.50	54.00	-54.00	0.00	465.00	467.00	619.20	586.70
-24.50	110.00	-54.00	54.00	466.00	462.00	566.40	538.10
109.00	-109.00	0.00	-3.00	451.00	451.00	646.30	641.80
110.50	-54.00	-6.50	3.50	463.00	470.00	664.90	618.70
55.00	55.00	0.00	1.00	446.00	458.00	707.50	673.20
1.00	-57.00	-328.00	328.00	464.00	470.00	805.80	696.60
54.00	1.00	-0.50	54.00	445.00	436.00	508.30	498.70
-55.00	159.00	-56.00	54.00	458.00	464.00	710.30	678.30
108.00	-1.00	-0.50	-55.00	473.00	476.00	578.80	557.50
55.00	-51.00	0.00	-0.50	461.00	457.00	542.60	542.10
-108.00	0.00	-110.50	55.00	442.00	453.00	606.60	622.90
56.50	54.50	0.00	-54.00	460.00	459.00	623.10	611.80
-1.00	-109.00	0.00	1.50	452.00	459.00	693.90	722.50
1.00	0.00	-55.50	1.00	450.00	449.00	623.00	612.10
-1.00	0.00	1.00	-1.00	471.00	469.00	634.00	623.60
55.00	112.00	219.50	-53.50	477.00	474.00	821.10	798.60
1.00	-55.00	108.00	-55.00	468.00	473.00	634.30	666.80
54.00	107.50	55.00	0.00	465.00	457.00	700.40	667.90
55.00	53.00	-108.00	53.00	459.00	465.00	656.00	590.90
138.50	57.00	54.00	55.00	472.00	475.00	788.60	760.70
56.50	106.50	0.00	0.00	457.00	459.00	558.60	521.20
-1.50	0.00	-53.00	-1.00	461.00	463.00	589.80	578.40
3.00	54.00	54.50	-54.50	469.00	465.00	612.50	601.40
-55.00	-2.00	0.00	1.00	461.00	468.00	765.70	766.40
52.00	-163.50	-164.50	109.50	462.00	466.00	634.60	624.00
54.00	1.00	-56.00	55.50	459.00	471.00	612.70	589.50
27.50	56.00	-57.00	56.00	446.00	462.00	718.60	690.50
54.50	-53.00	-1.50	2.50	450.00	448.00	586.80	575.00
0.00	-105.00	1.00	-1.00	468.00	459.00	578.90	621.80

## Appendix 8: Raw Data Experiment 2

No	GROUP	UMD	HMD	CMD	ACU	ACH
1	1	628.50	601.50	602.00	92	92
2	1	604.00	549.00	549.00	92	93
3	1	657.00	657.00	657.00	92	93
4	1	602.00	602.00	547.00	95	94
5	1	802.00	801.50	697.00	93	92
6	1	738.50	656.00	600.00	94	96
8	1	656.50	602.00	602.00	96	96
9	1	822.00	656.00	712.00	93	91
10	1	860.00	916.00	917.00	93	96
11	1	587.00	588.00	588.00	93	92
12	1	903.50	819.50	657.00	86	90
13	1	547.00	602.00	547.00	50	85
15	1	532.00	533.00	477.00	93	96
16	1	656.00	602.00	657.00	95	95
17	2	655.00	655.00	601.00	88	95
19	2	767.00	712.00	657.00	94	92
20	2	531.00	532.00	531.00	94	96
21	2	602.00	602.00	657.00	94	96
22	2	657.00	655.00	628.50	93	89
23	2	711.00	767.00	710.00	95	91
24	2	712.00	602.00	602.00	93	96
25	2	910.00	862.00	862.00	95	96
26	2	875.00	822.00	821.00	91	92
27	2	547.00	492.00	492.00	92	87
28	2	599.50	548.00	548.00	92	92
29	2	643.00	643.00	642.00	94	94
30	3	558.00	528.00	533.50	92	94
31	3	641.00	641.00	587.00	94	84
32	3	545.00	516.00	547.00	88	90
33	3	532.00	532.00	533.00	94	92
34	3	588.00	589.00	534.00	93	95
35	3	642.00	696.00	695.00	92	93
36	3	669.00	696.00	693.00	88	89
37	3	530.50	477.00	477.00	86	87
38	3	602.00	655.00	656.00	90	93
39	3	534.00	532.00	532.00	92	94
40	3	545.00	546.00	492.00	94	95
41	3	601.00	602.00	600.00	91	90
42	3	601.00	601.00	548.00	87	90
43	3	766.50	766.00	657.00	88	90
44	3	547.00	600.00	547.00	92	95
45	4	656.00	601.00	624.00	93	95
46	4	643.00	696.00	642.00	92	93
47	4	601.00	600.00	601.00	93	88
48	4	547.00	546.50	601.50	89	92
49	4	600.00	543.50	547.00	94	92
50	4	710.00	765.00	765.00	94	94
51	4	655.00	656.00	656.00	94	95
52	4	547.00	656.50	547.00	90	92
53	4	477.00	501.50	477.00	92	94
54	4	478.00	477.00	478.00	88	92
55	4	642.00	697.00	642.00	95	95
56	4	545.00	547.00	546.00	92	92
57	4	547.00	545.00	547.00	92	93
58	4	710.00	766.00	655.00	94	92
59	4	545.00	546.50	544.00	92	96



ACC	INTMDUH	INTMDUC	INTMDHC
94	27.00	26.50	-0.50
94	55.00	55.00	0.00
95	0.00	0.00	0.00
95	0.00	55.00	55.00
93	0.50	105.00	104.50
93	82.50	138.50	56.00
96	54.50	54.50	0.00
91	166.00	110.00	-56.00
94	-56.00	-57.00	-1.00
92	-1.00	-1.00	0.00
94	84.00	246.50	162.50
85	-55.00	0.00	55.00
91	-1.00	55.00	56.00
96	54.00	-1.00	-55.00
95	0.00	54.00	54.00
95	55.00	110.00	55.00
95	-1.00	0.00	1.00
95	0.00	-55.00	-55.00
92	2.00	28.50	26.50
89	-56.00	1.00	57.00
93	110.00	110.00	0.00
96	48.00	48.00	0.00
93	53.00	54.00	1.00
90	55.00	55.00	0.00
92	51.50	51.50	0.00
95	0.00	1.00	1.00
92	30.00	24.50	-5.50
86	0.00	54.00	54.00
89	29.00	-2.00	-31.00
91	0.00	-1.00	-1.00
95	-1.00	54.00	55.00
95	-54.00	53.00	1.00
92	-27.00	-24.00	3.00
85	53.50	53.50	0.00
94	-53.00	-54.00	-1.00
93	2.00	2.00	0.00
93	-1.00	53.00	54.00
92	-1.00	1.00	2.00
93	0.00	53.00	53.00
92	0.50	109.50	109.00
94	-53.00	0.00	53.00
96	55.00	32.00	-23.00
92	-53.00	1.00	54.00
89	1.00	0.00	-1.00
88	0.50	-54.50	-55.00
91	56.50	53.00	-3.50
96	-55.00	-55.00	0.00
95	-1.00	-1.00	0.00
93	-109.50	0.00	109.50
90	-24.50	0.00	24.50
92	1.00	0.00	-1.00
90	-55.00	0.00	55.00
90	-2.00	-1.00	1.00
92	2.00	0.00	-2.00
95	-56.00	55.00	111.00
95	-1.50	1.00	2.50

## Appendix 8: Raw Data Experiment 3

No	Group	MdBN	MdGN	MdPN	Mdbadj	Mdgadj	Mdpadj	%c bn	%c gn
1	1	655.00	655.00	602.00	710.00	602.00	655.00	97.96	92.86
2	1	548.00	549.00	548.00	604.00	549.00	548.00	95.92	95.92
3	1	710.00	657.00	657.00	657.00	656.00	657.00	100.00	98.98
4	1	577.00	602.00	598.50	602.00	602.00	547.00	100.00	100.00
5	1	753.00	752.00	750.00	806.00	753.00	696.00	95.92	97.96
6	1	710.00	601.00	710.50	600.00	601.00	707.50	97.96	96.94
7	1	822.00	767.00	822.00	822.00	877.00	904.00	97.96	98.98
8	1	656.00	602.00	656.00	656.00	602.00	547.00	100.00	98.98
9	1	712.00	712.00	713.00	712.00	684.50	767.00	96.94	96.94
10	1	701.00	806.00	861.00	806.00	751.00	968.00	96.94	98.98
11	1	587.00	588.00	532.00	590.00	587.00	532.00	94.90	95.92
12	1	820.00	767.00	877.00	903.50	873.00	767.00	94.90	94.90
13	1	547.00	547.00	602.00	602.00	547.00	547.00	63.27	85.71
14	1	600.00	493.00	657.00	601.00	600.50	600.50	96.94	94.90
15	1	477.00	477.00	477.00	477.00	478.00	477.00	94.90	98.98
16	1	601.50	602.00	602.00	602.00	601.00	602.00	95.92	93.88
17	2	656.00	655.50	602.00	656.50	601.00	656.50	96.94	95.92
18	2	712.00	711.00	765.00	710.00	711.00	704.00	94.90	95.92
19	2	712.00	767.00	739.00	712.00	712.00	712.00	98.98	97.96
20	2	533.00	532.00	532.00	586.50	532.00	532.00	96.94	96.94
21	2	657.00	657.00	657.00	657.00	657.00	657.00	100.00	100.00
22	2	574.50	657.00	656.00	651.00	657.00	602.00	95.92	94.90
23	2	711.00	712.00	711.00	764.50	712.00	767.00	97.96	95.92
24	2	657.00	602.00	657.00	684.00	547.00	712.00	95.92	97.96
25	2	916.00	861.00	860.00	806.50	861.00	808.00	98.98	97.96
26	2	767.00	820.00	766.50	822.00	767.00	767.00	93.88	92.86
27	2	547.00	547.00	547.00	547.00	492.00	492.00	94.90	96.94
28	2	596.00	604.00	549.00	549.00	548.00	494.00	95.92	94.90
29	2	696.00	696.00	696.00	697.00	695.00	696.00	96.94	95.92
30	3	533.00	533.00	533.00	479.00	533.00	532.00	94.90	94.90
31	3	611.50	588.00	641.00	643.00	586.00	643.00	89.80	91.84
32	3	545.00	547.00	602.00	491.00	547.00	600.00	92.86	91.84
33	3	531.00	477.00	533.00	585.50	477.00	532.00	97.96	93.88
34	3	587.00	589.00	587.00	534.00	588.00	582.00	98.98	98.98
35	3	806.00	751.00	751.50	697.00	697.00	696.00	97.96	97.96
36	3	642.00	689.00	588.00	697.00	696.00	642.00	94.90	94.90
37	3	475.50	477.00	423.00	476.00	532.50	478.00	87.76	91.84
38	3	657.00	601.00	656.00	656.00	602.50	600.00	98.98	96.94
39	3	530.50	532.00	523.50	586.00	530.00	530.50	97.96	96.94
40	3	492.00	547.00	545.00	601.00	544.00	544.00	98.98	96.94
41	3	598.50	602.00	601.00	600.00	549.50	600.00	93.88	91.84
42	3	627.00	602.00	547.00	602.00	600.00	601.00	89.80	95.92
43	3	765.00	710.00	766.00	657.00	710.00	657.00	90.82	91.84
44	3	656.00	547.00	602.00	601.00	547.00	600.00	93.88	95.92
45	4	654.00	602.00	601.00	657.00	602.00	599.00	98.98	98.98
46	4	642.00	587.00	697.00	643.00	641.00	641.00	96.94	96.94
47	4	657.00	657.00	656.00	710.00	602.00	602.00	92.86	92.86
48	4	548.00	603.00	603.00	500.00	603.50	548.00	52.04	48.98
49	4	576.50	600.00	546.00	547.00	547.00	600.00	95.92	94.90
50	4	712.00	708.00	710.00	712.00	656.00	657.50	98.98	100.00
51	4	656.50	709.00	657.00	767.00	710.50	657.00	97.96	94.90
52	4	546.00	547.00	600.00	574.00	546.00	545.50	96.94	94.90
53	4	531.00	532.00	532.00	532.00	531.00	531.00	95.92	95.92
54	4	531.00	477.50	531.50	477.00	530.00	478.00	100.00	95.92
55	4	642.00	643.00	697.00	744.00	696.00	698.00	97.96	98.98
56	4	545.00	492.00	545.00	546.00	491.00	545.00	96.94	96.94
57	4	545.50	601.00	547.50	601.00	600.00	600.00	97.96	98.98
58	4	710.50	712.00	712.00	766.00	765.00	657.00	97.96	98.98
59	4	601.00	546.00	603.00	493.50	548.00	493.00	98.98	92.86



## Appendix 8: Raw Data Emotionality Ratings Experiments 1, 2 and 3

Group	H	UH	C	SE soc-T	soc-C	aut-T	aut-C
2	0.00	0.00	0.00	9.13	0.00	2.13	0.00
2	5.50	0.83	4.00	2.13	3.13	4.25	4.13
1	9.50	1.00	5.00	1.00	4.88	3.00	5.13
1	5.00	4.00	5.00	1.88	5.13	3.88	5.00
1	5.00	5.00	5.00	0.00	4.38	0.75	3.75
2	6.00	5.17	5.00	1.63	5.00	1.75	5.38
2	6.67	6.67	7.50	4.25	7.25	5.00	7.13
2	3.83	0.00	5.00	0.38	5.00	1.88	3.63
1	5.33	3.33	5.00	4.25	6.13	3.88	5.63
1	2.83	5.00	0.00	0.50	0.50	0.25	0.00
2	5.00	5.83	5.67	1.75	4.75	0.63	5.00
2	10.00	5.33	6.17	4.38	5.50	3.50	5.00
1	5.00	5.00	5.00	3.25	5.50	5.25	5.00
1	5.00	4.67	5.00	4.63	5.00	5.00	5.00
1	7.67	4.00	5.50	2.00	4.75	3.38	4.63
1	5.83	5.33	5.00	4.63	5.00	4.63	5.00
3	4.33	4.83	5.33	2.25	5.00	3.63	5.00
3	5.00	5.50	5.00	6.13	5.00	5.00	5.00
3	5.17	3.83	5.83	2.50	5.38	4.00	5.00
3	5.33	4.33	4.83	2.75	5.00	2.13	4.63
2	10.00	6.50	5.00	0.88	4.88	2.00	5.25
2	5.00	5.83	5.00	1.88	5.00	2.00	5.25
2	5.00	5.00	5.00	3.25	5.00	3.38	5.00
1	4.67	2.33	5.00	1.25	4.75	1.75	4.63
2	5.83	4.83	5.00	3.13	5.00	4.00	5.00
2	5.00	5.00	5.00	1.00	5.00	3.00	5.63
3	5.50	5.67	5.17	3.38	5.00	3.38	4.88
3	5.33	5.00	5.00	3.75	5.00	3.88	5.25
3	5.67	5.00	4.17	1.00	5.00	2.25	5.00
3	5.83	6.33	5.00	2.75	5.00	3.88	4.75
4	5.00	5.83	5.50	1.38	5.38	4.13	6.00
4	5.00	5.50	5.00	2.75	5.00	3.75	5.00
4	4.50	4.67	2.17	0.88	2.88	1.75	3.25
4	7.00	7.33	5.00	2.25	4.13	3.13	3.75
4	5.00	4.50	4.33	2.25	2.50	3.25	3.00
4	5.00	5.00	5.00	5.50	4.88	5.00	5.13
4	5.83	6.17	5.00	4.50	5.00	3.38	5.38
4	5.50	5.33	4.67	4.00	4.88	4.13	4.63
4	5.33	5.17	5.00	4.75	5.00	4.88	5.13
3	5.00	5.00	5.00	0.50	5.00	3.00	4.88
3	5.00	5.00	5.00	2.38	5.00	3.50	5.13
3	7.33	3.00	8.00	3.00	8.00	4.13	7.00
4	3.50	4.50	5.00	3.88	4.88	4.75	5.00
4	5.50	6.17	5.33	1.88	4.50	3.88	4.75
3	5.33	4.33	5.00	3.38	4.00	3.75	4.25
4	6.00	5.83	5.17	2.50	5.00	3.75	5.00
4	5.00	5.00	5.00	2.63	5.00	3.88	5.00
4	5.17	5.33	5.00	2.88	5.00	1.00	5.13
3	5.00	5.67	5.00	2.25	5.00	3.13	5.25
3	5.00	5.00	5.00	4.13	5.00	4.88	5.00
4	5.00	5.00	5.00	3.75	5.00	4.13	5.00
1	5.00	5.00	5.00	2.63	5.00	3.75	5.00
3	5.00	5.00	5.17	1.50	5.25	2.13	4.88
2	5.50	4.33	5.67	4.50	6.00	4.25	5.63



Body- BA	BN	PA	PN	CA	CN
5.43	0.00	2.14	0.00	1.43	7.43
0.57	4.71	0.29	6.57	3.86	1.57
1.00	7.14	1.00	8.71	5.57	1.29
3.14	5.00	3.86	5.00	5.29	3.86
0.00	5.00	0.00	5.00	3.57	0.00
4.86	6.86	5.43	8.57	6.14	1.29
2.57	6.14	2.71	8.86	6.86	3.71
0.00	5.00	0.00	5.00	5.00	0.86
0.14	6.29	0.86	6.00	6.00	3.29
2.14	0.00	6.29	1.71	1.14	0.57
0.71	6.00	1.86	7.00	5.43	3.29
5.00	9.29	5.14	10.00	7.29	3.29
3.57	5.00	4.86	5.00	5.57	3.14
4.29	5.00	5.00	5.00	5.00	4.00
2.71	7.14	3.00	8.71	6.43	2.57
4.86	6.14	4.29	7.86	5.00	4.57
4.14	5.00	4.57	5.00	5.00	3.00
6.14	5.00	5.00	5.00	5.00	6.00
2.43	5.86	2.14	6.57	6.00	1.86
3.00	5.43	3.00	6.43	5.86	2.29
3.14	7.57	4.86	9.00	5.43	1.57
4.43	5.00	4.71	5.29	4.86	3.00
3.57	5.00	5.00	5.29	4.00	2.57
1.86	4.86	2.00	5.00	4.71	1.14
4.57	6.00	5.00	5.71	5.29	4.00
3.71	6.86	5.00	8.57	6.43	0.00
4.29	5.71	5.14	5.86	5.43	2.57
3.29	5.43	4.57	7.00	5.43	3.86
3.14	6.71	5.00	8.00	5.00	1.71
3.57	5.57	4.57	6.71	5.57	1.57
2.86	7.14	4.29	8.57	7.00	0.86
4.57	5.29	4.86	5.57	5.29	3.71
0.57	4.71	3.43	5.14	4.14	0.86
4.43	6.43	6.14	6.57	6.43	2.14
2.57	3.00	3.57	6.00	4.71	1.86
5.00	5.14	5.14	5.14	5.71	4.43
2.43	5.29	4.29	6.29	5.57	2.14
4.43	6.00	5.00	6.29	5.29	3.57
4.71	5.14	4.57	5.14	5.14	5.00
3.14	5.43	5.00	5.29	5.00	1.00
4.57	5.14	5.00	5.00	5.86	3.00
1.71	7.71	1.00	8.29	6.29	3.71
5.00	5.00	4.00	5.00	4.57	4.00
4.14	6.00	4.43	8.14	6.29	2.00
2.00	5.29	3.57	6.29	4.86	3.14
4.86	5.29	5.00	5.29	5.29	2.71
2.57	5.43	5.00	5.00	5.00	1.71
4.86	6.00	4.71	5.71	5.71	4.29
3.00	5.57	4.43	5.71	5.29	2.14
2.86	5.00	2.86	4.57	5.00	4.43
4.43	5.00	5.00	5.00	5.00	4.00
2.57	5.00	4.43	5.00	4.86	2.57
2.86	4.86	4.86	5.43	5.57	1.43
4.71	6.14	5.00	7.00	6.57	4.14

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