IMPLICIT ATTITUDES TOWARDS FOOD AND THE SELF IN SUB-CLINICAL EATING DISORDER PATHOLOGY

Alisa Anokhina

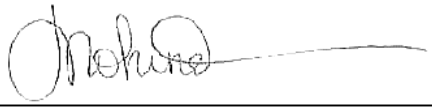
Submitted for the degree of Doctor of Philosophy

Research Department of Clinical, Educational and Health Psychology

University College London

January 2015

I, Alisa Anokhina, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.



Abstract

This thesis focuses on the assessment of implicit cognition in disordered eating behaviour, and specifically on the role of implicit attitudes towards the self and food in sub-clinical levels of eating disorder (ED) pathology. **Chapter I** reviews key theoretical approaches to implicit cognition and an assessment of the properties of implicit attitudes. **Chapter II** discusses methodological approaches to implicit attitude assessment, with a focus on the Implicit Attitude Test (IAT) which was used in the empirical studies. **Chapter III** (Study 1) outlines research in implicit cognition in ED pathology and assesses differences in implicit self-esteem (i.e., implicit attitude towards the self) between high-pathology and low-pathology participants. While the results of the study supported the presence of a self-esteem discrepancy in the high-pathology group, the findings were insufficient to pursue further research in this area. The next three studies were focused on the role implicit food attitudes. **Chapter IV** (Study 2) introduces the hypothesis that implicit food attitudes and ego depletion may play a role in elevated ED pathology. However, the ego depletion procedure used was not successful and the results were therefore insufficient to either support or reject the hypothesis. **Chapter V** (Study 3) assessed similar questions to Study 2, but from the angle of automatic approach and avoidance towards food stimuli and dietary restraint failure. Contrary to expectations, the results suggested that it is unlikely that either ego depletion or a positive implicit attitude towards high-fat foods contributes to dietary restraint failure. **Chapter VI** (Study 4) was designed to clarify the findings of Study 3 and found that implicit food attitudes may change following novel goal activation or changes in behaviour. **Chapter VII** is a general discussion which summarises the findings, discusses the outcomes within the broader context of implicit cognition theories, and proposes directions for further study.

Table of contents

CHAPTER I

Implicit attitudes: concepts and definitions

The human body is a remarkably efficient system. Our homeostatic systems function automatically and require little or no conscious input to operate effectively: we can breathe and digest, heal when we are injured and shiver to warm up when we are cold, all without effort or awareness. Automatic reflexes ensure that we do not spend precious seconds deliberating whether to flee from a predator or remove a hand from a hot frying pan. The human mind, while capable of making complex decisions, also partially relies on automatic shortcuts for efficiency. Heuristics allow us to categorise and make sense of an incredibly information-dense environment (Macrae, Milne, & Bodenhausen, 1994), make choices quickly (Marsh, Todd, & Gigerenzer, 2004) and predict future events (Gigerenzer, 2008). Unfortunately, efficiency comes at a cost: for instance, our tendency to misunderstand statistics, which leads to unrealistic optimism (Armor & Taylor, 2002), or the prejudice which stems from stereotyping (McCauley, Stitt, & Segal, 1980).

Our behaviour towards the objects in our environment is predicated on our attitudes: evaluative judgments of attitudinal objects (Allport, 1935). These evaluations are subjective, introspective, affective and usually constructed on the basis of acquired experience and knowledge (Eiser, 1996). How we feel about something affects our behaviour intentions: positive attitudes tend to elicit approach tendencies while negative attitudes are more likely to result in avoidance (Elliot & Covington, 2001). Of course, this is an oversimplification of reality: how we construct attitudes and how they subsequently affect our behaviour is subject to the

effects of context and motivation (Ajzen & Fishbein, 1977). The cognitive heuristics which allow us to respond efficiently to encountered stimuli also allow us to efficiently retrieve attitudes; the ability to effortlessly carry out evaluations is a processing advantage which allows us to conserve time and energy (Fazio, 2001). This thesis is concerned with the differences between automatic attitude retrieval (implicit attitudes) and effortful (explicit) attitude construction and their effects on cognition and behaviour.

1. Introduction to structure and terminology

The concept of "implicit cognition" is a somewhat controversial one. Different researchers have used different terms, including *associative*, *experiential* and *impulsive*, to describe automatically elicited associative processes. Different theoretical models have also ascribed different properties to these processes, including conscious inaccessibility, uncontrollability and goal-independence. It is important to note that the measurement of implicit attitudes, particularly at this early stage in the research field, is fallible. The specific problems and limitations of implicit attitude measures will be discussed in Chapter II; however, it is worth bearing in mind that while theoretical models tend to make hypotheses on the nature of "implicit attitudes" as an abstract concept, measurement outcomes (or the results of studies) are not the same as the concepts they are designed to measure. For the sake of parsimony it should be assumed that references made in this thesis to "implicit attitudes" in the context of theory pertain to the abstract concept of an implicit attitude. However, when "implicit attitudes" are discussed in the context of experimental data, the term refers to "the outcome of an implicit attitude measure" and cannot be used to make assumptions about the nature of the theoretical concept being assessed.

This chapter will begin by summarising the key theories in the field, from dual-process theories, which conceptualise implicit attitudes as distinct from explicit ones, to integrated models, which argue that cognition exists on an implicit-explicit continuum. Once the key

models have been introduced, empirical evidence supporting the common claims about the nature and properties of implicit attitudes will be evaluated. The chapter will conclude by summarising the literature and drawing conclusions with regards to the definitions and assumptions which will be upheld during the design and analysis of the empirical research carried out over the course of the thesis.

2. Dual-process theories

Dual-process theories posit that cognition can be broadly categorised into "implicit" and "explicit" processes. The terminology varies between models; implicit processes have been variably defined as unconscious, preconscious, automatic, uncontrollable, affective, effortless and/or efficient. Explicit processes have been conceptualised as conscious, rational, resource-dependent, effortful, slow and/or logical. The distinction echoes concepts familiar from literature, poetry and art: the dichotomy between the heart and the mind, the rational and the emotional. The idea that we experience an internal conflict between conscious beliefs and subconscious desires stems from psychodynamic theory (see Hall & Lindzey, 1978), but this dichotomy was not formulated within the approach in a way that would allow for empirical validation (Popper, 1963, Chapter 1).

Psychological research in the mid-twentieth century tended to focus on explaining behaviour from a rational, or at least conscious, standpoint: attitudes were assumed to be, and therefore defined as, a conscious construct (Greenwald, 1990). Direct measures, in which a participant is overtly asked to report their feelings about something, were (and still are) the prevalent method of attitude assessment. This approach requires introspection on the part of the participant, which assumes that people are capable of accurately identifying and reporting their mental states. On first consideration, this assumption seems reasonable: people usually know how they feel (Hixon & Swann, 1993) and we are taught from childhood how to identify and express our emotions ("If you're happy and you know it, clap your hands"). However, self

report measures, which ask a participant's careful and rational opinion of an attitude object, assume that people tend to construct their opinions carefully and rationally, which is not necessarily the case (Zajonc, 1980). Self-report is especially problematic in research concerning ambivalent, ambiguous or sensitive topics. People are simply capable of lying (to both experimenters and themselves); as a result, self-report measures are susceptible to intentional deceit and self-presentation biases such as social desirability (Blair, 2002; Vartanian, Polivy, & Herman, 2004; Vitousek, Daly, & Heiser, 1991).

Despite the accuracy of introspection, people may know *what* they feel they may not necessarily be able to articulate *why* they feel it and what has caused the feeling. Zajonc (1980) noted that the affective response often precipitates the articulation of a rational response: first impressions, for instance, are formed within seconds of stimulus presentation (Berry, 1990). Fiske (1982) proposed that encountering an attitudinal object automatically triggers previous associations in memory; this is considerably more efficient than constructing a new attitude upon each new encounter. However, we may not always accept the triggered association as valid and therefore reject it. This may be the case in, for example, racial prejudice. However, even when we rationally reject an implicit, emotional response in favour of an explicitly-held attitude, the former still has the power to affect our behaviour (Stangor, Sullivan, & Ford, 1991). Try as we may, we are not the calculating, rational creatures we are presumed to be by economic behaviourists (Sen, 1977; Friedman, 1976).

Dual-process theories use a binary classification system to distinguish between the spontaneous, automatic reaction to an attitude object, and the subsequently consciously articulated attitude (Chaiken & Trope, 1999). In this approach, implicit and explicit attitudes are deemed to be distinct responses to the same stimulus. The terms *implicit* and *explicit*, respectively, are used most frequently, although terminology varies depending on the theoretical model. The models also vary somewhat in the specific ways they define each system. Petty and Cacioppo (1986) were among the first to formalise observations about the dichotomy of automatic and conscious attitude formation into a theoretical model. Their model

was focused on attitude change; the processes identified were termed *heuristic* and *systematic*. Heuristic evaluations are made faster than systematic ones and are largely based on a hedonic, emotional reaction to the object. Attitudes arrived at in a systematic way come later as a result of conscious processing of information, but do not need to be rational (in the sense of being logical) as a prerequisite.

Epstein's (1994) dual-process model terms the two systems *experiential* and *rational*. This model draws heavily on psychodynamic principles and each system is defined through 11 contrasting features (e.g., the experiential system is passive and preconscious; the rational system is active and conscious). Smith and DeCoster (2000) use the terms *associative* and *rule-based* processing. Although their model is predominantly concerned with differentiating between memory systems they do outline the mechanisms involved in automatic attitude retrieval, similar to those proposed by Fiske (1982). The associative system quickly and automatically activates previously acquired associations in memory to form an 'intuitive' impression of the target object. The rule-based system deliberately retrieves knowledge stored in memory in order to construct the attitude; its operation is dependent on the availability of cognitive capacity and motivation.

The importance of cognitive resources also features in Strack and Deutsch's (2004) *reflective-impulsive* model. A key difference here is that the two systems are thought to operate in parallel, rather than sequentially. The importance of cognitive resources also features prominently, where the impulsive system comprised of an associative network capable of operation without taxing cognitive resources. The activation of the reflective system, by contrast, requires motivation to use resources and effort to process data. The impulsive system is not limited to affective associations: rather, an attitude object triggers a complex schematic representation in memory which is then made available for conscious analysis as a proposition.

Most dual-process theories assume a certain degree of interaction between the two systems, but still conceptualise them as distinct processes. Correlations between implicit and explicit attitudes tend to be low; mean correlation between the two has been found to be .24 in

one meta-review (Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005). Greenwald and Banaji (1995) have argued that implicit attitudes are inaccessible to conscious introspection, which could account for the lack of correspondence between the two and also supports the approach that the two systems are largely independent. But are they? How do we reconcile our automatic, affective responses to attitudinal constructs with the attitudes we derive from conscious deliberation, especially when they differ? Which of the features ascribed to the implicit system (unconsciousness, automaticity, stability, uncontrollability) are supported by empirical evidence? How do we measure implicit attitudes and how do we reconcile methodological flaws with the theoretical conceptualisation? These questions are essential in the discussion of the dual-process approach to cognition, and the validation of dual-process models.

3. The properties of "implicitness"

Dual-process models are similar from a conceptual standpoint, but the variations in terminology, however slight, are meaningful. As De Houwer (2006) notes, many empirical studies fail to specify which definition of *implicit attitude* they are using. First of all, this complicates the discussion of the findings. Conclusions about empirical results are more difficult to draw if the nature of the cognitive processes involved is unclear. Second, choosing a specific definition has relevance to the selection of appropriate methodology. Different implicit measures are founded on different assumptions about implicit cognition. In this section, the most prevalent assumptions about implicit attitudes will be discussed in terms of their validity in the face of supporting data, compatibility with theoretical approaches and ecological validity.

3.1. ASSUMPTION 1: IMPLICIT ATTITUDES ARE UNAVAILABLE TO CONSCIOUS INTROSPECTION

This definition (e.g., Epstein, 1994; Greenwald & Banaji, 1995; Wilson, Lindsey, & Schooler, 2000; Bosson, Swann, & Pennebaker, 2000; Kihlstrom, 2004) suggests that implicit attitudes are implicit in the sense that people are not aware they hold them. From a methodological point of view, awareness of an implicit attitude is difficult to assess, as it depends on how we define awareness. Gawronski, Hofmann and Wilbur (2006) draw the distinction between source awareness (origin of attitude), content awareness (contents of attitude) and impact awareness (what influence the attitude has on other processes). This section is predominantly concerned with people's implicit attitude content awareness, as this is the definition predominantly used.

There is some evidence to support unconscious "liking", where affective responses to target objects can be primed in participants without conscious awareness but nevertheless affect subsequent behaviour (Berridge & Winkielman, 2003). An example of this is the mere exposure effect, which suggests that we have a tendency to like the familiar more than the unfamiliar. In a study by Monahan, Murphy and Zajonc (2000) participants were repeatedly presented with subliminal stimuli; subsequently, participants rated the previously encountered stimuli more positively even though they had no awareness of having been presented with them.

Schwitzgebel (2008) argues, from a philosophical standpoint, that we are, by and large, terrible at introspection – not only as a consequence of various deliberate and unconscious biases, but also through sheer ineptitude. Some neurobiological data suggests that the mere act of introspection can attenuate emotional arousal (Herwig, Kaffenberger, Jäncke, & Brühl, 2010), which complicates the interpretation of self-report data. Our prospects for accuracy in identifying our own implicit attitudes, it would seem, looks rather bleak.

Low correlations between implicit and explicit attitudes have also been cited as possible support for the assertion that people are not aware of their implicit attitudes (e.g., Phelps et al.,

2000; Banaji, 2001). However, a lack of explicit endorsement does not imply a lack of awareness. For instance, a person may hold unfavourable implicit associations with an ethnic minority, be aware of their bias, but consciously reject it because they believe racial prejudice to be wrong. This is supported by studies which have contrasted people with high and low motivation to control their prejudice: implicit-explicit correlations tend to be lower for highly motivated participants (Hausmann & Ryan, 2004; Hing, Chung-Yan, Hamilton, & Zanna, 2008). Additionally, correlations between implicit and explicit attitudes tend to increase when participants are more inclined (or instructed to) respond on self-report measures in a more intuitive, less deliberative manner (Jordan, Whitfield, & Zeigler-Hill, 2007; Hofmann et al., 2005). This suggests that self-report partially involves analysing initial, intuitive reactions for their truth value – and rejecting them if they are found to be subjectively wrong. This, in turn, suggests that conscious awareness of implicit attitudes is possible at least to some extent.

In the instance of unambiguous, or uncontroversial attitudes, people presumably have very little reason to alter their automatic associations during self-report. Studies within 'known groups', where objects used as stimuli are strongly and uncontroversially valenced, tend to have considerably higher correlations than more ambiguous stimuli (Nosek, 2007). An example of a known group measure is the flower-insect Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998), on which people typically report more positive associations with flowers compared to insects[1]. Most people also report holding similar attitudes explicitly; entomologists notwithstanding. However, the question is: does a high positive correlation denote awareness, or simply a correspondence between the implicit and explicit attitudes?

Several studies have directly asked participants about their experiences with implicit measures. Monteith, Voils and Ashburn-Nardo (2001) asked people about their experiences with the race attitude IAT, where participants completed two trial blocks: in one, faces of white people were paired with positive words and faces of black people were paired with negative

[1] The IAT procedure is discussed in detail in Chapter II (p.48). Figure 1 (p.50) illustrates the procedure.

words; in the other, the pairings were reversed (white with negative, black with positive). Most participants (64%) noticed that they were faster to respond in the white-positive/black-negative pairing, and 37% suggested that this may reflect a more favourable attitude towards white people. In fact, bearing in mind the sensitive nature of the research and the biasing effects of social desirability, it is likely that the figures are underestimated. Still, these findings suggest that people are at least to some extent, aware of the implicit associations they hold and how these might affect performance on implicit measures.

However, it is worth noting that while these findings support introspection *to an extent*, people are also not very good at estimating contextual influences on their performance on implicit measures. Mitchell, Nosek and Banaji (2003) found that participants were not able to correctly predict their implicit attitudes towards black athletes and white politicians on different IATs measuring attitude on the basis of race and occupation. Perhaps this is another example of the extent to which we are blind to our own biases (Pronin, 2007), but regardless of the underlying cause, our introspection seems to be limited.

An experimental approach to assessing awareness of implicit attitude involves measuring implicit and explicit attitudes towards novel, neutral objects. Olson and Fazio (2001) presented participants with images of unfamiliar cartoon characters, paired with either negative or positive stimuli (words and pictures), disguised as a video surveillance task, in a classical conditioning paradigm. Following the task, participants reported a more positive implicit attitude towards characters paired with positive stimuli, compared with characters that were paired with negative stimuli. Participants were also able to articulate the preference on an explicit level, although they were not able to rationalise it and did not remember seeing consistent stimuli pairs during the 'surveillance' task which could account for it. These findings suggest that people can accurately identify their affective, automatic response to target objects (as assessed by the implicit attitude measure), even if they cannot articulate a rational reason for that response.

Together, the evidence suggests that while implicit attitudes appear to be at least partially available to introspection, people are not as accurate at identifying them as explicit attitudes. Gawronski, LeBel and Peters (2007) point out that just because an implicit attitude does not *require* accurate introspection to be valid, it does not follow that implicit attitudes must therefore be unavailable to introspection. In other words, implicit attitudes can be, and are, activated on the periphery of conscious awareness (e.g., the mere exposure effect), but they become available to conscious processing if necessary (e.g., prejudice suppression).

3.2. ASSUMPTION 2: IMPLICIT ATTITUDES ARE MORE STABLE THAN EXPLICIT ATTITUDES

Several approaches to implicit cognition suggest that implicit attitudes are formed over a longer period of time than explicit attitudes and are therefore more stable (Beck, 1976; Wilson et al., 2000; Strack & Deutsch, 2004; Conner & Feldman-Barrett, 2005). In the context of Greenwald and Banaji's (1995) definition of implicit attitudes as introspectively unidentified, implicit associations can be viewed as the non-conscious consequence of the things we have experienced or encountered. One possible hypothesis stemming from this approach is that implicit attitudes would reflect a person's "true" attitude; the net associations a person has accumulated over the course of their lifetime. This approach is supported by the fact that implicit attitudes are measured indirectly and are therefore presumably less susceptible to the effects of self-presentation bias. An alternative hypothesis is that implicit attitudes reflect experience, but are more closely indicative of a person's socialisation experiences as opposed to the attitudes they actually endorse as being subjectively true (Devine, 1989; Dovidio, Kawakami, & Gaertner, 2002; Rudman, 2004). For instance, negative implicit associations with a particular ethnicity could be the consequence of living in a prejudiced society and constant exposure to racist ideas, images and text – rather than the consequence of personal beliefs or behaviour.

In terms of real-life experience, the hypothesis that implicit attitudes are formed over a longer period of time than explicit ones is better applied to more unambiguous attitudes. For instance, the implicit association *cake–good* might form through repeated different instances of eating different cakes and consistently experiencing a pleasant taste as a consequence. By contrast, the hypothesis that implicit attitudes reflect a person's social environment might explain (beyond the biases of self-report) why people who do not consider themselves to be racist still respond in a way that suggests ethnic bias on implicit attitudes measures (Devine, 1989; Stangor et al., 1991; Hausmann & Ryan, 2004). Constant, repeated exposure to images or text in the media which consistently portray black people in a negative light could potentially contribute to the formation of the automatic association *black–bad*. Without an equally salient source of alternative information to counteract the negative exposure in the environment, we would expect ethnic prejudice to be present on an implicit level even in members of the stigmatised group – which has, in fact, been found in cross-population studies (Uhlmann, Dasgupta, Elgueta, Greenwald, & Swanson, 2002). In this context, the negative implicit attitude can be interpreted as a reflection of social or cultural bias, rather than a suppressed "true" racist attitude, as "true" racism would require additional conscious endorsement of such associations. The validity of this hypothesis can be assessed through research in implicit attitude formation.

Findings from operant conditioning paradigms support the hypothesis that implicit attitudes are formed through repeated exposure to an object-response pairing (e.g., *cake–good* or *black–bad*) in close temporal or spatial proximity. Several studies have found that repeatedly pairing target objects with indicators of valence results in implicit attitude change (Olson & Fazio, 2001; Baccus, Baldwin, & Packer, 2004; Dijksterhuis, 2004; Ebert, Steffens, von Stülpnagel, & Jelenec, 2009; Hollands, Prestwich, & Marteau, 2011). Dijksterhuis (2004) found consistent positive changes in participants' implicit self-esteem (effectively, positive implicit associations with the self) following a lexical decision task where the word 'I' was primed before positively-valenced words. Hollands, Prestwich and Marteau (2011) conducted a study where

participants were shown images of high-fat, calorie-dense food followed by aversive body images (or a neutral screen in the control condition). Participants in the aversive condition subsequently reported a more negative implicit attitude towards high-fat food compared to controls, and also were more likely to select fruit as opposed to a high-fat snack at the end of the study. It is possible that this outcome is the result of social bias, as negative attitudes towards obesity are prevalent in Western culture.

It can be argued that these studies demonstrate how implicit attitudes are formed in naturalistic settings; repeated pairing of stimuli eventually becomes automated as an implicitly-accessible heuristic, available to memory retrieval spontaneously and effortlessly. However, these studies also suggest that implicit attitudes respond to conditioning fairly quickly and easily, to the extent where changes can be seen as a result of one experimental session. The claim that implicit attitudes are more stable than explicit attitudes implies that they are more resistant to change. However, the evidence largely does not support this. For instance, Olson and Fazio (2001) found corresponding attitudinal change in both implicit and explicit attitudes as a consequence of their conditioning procedure. Gawronski, Walther and Blank (2005) similarly found that presenting imaginary 'new' colleagues in pair with a known, liked colleague positively affected participants' implicit and explicit attitudes.

Some studies even suggest that implicit attitudes are *more* susceptible to change than explicit ones (Karpinski & Hilton, 2001; Dasgupta & Greenwald, 2001). For instance, Dasgupta and Greenwald (2001) found that it was possible to induce change in participants' implicit attitudes towards white and black people simply through exposure. Participants who saw images of positively-valenced black people (such as Martin Luther King) and negatively-valenced white people (such as Jeffrey Dahmer) subsequently reported more positive "black" associations compared to people who saw images of negatively-valenced black people (such as Mike Tyson) and positively-valenced white people (such as Tom Hanks). However, the groups did not differ in their explicit attitudes. This finding may be attributed to the processes through which implicit and explicit attitudes are formed; a paradigm based in operant conditioning can

be expected to be more likely to affect implicit attitudes, while an exercise in deliberation and the analysis of evidence might be more likely to affect explicit ones. Although some studies have shown implicit attitudes to be more stable than explicit ones (Gregg, Seibt, & Banaji, 2006; Gawronski & Strack, 2003), the majority of the findings do not support the assertion that implicit attitudes are more resistant to change than explicit ones.

Further evidence against the heightened stability of implicit attitudes comes from research on the effects of context. Explicit (self-reported) attitudes are known to be susceptible to context: self-reported attitudes change with a variety of factors, including how a question is asked, which questions have been asked previously and the participant's mood (Schwarz & Strack, 1991). For example, Salancik and Conway (1975) found that participants cued to endorse religious behaviour were more likely to subsequently express a more positive attitude towards religion, compared to participants who were cued to reject religious behaviour. One explanation is that we hold a lot of information about attitudinal objects in memory, but retrieve it selectively depending on which information has been primed and which behavioural goals are activated (Tourangeau, Rasinski, & Bradburn, 1989). If implicit attitudes constitute automatic memory retrieval, it would seem possible that this retrieval process can also be manipulated.

Indeed, responses on implicit measures, such as the IAT, have been found to be affected by both the content of the stimuli and the actual context in which the measure is completed. For example, implicit attitudes towards ethnic groups have been found to change according to the ethnicity of the experimenter conducting the study (Lowery, Hardin, & Sinclair, 2001). Mitchell, Nosek and Banaji (2003) found that participants tend to report an implicit preference for white, compared to black, people on race IATs; however, if the categories are labelled as politician vs. athlete, people tend to prefer black athletes to white politicians. This suggests that implicit attitudes are, at least to an extent, malleable. Gawronski and Bodenhausen (2007) suggest that activations in the associative memory network depend on a) the pre-existing structure of the network, and b) the content of the input which elicits the response. So, to use

the race IAT example, responses on the measure would depend on the types of associations which had been formed in relation to black people, but also on the specific person to whom the response is activated (e.g., corrupt politician or admired athlete). That is, assuming the respondent holds at least some positive *and* negative associations with each stimulus. Hypothetically, it should therefore impossible to influence the outcome of an implicit attitude measure through context if the attitude being assessed is unambiguously positive or negative.

It must be noted that none of these findings adequately disambiguate the conflict between implicit attitudes derived from personal beliefs and behaviours, from implicit associations which reflect cultural norms. Drawing the distinction may be important for some experimental paradigms. Olson and Fazio (2004) developed a personalised version of the IAT intended to reduce the 'contaminating' effects of extra-personal associations by rephrasing the valence categories in the first person (e.g., 'I like' cf. 'Positive'). The modified version of the IAT was found to reduce implicit racial bias, suggesting that people may hold personal implicit attitudes which are different from their internalised cultural norms. However, while the source of any implicit attitude could lie in cultural norms or personal experience (or both), there is no evidence that differences in source origin has any behavioural or cognitive effect. First of all, data about information source is stored separately from information content and there is no evidence to suggest that one can influence the other in automatic association retrieval (Johnson, Hashtroudi, & Lindsay, 1993). Attitudinal source information may be important for attitudinal change, or from the perspective of theoretical modelling. However, automatically activated associations appear to have the same consequences regardless of *why* they are activated.

In sum, there is not much evidence to suggest that implicit attitudes are older, more stable or more resistant to change than explicit attitudes. Although the change occurs through different means (operant or classical conditioning for implicit attitudes and information-processing for explicit attitudes), both seem to be susceptible to manipulation in an experimental setting. Perhaps the question is how well this translates to a real-world setting;

how often are we exposed to repeated stimuli pairings which might lead to implicit attitude change, or how often do we encounter information which forces us to re-evaluate existing opinions? It is likely that the answer will depend on the specific attitudinal construct and the social context in which it is processed. However, it does not appear that stability can be cited as a "benefit" of implicit attitude assessment.

3.3. ASSUMPTION 3: IMPLICIT ATTITUDES ARE AUTOMATIC, UNCONTROLLABLE AND/OR GOAL-INDEPENDENT

Implicit attitudes have variably been ascribed the properties of automatic (De Houwer, 2006), efficient (Strack & Deutsch, 2004), uncontrollable (Perugini, 2005), or goal-independent (De Houwer & Moors, 2007) activation in memory upon encountering an attitude object. These definitions are not entirely synonymous, and differ on how supported they are by empirical evidence. Efficiency refers to the amount of cognitive resources a process requires for operation. Controllability and goal-independence refer to the activation of associations regardless of the intention to (not) activate them. The definition of automaticity is somewhat more complex and will be discussed in greater detail later on in this section.

In terms of implicit attitude measurement, goal-independence can be translated to the question of whether people are able to deliberately affect their performance on measures such as the IAT. As discussed previously, people are somewhat aware of the purpose of implicit measures and their own response biases while completing them (e.g., Monteith, Voils, & Ashburn-Nardo, 2001). Awareness constitutes the first pre-requisite to deliberate manipulation; however, it does not seem to be sufficient, as for the most part people do not seem to be very good at faking their responses on the IAT when explicitly asked to fake their attitude. Failure to fake has been found in attitudes towards homosexuality (Banse, Seise, & Zerbes, 2001, Study 2), flowers (Kim, 2003, Study 1), race (Kim, 2003, Study 2), imaginary social groups (Gregg et al., 2006, Study 4), and gender (Karpinski & Steinman, 2006). Some evidence does suggest that some degree of faking is possible if *novel* stimuli (with valence ascribed to them) are used in the

study, and participants are instructed to behave contrary to the researcher's expectations (De Houwer, Beckers, & Moors, 2007). However, these results cannot be extended to familiar stimuli.

Faking success seems to improve when people are given more explicit instructions. For instance, Steffens (2004) found that participants attempting to fake self-conscientiousness on an IAT tended to increase error rates in the congruent block, which is an incorrect strategy. Participants were more adept at faking when given specific instructions to alter their response latencies. Similarly, Fiedler and Bluemke (2005) found that participants were reasonably capable of faking their responses on a Turkish-German IAT; 34 out of 50 participants were successfully able to reverse their IAT score from positive (pro-German) to negative (pro-Turkish). Again, success rates increased when participants were given explicit instructions on how to fake IAT responses. Faking seems to be more difficult when implicit attitudes are assessed using the Implicit Relational Assessment Procedure (IRAP; Barnes-Holmes et al., 2006), in which participants use key presses to make relational responses (such as "similar" or "better") to stimuli pairs. The key to faking on the IRAP is to increase response times for the "undesired" attitude. However, even with explicit instructions, people appear to find faking IRAP responses challenging (McKenna, Barnes-Holmes, Barnes-Holmes, & Stewart, 2007).

It must be noted that even though some evidence suggests that faking responses on implicit measures is technically *possible* under certain circumstances, this does not imply that this is something participants normally attempt. It is conceivable that faking may be more prevalent for studies on subjects where socially desirable responses are more important, such as research in prejudice. However, a meta-review of the research found that social desirability does not tend to moderate implicit-explicit attitude correlations (Hofmann, Gschwendner, & Schmitt, 2004). It must be noted that there is a difference between a deliberate control of implicit attitudes and a deliberate control of responses on an implicit attitude measure. The studies outlined above provide some evidence for people's ability to do the latter. Strack and Deutsch (2004) argue that if implicit attitudes constitute the automatic activation of

associations in memory, then they are uncontrollable by definition. Perception is involuntary: we cannot, by a sheer act of will, perceive a blue square as red (Shanks & St John, 1994). By the same reasoning, perception of its valenced properties is also involuntary. If we believe an affective response to be invalid or incorrect, we can attempt to correct it; however, this will constitute a conscious, propositional process and therefore fall within the classification of explicit attitude formation.

Efficiency refers to the amount of resources required for the operation of a cognitive process. The associative memory network which constitutes implicit attitudes is thought to operate highly efficiently, with little effort or demand on resources. This implies that implicit attitudes should be relatively unaffected by concurrent tasks which do require effort and resources. In support of this, Hermans, Crombez and Eelen (2000) found that performance on an affective priming task was unaffected by the amount of simultaneous memory load. Friese, Hofmann and Wänke (2008) also found that cognitive load did not affect implicit attitudes as assessed by the IAT. These findings support the conceptualisation of implicit attitudes as a cognitive heuristic which allows for judgments to be made quickly and efficiently.

Whether or not implicit attitudes can be considered automatic depends, to a large extent, on how automaticity is defined. For instance, Posner and Snyder (1975) include unintentional and unconscious processing in their definition of automaticity. However, as we saw previously, these definitions do not necessarily apply to implicit associations. Hasher and Zacks (1979) conceptualise automaticity on a continuum, with fully automatic processes on one end, and non-automatic at the other. The continuum is defined as a function of cognitive effort: the more automatic a process is, the fewer resources, attention and effort it requires to operate. Fully automatic processes are therefore spontaneous and effortless. This definition is more consistent with what we know about implicit associations, including efficient operation and the difficulty associated with faking responses on implicit measures; it is also consistent with the theoretical premise of implicit attitude measures, and supported by findings in neuroscience.

Implicit measures often limit windows of response time, typically a few seconds, to ensure that participants respond spontaneously, rather than deliberatively (e.g., Greenwald et al., 1998). Although this does not act as evidence of implicit attitude automaticity, it can at least be argued that the responses on implicit measures constitute a series of automatic responses. This assertion is supported by behavioural data, which suggests that implicit attitudes are better predictors of spontaneous, automatic behaviour, compared to explicit attitudes (Stangor et al., 1991; Dovidio et al., 2002; Hofmann, Rauch, & Gawronski, 2007). Research from Fazio, Sanbonmatsu, Powell and Kardes (1986) and Hermans and colleagues (Hermans, De Houwer, & Eelen, 1994; Hermans, De Houwer, & Eelen, 1996) supports the automatic nature of implicit attitudes. The studies assessed implicit attitudes using affective priming paradigms, where responses to stimuli following a prime are thought to be facilitated or inhibited by the implicit associations with the prime object. Facilitation and/or inhibition was found to occur when the prime was presented for 300msec (including interval to stimulus), but not when it was presented for 1,000msec. These findings support the automatic nature of the effects assessed by response-compatibility paradigms.

Implicit attitude automaticity is supported by neuroimaging data. Single-neuron responses to emotional visual stimuli have been found as soon as 120-160ms after exposure (Kawasaki et al., 2001). The key area thought to be implicated in the automatic processing of valenced information is the amygdala. The amygdala is connected to the orbitofrontal cortex, which regulates affective processing, and with the hypothalamus, which is associated with autonomic functioning (Kringelbach, 2005). Its role in implicit attitude processing is supported by findings that amygdala activation is correlated with implicit, but not explicit attitudes (Phelps et al., 2000). Additionally, the amygdala has been found to respond to valenced stimuli (Zald, 2003), even if the stimuli are primed non-consciously (Whalen et al., 1998), which is consistent with affective priming paradigms (Klauer & Musch, 2008). Amygdalar response to valenced stimuli appears to be very rapid: as quick as 200ms after stimulus presentation (Krolak-Salmon,

Hénaff, Vighetto, Bertrand, & Mauguière, 2004). These results support automatic implicit attitude activation in response to attitude object exposure.

De Houwer (2006) argues that 'automatic' (referring to the automatic activation of associations in memory following stimulus exposure) is the least ambiguous definition of 'implicit' and the one most consistent with the theoretical premise of most implicit attitude measures. Performance on implicit tests does not appear to be entirely uncontrollable or goal-independent, although people certainly find it harder to deliberately manipulate them than self-report measures. By contrast, the actual *activation* of implicit attitudes does indeed appear to be efficient (in the sense of being effortless) and automatic (in the sense of being spontaneously activated in response to an attitude object).

3.4. SUMMARY

This section outlined the evidence for some of the common claims made about implicit attitudes in experimental research and as components of dual-process models. Dual-process models tend to conceptualise implicit and explicit cognition as a dichotomy, with different properties assigned to each. However, research findings suggest that the distinction may not be as categorical as they assume. Implicit attitudes do not appear to be entirely outside of conscious introspection or entirely immune to the effects of different goals or contexts. While responses on implicit measures can be consciously manipulated to some extent, people find it significantly more challenging than faking responses on a self-report measure, and generally require explicit instruction to attain a significant level of success. As a consequence, implicit attitudes can only be said to be *less* conscious or susceptible to manipulation than explicit ones. These findings cast some doubt on theoretical accounts which conceptualise cognition as two entirely distinct processes.

Research for the most part does not support the notion that implicit attitudes are older, more stable or more resistant to change than explicit attitudes, although the findings have been

somewhat mixed. It is unclear to what extent implicit attitudes reflect personal, compared to culturally normative, associations. Some methodological solutions have been proposed to disambiguate the two, if this is contextually necessary for the study being carried out. However, there is no evidence that the source of the attitude has a significant effect on how people perform on most implicit attitude measures, or on their behaviour.

Several dual-process theories have suggested that implicit attitudes are automatic and efficient, in the sense that they a) do not require effort or cognitive resources to operate, and b) occur spontaneously in response to attitude objects. These assertions are supported by both experimental and neuroimaging data, and are consistent with the premise of implicit attitudes and the conceptualisation of implicit attitudes as associative networks in memory.

In sum, implicit attitudes can best be described as less introspectively available and controllable than explicit attitudes, although not necessarily more robust. The most parsimonious definition of an implicit attitude given the evidence available at this stage is a valenced association stored in memory which is automatically activated in response to an attitude object.

4. Integrative models

Integrative models of cognition are conceptually similar to dual-process models, in that they discuss cognition in terms of implicit and explicit processes. However, with increasing evidence to challenge some of the earlier assumptions about the nature of implicit cognition and its interaction with explicit attitudes, more recent models aim to account for an integration of the two components.

4.1. THE MOTIVATION AND OPPORTUNITY AS DETERMINANTS OF BEHAVIOUR (MODE) MODEL

Fazio (Fazio, 1990; Fazio & Towles-Schwen, 1999) developed the MODE model to address dual-process cognition from a social psychology perspective. The model is still a dual-process one in the sense that implicit and explicit processes are viewed as qualitatively and functionally distinct, but integrative in the sense that allowances are made for how these components interact with each other and, crucially, how these interactions can be used in predicting behaviour. The acronym refers to the ways in which the behavioural context can influence whether behaviour will be driven predominantly by *spontaneous* (implicit) or by *deliberative* (explicit) processes.

The extent to which (the activation of) an attitude is spontaneous or deliberative is defined by the amount of conscious deliberation involved; attitude automaticity therefore lies on a spectrum from more automatic to more controlled. Spontaneous behaviours are driven by judgments of attitude objects in their current context, made as a consequence of automatically activated attitudes. Fazio (1990) disagrees with reasoned action theories (e.g., Fishbein, 1979; Ajzen, 1991), which suggest that people's behaviour is, for the most part, conscious and rational. Rather, human behaviour is often not consciously deliberated upon before execution (Zajonc, 1980); this would be an inefficient and laborious way to go through life. Most daily behaviour is therefore routine, according to Fazio, and happens relatively efficiently and effortlessly. Implicit processes are defined as automatic; Fazio (1990) argues that this is supported by people's performances on implicit attitude measures, such as the IAT: differences in association strengths can be seen even though participants are not instructed to make any judgment about the test stimuli.

The deliberative processes which underlie consciously enacted behaviours, consist of a cost-benefit analysis of a behavioural response. Such an analysis can be expected to take place in contexts where people are motivated to re-evaluate their automatic responses to attitude objects. One example of such a motivation is the "fear of invalidity" (Freund, Kruglanski, &

Shpitzajzen, 1985), or the belief that making mistakes in judgment will be costly to oneself. Of course, deliberative analysis can only take place when resources and motivation are available to do so. The MODE model therefore differs from more categorical dual-process models in that it allows for the fact that a) people are at least to some extent aware of their implicit attitudes and b) implicit attitudes are activated automatically but do not necessarily lead to consistent behaviour if resources and motivation are available to engage in inconsistent behaviour.

The MODE approach is consistent with research on awareness and automaticity, but is particularly relevant to socially controversial attitudes, such as those pertaining to racial stereotypes. Implicit-explicit correlations tend to be particularly low for racial attitudes (Blair, 2002); the MODE model can explain this in terms of the increased levels of deliberation required to make behavioural decisions in sensitive contexts, which then influences the outcomes of explicit measures. For uncontroversial domains, less deliberation is required, which leads to greater correspondence between measures (Nosek, Banaji, & Greenwald, 2002). The question therefore is not where there is a relationship between implicit and explicit attitudes and what this means for the theory of implicit cognition; rather, there is a need to understand the contexts and people where such a relationship is present or absent, and why (Fazio & Olson, 2003).

The model rejects the notion that implicit attitudes are more "real", i.e., that they are a more reliable index of beliefs which people hold as objectively true. Rather, implicit and explicit attitudes are better predictors of different behaviours, in different contexts. Specifically, self-reported attitudes are better predictors of behaviour which is deliberate and controlled, while implicit attitudes are better predictors of behaviour which is spontaneous or impulsive (Asendorpf, Banse, & Mücke, 2002; Haeffel et al., 2007). The focus of the MODE model is rooted in social psychology; as a consequence, research based within its framework has often been focused on the issue of racial prejudice and related behaviour. Research in implicit attitudes towards minority ethnic groups suggests that explicit attitudes tend to predict deliberate verbal behaviour in interactions. By contrast, implicit attitudes tend to predict

nonverbal behaviour, which is less consciously controllable, including observer ratings of friendliness within the interaction (Dovidio et al., 2002; Stangor et al., 1991). Implicit measures may therefore be more relevant for understanding behaviour in contexts where the person is less able, or less motivated, to control it.

4.2. THE ASSOCIATIVE-PROPOSITIONAL EVALUATION (APE) MODEL

Gawronski and Bodenhausen have proposed the APE model (Gawronski & Bodenhausen, 2007; Gawronski & Bodenhausen, 2011) as a re-interpretation of dual-process approaches, such as the Reflective-Impulsive model (Strack & Deutsch, 2004), on the basis of empirical findings. The basic approach is similar: cognition is separated into processes which are mostly automatic, and those which are mostly controlled; these processes are understood to be qualitatively different. The model is aimed at qualifying the differences between these processes in light of empirical findings, and explaining what elicits change in each type of process. An additional concern is explaining the typically low correlations between implicit and explicit attitudes (Hofmann et al., 2005), which are discussed in terms of reconciling cognitive dissonance (Festinger, 1962).

Within the APE model, cognitive processes are defined as either *associative*, thought to be the consequence of automatic activation of associations in memory, or *propositional*, which consist of the conscious validation of associative information. Associative processes are not all-or-nothing; different associations can be made depending on context or motivation. After the initial association is consciously acknowledged, it is translated into a propositional statement (e.g., 'I like it'/'I don't like it'), which can then be assessed for logical consistency. Attitudinal change is thought to be mediated by different mechanisms, depending on the process. Associative processes are likely to change if a novel affective reaction occurs, given that it is also endorsed by propositional reasoning. Propositional processes are changed by encountering new, persuasive information which is at odds with old information.

A discrepancy between an associative and a propositional process creates a state of dissonance, which we are motivated to reconcile, either by discounting the affective (implicit) response or by modifying the propositional assessment. This is supported by research which suggests that higher levels of elaboration during an explicit attitude measure tends to decrease the implicit-explicit correlation (Koole, Dijksterhuis, & van Knippenberg, 2001). Presumably, when we spend more time trying to rationalise our beliefs, we are either trying to quell an instinctive response we believe to be incorrect, or trying to come to a satisfactory explanation why our instinctive response is the correct one despite appearances. This does not imply that we can effectively regulate our associative processes; in fact, quite the opposite, as evidenced by the relatively modest success of 'faking' studies (see p.23)

Although the APE model is structurally similar to dual-process theories, it also rejects qualifying features which are inconsistent with research evidence. For instance, associative processes are not classified as non-conscious, as people are capable of accurately identifying their affective responses to attitude objects. The model also accepts the view that automatic associations require little or no effort for retrieval, and are, by definition, not controllable. However, the authors argue that implicit associations are not always automatic because they *can* be activated intentionally, such as when a person does a memory search for information which can bias the affective response. This is not a convincing argument against the automatic nature of implicit attitudes because while the memory search itself does indeed require effort, it can be argued that the resulting activation of associations is still automatic. In fact, conscious 'control' of automatic attitudes can be better explained by the contextual effects on parallel distributed processing (see the Iterative Reprocessing model for more on this, p.36).

Although the model is mostly consistent with empirical evidence, the claim that associative processes change through novel, explicitly endorsed affective associations, is inconsistent with studies which have found that implicit attitudes can be affected through conditioning procedures, without the need for endorsement (Olson & Fazio, 2001). Kruglanski and Dechesne (2006) argue that the APE model is too categorical in its distinction between

implicit and explicit attitudes, and that evidence supports a continuum model where attitudes vary in the degree of automaticity and resource demands. The authors argue that attitude construction is mediated by a single computational process comprised of conditional ('if... then') rule generation.

Nevertheless, the APE model is probably the most consistent consolidation of recent research into a coherent theoretical account. Studies based on APE model principles have been carried out in areas such as prejudice reduction (Sritharan & Gawronski, 2010), self-anchoring (Gawronski, Bodenhausen, & Becker, 2007) and self-esteem (Grumm, Nestler, & von Collani, 2009). The APE principles allow for the formulation of research within a ready theoretical framework, without derailing the discussion into a semantic analysis of the underlying assumptions. However, the model is heavily feature- rather than process-based and therefore would be less useful in research specifically concerned with the mechanisms underlying attitude formation and its behavioural outcomes.

4.3. RELATIONAL ELABORATION AND COHERENCE (REC) MODEL

Relational frame theory (Hayes, Barnes-Holmes, & Roche, 2001) is an approach to understanding human language and higher cognition in terms of arbitrary relational responses. According to the theory, we understand the world through relative relationships, such as feature similarity, location within a hierarchy, cause and effect or functional difference. The relationships are arbitrary in the sense that they are culturally determined and learned socially (Chase & Danforth, 1991); a child is rewarded for making responses consistent with contextually controlled relations termed 'relational frames'. A basic example of a relational frame is hearing the sentence "this is an apple" when being given an apple, forming the relational link between the word "apple" and the concept of apples, on the basis of contextual cues such as the speaker's behaviour and words like "this" and "is" (Barnes-Holmes, Barnes-

Holmes, & Cullinan, 2000). Later on, similar relational links will be formed between apples and their attributes, such as sweetness.

The REC model (Barnes-Holmes, Barnes-Holmes, Stewart, & Boles, 2010) is an extension of relational frame theory. Within this model, attitudes constitute a network of relational associations; these may be constructed automatically or consciously, depending on context, motivation and processing goals. The REC model assumes that a single process underlies attitude formation and, as such, is not a dual-process model. Both implicit and explicit attitudes are seen as relational associations, but retrieved under different circumstances. Brief, automatic responses reflect implicit attitudes. Explicit attitudes are the consequences of deliberative processes where a person needs to produce a response which coheres with a set of other relational associations which are relevant to the context (Hughes & Barnes-Holmes, 2011). Implicit and explicit attitudes will diverge when a person concludes that the initially generated automatic response is inconsistent with extended relational responses (Barnes-Holmes et al., 2010). Similar to the APE model, this model assumes that implicit attitudes are, to an extent, available to conscious introspection. It also stresses the importance of context and motivation in attitude retrieval (both implicit and explicit) and rejects the notion that implicit attitudes are more stable or reflect older associations. However, it does accept that implicit attitudes may reflect experience and therefore social norms which may or may not be endorsed by the person who holds them.

It has been suggested that one of the benefits of the REC model is that it is compatible with emerging theoretical approaches which reject the assumption that attitudes constitute an associative memory framework. Hughes, Barnes-Holmes and De Houwer (2011) argue that implicit attitudes should not be limited in definition to concepts occurring in close temporal or spatial proximity, and that making this assumption limits the scope of the research field and the types of measures which can be used in implicit attitude measurement. According to the authors it is more parsimonious to assume that attitudes are constructed ‘on the spot’ as needed, rather than stored and retrieved from memory. In this approach, people’s behaviour

constitutes a relationship between the environment and their response (Fox, 2006); this functional contextualism approach removes the need for hypothetical mechanisms which might underlie attitude retrieval. Within the REC model, attitudes are not viewed as conceptual entities which determine behaviour towards attitude objects; rather, they are the behaviour itself.

While the functional contextualism account is intriguing as a philosophical interpretation of attitude formation, there is currently insufficient evidence to support it in the context of implicit attitude research. Studies in conditioning implicit attitudes through repeated paired exposure (Olson & Fazio, 2001; Baccus et al., 2004; Dijksterhuis, 2004; Hollands et al., 2011) suggest that implicit attitudes *are*, in fact, stored in memory. Second, the claim that attitudes are constructed spontaneously within each new context requires a computational or neurobiological explanation of the processes involved. Finally, it is true that many attitude objects are evaluated relative to alternatives; for instance, as is the case with social comparison (Wills, 1981). However, even when such alternatives exist, people are capable of subjective judgments (and therefore single-category attitudes) as well as relational associations (VanderZee, Buunk, & Sanderman, 1995). Relational frame theory and the REC model are therefore useful supplements to other integrative approaches, but are currently insufficiently detailed and insufficiently empirically supported to replace them. It is, however, useful for broadening the scope of what constitutes 'implicit' cognition and how it can be measured.

4.4. THE ITERATIVE REPROCESSING (IR) MODEL

The IR model was developed by Cunningham, Zelazo and colleagues (Cunningham, Zelazo, Packer, & Van Bavel, 2007; Cunningham & Zelazo, 2007; Cunningham & Zelazo, 2010). The model is a computational one; it is informed by research in neuroscience, particularly on the development of the prefrontal cortex (PFC) in childhood (Zelazo, Carlson, & Kesek, 2008). Iterative reprocessing refers to the dynamic processing of cognitive information between

higher-order and lower-order processes. Lower order processes are conceptually similar to automatic attitudes; they constitute a set of stable representations in memory, activated in response to encountering or imagining an attitude object. The activated attitude is then passed on to higher-order processes which can then incorporate additional variables such as goals or context into a more complex evaluation. The evaluation is then fed back to lower-order processes for a recalculation of the affective response.

Higher-order and lower-order processes are thought to operate dynamically and in concert, with information being passed back and forth between the system networks. Top-down processing then allows for evaluative processes to alter input weights between affective associations and the attitude object. The number of total iterations taking place depends on the complexity of the evaluation and its compatibility with the automatic affective response. Awareness and controllability of attitudes in this context is viewed on a continuum, with the first few iterations being entirely non-conscious and automatic, and becoming gradually more controlled and available to introspection with each subsequent iteration.

The IR model is based on the assumption that brain systems are structured hierarchically (Bunge & Zelazo, 2006). The initial affective response is retrieved automatically; amygdala response can be detected within a few hundred milliseconds (Oya, Kawasaki, Howard, & Adolphs, 2002). Amygdala response is then relayed to the orbitofrontal cortex, which allows for a more a more nuanced analysis of expected rewards and punishments with the actual bodily state (Beer, Heerey, Keltner, Scabini, & Knight, 2003). In many cases, where no conflict is detected, these iterations will be sufficient. However, if the input stimulus triggers an ambivalent response (strong positive *and* negative response activation), further iterations will take place in the lateral PFC (Bunge & Zelazo, 2006). Processing associated with the lateral PFC is higher-order rule-selection, which is then used for top-down modulation of the lower-order processes. From this perspective, lower-order processes are not simply single association paths; rather, they constitute complex networks of associations where relative connection weights are constantly updated. Stronger connection weights increase the likelihood of activation in the

future. At the same time, some attitudes will remain relatively stable over the course of a person's lifetime, while others will be constantly updated and re-processed. This approach is also consistent with parallel distributed processing models (Smith, 1996), which suggest that mental representations constitute a series of connections between concepts; these can operate in parallel, and activation strength can vary depending on context.

The iterative-reprocessing approach is valuable from several perspectives. First of all, it makes the attempt to tie in cognitive theory of attitude formation with measurable neurophysical phenomena. Data from research in neuroscience supports a biological distinction between automatic, affective processes and conscious, deliberative ones. However, it appears that the two processes are best characterised as a dialogue, with information being passed back and forth on a continuum, rather than as two independent cognitive structures. Second, as with the APE model, it suggests that evaluative judgments ('explicit attitudes') are motivated by resolving ambivalence (Cunningham et al., 2007); in all other cases, parsimony and resource conservation takes precedence. However, the IR model does not adequately account for studies which suggest that we are, at least to some extent, aware of our implicit attitudes, even in the absence of conflict with explicit attitudes (e.g., Monteith et al., 2001).

The principles of iterative-reprocessing are consistent with neurobiological data, although the majority of the studies have not been designed to test the model specifically. It is also necessary to test its applicability to experimental research contexts; its compatibility with implicit attitude measures currently in use and consistency with observable behaviour. The model also suggests that implicit cognition may be assessed through neuroimaging techniques; this may not be practical in most research contexts but could be intriguing as the purest form of indirect automatic attitude assessment.

Overall, the IR model allows for considerable fluidity in the process of attitude formation and is consistent with the majority of the research-revised definitions of 'implicitness.' It supports the re-conceptualisation of dual-process models from categorical to continuous; implicit attitudes are therefore represented as being *less* available to introspection or *more*

goal-independent than explicit processes. Attitudes can therefore travel along the continuum based on context demands, resource availability and motivation, which can explain the results of studies which have successfully manipulated implicit attitudes using these factors (Hermans, Crombez, & Eelen, 2000; Lowery et al., 2001; Hausmann & Ryan, 2004; Fiedler & Bluemke, 2005; Friese, Hofmann, & Wänke, 2008).

5. Summary

Research from the past decade suggests that implicit and explicit cognition may not be as categorically segregated as has been implied by dual-process models. Implicit attitudes have been demonstrated to be, to an extent, available to introspection (Olson & Fazio, 2001; Mitchell, Nosek, & Banaji, 2003) and susceptible to the effects of context (Lowery et al., 2001; Mitchell et al., 2003) and motivation (Jordan et al., 2007; Hing et al., 2008). Integrative models of cognition take these findings into account to develop models which are concerned not only with the functional and conceptual differences between implicit and explicit attitudes, but also with their interaction and behavioural consequences. Contemporary 'dual-process' models tend to view implicit and explicit cognition on a continuum, with attitudes being more or less automatic or more or less deliberative depending on what is required for the specific context.

The integrative models discussed in this section come from vastly different psychological perspectives and have very different goals. As such, they can be viewed as complimentary, rather than competitive. The MODE model is a continuum model, with attitudes classified on a spectrum from more automatic to more controlled. Attitudes become more controlled when a person is motivated to re-assess their automatic response for potential cost-and-benefit outcomes; however, most daily behaviour is viewed as more automatic than deliberative. The MODE model is most useful in the discussion of social behaviour. The APE model is conceptually closest to dual-process models, as it categorises implicit and explicit processes as qualitatively different. In this model, a discrepancy between implicit and explicit attitudes is thought to

indicate a state of dissonance, where an automatic association is consciously rejected as invalid. The approach consolidates much of the recent empirical findings and is therefore useful as a foundation to further research.

The REC model probably takes the most unconventional approach of the models discussed. It suggests that attitudes do not constitute stored associations in memory; rather, both implicit and explicit attitudes are behavioural expressions of the same relational network. However, at this stage the model is mostly conceptual and is in need of supporting research evidence. Finally, the IR model is aimed at qualifying the theoretical approach to dual-process cognition in neurobiological terms. Findings from fMRI studies appear to support the suggestion that attitudes are processed on a continuum, from the relatively automatic to the relatively controlled, and that different regions of the brain become increasingly involved as processing demand changes.

6. A perfect model of implicit cognition?

None of the models discussed in this section can be considered to be an exhaustive or definitive account of implicit and explicit cognition. In all likelihood, no such model will ever exist, because theoretical approaches need to be specific to the research area and the research aims. However, researchers do appear to be converging on the answers to the big questions: a) the definition of an implicit attitude, b) the interaction (if any) between implicit and explicit processes in attitude formation and c) the extent to which implicit attitudes are malleable and how they are shaped.

Most recent approaches have moved away from a strictly dual-process approach to allow for 'implicit-ness' to be thought of in relative terms. Most models (with the exception of the REC model) tend to agree that implicit attitudes can be defined as associations in memory, activated automatically in response to an attitude object. Deliberative processes then take place when the automatic attitude is considered to be an invalid one, or inconsistent with

current contextual information. Explicit processes only occur when there is sufficient motivation and sufficient cognitive resources available to enact them. Interaction between implicit and explicit processes therefore consists of both bottom-up and top-down regulation; awareness of affective responses (usually perceived as 'gut feelings') can affect how we verbalise our attitudes – at the same time, we can reject our emotional responses if we do not consider them to be valid or contextually appropriate.

The models differ somewhat in how they explain the malleability of implicit attitudes, their susceptibility to the effects of context and motivation. However, the IR model's computational account is consistent with most approaches as well as experimental research. Implicit attitudes do not merely consist of a single object-valence association; rather, they are comprised of an associative network where different associations hold different strength values, which determine probability of activation as well as activation within a specific context.

7. Conclusions

De Houwer (2006) correctly notes that much of the research in implicit cognition fails to define what is meant by "implicit" or "explicit" cognition. Different theoretical models have ascribed different features to implicit attitudes. Empirical evidence suggests that implicit attitudes are best defined as associations in memory which are activated effortlessly and spontaneously upon encountering an attitude object. In the context of the definition of "attitude", it is implied that these associations are presumed to be valenced – i.e., eliciting a positive or a negative response.

Dual-process theories conceptualise implicit and explicit cognition as distinct processes. However, the more recent integrative models tend to agree that evidence suggests that cognition lies on a continuum, from the more implicit to the more explicit. From this perspective, implicit and explicit attitudes are different sides of the same coin; qualitatively

different responses to the same attitude object which can nevertheless interact between each other.

It is beyond the scope of this thesis to refine existing theoretical models of implicit cognition. The research presented here is grounded in the least controversial assumptions about the nature of implicit attitudes (specifically that their activation is automatic and effortless). There is no single theoretical model which is upheld as being unequivocally and completely accurate. The APE model is probably the most consistent with the empirical evidence pertaining to the *features* of implicit and explicit processes. The parallel distributed processing model of activation adapted by the IR model can explain implicit attitude *activation*, and their susceptibility to the effects of context. Finally, the REC model's focus on the behavioural *consequences* of implicit cognition is important for the present research focus on behaviour. These different elements have been adapted in the present thesis during study design and the formulation of hypotheses, and also in the discussion and interpretation of results.

This thesis was designed to address the role of implicit cognition in pathological eating behaviour. Four studies were conducted to assess implicit associations with the self and with food in women with concerns about their eating behaviour and their bodies. The theoretical context and research background of each study is discussed in detail in the introduction of each relevant chapter. Chapter II will introduce the different methodological approaches to measuring implicit attitudes and discuss their theoretical context and limitations. Chapters III, IV, V and VI will present empirical data and discuss the findings in the immediate context of each study's hypotheses. Finally, Chapter VII will summarise the findings and discuss the results within the broader context of theoretical accounts of implicit cognition.

CHAPTER II

Approaches to implicit attitude measurement

So far, implicit attitudes have been discussed purely as conceptual entities. The research has been discussed on the assumption, for the sake of argument, that the measures used have yielded a perfect assessment of the participant's automatic associations. Of course, this is unlikely to be the case. There are a variety of ways to assess implicit attitudes; some are more commonly used than others, some have been more heavily criticised than others, some are better suited to specific research purposes than others. In this section, some of the methods used in implicit attitude assessment are outlined and briefly discussed in terms of their application, strengths and limitations.

This chapter is not an exhaustive discussion of implicit attitude measurement. The assessment of implicit attitudes is subject to an ongoing and multifaceted debate, from practical issues such as the relative merits of different scoring algorithms (Greenwald, Nosek, & Banaji, 2003) to more abstract issues, such as the nature of the processes which implicit measures assess and the potential influences of confounding variables (De Houwer, 2006; Gawronski, Peters, & LeBel, 2008). The purpose of the chapter is not to provide a complete account of all the controversies. Rather, it is to provide sufficient background on the context in which each measure was developed, a practical outline of the procedures used and an overview of its relative merits. This information is included to give background to discussion of methodological design and outcomes in the subsequent chapters.

A note must also be made on terminology. As De Houwer (2006) points out, measures are frequently termed 'implicit' without specifying in which ways they are implicit. As seen in Chapter I, the "implicit-ness" of something is far from being an unequivocal, clearly defined

attribute in the literature. Frequently, an “implicit” measure is simply “indirect”, in the sense that the participant is not overtly requested to give their opinion on an attitude object. Sometimes it refers to giving responses rapidly, which supposedly diminishes conscious elaboration. In this section, the term “implicit” is used to refer to implicit attitudes (automatic associations in memory) and implicit measures (procedures designed to assess automatic associations in memory). Whether or not implicit measures can be deemed to actually succeed in accurately measuring implicit attitudes is discussed separately for each type of measure.

1. Indirect measures

Although implicit attitudes can be broadly defined as implicit associations in memory, research in implicit attitudes is concerned specifically with associations between an attitude object and *valence*. An emotional response can constitute a behavioural expression of a valenced association, and is implicit in the sense that it is automatic, uncontrollable and efficient. Some studies have therefore adopted the assessment of physiological responses to attitude objects as an indirect measure of (implicit) attitudes. The “indirect” aspect of the measure refers to the fact that participants are not asked to overtly report their attitudes. The term “implicit” is implied; many physiological attitude measures were developed before implicit cognition featured in literature in the modern sense. Nonetheless, they fit the criteria for the assessment of how we define implicit attitudes today.

Examples of physiological indirect measures include the electrical conductiveness of skin (Wesolowki & Deichman, 1980), pupil dilation (Hess, 1965), eyeblink response (Bradley, Cuthbert, & Lang, 1990) and heart rate (Marinelli & Kelz, 1973). Advanced information technology has allowed for more sophisticated measurements to be carried out, such as facial electromyography to measure muscle activation involved in smiling or frowning (Vanman, Saltz, Natahan, & Warren, 2004), fMRI to measure blood flow to specific brain regions (Hart et al., 2000) and electroencephalography (He, Johnson, Dovidio, & McCarthy, 2009).

Physiological measures have the advantage of being minimally susceptible to conscious control, and also lend themselves more easily to concealing the purpose of the measurement, which can also help circumvent the effects of conscious control and social desirability. However, it can be argued that traditional (computerised) implicit attitude measures already have these attributes to a satisfactory level. On the negative side, physiological measures are more time-consuming and costly. It is also debatable whether a physiological response is a fair indicator of automatic associations. Physiological measurements are, in a sense, reverse-engineered from research which examines how we respond to stimuli of different valence. If we know that people, for example, tend to respond to negative stimuli with an uncontrollable blink response, or threatening ones with an elevated heart rate, then these tendencies can be adapted to indirectly assess attitudes. However, such responses are not *uniquely* indicators of stimulus valence and can therefore complicate the interpretation of results if they occur for other reasons. Further research is necessary to focus on how well physiological indicators predict behaviour, compared to computerised attitude measures. However, it must be noted that neuropsychological data is in any case important for understanding the biological processes underlying the theoretical constructs used in implicit cognition models.

2. Priming tasks

Priming tasks designed to measure implicit attitudes operate on the principle of response facilitation. Affective priming procedures are designed to assess which associations are automatically activated in response to an attitude object (Fazio & Olson, 2003). The affective priming procedure has been used in the assessment of, among other things, racial attitudes (Fazio, jackson, Dunton, & Williams, 1995), gender stereotypes (Kawakami & Dovidio, 2001) and implicit self-esteem (Spalding & Hardin, 1999).

During an affective priming task, a participant will be primed (briefly shown an image or word) with the target attitude object. The participant will then need to identify, as quickly as

possible, whether the subsequent stimulus is positive or negative. The premise of the procedure is that if the participant holds a positive association with the attitude object their response to a subsequent stimulus will be facilitated if it is positive and inhibited if it is negative (and vice versa if the associations with the attitude object is negative). For example, a participant may be primed with a picture of a spider and then see the word "dangerous" (congruent trial) or the word "safe" (incongruent trial). Subsequently, the participant responds to indicate whether the word they see falls under the category "good" or "bad". Assuming participants have negative automatic associations with spiders, we can expect them to perform quicker in the congruent trial (spider → dangerous/negative) compared to the incongruent trial (spider → safe/positive).

An alternative approach to implicit attitude assessment using priming is the affect misattribution procedure (AMP; Payne, Cheng, Govorun, & Stewart, 2005). The premise of the measure combines the effects of priming with people's tendency to incorrectly attribute the source of their affect, or underestimate how much unrelated factors (such as the weather) can bias their attitudes (Dutton & Aron, 1974; Schwarz & Clore, 1983). During an AMP procedure participants are shown a target prime: for example, an insect or David Cameron. Participants then see a neutral stimulus, such as a Chinese pictograph, and asked to rate how much they like or dislike it. The extent to which the prime affects the evaluation of the neutral stimulus is then arguably an index of the participant's implicit attitude towards the primed object. This effect has been found even when participants are explicitly instructed to not allow their judgment of the neutral stimulus to be biased by the prime (Payne et al., 2005). However, the AMP is not as commonly used in implicit attitude research as affective priming, and recent research directions have tended to adapt it for the study of the consequences of affect on behaviour (e.g., Hofmann & Baumert, 2010).

Affective priming is thought to operate on similar principles as semantic priming, through the effect of spreading activation. Exposure to the prime is thought to activate a node in an associative network, thereby facilitating access to related concepts or attitude objects (Bower,

1991). This is conceptually consistent with the principles of the Iterative-Reprocessing model (Cunningham et al., 2007) and parallel distributed processing (Smith, 1996). Affective priming tasks do not appear to be susceptible to concurrent task interference, such as reciting digit spans (Hermans et al., 2000) or word memorisation (Bargh, Chaiken, Govender, & Pratto, 1992). This suggests that the mechanisms underlying the task place relatively low demand on cognitive resources and can therefore be considered efficient. Results from the manipulation of stimulus onset asynchrony (SOA; the time interval between prime presentation and the appearance of the target response stimulus) also support the hypothesis that affective priming tasks assess automatic associations. Significant priming effects emerge with SOA at 300ms, but not at 1,000ms (Fazio, Sanbonmatsu, Powell, & Kardes, 1986; Hermans et al., 1994); this suggests that the effect is only significant when participants are not given the opportunity to consciously evaluate the priming stimuli (Klauer & Musch, 2008). Similar effects have been found in AMP studies, where the prime has been found to affect subsequent stimulus attitude when presented at 4ms, but not at 2,000ms (Murphy & Zajonc, 1993). However, other studies have found that increasing SOA up to 1,500ms decreases, but does not entirely erase, the affect misattribution effect (Payne et al., 2005). In affective priming procedures, windows of response times for the target stimuli are also kept low, typically at 1.75sec (Fazio et al., 1995; Sherman, Rose, Koch, Presson, & Chassin, 2003). This is done to help minimise conscious elaboration at response stage. However, the time criterion for when cognition can be considered automatic and when it can be considered conscious, is at this stage somewhat arbitrary, in the sense that there is no consensus for where the cut-off for automatic processing should be. Future functional imaging research should help resolve this ambiguity and allow for universal standards to be established.

It must be noted that test-retest reliability of affective priming has been found to be modest (.56 in one study; Kawakami & Dovidio, 2001), although it is debatable whether this reflects the quality of the measure or the relative instability of implicit attitudes. There is also some suggestion that affective priming is more susceptible to the effects of context than other

measures. Sherman and colleagues (2003) found that, on completing an affective priming task, smokers had a positive implicit attitude towards smoking in response to stimuli which focused on the sensory experience of smoking, but not when the stimuli used were focused on branding and packaging. There was no such difference on equivalent IATs. Heavy smokers also had positive implicit associations with smoking on an affective priming task when deprived of nicotine, yet not when satiated. The trend was reversed for light smokers and was absent on the IAT.

Some research findings suggest that affective priming paradigms are effective at assessing implicit attitudes even when the prime is presented subliminally (Klauer, Mierke, & Musch, 2003; Wentura, Kulfanek, & Greve, 2005). De Houwer (2006) argues that a subliminal affective priming task may be the best currently available option for implicit attitude measurement, as it minimises the opportunity for participants to consciously manipulate the measure. However, it also decreases the ecological validity of the measure. It can be argued that a typical affective priming measure assesses our automatic associations with an object, in the way that they would be activated under normal circumstances. Presenting primes at a non-conscious level is inconsistent with the way in which we typically experience the world and therefore react to it. Nevertheless, non-conscious affective priming paradigms may be useful for research which has a particular interest in controlling for conscious manipulation or social desirability.

3. Response compatibility tasks

3.1. THE IMPLICIT ASSOCIATION TEST (IAT)

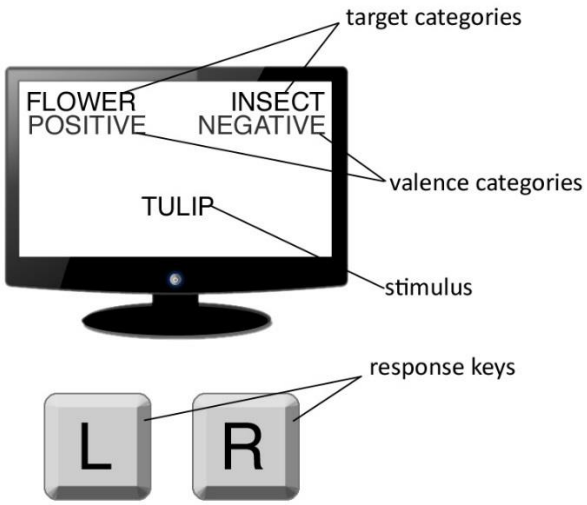
The IAT (Greenwald et al., 1998) is designed to measure relative association strengths between target concepts and valence. The measure is usually computerised, although a pen-and-paper version has also been developed (Lemm, Lane, Sattler, Khan, & Nosek, 2008).

Participants see a sequence of stimuli (words or pictures) and press one of two response keys to identify the category affiliation of each stimulus. The stimuli will belong to one of four categories: two target categories (contrasting attitude objects, such as flowers/insects, Coke/Pepsi, rock/pop, etc.) and two valence categories (indicators of evaluation, such as good/bad, pleasant/unpleasant, tasty/disgusting). The procedure contrasts participants' performance speed on a congruent, compared with an incongruent trial.

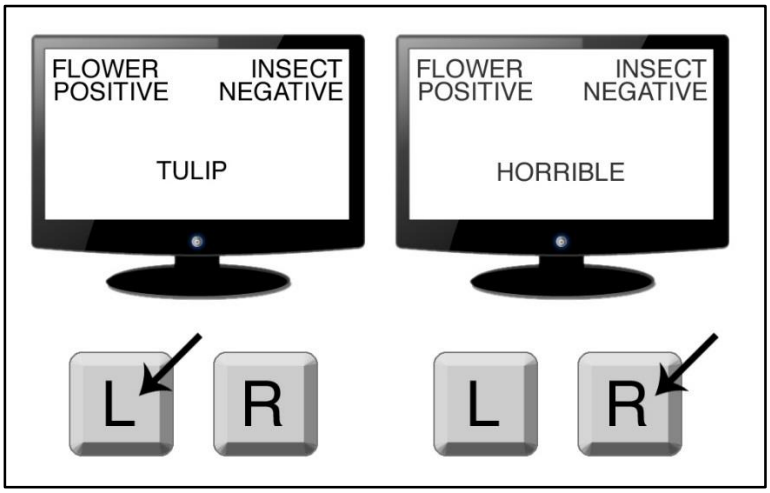
In a congruent trial block, participants use one key to respond to one of the target categories and all positive stimuli (e.g., rock and pleasant), and another key to respond to the other target category and all negative stimuli (e.g., pop and unpleasant). In an incongruent trial block, the valence categories are switched: in this example, one key will correspond to rock/unpleasant and pop/pleasant. Figure 1 illustrates an example of screen configuration during the IAT using a flower/insect IAT. Which pairing is assigned to which trial block is arbitrary, but irrelevant to the results as the order of presentation is normally counterbalanced between participants. Participants are given several practice trial blocks before each congruent/incongruent trial to help them habituate to the new pairing; however, these will typically be excluded from analyses. Participants are encouraged to respond as quickly as possible, but without making too many errors. Responses below or above certain response latencies (usually <300ms and >3,000ms) are typically discarded. The reason for this is because a very fast response is likely to have been made accidentally or in error, while a response which is too long is indicative of a deliberative, explicit response rather than a response made on the basis of implicit associations (Dasgupta, McGhee, & Greenwald, 2000). Finally, response times on error trials are meaningless to the assessment of an implicit attitude and for this reason are also excluded from analyses.

Response latencies on the congruent and incongruent trial are then synthesised into a calculation of relative preference. Greenwald, Nosek and Banaji (2003) recommend the IAT-D, an algorithm which calculates the difference between mean performance in the congruent and incongruent block and then divides it by the standard deviation of trials in both blocks. An IAT-D

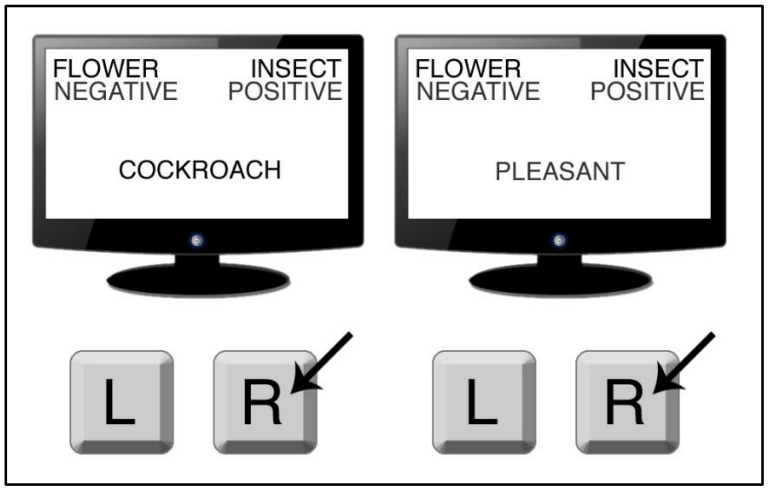
Figure 1
The IAT procedure



Congruent trial example



Incongruent trial example



effect significantly and positively different from zero suggests that the participant responded quicker in the congruent trial (rock+/pop–), compared to the incongruent trial (rock–/pop+) (and vice versa for a significantly negative IAT-D effect). From this, it can be surmised that the participant found the congruent trial easier than the incongruent trial. The implication is that the participant holds more positive implicit associations with rock, relative to pop.

Psychometric properties. The IAT-D effect size tends to vary dramatically depending on the subject area and the types of stimuli used. For instance, in Nosek, Greenwald and Banaji (2005), *d* values ranged from .34 on the Native/White stereotype IAT to 1.35 on the Young/Old attitude IAT. The same can be said for discriminant validity; correlations between the implicit attitudes as assessed by the IAT and explicit attitudes as assessed through self-report; for instance, Nosek and Smyth (2007) found a correlation of r = .56 with explicit attitudes on the Creationism/Evolution IAT, but only r=.01 on the White/Asian IAT. One explanation is that either awareness, or explicit endorsement, of attitudes varies depending on the attitude domain. Social desirability and culture could also play a role, as a greater discrepancy between implicit and explicit attitudes can be expected if a person is motivated to re-assess their "gut feeling" when completing an explicit measure. This can be true for, for example, a non-racist person who is frequently exposed to racist media. Hofmann, Gawronski, Gschwendner, Le and Schmitt (2005) point out that at approximately half of the variability in correlations can also be attributed to moderators such as response spontaneity on the explicit measures. Test-retest reliability of the IAT is variable depending on the stimuli used and the time elapsed between sessions. For example, Bosson, Swann and Pennebaker (2000) found a test-retest correlation of r = .69 for a one month elapsed period for a self-esteem IAT. In Egloff, Schwerdtfeger and Schmukle (2005), test-retest on an anxiety IAT over the period of a week yielded r = .58. Research which suggests that implicit attitudes can be changed relatively quickly (Olson & Fazio, 2001; Baccus et al., 2004) suggests that the arguably low stability could reflect natural variations in automatic associations. Contextual or individual differences between

testing sessions could also be “at fault”. However, it could also be an indicator of methodological error.

Predictive validity of the IAT has been found to be on average around *r* = .27 (Greenwald, Poehlman, Uhlmann, & Banaji, 2009). This was lower than the average predictive validity of self-report measures within the same studies (mean *r* = .36). However, implicit and explicit attitudes are typically used to predict different types of behaviour: the IAT has been found to be a better predictor of more impulsive, spontaneous or non-verbal behaviour, while explicit attitudes tend to be used in the prediction of more rational or controlled behaviour (Stangor et al., 1991; Dovidio et al., 2002). For instance, one study of attitudes towards people with AIDS found that IAT predicted automatic approach and avoidance behaviours, while explicit attitudes predicted self-reported behavioural intentions (Neumann, Hülsenbeck, & Seibt, 2004). In another study, Maison, Greenwald and Bruin (2004) found that implicit attitudes significantly predicted brand recognition of soft drinks in a blind taste test, while explicit attitudes did not.

Theoretical approaches to the IAT. The differential task-switching (DTS) model of the IAT (Mierke & Klauer, 2001; Klauer & Mierke, 2005) suggests that relative response ease reflects executive function facilitation. Consider a situation in which the participant has performed significantly faster in the congruent, compared with the incongruent trial. According to the DTS model, this reflects differential task-switching demands within each trial type. If the participant closely associates rock music with positive features more closely than pop music, the congruent trial block task can be simplified to “left key for positive, right key for negative”: the categories assigned to each response key have something in common, which simplifies responding. Consider sorting a deck of cards into a pile of red suits and a pile of black suits: this is a relatively easy, quick task to perform. However, in the incongruent trial block, there is less common ground between the two stimulus types assigned to each key: in this example, like sorting cards into a pile of clubs and diamonds, and a pile of spades and hearts. This means that participants must switch between making target category responses

and valence category responses in each trial. The demands of task-switching on response time has been demonstrated experimentally (Mierke & Klauer, 2001). The incongruent trial block is similar to sorting a deck of cards into one pile of hearts and clubs, and another pile of spades and diamonds: this is considerably more difficult (and slower) than simply sorting by colour.

Despite studies which suggest that participants are, to an extent, aware of how their implicit attitudes bias their performance on the IAT (Monteith et al., 2001), the IAT can be considered an implicit measure in the sense of being a) indirect (participants are not overtly asked to express their opinion) and b) automatic. The assertion that the IAT assesses associations in memory is supported by classical conditioning studies, which have demonstrated that the IAT can detect new implicit associations which have been formed just minutes prior as part of the experimental design (Olson & Fazio, 2001; Baccus et al., 2004). The IAT response latency limit is intended to ensure that responses remain automatic. Dasgupta et al. (2000) argue that participants are unable to make consciously controlled decisions which could bias the outcome of the study, in such a short window of time. Discarding latencies above a certain cut-off also ensures that data which likely reflects deliberative processes is not included in the calculation of the IAT-D effect (De Houwer, 2006). However, it must be noted that current conventions with regards to acceptable response latencies are reasonable, but largely arbitrary. As more neuroimaging data becomes available we should be better able to differentiate between the temporal functionality of automatic and controlled processes, which will allow us to refine the testing parameters.

Criticisms. The IAT has been criticised for its susceptibility to context and content, which can bias the output. For instance, the IAT has been demonstrated to measure general similarity between stimuli, such as the visual correspondence between a snake and a river, or between a pizza and a coin (De Houwer, Geldof, & De Bruycker, 2005). Familiarity has also been cited as a possible concern (Dasgupta, Greenwald, & Banaji, 2003), yet its potentially confounding effects have not been supported experimentally (Dasgupta et al., 2000). Significant

order effects for trial block presentation have also been found, which could be an indicator of practice effects (Bluemke & Friese, 2006). However, Nosek, Greenwald and Banaji (2005) argue that these factors can be methodologically controlled for, by ensuring stimulus similarity and/or familiarity is equal within each stimulus group, and by ensuring trial order is counterbalanced.

It appears that the IAT reflects individual differences in ability, in addition to automatic associations: namely, the ability to make quick and accurate responses (McFarland & Crouch, 2002). For instance, Hummert, Garstka, O'Brien, Greenwald and Mellott (2002) found that older participants performed overall slower on the IAT, which is consistent with cognitive decline as a consequence of ageing. However, the effect of individual differences in skill can be minimised, if not entirely eliminated, by using the IAT-D algorithm in analysis (Cai, Greenwald, & McFarland, 2004).

Another potentially biasing factor is feature relevance. De Houwer (2001) argues that stimuli sets used in the IAT tend to have a valence bias: for instance, the insect/flower IAT will usually use pleasant flowers and unpleasant insects. Whether this is problematic depends on whether one subscribes to the feature-relevant or feature-irrelevant explanation of the IAT effect. Feature-relevant approaches (such as the DTS) assume that the IAT measures associations between categories. In this case, the valence of individual stimuli is not relevant because participants make their responses on the basis of their parent categories. Feature-irrelevant approaches suggest that, actually, the IAT effect reflects mean association strengths for the stimuli in each category. While category content has indeed been demonstrated to affect IAT effect outcome (De Houwer, 2001; Mitchell et al., 2003), it is important to consider this criticism in the context of research goals. If we are interested in assessing implicit attitudes towards insects, relative to flowers, it is important that the stimuli sets used are familiar, common and representative within each category. Using a more diversified set may be more egalitarian, but will yield results which are less applicable to participants' actual experience and behaviour. However, the problem of conflating relevant and irrelevant features must still be considered in stimulus selection and in the interpretation of IAT data.

Related to the issue of feature relevance is figure-ground asymmetry, or salience asymmetry. Rothermund and Wentura (Rothermund & Wentura, 2001; Rothermund & Wentura, 2004) suggest that participants may not necessarily complete the congruent IAT block in a binary way (e.g., "press A for positive things, press B for negative things"); rather they may make an active response when the stimulus is salient, and make the alternative response when it is not (e.g., "press B for salient things, otherwise press A"). Salience can refer to stimuli which arouse attention, are uncommon or unfamiliar. The IAT effect may therefore reflect participants' tendency to group things on the basis of salience, rather than just associations in memory. This interpretation is consistent with the effects of similarity (Dasgupta et al., 2003; De Houwer et al., 2005), but is potentially more problematic because negative evaluative associations are salient by default and therefore cannot be controlled for during stimulus selection.

Empirical support for the salience problem has been found using category combinations which have similar salience, but no prior associations. For example, Rothermund and Wentura (2004, experiment 1b) found a significant IAT effect by using old and young names (names stereotypically associated with old and young people and bearing negative and positive connotations, respectively) and neutral words and non-words (random strings of letters). Participants found the congruent trial block "young/word & old/non-word" easier to complete than the incongruent "young/non-word & old/word". As there is no logical similarity between the categories in the congruent block, the IAT effect can most likely be attributed to salience. Houben and Wiers (2006a) suggest that salience asymmetry can partially explain some counter-intuitive findings in implicit attitude research, such as alcohol drinkers' tendency to have negative implicit associations with alcohol, despite explicitly reporting a positive attitude (Houben & Wiers, 2006b). In their study (2006a) the negative implicit associations with alcohol were found to decrease when alcohol salience was manipulated through stimulus familiarity. However, the manipulation failed to *reverse* the effect, which suggests that the influence of salience is limited.

The developers of the IAT have responded to the salience asymmetry concern (Greenwald, Nosek, Banaji, & Klauer, 2005) and agree that evidence suggests that it affects the IAT effect; however, they note that the extent to which this is a problem is uncertain. The authors argue that there are fundamental differences between the studies in their theoretical approach: Rothermund and Wentura (2001) attribute the IAT effect to strategic encoding (based on theories of spreading activation and semantic networks) while Greenwald and colleagues argue that it is an assessment of relative association strengths. Rothermund, Wentura and De Houwer (2005) had further responded to these comments, but the discussion has not yielded a satisfactory resolution, either conceptually or methodologically. The problem of salience should therefore be considered as a potential confound when using the IAT in research.

One possible solution to the problem of salience is the single-block, or single-category, IAT (SC-IAT; Karpinski & Steinman, 2006; Teige-Mocigemba, Klauer, & Rothermund, 2008). The SC-IAT follows the same procedure as the conventional IAT, but only one target category is present in any experimental block. For example, in one block participants will use the left key to respond to positive words and flower names, and the right key to negative words only. In another block, the left key will correspond to positive words only, and the right key to negative words and flower names. The single-target IAT (ST-IAT; Bluemke & Friese, 2008) is a variation on the SC-IAT, which includes several attitude objects in a series of independent SC-IAT trials, thus allowing for the efficient assessment of domains with several representatives (such as political parties). The SC-IAT appears to have acceptable internal consistency (mean r = .62) (Bohner, Siebler, González, Haye, & Schmidt, 2008). Similarly, the ST-IAT has been found to have satisfactory reliability (mean α = .71) and test-retest reliability (mean r = .83) (Bluemke & Friese, 2008). Arguably, a unilateral assessment removes confounds such as familiarity and salience because the target stimuli are not contrasted against an alternative. However, this approach may also be less valid for hypotheses which are specifically interested in relative implicit attitudes for different concepts.

Conclusion. The IAT is perhaps the most widely known and commonly used measure of implicit associations. It is also the most extensively criticised, which may be a consequence of exposure and interest, rather than objective quality. It is debatable whether the most salient limitations (context susceptibility, sensitivity to individual differences and salience asymmetry) can be controlled for with subtle alterations to the stimuli or procedure, or, if they cannot, whether they can have a significant impact on the observed results. The IAT has an overall satisfactory psychometric profile, but there are significant variations observed depending on the specific research area. Single-category variations on the IAT appear to circumvent some of the concerns, but may not always be appropriate depending on the research question.

3.2. IMPLICIT RELATIONAL ASSESSMENT PROCEDURE (IRAP)

Similar to the IAT, the IRAP (Barnes-Holmes et al., 2006) is a response-compatibility task, in the sense that it assesses interference from stimuli which are compatible or incompatible with the required response. In contrast to the REP, the IRAP introduces response latency restrictions to the procedure. Participants see pairs of stimuli (e.g., "love" and "pleasant") and are asked to give a relational response (e.g., "similar" or "opposite"). On congruent trials, the required response is consistent: love + pleasant → similar. On incongruent trials, it is inconsistent: love + pleasant → opposite. The limit for response latency on each trial is typically 2,000ms; this cut-off has yielded results suggestive of stronger implicit prejudice compared to responses made up to 3,000ms (Barnes-Holmes, Murphy, Barnes-Holmes, & Stewart, 2010). Response latencies for each participant are then typically log-transformed into a D-IRAP value, similar to the IAT-D: mean response latencies are averaged within each block type, the means subtracted and divided by the standard deviation within all blocks (e.g., Nicholson & Barnes-Holmes, 2012).

The IRAP has been successfully adapted to the assessment of food attitudes in vegetarians and meat eaters (Barnes-Holmes, Murtagh, Barnes-Holmes, & Stewart, 2010), spider fear (Nicholson & Barnes-Holmes, 2012) and cultural bias (Power, Barnes-Holmes, Barnes-Holmes, & Stewart, 2009). Barnes-Holmes, Barnes-Holmes, Stewart and Boles (2010) conceptualise the IRAP from a similar theoretical perspective as the APE model (Gawronski & Bodenhausen, 2007): implicit attitudes reflect social experience, and may or may not be consciously endorsed as valid. The distinction between implicit and explicit attitudes in the context of the IRAP can therefore be defined as the extent of conscious elaboration following the initial response. As such, the IRAP was designed as a multi-process (rather than a dual-process) measure (Barnes-Holmes et al., 2010). However, these interpretations reflect a theoretical approach rather than any specific aspect of IRAP methodology.

It must be emphasised that while the IRAP and the IAT can be described in deceptively similar ways, they have been designed from different theoretical perspectives and are technically designed to measure different things: relational associations between concepts (IRAP) and relative association strengths between concepts (IAT). Nevertheless, the measures are sufficiently similar to result in moderately strong correlations: r = .54 in one study (Barnes-Holmes et al., 2010).

Psychometric properties. Although the IRAP is a relatively new measure, psychometric assessment supports its use in implicit research. Internal consistency appears to be satisfactory: split-half correlations were r = .58 in one study (Barnes-Holmes et al., 2010). Similar to other implicit measures, the IRAP is typically not significantly correlated with explicit attitudes (Power et al., 2009). Predictive validity of the measure varies depending on the research area. In a study of weight bias, the IRAP predicted behavioural intentions towards overweight people marginally better than the IAT, R^2 change =.057 (Roddy, Stewart, & Barnes-Holmes, 2009); this suggests that the IRAP may be beneficial for certain types of research questions. By contrast, in a study of implicit food attitudes, the IAT and the IRAP increased the

predictive validity of a regression model by 13% and 14%, respectively (Barnes-Holmes et al., 2010).

Research into IRAP's susceptibility to faking suggests that it may perform better than the IAT; participants were unable to fake their responses either intuitively, or with the knowledge of a specific strategy (McKenna et al., 2007). However, the suggested strategy may have been too difficult; only two of the 12 participants reported being able to use it successfully.

Conclusion. The IRAP was developed on the basis of the REC model, which is concerned with cognitive interpretation of language. As discussed in Chapter I, theoretical interpretations of the measure suggest that implicit attitudes may not be the result of semantic network activation and are instead constructed on-line as required (Hughes, Barnes-Holmes, & De Houwer, 2011). While this account is arguably more controversial than associative memory theories, the IRAP does not appear to deviate significantly from the IAT in terms of psychometric validity or the result patterns it obtains. However, it can be argued that the IRAP is more reliant on articulation and introspection than other implicit attitude assessment approaches. The REC model is specifically concerned with relational links in language as a path to understanding language comprehension. The IRAP therefore somewhat deviates from models which construe implicit attitudes as automatic affective responses to target concepts.

3.3. EXTRINSIC AFFECTIVE SIMON TASK (EAST)

De Houwer (2003) describes the EAST as a "modified version" of the IAT. Like the IAT, it is a response-compatibility task, where participants' relative response times are contrasted to assess the strength of associations between different concepts. It is therefore implicit in the sense of being indirect and time-constrained, but is not non-conscious, unlike subliminal priming paradigms. The EAST is based on the Affective Simon Task (AST) (De Houwer & Eelen, 1998). The Simon paradigm (Simon & Rudell, 1967) refers to quicker response times when the

stimulus and response correspond, compared to when they do not (e.g., De Jong, Liang, & Lauber, 1994). In the AST, participants are asked to make a response (usually verbal) to the stimuli they see: e.g., "good" for names of flowers and "bad" for names of insects. The response associations are then reversed, and relative response times are calculated for each block. In contrast to the AST, participants completing the EAST will additionally make their responses to task-irrelevant features of the stimuli, such as their colour. For example, participants are instructed to classify adjectives (presented in a white font) on the basis of their valence: e.g., press Q for good words and P for bad words. Nouns, on the other hand, are classified on the basis of their colour: e.g., press Q for blue words and P for green words. The consistent categorisation of the white valence words conditions positive or negative associations with each response key; the strength of positive or negative associations with the nouns can be calculated from the response times made when the noun is presented in blue (Q: "good" key response) or green (P: "bad" key response).

The term "extrinsic" in the EAST refers to the fact that the response keys have no intrinsic valence: P or Q are not "good" or "bad". However, they acquire those associations as a consequence of performing the task. De Houwer (2003) argues that the task-switching "strategy" thought to be employed by people completing the IAT is problematic, because they are not directly engaged in making the desired associations. By contrast, the EAST allows for response-time comparison within the same task: target words can be presented in either colour during the same trial block, therefore changing their key assignment. The way in which the EAST is structured also does not require target stimulus pairs: i.e., it can be used to assess implicit associations between flowers and "positive" or "negative". This is in contrast to the IAT, which can only assess associations with flowers *relative* to insects.

Single-category implicit measures can be useful for certain types of research. The EAST has been commonly used in studies focused on associations in semantic networks, rather than valenced associations (i.e., implicit attitudes). For instance, research has been done in spider phobia, to assess associations between ambiguous spider/human stimuli and threat (Ellwart,

Becker, & Rinck, 2005). Vancleef, Gilissen and de Jong (2007) have assessed people's associations between illness and anxiety, and health protective behaviour. De Jong, Wiers, van de Braak and Huijding (2007) have also argued that the EAST paradigm has helped disambiguate research in implicit attitudes towards alcohol and alcohol abuse. Assessing attitudes towards alcoholic and non-alcoholic beverages in separate blocks suggests that alcohol attitudes in problem drinkers are ambivalent and not, as previously thought, negative. However, from a conceptual standpoint, the IAT is likely to be a better methodological choice for research which is specifically concerned with contrasting two attitude objects.

Psychometric properties. The EAST has been criticised for its poor predictive validity and internal consistency. De Houwer and De Bruycker (2007) found that while IAT-assessed attitudes towards beer and sprouts significantly predicted self-reported consumption behaviour, EAST scores did not. In a subsequent study of attitudes towards different sexual orientations, split-half reliabilities of the IAT were found at .83; for the EAST they were .02. Teige, Schnabel, Banse and Asendorpf (2004) took similar issues with the measure's reliability. Participants' self-associations with personality traits (shyness and angriness) were assessed using the IAT and the EAST. While the mean internal consistency of the IAT was found at α=.76; for the EAST it was α<.24. The IATs were also moderately correlated with the relevant self-reported personality measures only, indicating good discriminant validity. By contrast, the EASTs were not correlated with any of the relevant self-report measures.

It must be noted that a lack of correspondence between implicit attitudes, as assessed by the EAST, and self-reported traits or behaviour is not necessarily problematic. Self report requires introspection and accuracy, and the motivation to respond honestly when this may be at odds with social desirability. By contrast, implicit attitudes are thought to be more closely associated with behaviour which is less conscious and more spontaneous (e.g., Dovidio, Kawakami, Johnson, Johnson, & Howard, 1997). Additionally, some research does lend credibility to the EAST as predictive measure: Vermeulen, Corneille and Luminet (2007) found

that faster response times on positively-valenced words were negatively associated with expressions of negative affect (e.g., depression, anxiety, alexithymia). While this is not strictly speaking the intended application of the EAST, it does support a potential for its application in research.

The same can be said for convergent validity: for instance, De Houwer and De Bruycker (2007) have found a very low correlation between the IAT and the EAST (r= –.10). This may be problematic for some multi-method experimental designs but is not altogether surprising, as the two paradigms are designed to assess different types of cognitive processes: the IAT for relative associations, the EAST for individual ones.

Conclusion. The EAST falls under the broader category of response-compatibility tasks. Unlike the IAT, it can be adapted to assess associations with single stimulus categories and does not require task-switching on the part of the participant, which can be useful in some experimental paradigms. However, its psychometric properties, both in terms of predictive validity and internal consistency, appear to fall short of the IAT. The EAST may therefore be useful in research where a single-category attitude assessment is required, but the IAT is otherwise preferable due to its superior psychometric attributes.

4. Conclusions

Various approaches to implicit attitude measurement have been developed, even before the concept of dual-process cognition was articulated in the literature. Measures of physiological or emotional response have been used to indirectly assess valenced reactions to target stimuli. However, it cannot be said with certainty whether these indirect measures specifically measure automatic associations between concepts, or tap into physiological responses to other stimuli. Affective priming procedures are effective and are consistent with some theoretical approaches, such as the IR model. Non-conscious priming procedures have

been proposed as the least biased form of assessment, but their ecological validity is debateable.

Response-compatibility tasks, including the IAT, IRAP and the EAST, are most common in recent research. The IAT is the most commonly used and, perhaps as a consequence, the most frequently criticised. The severity of its limitations are debatable: many can be controlled for with careful material development and the extent of the role which others play is unclear. For the moment, the psychometric properties, versatility, and wide use of the IAT suggest it to be the most obvious choice for research in which a dual-category paradigm is theoretically acceptable. The psychometric properties of the IRAP, a relatively new measure, are similar to the IAT. However, the model is based in language comprehension theory, which suggests that it may not always be appropriate in research more concerned with affective or intuitive associations. Finally, the EAST may be an acceptable single-category alternative to the IAT, however research into its psychometric properties suggest that it may be less robust.

The measures discussed here all have relative merits and limitations. They vary in the definition of "implicitness" which they employ, from indirect assessment to automatic association. While psychometric properties can be directly contrasted as an index of quality, the theoretical background of each measure suggests that some may be more appropriate to different research questions than others. The IAT has been used for studies in the current thesis. Although its psychometric properties and widespread use (helpful for the contrasting of results and awareness of limitations) have played a role in that decision, individual reasons for method and stimulus selection are discussed in the *Method* section of each individual study.

CHAPTER III

Study 1: Implicit self-esteem and eating disorder pathology

Over the years, a great deal of research attention has been given to the role of self-esteem in eating behaviour. It has been incorporated into theoretical models of eating disorders and plays a significant role in treatment approaches. More recently, however, some studies with a focus on the potential importance of implicit self-esteem in eating behaviour have emerged. The present chapter assesses the role of implicit self-esteem, and its relationship to explicit self-esteem, in elevated eating disorder (ED) pathology. First, key concepts from explicit self-esteem literature will be briefly introduced, following by a more in-depth discussion of self-esteem in eating disorder pathology (both explicit and implicit). The hypotheses and methods used in Study 1 will then be outlined and explained, followed by a summary of the results and a discussion of the findings. A broader theoretical discussion of the study outcomes for this and all other empirical chapters can be found in Chapter VII.

1. High and low self-esteem

Self-esteem refers to a person's attitude towards themselves: their evaluation of their own self-worth. It is typically measured via self-report: participants complete a questionnaire or series of questionnaires pertaining to their self-evaluation. For example, the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965), possibly the most widely used self-esteem measure, uses questions pertaining to subjective assessment (e.g., "On the whole, I am satisfied with myself"), as well as elements of social comparison (e.g., "I am able to do things as well as most other people"). Some measures have been developed to assess self-esteem from a more objective perspective: for example the Texas Social Behavior Inventory (Helmreich & Stapp,

1974) assesses self-competence relative to others. However, these types of measures assess self-awareness of one's self-esteem rather than self-esteem itself (Ickes, Wicklund, & Ferris, 1973); fundamentally, self-esteem is defined as a subjective evaluation.

In Western societies, including the United Kingdom (UK), self-esteem tends to be high: i.e., most people will evaluate themselves more positively than negatively (Bagley & Mallick, 2001; Roth, Decker, Herzberg, & Brähler, 2008). Of course, everyone is prone to self-criticism and insecurity, but individualist societies tend to produce people who believe themselves to be overall good (Trzesniewski, Donnellan, & Robins, 2003). High self-esteem is typically correlated with life satisfaction (r = .47) – however, this relationship is moderated by the individualism of the person's culture (Diener & Diener, 1995). For the sake of parsimony, the discussion from here on will focus on self-esteem research pertaining to individualist, Western cultures such as the UK and the United States (US).

Research consistently demonstrates that high self-esteem is associated with psychological and social benefits. People with high self-esteem tend to have more adaptive psychological traits, such as resilience, which can lead to a better ability to cope with depression and stress (Dumont & Provst, 1999). They tend to be more confident in their abilities and their likeability (Tafarodi & Swann, 1995) and experience personal failure less severely (Stotland, Thorley, Thomas, Cohen, & Zander, 1957). Of course, high self-esteem and the "benefits" of having high self-esteem are symbiotic: positive experiences improve subjective evaluation, and positive self-evaluation in turn promotes socially desirable behaviour, which is likely to generate more positive experiences.

It must be said that high self-esteem is not, in all cases, an asset. While high self-esteem normally contributes to more confident task performance, under conditions of evaluative ego threat (i.e., feedback which can challenge positive self-evaluation) it can lead to the overestimation of one's abilities and behaviour which is inappropriate to the level of ability (Baumeister, Heatherton, & Tice, 1993). This can sometimes manifest as violent behaviour (Baumeister, Smart, & Boden, 1996). It must also be noted that not all high self-esteem is

"genuine". Models of defensive self-esteem (e.g., Schneider & Turket, 1975) suggest that apparently high self-esteem in some people may be the consequence of self-enhancement techniques designed to buffer the adverse consequences of ego threat. High self-esteem in these cases manifests as grandiosity, narcissism, and an overvaluation of social desirability (Raskin, Novacek, & Hogan, 1991).

By contrast, low self-esteem is associated with lower confidence, less subjective clarity, and less certainty (Campbell, 1990; Campbell & Lavallee, 1993). As a result, people with low self-esteem tend to be more susceptible to the influence of others (Cohen, 1959), which can have a negative impact on social relationships. People with low self-esteem also tend to have a more internal locus of control, particularly with regards to negative feedback. For example, Fitch (1970) found that, following failure feedback, people with low self-esteem had a much stronger tendency than those with high self-esteem to attribute that failure to internal causes. Furthermore, people's expectations about future performance tend to be predicated on their chronic self-evaluation, rather than current performance feedback (McFarlin & Blascovich, 1981). Therefore, even experiences inconsistent with a negative self-evaluation may not be enough to improve it.

Reasons for having low self-esteem can be both internal and external. External reasons include social rejection and social stigma. For example: people diagnosed with a mental illness are seven to nine times more likely to have low self-esteem if they feel that they are being stigmatised because of their illness, compared to those who do not (Link, Struening, Neese-Todd, Asmussen, & Phelan, 2001). Internal reasons (feelings of inadequacy, failure, or incompetence) often arise as a self-perpetuating cycle of low self-esteem and its consequences. For instance, the propensity for self-directed blame following failure can contribute to overemphasis of one's negative traits. Baumeister and Tice (1985) argue that while people with high self-esteem are motivated by improving their strengths, people with low self-esteem are focused on remedying their perceived flaws. This negative focus serves to perpetuate negative self-evaluations. Low self-esteem can also be difficult to overcome because of its relationship

with depression. For example, Rosenberg, Schooler and Schoenbach (1989) found, in a study of adolescent boys, that while self-esteem had an effect on depression (r = –.21), depression also had an effect on self-esteem (r = –.27). This can become a self-perpetuating cycle which is difficult to break.

It thus seems we have a strong need to feel good about ourselves. Explanations for this apparent need have included the hedonic benefits of feeling good about oneself (Leary & MacDonald, 2003), the enhanced motivational resources which high self-esteem can offer (Taylor & Brown, 1988), and its usefulness as a monitoring tool in achieving one's goals (Deci & Ryan, 1995). However, the two most comprehensive theories addressing *why* we need positive self-esteem are a) Terror Management Theory (TMT) and b) the Sociometer theory.

1.1. TERROR MANAGEMENT THEORY

Anthropologist Ernest Becker (1962; 1973) can be credited with writing the works which would eventually become the foundations of TMT. He believed self-esteem to be the fundamental human motivation as our main defence against anxiety, and the ultimate anxiety to be death. This approach was adapted into a formal psychological theory by Greenberg, Pyszczynski and Solomon (1986). TMT proposes that the inevitability of death is terrifying; over time, we have developed several strategies of managing that terror. As a result, cultural values often reflect the need to give symbolic meaning to a person's life, through accomplishments, social input and social connections (Palgi & Abramovitch, 1984). Through these values, we can attain symbolic immortality through our contributions (Pyszczynski, Greenberg, Solomon, Arndt, & Schimel, 2004). TMT posits that self-esteem reflects our need to receive confirmation that we are valuable and meaningful in order to mitigate that fear. Although TMT has been criticised for its establishment within the literature as an evolutionary theory (Kirkpatrick & Navarrette, 2006) and the assumption that mortality salience is common (Paulhus & Trapnell, 1997), a significant amount of self-esteem research continues to be conducted within the

context of TMT, including healthcare (Johnstone, 2012), political attitudes (Weise, Arciszewski, Verlhiac, & Pyszczynski, 2012) and interpersonal relationships (Van Tongeren, Green, Davis, Worthington, & Reid, 2013).

However, empirical data fails to support the use of TMT concepts for understanding the function of implicit self-esteem in the context of disordered eating behaviour. Some studies indeed suggest that implicit self-esteem can increase in response to ego threat, such as social rejection (Rudman, Dohn, & Fairchild, 2007) or performance anxiety (Komori & Murata, 2008). These findings do not appear to generalise to cognitions related to disordered eating. Studies have repeatedly failed to demonstrate an increase in implicit self-esteem following body salience tasks, which would be expected to be more uncomfortable and more self-esteem threatening to someone with higher ED pathology. Hoffmeister et al. (2010) found that while a body salience task increased implicit self-esteem in the low-restraint group, it was unaffected in high-restraint participants. Svaldi et al. (2012) also found that a positive self-esteem manipulation increased implicit self-esteem, for people both high and low in body dissatisfaction – while a negative self-esteem manipulation decreased it. In a clinical study by Vanderlinden et al. (2009), participants in the clinical ED group increased in implicit self-esteem following a positive feedback, but had no response to negative feedback. It therefore seems unlikely that high implicit self-esteem in people with elevated ED pathology is the manifestation of threat defence.

1.2. SOCIOMETER THEORY

An alternative to TMT, the sociometer theory (Leary & Downs, 1995; Leary & Baumeister, 2000) reconceptualises self-esteem as a *tool*. This theory suggests that we are motivated to maintain or increase our social value and that our self-esteem decreases when we receive cues (e.g., rejection or shaming) which suggest that we are not doing this successfully. Canadian anthropologist Jerome H. Barkow was among the first to suggest that self-esteem may be a

monitoring mechanism for the construction of social hierarchies (Barkow, 1980). Sociometer theory proposes that subjective feelings of self-worth are closely linked to others' attitudes and behaviour towards ourselves, which allows us to regulate our behaviour accordingly (Leary, 2004).

There is both observational and experimental data which support the sociometer theory. People with low self-esteem (either chronic or experimentally induced) act more cautiously in situations where social ostracism is likely than those with high self-esteem (Anthony, Wood, & Holmes, 2007 in Leary, 2005; Leary, Rice, & Schreindorfer, 2005). Neurocognitive data also suggests that response to negative social feedback is processed in the medial prefrontal cortex, which is associated with self-referential processing (Lieberman, 2010). This suggests that negative social feedback engaged cognitive structures involved in self-reflection, which is consistent with the sociometer theory. However, the theory has not been supported unequivocally. Some findings suggest that negative feedback can lead to an increase in aggression, which is not conductive to social acceptance (Twenge, Baumeister, Tice, & Stucke, 2001). Pruessner, Hellhammer and Kirschbaum (1999) also point out that self-esteem is also responsive to non-social events, such as trying to solve a set of difficult maths problems.

Both TMT and Sociometer theories have evidence in their favour, but both have also been criticised for empirical inconsistencies and conceptual lapses. It is beyond the scope of this chapter to provide a comprehensive account of the relative merits of each theory. However, Sociometer theory has the most relevance to the present research due to its focus on social comparison, which plays a more significant role in eating behaviour and eating disorder pathology than mortality salience. Research suggests that even when accounting for self-esteem and objective body size, the extent to which people compare themselves with others can predict the extent of their body dissatisfaction and eating disorder symptoms (Stromer & Thompson, 1996). Studies conducted on the effect of media on body dissatisfaction suggest that viewing attractive body images has an immediate, negative effect on the body image of people who have internalised the thin ideal (i.e., those who endorse thinness as a desirable

characteristic) (Cattarin, Thompson, Thomas, & Williams, 2000). Social comparison has been found to be the mediating factor in the effect of media images of attractive bodies has on the viewer's body dissatisfaction (Tiggemann & McGill, 2004). Even at clinical levels of disordered eating, symptom severity is positively associated with levels of unfavourable social comparison. (Troop, Allan, Treasure, & Katzman, 2003). On the other hand, while TMT may play a role in ED pathology, the elevated mortality rate associated with it does not support the role of an acute fear of death as the primary motivating factor. Anorexia Nervosa has a weighted mortality rate of 5.10, with about 1/5th the consequence of suicide (Arcelus, Mitchell, Wales, & Nielsen, 2011) – i.e., five times higher than in the general population. This is in contrast to, for example, the weighted mortality rate in schizophrenia (3.29) and the general mortality rate for all psychiatric disorders (1.56) (Joukamaa et al., 2001). At the very least this suggests that mortality salience alone is not sufficient for recovery. The Sociometer theory will therefore predominantly be used for the design and interpretation of research in this Thesis. The next section will outline the role of self-esteem in eating behaviour and the overvaluation of shape and weight in the evaluation of self-worth.

2. Self-esteem in eating behaviour and eating disorders

Two of the most extensively researched eating disorders are Anorexia Nervosa (AN) and Bulimia Nervosa (BN). AN is characterised by excessive dieting which leads to a low weight, a pathological fear of weight gain and an excessive influence of shape or weight on self-evaluation. BN is characterised by frequent episodes of binge-eating (uncontrollably consuming large amounts of food), followed by compensatory behaviours such as vomiting or fasting in order to avoid weight gain. People who exhibit clinically significant pathology but do not satisfy inclusion criteria for AN or BN have been commonly diagnosed with Eating Disorder Not

Otherwise Specified (EDNOS). The revisions made for the DSM-5 (American Psychiatric Association, 2013) have also introduced Binge Eating Disorder (BED), which was previously diagnosed under the EDNOS label, and is characterised by uncontrollable over-eating. In the UK, the annual incidence of EDs (between the ages of 10 and 49) is approximately 37 per 100,000 people (Micali, Hagberg, & Treasure, 2013)..

Although low self-esteem is common in both disorders, it is thought to play a different role in AN compared to BN. Fairburn, Shafran and Cooper (1998), in their cognitive behavioural model of AN, argue that people with AN use self-starvation as an expression of self-control, from which they derive feelings of accomplishment. In a stepwise regression model of traits predictive of AN symptom severity, self-control accounted for 19% of the variance (Birgegard, Björck, Norring, Sohlberg, & Clinton, 2009). Marilyn Lawrence wrote: "Anorexics are attempting to solve the problem of their own powerlessness [...] The struggle takes the form of an effort to transcend the body which debases them, and to achieve self-respect through self-denial." (Lawrence, 1979, p.93) The paradox is that people with AN are able to maintain very rigid control over their eating, and yet perceive their own self-control as poor (Horesh, Zalsman, & Apter, 2000). Perfectionism is also thought to contribute to the pathology: people with AN tend to score significantly higher on measures of perfectionism than healthy controls, with the score positively correlated with symptom severity (Halmi et al., 2000) and negatively with treatment outcome (Sutandar-Pinnock, Woodside, Carter, Olmsted, & Kaplan, 2003). Excessively high standards can exacerbate the anorexic behaviour and have a negative effect on self-esteem. However, it must be noted that low self-esteem in AN may be partially attributable to depression, which is highly comorbid: in one longitudinal study, 68% of women diagnosed with AN had also been diagnosed with a major depressive disorder (Halmi et al., 1991). Once depression is controlled for, differences in self-esteem between people with AN and restrained eaters (people who voluntarily restrict their diet) are significantly reduced (although they still remain lower than healthy controls) (Wilksch & Wade, 2004).

In BN, low self-esteem is theorised to contribute to the binge-purge cycle. Low self-esteem (Laessle, Tuschl, Waadt, & Pirke, 1989) and elevated perfectionism (Vohs, Bardone, Joiner, & Abramson, 1999) are both typical of BN. Bardone, Vohs, Abramson, Heatherton, & Joiner (2000) found that BN was best predicted by a combination of high perfectionism, body dissatisfaction, and low self-esteem. Vohs et al. (1999) theorise that the binge-purge cycle can arise as a consequence of holding oneself to very high standards (e.g., low target weight), but lacking the confidence that they can be achieved. Repeated self-control failures (binges) serve to negatively affect self-esteem and therefore exacerbate the symptoms. This explanation was adapted from the diathesis-stress model of depression, which proposes that perfectionism and life stress interact to predict depressive pathology (Hewitt & Dyck, 1986). Impulsivity also plays a role in bulimic behaviour, as people with BN tend to be more impulsive than those with AN or healthy controls (Díaz-Marsá, Carrasco, & Sáiz, 2000), which can leave them more susceptible to engage in the binge-purge cycle.

Restrained eaters (REs), defined as people who deliberately attempt to restrict their diet (either in the types or quantity of food) with the intention of weight loss, often exhibit similar behavioural and cognitive patterns as those with eating disorders. Similar to BN, restrained eaters are often unable to consistently sustain the restraint, which leads to overeating – often triggered by the experience of negative emotions (Cools, Schotte, & McNally, 1992; Polivy & Herman, 1999). REs also report lower self-esteem than unrestrained eaters (unREs) (Wilksch & Wade, 2004). REs with low self-esteem are more prone to abstinence violation, or the 'what the hell' effect (Herman & Mack, 1975), where a single lapse in restraint leads to overeating (Polivy, Heatherton, & Herman, 1988) – which is behaviourally similar to the way binges are thought to be triggered in BN. Low self-esteem is also associated with other precursors of clinically disordered eating behaviour, such as body dissatisfaction (Tiggemann, 2005). It must be noted that low self-esteem does not, by itself, predict restrained eating; rather, body dissatisfaction predicts both restraint and low self-esteem (Johnson & Wardle, 2005).

2.1. SHAPE- AND WEIGHT-BASED SELF-ESTEEM

While low self-esteem is common in both EDs and in dietary restraint, they are not exclusively associated. However, what does appear to be specifically important in ED pathology is Shape- and Weight-Based Self-esteem (SAWBS) (Geller et al., 1998). SAWBS refers to the over-valuation of one's shape and weight in assessing one's self-worth and is typically assessed using the SAWBS Inventory (Geller, Johnston, & Madsen, 1997; Geller et al., 1998). Participants are asked to select personal attributes which have affected how they felt about themselves over the past four weeks. They are then asked to order-rank these attributes in order of importance and assign them a relative importance value. The relative importance of shape and weight is designated the SAWBS score. The inventory reliably discriminates between people with EDs, those with other psychiatric disorders, and healthy controls – both adults and children/adolescents with an ED consistently score higher (Geller et al., 1998; Serpell, Neiderman, Roberts, & Lask, 2007). Clinical research in AN populations indicates that a decrease in weight is correlated with an increase in self-esteem (Brockmeyer et al., 2012). Conversely, SAWBS significantly decreases as a consequence of treatment (Geller, Zaitsoff, & Srikameswaran, 2005). One study has found that this decrease can be qualified by a *shift* in self-esteem source: outpatients enrolled in a treatment programme decreased their reliance on shape and weight as a source of self-esteem, but increased their reliance on personal relationships (Geller, Cassin, Brown, & Srikameswaran, 2009)

In non-clinical samples, girls who evaluate their self-worth primarily on the basis of their body shape and weight have also been found to score higher on measures of anorexic and bulimic cognitions than girls who do not (Geller, Srikameswaran, Cockell, & Zaitsoff, 2000). Higher SAWBS scores have also been found to mediate the correlation between self-esteem and dietary restraint (Wade & Lowes, 2002): that is, low self-esteem is positively associated with ED pathology, but only if feelings of low self-worth are associated with an over-valuation of shape and weight. Although no studies have directly addressed this, it can be hypothesised that an over-emphasis on shape and weight in the evaluation of self-worth typically precipitates

restrained eating behaviour and ED pathology. This hypothesis is consistent with both the DSM criteria for both AN and BN and with Bardone et al.'s (2000) prospective research which found that low self-esteem is one of the factors in the cognitive profile predictive of future bulimic symptomatology.

3. Implicit self-esteem

If explicit self-esteem can be characterised as an attitude towards the self, implicit self-esteem could therefore be defined as automatic, valenced associations with the self. Buhrmeister, Blanton and Swann (2011, p.366) summarise it as "a global self-evaluation that people are unable or unwilling to report". Explicit self-esteem is typically assessed globally – as an overall self-evaluation – however, it is sometimes measured in terms of a self-evaluation in specific domains, such as academic competence (Rosenberg, Schooler, Schoenbach, & Rosenberg, 1995) or, in the case of SAWBS, shape and weight. Implicit measures of self-esteem also typically assess global associations, such as those between "me" and "good". However, the flexibility of implicit assessment does lend itself to more specific assessment, such as the associations between "me" and "intelligent". In contrast to explicit self-esteem, where several theoretical models have been developed to explain its importance and function, no comprehensive theoretical framework of implicit self-esteem yet exists. However, several early hypotheses have been proposed. These will be discussed primarily in the context of research in restrained eating behaviour and ED pathology.

Chapter I has already discussed the relationship of implicit and explicit attitudes to behaviour: explicit attitudes tend to be associated with conscious and controlled behaviour, while implicit attitudes predict behaviour which is more spontaneous and automatic. Studies in implicit self-esteem tend to yield findings which are consistent with this distinction. For example, implicit self-esteem has been found to predict non-verbal behaviour in romantic interaction (Peterson & DeHart, 2013), and behaviour indicative of anxiety in a self-relevant

interview (Spalding & Hardin, 1999). These findings suggest that it is possible for self-esteem to have a quantifiable effect on behaviour. Given the relevance of impulsive behaviour in BN (Claes, Nederkoorn, Vandereycken, Guerrieri, & Vertommen, 2006), binge eating (Kane, Loxton, Staiger, & Dawe, 2004) and restrained eating (Nederkoorn, Van Eijs, & Jansen, 2004), it is possible that implicit self-esteem can play a role in at least some aspects of disordered eating behaviour.

3.1. IMPLICIT SELF-ESTEEM ASSESSMENT

The two most common measures used in implicit self-esteem assessment are the Name Letter Test (NLT; Nuttin, 1985) and the IAT – the latter of which was used in the assessment of implicit self-esteem in the present study. The NLT takes a somewhat different approach to implicit measures based on response times: participants are asked to rate the letters of the alphabet for likeability. The 'name letter effect' (NLE) refers to people's tendency to rate their own initials higher than average (Nuttin, 1987). This approach can arguably be anchored within the theoretical concept of 'implicit egotism' (Jones, Pelham, Mirenberg, & Hetts, 2002). Implicit egotism refers to the unconscious over-valuation of objects and concepts associated with the self. Therefore, the higher a person's implicit self-esteem, the stronger a NLE they should exhibit. The NLT is an implicit measure by virtue of being indirect: participants are not asked to consciously evaluate their self-worth, nor are they likely to be aware of the bias in their ratings.

By contrast, the IAT takes the conventional approach of contrasting relative performance times on congruent blocks (in which one response key is used for, for example, "Me" and "Positive" and another for "Not Me" and "Negative") and incongruent blocks (in this example, one key for "Me" and "Negative"; another for "Me" and "Positive"). The IAT has been criticised in the assessment of implicit self-esteem because self-esteem is, ostensibly, a unipolar construct rather than a relative one: i.e., one's attitude towards oneself (Nosek, Greenwald, & Banaji, 2005). However, assessing automatic associations towards the self *relative* to others is consistent with both the Sociometer theory of self-esteem and with social comparison theory

(Martinot & Redersdorff, 2006; Buunk & Gibbons, 2007), both of which assert that our self-evaluations are made with reference to other people. Some unipolar measures of implicit attitudes including the EAST (De Houwer, 2003) and affective priming (Wentura et al., 2005) have been adapted for the assessment of implicit self-esteem, but these have been used less commonly and therefore have less available data to assess generalizability and psychometric properties. The majority of research relies on IAT for implicit self-esteem assessment.

Karpinski (2004) also conducted a series of studies to demonstrate that the content of the comparison category can influence the outcome of the self-esteem IAT. In Study 1, self-esteem scores were lower when "Self" was contrasted with a "known" group of friends or relatives, compared to when it comprised of unspecified "Others". However, IAT-D values were positive in both conditions, indicating overall positive implicit self-esteem. In Study 2, "Self" was assessed against a strongly positive (Santa Claus), strongly negative (Hitler), and a neutral (unspecified "Other") comparison category. Similarly to the outcomes of Study 1, implicit self-esteem was lower in comparison to Santa than "Other"; however, there were no differences between the "Other" and the Hitler IAT. These findings suggest that the stimuli selected for the "Other" category can significantly bias the IAT outcome. However, this is an argument for careful stimulus selection, rather than the disuse of the IAT in implicit self-esteem measurement. The author recommends either the use of a neutral "Not Self" category, or the use of "familiar, not self-identified, and neither strongly liked or disliked" stimuli (Karpinski, 2004, p.30) to contrast with the "Self" category. This is again consistent with both the Sociometer and Social Comparison theories, according to which self-esteem is constructed relative to a perceived external standard. In accordance with this, a "Not Me" category has been used in the IAT in the present study.

3.2. NORMATIVE IMPLICIT SELF-ESTEEM

Similarly to explicit self-esteem, implicit self-esteem in individualist, Western cultures (including the UK and the US) tends to be high. The NLE has been consistently robust in cross-cultural studies, including the UK, Belgium, Germany, Italy, Norway, Poland and Hungary (Nuttin, 1987). However, the key difference is that people appear to hold positive implicit associations with the self, even in cultural contexts where high explicit self-esteem is not normative (Yamaguchi et al., 2007). An example of this is Japan – in a study of the Rosenberg Self-esteem Scale (Rosenberg, 1965), Japanese participants scored on average just 25.50, compared to the overall sample's mean of 30.85 (Schmitt & Allik, 2005). This can be attributed to a difference in self-construal: while Westerners typically view themselves as independent individuals, Japanese culture emphasises the individual's value in the context of his or her community (Markus & Kitayama, 1991; Heine, Lehman, Markus, & Kitayama, 1999). Despite this, a significant NLE has been found in Japanese participant samples (Kitayama & Rarasawa, 1997) suggesting that implicit SE is high. One study which assessed implicit self-esteem using the IAT actually found that Japanese participants had a *higher* implicit self-esteem than American and Chinese participants (Yamaguchi et al., 2007). These findings suggest that despite the fact that explicit self-esteem is constructed within the boundaries of cultural norms, positive implicit associations with the self typically persist regardless.

3.3. DO WE NEED POSITIVE IMPLICIT SELF-ESTEEM?

No formal theoretical models have yet been developed to address the function (if any) of positive implicit self-esteem. Some tentative hypotheses have been put forward, and theories of explicit self-esteem (TMT and Sociometer) could theoretically be extended to the implicit – some tentative suggestions have been made in the Discussion section of this chapter. However, the apparent universality of positive implicit self-esteem is consistent with hypotheses of

implicit attitude development. Assuming that implicit attitudes are formed through the repeated presentation of stimulus pairs (e.g., snake-dangerous), then implicit self-esteem will also develop through experiences with self-relevant cues (e.g., me-good). Most people could reasonably be expected to experience a greater amount of positive or neutral self-relevant cues (through praise from parents, academic achievement, social acceptance, or milestones of personal development) than negative ones (through social ostracism, abuse, or delayed personal development). No systematic study has yet addressed this hypothesis, but one study did find that implicit self-esteem was higher in young adults who reported that their parents were more nurturing to them as children (DeHart, Pelham, & Tennen, 2006). Baccus et al. (2004) and Dijksterhuis (2004) also found that implicit self-esteem can be increased through a classical conditioning paradigm, similarly to implicit attitudes towards cartoon monsters (Olson & Fazio, 2001) and healthy food (Hollands et al., 2011). These findings are consistent with the hypothesis that positive implicit self-esteem is likely to be the consequence of repeated matches between the self and positive valence. Personal experiences might therefore be expected to affect both implicit and explicit self-esteem similarly: positive self-relevant experiences would enhance explicit self-esteem through rational analysis of the outcome, while *repeated* positive experiences would reinforce positive implicit associations with the self (and vice versa for negative ones). However, research suggests that implicit and explicit self-esteem do not always correspond. In fact, studies with ED participants consistently suggest that, despite low explicit self-esteem, implicit self-esteem appears high.

Hetts and Pelham (2001) propose several possible explanations for what implicit self-esteem actually *is*, which can help explain its apparent universal positivity. One explanation, consistent with Steele's (1988) self-affirmation theory, is that implicit self-esteem acts as a buffer against stress: a shield against ego threat. Two other explanations are derived from functional accounts of explicit self-esteem: Terror Management and Sociometer theories. Consistently with TMT, implicit self-esteem may act as defence against the anxiety we experience as a result of our consciousness of our own mortality. With regards to Sociometer

theory, implicit self-esteem could act as a chronically accessible evaluation of the self, which can then be used in the interpretation of others' social behaviour and subsequently our behavioural response to it. This assertion is supported by research which supports implicit self-esteem compensation following ego threat, including threats to gender identity, race, and social rejection (Rudman et al., 2007). If one is to assume that the implicit and explicit self-esteem are different processes, and therefore serve different functions, then it could be argued that implicit self-esteem works to monitor the social environment on an automatic, non-conscious level which serves to free up cognitive resources from performing the same work consciously. Finally, the authors propose a hypothesis derived from attachment theory (Bowlby, 1977). Research by DeHart and colleagues (DeHart, Pelham, & Murray, 2004) found that people whose parents had divorced had lower implicit self-esteem than those whose parents hadn't. If implicit self-esteem does indeed develop prior to conscious self-conceptualizations, then it could constitute an "internal working model" (Hetts & Pelham, 2001, p.115) of the infant's relationship to herself and to her caregiver(s). Koole et al. (2001) also take the position that the earliest developments of an infant's self-concept is most likely to be automated, and implicit self-esteem is therefore best conceptualised as a consolidation of the associations between self-relevant cognition and affective associations. These associations become integrated into the person's "automatic self", which is a non-conscious but chronically accessible self-representation. By contrast, Greenwald and Banaji (1995) view implicit self-esteem as simply an attitude towards the self, an "introspectively unidentified […] effect of the self-attitude on evaluation of self-associated and self-disassociated objects" (Greenwald & Banaji, 1995, p.11) and therefore no different to any other implicit attitude construct. It must be noted that, at present time, there is insufficient empirical evidence to significantly favour one of these accounts above all others. However, for the purpose of the present study, which seeks to examine the role of implicit self-esteem in ED pathology, it is the function and behavioural consequences of implicit self-esteem which are of primary relevance and interest.

3.4. IMPLICIT SELF-ESTEEM IN EATING DISORDERS

Several studies have assessed implicit and explicit self-esteem in clinical ED populations. Cockerham, Stopa, Bell and Gregg (2009) asked female participants in a mixed BN/binge eating disorder sample and healthy female controls to complete explicit measures of self-esteem as well as a self-esteem IAT. Participants in the clinical group scored significantly lower than healthy controls on the explicit self-esteem measure, even after controlling for depression. However, the clinical group scored significantly *higher* on the self-esteem IAT (M=.87), indicating stronger positive associations with the self compared to controls (M=.59).

Vanderlinden et al. (2009) found a pattern of results similar to Cockerham et al. (2009). The authors used an EAST paradigm (see p.60) to assess implicit self-esteem in a mixed AN/BN sample compared to healthy controls. Again, the clinical group reported significantly lower explicit self-esteem than the controls. Although a marginal group x stimulus valence interaction was found, further analyses within each group found no significant effect of valence in either. This suggests that there were no significant differences in implicit self-esteem between the groups. It is worth noting that the study also assessed implicit self-esteem change following feedback. Participants were given mock results (either positive or negative) on an intelligence test with self-esteem assessed before and after. Analyses of both the implicit and explicit measures found a main effect of feedback in the ED group only: both implicit and explicit self-esteem was found to increase in response to positive feedback and decrease in response to negative feedback. Such an effect was absent in the control group. It is unclear whether these findings indicate that implicit self-esteem was more responsive to feedback in the clinical group, or whether implicit self-esteem instability could have contributed to the development of ED pathology.

Self-esteem discrepancy has also been found in non-clinical participant samples. Hoffmeister, Teige-Mocigemba, Blechert, Klauer and Tuschen-Caffier (2010) assessed self-esteem in restrained and unrestrained eaters using an IAT paradigm, and found that, like ED patients, REs scored lower on explicit self-esteem than unRE, whilst the two groups did not

differ in implicit self-esteem. The study also assessed changes in self-esteem following a body salience task (in which participants were asked to examine their own bodies in a mirror). Implicit self-esteem was found to increase following the task, but only in the unRE group. This contrasts with Vanderlinden et al.'s findings (2009), but the tasks used (intelligence test feedback vs. body salience) are quite different. It could be argued that both could be associated with feelings of insecurity, anxiety and ego threat, but these were not assessed in participants in either study. However, both studies suggest that while implicit self-esteem does not differ between clinical/RE groups and healthy/unRE controls, there do appear to be individual differences in how it changes in response to external threat.

Implicit attitude measures have also been used to assess the possibility of implicit SAWBS. Blechert, Ansorge, Beckmann and Tuschen-Caffier (2010) carried out an affective priming study using shape and weight sentences as primes and adjectives related to self-esteem as target stimuli. Participants diagnosed with an ED (and in particular those with BN) had significantly stronger associations between shape and weight concerns and congruent interpersonal adjectives (e.g., "When I lose weight I feel..." + "Liked", or "When I stop dieting I feel..." + "Incompetent"). A significant effect was also found for REs, but it was less pronounced than in the two ED groups. These findings suggest that the associations between self-worth and body and shape are internalised to the extent of forming automatic associations in people with EDs, and, to some extent, in REs. In the context of implicit attitude theories which espouse spreading activation (such as the REC model), ED pathology could strengthen associations between self-worth and body image (and vice versa). These associations may weaken after undergoing treatment in favour of enhancing connections between self-worth and other attributes (e.g., social relationships). While these hypotheses are consistent with their theoretical context, longitudinal research would be necessary to test potential change in implicit associations over the course of the illness and treatment.

3.5. THEORETICAL ACCOUNTS

There are currently several hypothesis which have been proposed to explain the apparent self-esteem discrepancy in clinical or sub-clinical ED pathology. Cockerham et al. (2009) suggest that discrepant self-esteem (where explicit self-esteem is low but implicit self-esteem is high) is fragile, which could be indicative of "psychological distress" (p.271) and may be a risk factor for developing ED pathology. This is consistent with Rydell, McConnell and Mackie (2008), who found that greater discrepancy between implicit and explicit attitudes also lead to greater dissonance-based discomfort. More relevant to disordered eating, discrepant self-esteem has been found in people with depression (De Raedt, Schacht, Dranck, & De Houwer, 2006; Schröder-Abé, Rudolph, & Schütz, 2007) and in those with elevated perfectionism (Zeigler-Hill & Terry, 2007). Both are frequently co-morbid with ED symptoms, both at clinical and sub-clinical levels (Halmi, Casper, Eckert, Goldberg, & Davis, 1979; Joiner Jr, Heatherton, Rudd, & Schmidt, 1997).

Alternatively, Zeigler-Hill and Terry (2007) suggest that people who report a pattern of low explicit but high implicit self-esteem can be characterised as possessing a "glimmer of hope" (p.140). The authors propose that the discrepancy creates an ambivalence in the person's feelings of self-worth; the automatic positive attitude can potentially affect cognition and behaviour despite the negative explicit self-evaluation. This hypothesis has been supported in a study by Spencer, Jordan, Logel and Zanna (2005), who found that perseverance on a task was correlated with implicit, but not explicit self-esteem. The research evidence appears to converge; self-esteem discrepancy may be associated with a range of pathologies co-morbid with ED symptoms. However, no study has yet addressed these together with ED symptoms. The next steps should therefore be aimed at modeling the relationship, if any, between perfectionism, perseverance/persistence, depression, ED pathology and implicit and explicit self-esteem.

It must be noted that the findings have not been unequivocal. Fronza, Galimberti, Fadda, Fanini and Bellodi (2011) assessed implicit and explicit self-esteem using the IAT in a mixed

AN/BN/BED sample and in healthy controls. In contrast to previous findings, the authors found that those in the clinical sample had significantly lower implicit self-esteem compared to healthy controls. However, the study was never published as a full article (only as a conference abstract), therefore it is unclear how methodology or analysis could have affected the outcome. Additionally, a study by Svaldi, Zimmermann and Naumann (2012) found that participants who reported low body dissatisfaction also reported lower implicit self-esteem than those with high body dissatisfaction. However, while body dissatisfaction can be consistent with disordered eating behaviour, it is can also exist without it. This study is therefore not necessarily inconsistent with previously discussed studies.

It is also worth noting that studies in ED pathology and implicit self-esteem typically do not report the IAT-D value. The calculation of the IAT-D reflects the relative association strength: e.g., an IAT-D value above zero indicates stronger associations between self-positive than self-negative (and vice versa for values below zero). However, many studies (Cockerham, Stopa, Bell, & Gregg, 2009; Hoffmeister, Teige-Mocigemba, Blechert, Klauer, & Tuschen-Caffier, 2010) report only analyses pertaining to group differences. While this is helpful when contrasting high- and low-pathology participants, there is a difference between implicit self-esteem which is *lower* in one group than another, and implicit self-esteem which is *low* – that is, where an IAT-D is significantly different from zero in a direction which suggests stronger negative associations with the self.

The research picture which emerges is therefore as follows: people with elevated ED pathology tend to report lower *explicit* self-esteem than healthy controls, but report high *implicit* self esteem; it is unclear what role this discrepancy plays in the development or maintenance of ED pathology, or how it is related to other traits associated with ED pathology (such as perfectionism). The present study was designed as a first step towards resolving these questions.

4. Research aims and hypotheses

- *Hypothesis 1: Elevated ED pathology will be associated with decreased explicit, but not implicit, self-esteem.* Although research in both implicit cognition and self-esteem is extensive, only a handful of studies have been carried out to address both in the context of ED pathology. Only one study has addressed discrepant self-esteem in a non-clinical population (Hoffmeister et al., 2010) – the present study is designed to address self-esteem discrepancy in elevated, but sub-clinical levels of disordered eating. The hypothesis was based on clinical study outcomes (Vanderlinden et al., 2009; Cockerham et al., 2009). While it is possible that these findings will not generalise to sub-clinical levels of pathology, it is sensible to suggest a consistent result of patterns. It is therefore anticipated that participants with elevated ED pathology will have lower explicit self-esteem than the non-elevated group's, but that the groups will not differ significantly in their implicit self-esteem.
- *Hypothesis 2: Implicit and explicit self-esteem discrepancy will be better predictors of ED pathology than explicit self-esteem alone.* Cockerham et al. (2009) and Zeigler-Hill and Terry (2007) have suggested that self-esteem discrepancy may be negatively associated with psychological well-being. Hypothesis 2 is therefore concerned with the predictive validity of self-esteem discrepancy for ED pathology. This will be assessed using multiple regression models including both variables, and, alternatively, the calculation of a "self-esteem discrepancy" value used in the assessment of covariance with ED pathology.
- *Hypothesis 3: (If Hypothesis 2 is supported) Perfectionism will act as a moderator between discrepant self-esteem (low explicit, high implicit) and ED pathology*. A small number of studies have suggested that discrepant self-esteem may be associated with both elevated perfectionism (Zeigler-Hill & Terry, 2007) and elevated ED pathology (Cockerham et al., 2009; Vanderlinden et al., 2009; Hoffmeister et al., 2010). If both

findings are replicated, a structural equation model could be developed to arrive at a better understanding of how the variables are related.

5. Method

5.1. PARTICIPANTS

Participants were recruited using a university subject pool. Participants consisted of 79 women, predominantly undergraduate students and university staff. Men were not included to avoid confounding the data with gender differences in attitudes and aetiology: non-eating-disordered men typically exhibit significantly less weight and shape concern than women (Rozin & Fallon, 1988), are less likely to engage in dietary restraint (Brand, Rothblum, & Solomon, 1992), and tend to report slightly higher self-esteem than women (Kling, Hyde, Showers, & Buswell, 1999). The relative limitations of this sampling strategy are discussed under the *Limitations* section.

Ten participants were excluded for failing to reach the minimum required accuracy rate on the implicit self-esteem measure (see: *Measures*). The final sample therefore included 69 women, which is comparable to a sample of 71 used in the Hoffmeister et al. (2010) study with a similar design. Mean age was 22.43 (SD=4.64) and mean BMI was 21.60 (SD=3.36). Participants were predominantly white (50.7%) and British (46.4%). Six (8.7%) participants reported being formally diagnosed with an eating disorder (1 AN, 1 BN, 1 mixed AN/BN, 1 EDNOS,1 other, and 1 participant who did not respond). Participants' first language was inferred from their self-reported nationality during data analysis, resulting in approximately 39 native speakers and 30 non-native speakers.

5.2. MEASURES

The Self-Esteem Implicit Association Test (SE-IAT). The IAT was selected as an assessment of implicit self-esteem, in favour of, for example, the NLT or the EAST. The SE-IAT is conceptually consistent with research pertaining to the sociometer theory, and also with explicit self-esteem measures: all conceptualise self-esteem as a construct *relative* to the perception of others. The SE-IAT assesses *relative* association strengths between Me/Not Me and Positive/Negative – as such, it is a measure of positive associations with the self, relative to positive associations outside of the self.

The IAT procedure was adapted from other IAT studies on implicit self-esteem (Farnham, Greenwald, & Banaji, 1999; Greenwald & Farnham, 2000). The target words in the Me category were *me, myself, my, mine, own* and *I*. In the Not Me category were *they, them, he, other, she* and *others*. Valence words in the Positive category were *good, capable, competent, successful, valuable* and *worthy.* In the Negative category the words were *wrong*, *weak, stupid, inadequate, worthless* and *inferior.* Stimuli in the Me and Not Me categories did not significantly differ by word length, $t(10)=-1.07$, $p=.308$. The same was true for stimuli in the Positive and Negative categories, $t(10)=.255$, $p=.588$.

The procedure consisted of three practice blocks, one experimental block, three more practice blocks and one more experimental block. In each block participants saw category labels in the top left and top right corners of the screen. Stimulus words appeared in the centre of the screen; participants were required to press the Z key if the word's corresponding category appeared on the left, or the M key if the category appeared on the right. The order of the two halves of the procedure was counter-balanced between participants, however a "congruent first" order is described here as an example for clarity.

In the first practice block, participants saw (and categorised) either Me and Not Me words. In the second practice block, participants saw Positive and Negative words. In the third practice block participants saw all four categories: Positive and Me category labels appeared

together in one corner of the screen, Negative and Not Me together in another corner – this is a "congruent" block. The fourth block was experimental (i.e., response data was recorded) and identical to block three. The fifth block was identical to the first. In the sixth practice block participants saw Positive and Negative words, but with response key assignment switched from block two. In the seventh practice block participants used one key to respond to Me and Negative words, and another to respond to Not Me and Positive words. The final, eighth, experimental block was identical to the seventh – with response data recorded. The purpose of the practice blocks was to habituate participants to key assignment in each experimental block to minimise learning error. Table 1 contains all the stimulus and key assignments. The stimuli were presented in a 15px black Verdana font on a Radeon HD, 32-bit colour, 96DPI display with a screen resolution of 1024x768px.

The IAT-D effect was calculated in accordance with recommendations by (Greenwald et al., 2003). First, trials on which participants used an incorrect response key were coded as errors. Second, trials on which participants responded faster than 300ms or longer than 3,000ms were also coded as errors – the former suggests a trigger response, the latter a distraction. Participants who made errors on 20% or more trials (N=10) were excluded from the analysis. The IAT-D was then calculated for each participant by dividing the mean difference between the congruent and incongruent block response latencies by the standard deviation of latencies in both blocks. The calculation was performed to ensure that a score above zero indicates stronger *positive* self-associations, and a score below zero indicates stronger *negative* self-associations.

Table 1
Self-esteem Implicit Association Test procedure

Block	Block type	Categories on the left (Z key)	Categories on the right (M key)	Data recorded?	# Trials
1	Practice	Me -	Not Me -	No	15
2	Practice	- Positive	- Negative	No	15
3	Practice	Me Positive	Not Me Negative	No	15
4	Experimental (Congruent)	Me Positive	Not Me Negative	Yes	40
5	Practice	Me -	Not Me -	No	15
6	Practice	- Negative	- Positive	No	15
7	Practice	Me Negative	Not Me Positive	No	15
8	Experimental (Incongruent)	Me Negative	Not Me Positive	Yes	40

Rosenberg Self-Esteem Scale (RSES). The RSE is a global measure of self-esteem consisting of ten items scored on a 4-point Likert scale from 0 (*strongly disagree*) to 3 (*strongly agree*). Items include "I am able to do things as well as most people" and "On the whole, I am satisfied with myself". The scale has good psychometric properties; internal consistency has been found to range between α=.77 and .88, and discriminant validity assessments indicate that the scale is not correlated with measures of academic competence, locus of control, or demographic variables such as age or gender (Blascovich & Tomaka, 1991). It has been recommended in the assessment of self-esteem in eating disorder research (Griffiths et al., 1999).

Eating Disorder Examination Questionnaire (EDE-Q). The EDE-Q (Fairburn & Beglin, 1994) was used as a measure of ED pathology, and therefore the independent variable. It is a 36-item questionnaire adaptation of the Eating Disorders Examination (EDE; Cooper & Fairburn, 1987), a structured interview used in clinical ED diagnosis. The EDE-Q has satisfactory concurrent and criterion validity (correlations with the EDE subscales range from *r*=.68 to .84), and has been

shown to reliably differentiate between clinical and non-clinical levels of disordered eating (Mond, Hay, Rodgers, Owen, & Beumont, 2004). Internal consistency for the overall scale has been found at α=.90, with subscale values ranging from α=.70 (Restraint) to .83 (Shape concern) (Peterson et al., 2007)[2]. The scale is scored on the basis of behaviour and thought frequency over the last 28 days and comprises of four sub-scales relating to different facets of ED pathology: dietary restraint, weight concern, shape concern and eating concern. Restraint refers to the extent to which respondents attempt to consciously limit their dietary intake (e.g., "Have you been deliberately trying to limit the amount of food you eat to influence your shape or weight?"). The other subscales reflect, respectively, preoccupation with weight (e.g., "Have you had a strong desire to lose weight?"), body shape ("Has your shape influenced how you think about yourself as a person?") and food and eating ("Have you been afraid of losing control over eating?").

The Multidimensional Perfectionism Scale (MPS). The MPS (Hewitt & Flett, 1991) was used for the assessment of perfectionism in the sample, for the purpose of addressing Hypothesis 2. The MPS is a 45-item, 7-point Likert scale designed to measure three facets of perfectionism: self-oriented, other-oriented and socially prescribed. Items include "I strive to be as perfect as I can be" and "I find it difficult to meet others' expectations of me". The measure has been found to have good stability and concurrent validity (Hewitt, Flett, Turnbull-Donovan, & Mikail, 1991). Internal consistency ranged between α=.82 and .87 for the subscales, and the measure was not correlated with an assessment of social desirability, indicating good discriminant validity (Hewitt & Flett, 1991). Assessments of concurrent validity also suggest that the MPS was moderately correlated with measures of self-attitudes (including self-criticism and high self-standards), with *r* values ranging from .47 to .76 (Hewitt et al., 1991).

[2] The factor structure of the EDE-Q is discussed in Chapter IV (Section 1.2, p. 118)

Demographic questionnaire. This included questions about participants' age, ethnicity, nationality and ED history, if any. Participants' weight and height were measured using scales accurate to 0.05kg and a portable stadiometer and used to calculate BMI as part of the demographic data.

5.3. PROCEDURE

Data was collected in a private room with the female experimenter present for the duration of the study. Study procedure was explained to participants at the beginning and informed consent obtained. The order of the three elements of the study (implicit measure, explicit measures and height and weight measurements) were counterbalanced across participants. For the IAT, participants were given instruction to use corresponding keys to categorise the words which appeared in the centre of the screen, and asked to respond as quickly and accurately as possible. Each session lasted approximately 30 minutes, at the end of which each participant was remunerated £3, or a course credit equivalent, and debriefed.

Missing data predominantly consisted of item nonresponse, and was assumed to be "missing at random" (MAR) – i.e., as a result of human error, rather than deliberate omission. Mean imputation (Schafer & Graham, 2002) was used in order to complete the data sets: a sub-scale (or total scale, where unavailable) mean for the participant was calculated, and used to substitute the missing value. Mean imputation ensures minimal impact on correlation and regression analyses, and is arguably the closest interpretation of the implied response. This approach was used in Study 1, and in subsequent studies, unless otherwise stated. Missing data was only possible for questionnaire-based measures, but not the computerised measures. None of the participants exercised their right to refuse height or weight measurements.

Normal distribution. In the present study, as well as in all subsequent studies, data was checked for normal distribution using the Shapiro-Wilk test of normality, and Levene's test for homogeneity of variance. Quantile-Quartile plots and Stem-and-Leaf plots were eyeballed for expected data distribution. Unless otherwise noted, the tests yielded non-significant results, indicating that data is normally distributed. If non-normal distributions were found, a log-transformation was applied to the values.

6. Results

6.1. DESCRIPTIVE RESULTS

Task order (i.e., the order of implicit, explicit and weight/height measurements) did not have a significant influence on any of the other measures. Native and non-native speakers also did not differ in their scores on any of the measures. Participants scored an average of 21.15 (*SD*=6.13) on the RSES, which falls within a normative range (Schmitt & Allik, 2005). RSES reliability in this sample was satisfactory at α=.896. Participants scored 1.86 (*SD*=1.30) on the EDE-Q. Mean scores for the restraint, weight, eating and shape subscales were 1.59 (*SD*=1.47), 2.29 (*SD*=1.63), 1.07 (*SD*=1.17) and 2.50 (SD=1.50), respectively. These values are somewhat higher than the normative sample data obtained by Mond, Hay, Rodgers and Owen (2004), in which female participants scored, on average, 1.29 on the restraint, 1.64 on the weight, 0.59 on the eating, and 2.16 on the shape concern subscale. Global EDE-Q score (1.42) was significantly lower than in the present sample, $t(262)=2.821$, $p=.005$, which indicates elevated levels of ED pathology in the current study sample. However, participants in the Mond et al. (2004) study were also older (mean age 35.3) and, on average, slightly overweight (mean BMI 25.2). Reliability for the EDE-Q in the current sample was found to be satisfactory, at α=.931.

Participants scored 46.23 (*SD*=4.00) on the MPS; reliability was found to be relatively low, at α=.671. Finally, mean IAT-D score was .50 (*SD*=.41) across the full sample (N=69) and was significantly different from zero, *t*(68)=10.13, *p*=.000. This indicates that participants performed significantly quicker in the congruent, compared to the incongruent, IAT trial block – which suggests stronger positive than negative, automatic associations with the self. A correlation matrix of these variables is found in Table 2. EDE-Q scores were significantly, negatively correlated with both the RSES, and the IAT-D. This suggests that higher ED pathology was associated with both lower explicit and implicit self-esteem. Surprisingly, EDE-Q was not significantly correlated with MPS (*p*=.611).

Table 2
Study 1 correlations

	1	2	3	4	5
1. RSES	1				
2. MPS	.061	1			
3. EDE-Q total	-.647**	.062	1		
4. IAT-D	.280*	-.279*	-.321**	1	
5. BMI	-.116	.076	.250	-.202	1

Correlations marked * are significant at the .05 level
Correlations marked ** are significant at the .01 level

6.2. HYPOTHESIS 1

The first aim was to replicate previous findings which suggest that higher levels of ED pathology are associated with low explicit (RSES), but not lower implicit (IAT) self-esteem. In an analysis procedure consistent with Cockerham et al (2009) and Hoffmeister et al. (2010), participants were categorised into high- and low-pathology groups using a median split procedure. Participants who scored below the EDE-Q median (1.76) were categorised as "Low EDE-Q" (N=34), and those who scored above were categorised as "High EDE-Q" (N=34). An independent samples t-test found significant group differences on the RSES score $t(66)=-4.144$, $p=.000$, 95% CIs [-8.237, -2.880]. A Shapiro-Wilk test with RSES score as the dependent variable and pathology group as factor was not significant, $p=.281$, indicating normal distribution for this measure. Participants in the High EDE-Q group scored significantly lower on the RSES (M=18.32) compared to the Low EDE-Q group (M=23.88). Contrary to hypothesis, a similar pattern was found on the implicit measure using an independent-samples t-test: participants in the High EDE-Q group scored significantly lower on the IAT-D (M=.377) compared to those in the Low EDE-Q group (M=.614), $t(66)=-2.462$, $p=.016$, 95% CIs [-.428, -.044]. This suggests that participants with elevated EDE-Q scores reported both lower explicit and lower implicit self-esteem.

Mean IAT-D values were also tested for difference from zero in each group using a one-sample t-test; the calculation of the IAT-D suggests values above zero to be indicative of faster performance in the congruent block (positive self-associations) and values below zero to be indicative of faster performance in the incongruent block (negative self-associations). Participants in the low EDE-Q group scored significantly above zero on the IAT-D, $t(33)=9.066$, $p=.000$, *d=3.156*. Likewise, IAT-D in the High EDE-Q group was also greater than zero $t(33)=5.530$, $p=.000$, *d=1.925*. This indicates that participants in both groups performed quicker

in the congruent trial of the SE-IAT, which suggests that both groups held stronger positive automatic associations with the self than negative.

Although comparisons between groups were only partially consistent with the hypothesis (i.e., the predicted difference in explicit self-esteem was found, but the differences in implicit self-esteem were unexpected), a repeated-measures ANOVA was carried out to assess a possible interaction between ED pathology and self-esteem. EDE-Q group (Low vs. High) was used as the independent variable, while IAT-D and RSES were used as outcome variables for implicit and explicit self-esteem, respectively. Consistently with previous results, a main effect of self-esteem was found, $F(1,66)=962.220$, $p<.000$, $\eta^2_p=.936$. The interaction was also found to be significant, $F(1,66)=16.045$, $p<.000$, $\eta^2_p=.196$. These findings suggest that despite the fact that participants both high and low in ED pathology held overall positive automatic associations with the self, the discrepancy between implicit and explicit self-esteem was indeed greater in participants with elevated pathology. Self-esteem discrepancy and ED pathology was then assessed systematically for Hypothesis 2.

6.3. HYPOTHESIS 2

The aim was to determine whether discrepant self-esteem (i.e., low explicit, high implicit) was a better predictor of ED symptomatology than low explicit self-esteem alone. First, a hierarchical regression model was run to determine whether both variables (RSE and IAT-D) explained more variance in Global EDE-Q scores than the RSES alone. The first model was significant, indicating that RSES significantly predicts EDE-Q, $F(1,68)=48.228$, $p=.000$, $R^2=.419$, $\beta=-.647$. The second model, incorporating both factors as independent variables, was also significant: $F(2,68)=25.891$, $p=.000$, $R^2=.440$. However, R^2 change for the second model (.021) failed to reach significance, $p=.120$. This suggests that implicit self-esteem may not contribute significant regression value to the model. However, the hypothesis was also specifically made with regards to self-esteem *discrepancy*, and a multiple regression model does not account for

an interaction between the variables entered into the model. For this reason, a second regression analysis was carried out.

First, a "self-esteem discrepancy (SED)" value was calculated. The RSES and IAT-D scores were standardised and their values subtracted: i.e., (z-IAT-D) – (z-RSES). As a result, a larger SED indicates a greater discrepancy between a participant's implicit and explicit self-esteem. A regression model was then conducted using SED as the predictor and EDE-Q as the outcome variable. A hierarchical stepwise regression was used with Global EDE-Q as the dependent variable, and SED, IAT-D and RSES as independent variables. The steps were as follows: 1) predicting Global EDE-Q from RSES, 2) predicting Global EDE-Q from RSES and IAT-D, and 3) predicting Global EDE-Q from SED. The overall regression model was significant, $F(1,67)=48.228$, $p<.000$, $R^2=.419$. However, only the RSES variable reached significance, $\beta=-.137$, $p<.000$ and was therefore included in the model. Neither the SED not the IAT-D significantly predicted the EDE-Q score, $\beta=-.182$ and $-.151$, respectively, $p>.1$. These results suggest that self-esteem discrepancy did not predict ED pathology better than RSES alone.

6.4. HYPOTHESIS 3

The third hypothesis was concerned with fitting the key variables (self-esteem discrepancy, ED pathology and perfectionism) to a structural equation model. However, this hypothesis was predicated on the assumption that perfectionism was correlated with both ED pathology and self-esteem discrepancy. In fact, EDE-Q was not correlated with the MPS, $r=.062$, $p=.611$, nor with any of its subscales. Participants in the High EDE-Q group did not score higher on the MPS compared to the Low EDE-Q group, $F(1,66)=.415$, $p=.522$. Similarly, no differences were found on the Self, Other or Social sub-scales. As a consequence, it was not possible to construct a model. However, it is worth noting that MPS was significantly correlated with the IAT-D, $r=-.279$, $p=.020$, which suggests that higher perfectionism was associated with lower implicit self-esteem in this sample.

As noted previously, the MPS is comprised of three subscales, designed to assess self-oriented, other-oriented, and socially prescribed perfectionism. Although it was not possible to address Hypothesis 3 in the intended way, some post-hoc analyses were carried out in order to assess any relationship between implicit self-esteem and the different facets of the MPS. No significant differences were found between high- and low-pathology groups on the Self, $F(1,68)=.057$, $p=.812$, Other, $F(1,68)=.742$, $p=.392$, or Social, $F(1,68)=.143$, $p=.707$, subscales of the MPS. Correlations between the MPS subscales and self-esteem measures were also carried out, but found no significant relationships between either a) the MPS subscales and the RSES (all *p*s >.1), or b) the MPS subscales and the IAT-D (all *p*s >.1). These results suggest that there was no significant relationship between either measure of self-esteem and the facets of the MPS.

7. Discussion

7.1. RESULTS OVERVIEW

Study 1 was designed to replicate and extend findings which suggest that elevated ED symptomatology is associated with lower explicit, but not implicit self-esteem (Cockerham et al., 2009; Vanderlinden et al., 2009; Hoffmeister et al., 2010). Only one of these studies (Hoffmeister et al., 2010) had been carried out in a non-clinical population, and included restrained eaters only – by contrast, the present study assessed participants with overall elevated pathology, including concerns with restraint, eating, weight and shape. The analyses carried out in previous studies were limited to the assessment of group differences rather than the interaction of implicit and explicit self-esteem, or self-esteem discrepancy as a predictor of ED pathology. The present study was designed to replicate previous findings as well as address both of the latter questions.

Overall, the results support the presence of a self-esteem discrepancy (low explicit, high implicit) in individuals with elevated ED pathology, but suggest that the discrepancy did not predict ED pathology better than explicit self-esteem alone. The study did not wholly replicate the findings from the only other non-clinical study in this area, by Hoffmeister et al. (2010), who found differences in explicit, but not implicit self-esteem between participants high or low in dietary restraint. By contrast, in the present study, participants with elevated ED pathology reported lower RSES and IAT-D scores than those with lower pathology levels; this suggests that both explicit *and* implicit self-esteem were associated with higher ED concerns. However, a follow-up repeated-measures ANOVA did indeed find a significant interaction between the self-esteem measures (RSES and IAT-D) and ED pathology levels, which lends further support to the role of discrepant self-esteem in ED pathology. Hypothesis 1 was therefore confirmed.

Hypothesis 2, pertaining to predicting ED pathology from both implicit and explicit self-esteem was not confirmed. Several multiple regressions were carried out, using both implicit and explicit self-esteem measures, and a value calculated to reflect their relative discrepancy. However, in all cases, the inclusion of implicit self-esteem did not explain pathology to a greater degree than the explicit self-esteem alone. The null findings may be attributed to the approach used in calculating SED, as there is currently no accepted way of calculating self-esteem discrepancy. However, the approach taken here was deemed to be sensible and consistent with the conceptual context of the research questions.

Finally, Hypothesis 3 could not be fully addressed, as it was predicated on the assumption that ED pathology would be correlated with perfectionism, which was not the case. While such a finding is unusual, it is not unique; for instance, Wood, Waller, Miller and Slade (1992) found no correlation between perfectionism and elevated ED pathology. In contrast to findings by Schröder-Abé et al. (2007) and Zeigler-Hill and Terry (2007), who argue that discrepant self-esteem is associated with several maladaptive psychological traits, including perfectionism and aggression, self-esteem discrepancy in the current sample was associated with *lower* perfectionism. Following a discussion of methodological limitations, these findings

will now be discussed in the context of previous research and the function of implicit self-esteem in the context of broader self-esteem theories. Further research directions will also be proposed.

7.2. LIMITATIONS

Data for the current study was collected using an opportunistic sample consisting mostly of undergraduate students: young, slim, educated women. For this reason, the generalisability of the findings is somewhat limited. However, it is worth noting that young, slim women are also at greater risk for developing disordered eating behaviours compared to other demographic groups (Hudson, Hiripi, Pope Jr, & Kessler, 2007), and therefore more relevant to the current research area.

Second, only one implicit measure of self-esteem was used, the IAT. The reasons for selecting the IAT in favour of other available measures was explained in the methodology section. However, the choice to use only *one* measure was mostly a choice made out of practical research constraints. Future studies should ideally include a variety of implicit measures in order to assess both relative and non-relative self-associations.

The stimuli used in the IAT can also be criticised in light of Karpiski's (2004) research with regards to the role of the "Other" category and its potential skewing effect on the measure's outcome. The IAT used for the assessment of implicit self-esteem in the present study were designed with the criticism in mind, and using the recommendation that a "neutral" reference category is used. However, it is still debatable which "Other" group is most relevant in implicit self-esteem research, particularly within the context of ED pathology. Different results with regards to the self-esteem discrepancy could be anticipated using an IAT which contrasts attitude towards the self compared to, for example, one's social group (peers, friends, and/or family), or "idealised" images of beauty in the media. Research suggests that both same-sex peers and media representations are used in social comparison, which is also correlated with body dissatisfaction (Jones, 2001). Further research using different "Other" categories (e.g.,

using peers or subjective shape/weight “ideals”) could contribute to a better understanding of the role of implicit self-esteem in ED pathology. However, studies which use these types of “non-neutral” categories should also take into account the potential mediating effect of Shape and Weight Based Self-Esteem (SAWBS) and include it in the assessment.

As outlined previously, it was not possible to assess the role of perfectionism in the association between discrepant self-esteem and ED pathology because no correlation was found between the MPS and the EDE-Q. While this was unexpected, it could suggest that the MPS is not the most suitable measure of perfectionism to use for this type of research. The MPS assesses other-directed perfectionism as well as the inwardly-directed type, which is not necessarily implicated in disordered eating behaviours (Franco-Paredes, Mancilla-Díaz, Vázquez-Arévalo, López-Aguilar, & lvarez-Rayón G., 2005). Alternative measures such as the Frost Multidimensional Perfectionism Scale (Frost, Marten, Lahart, & Rosenblate, 1990) should be considered for future studies.

Finally, the SED calculation used was developed specifically for the purpose of this study and has not yet been applied broadly. Further research is needed to evaluate other alternatives to representing self-esteem discrepancy quantitatively, while taking into account measurement error, individual variability and generalizability to different explicit and implicit self-esteem measures.

7.3. THEORETICAL ACCOUNTS OF SELF-ESTEEM DISCREPANCY

Overall, the findings of the present study support the assertion that greater discrepancy between implicit and explicit self-esteem is indeed associated with elevated ED pathology, even at a sub-clinical level. Additionally, this study is the first to suggest that self-esteem discrepancy is associated with a general cluster of ED symptoms. Further research directions could address specific facets of ED symptomatology by assessing implicit and explicit self-esteem in participants recruited specifically on the basis of elevated shape or weight concerns. Research

by Svaldi et al. (2012), who found consistent decreases in implicit self-esteem in people reporting high body image concerns, suggests that such distinctions may exist.

The results of the current study lend further support to the apparent "universality" of positive implicit self-esteem (Yamaguchi et al., 2007). Even in the high EDE-Q group the IAT-D effect was still significantly above zero, despite significantly lower explicit self-esteem. In Cockerham et al. (2009) and Vanderlinden et al. (2009), participants in the clinical ED groups reported significantly worse self-esteem than healthy controls, and yet their implicit self-esteem – the automatic associations they had with the concept of "self" – were just as positive. It is not clear why this should be. Although no comprehensive theoretical models concerning the role of implicit and explicit self-esteem have been developed, several hypotheses have been put forth. These will now be discussed in the context of the current study's findings.

Theories of implicit self-esteem. Various explanations of implicit self-esteem have been proposed, although there is currently no consensus with regards to which approach is the most likely and/or consistent with available data. Some of the explanations of the nature and function of implicit self-esteem which have been suggested include a) a stress buffer (derived from self-affirmation theory), b) defence against mortality salience (from TMT), and c) chronically accessible evaluation of the self (from Sociometer theory). In the context of implicit self-esteem acting as a buffer or threat defence mechanism (whether against stress or the anxiety of mortality salience), implicit self-esteem can be conceptualised as non-conscious efforts to protect the ego against thoughts of death (Pyszczynski, Greenberg, & Solomon, 1999). The results of the present study support the apparent "resilience" of implicit self-esteem, as it was found to be high even in participants struggling with elevated levels of ED pathology and lowered explicit self-esteem. However, this conceptualisation is inconsistent with the literature in implicit attitude research. Chapter I discussed the process through which implicit attitudes are hypothesised to form: repeated presentation of a target and a valence stimulus in close spatial or temporal proximity (e.g., snake-bad). This is supported by classical conditioning

studies, in which implicit associations have been found to form or change over the course of a single experimental session (Olson & Fazio, 2001; Baccus et al., 2004). Implicit attitudes are therefore unlikely to act as a mechanism of ego protection, as they are no more resilient or stable than explicit ones.

The current study was formulated within the framework of Sociometer theory, based on research which suggests that social comparison plays a significant role in self-esteem development, particularly with regards to SAWBS. Participants with elevated ED pathology were found to have lower explicit *and* implicit self-esteem, compared to those with few ED symptoms. This suggests that implicit self-esteem may also be susceptible to the negative effects of ED pathology, including body dissatisfaction and concerns over food and eating. However, further research using different implicit self-esteem assessments (e.g., unipolar measures, or IAT categories designed to more closely reflect real-life comparisons) is necessary to ascertain the extent to which social comparison affects implicit self-esteem within the context of ED pathology. Two specific explanations for the discrepancy between implicit and explicit self-esteem in EDs and ED pathology have been previously proposed: a "Glimmer of Hope" hypothesis, and an account of psychological distress. The "Glimmer of Hope" account of self-esteem discrepancy was put forward by Spencer et al. (2005) and Zeigler-Hill and Terry (2007), suggesting that people who retain high implicit self-esteem despite reporting low explicit self-esteem retain a certain unconscious optimism about their self-worth, which can motivate them to behave more proactively. On the one hand, this appears inconsistent with the present findings. The "glimmer of hope" hypothesis suggests that discrepant self-esteem would have positive behavioural outcomes, while in the present sample it was associated with more maladaptive behaviours and beliefs. On the other hand, research in implicit attitude change supports the "glimmer of hope" hypothesis; if the IAT reflects relative associations with the self, participants in the current sample appear to have retained positive self-associations despite their explicit beliefs about their bodies, eating habits or their objective self-worth. In an odd way, dietary restraint behaviour could be understood as "optimistic" in the sense that it is

proactive. People who engage in dietary restraint behaviours, even if they are not sustainable or healthy, seem to retain an underlying belief in their ability to change. This can be conceptualised as cognitive dissonance between implicit and explicit self-esteem, which could then motivate certain types of eating behaviours (Rydell, McConnell, & Mackie, 2008). However, the current body of research is insufficient to either support or reject this hypothesis; further assessments of implicit and explicit self-esteem interaction with ED symptoms should be carried out in people with low implicit/high explicit self-esteem, to determine its potential associations with different types of behaviour. An alternative hypothesis of self-esteem discrepancy has been made by Cockerham et al. (2009), who proposed that self-esteem discrepancy is fragile and could be indicative of "psychological distress", which could then be a risk factor in developing ED symptoms. However, in the present sample, discrepancy between RSES and IAT-D failed to significantly predict EDE-Q scores in a regression model, which does not appear to support this assertion. Alternatively, psychological distress could be manifest only at higher levels of such discrepancy, or in clinical contexts; further research is necessary to address these possibilities.

The hypothesis also implies that self-esteem discrepancy is associated with other negative psychological outcomes besides disordered eating. Indeed, studies have linked self-esteem discrepancy to perfectionism (Zeigler-Hill & Terry, 2007) and to depression (De Raedt et al., 2006). It could be proposed that self-esteem discrepancy is significant in ED pathology only when it is comorbid with other such "psychological distress" markers. However, findings from the current study have not supported this interpretation; self-esteem discrepancy was *negatively* correlated with MPS scores, which would suggest that greater discrepancy was actually associated with lower perfectionism. However, MPS also was not significantly associated with EDE-Q, RSES or BMI, which suggests that it had limited relevance to ED pathology in the current sample.

7.4. THEORETICAL AND PRACTICAL IMPLICATIONS.

The implications of current findings (and other research in self-esteem discrepancy) should be considered for their potential contributions to theoretical knowledge, but also for any practical implications for disordered eating interventions possible at a sub-clinical level. Sub-clinical levels of pathology, are known risks for the development of disordered eating (Jacobi, Hayward, de Zwaan, Kraemer, & Agras, 2004; Striegel-Moore, Silberstein, & Rodin, 1986). Present findings suggest that discrepant self-esteem is associated with pathology even at a sub-clinical level. It is possible that self-esteem discrepancy may precipitate the development of ED symptoms. This question could be addressed using a longitudinal design, by measuring both implicit and explicit self-esteem in an at risk sample to contrast self-esteem changes in people who go on to develop an ED, compared to those who do not. If such differences exist, self-esteem discrepancy could potentially be used in screening for people at risk for developing an eating disorder. The advantage of implicit measures is that they are difficult to consciously influence (as discussed in Chapter I); this can minimise the effects of social desirability. However, the current study suggests that self-esteem discrepancy may not have a significant effect on ED pathology at sub-clinical levels, hence it may not be an ideal target for predicting ED risk. As such, other screening tools such as the SCOFF questionnaire (Morgan, Reid, & Lacey, 1999) or even the EDE-Q (Mond et al., 2004) are considerably more diagnostically useful in practice, at least until more convincing evidence with regards to the role of implicit self-esteem emerges.

7.5. FURTHER DIRECTIONS

Several possible avenues for further research have already been outlined, including longitudinal studies to address the development of pathology and self-esteem discrepancy over time, and further research into the "glimmer of hope" hypothesis. More studies are necessary both from clinical and non-clinical populations to understand the relevance of self-esteem

discrepancy to behaviour. Clinical studies which have been conducted tend to recruit participants with diverse diagnoses into a generalised “clinical” group, which can complicate interpretation of the results, if implicit self-esteem is implicated in specific types of behaviour (such as restraint).

8. Conclusions

The current study has successfully replicated previous findings which suggest that elevated ED pathology is associated with self-esteem discrepancy. The new findings which emerged suggest that this relationship is generalizable to a) sub-clinical levels of pathology, and b) a broader range of cognitions and behaviours beyond dietary restraint alone. However, the hypothesis that self-esteem discrepancy would act as a better predictor of pathology than explicit self-esteem alone was not supported. As a result, the current study has found further evidence to support the theoretical role of implicit self-esteem in ED pathology, but suggests that the discrepancy may have limited practical value at sub-clinical levels of pathology. The findings do not appear to lend themselves to explanation through explicit self-esteem theories, and the suggestion that self-esteem discrepancy may play a key role in ED pathology is not likely to be upheld. The most likely explanation of the results is consistent with Rydell et al. (2008), who suggest that self-esteem discrepancy creates a dissonance-based discomfort. Although some further research directions are possible, there is no well-defined research path to be taken based on the results of this study. As a result, the remainder of this Thesis is predominantly focused on the assessment of implicit attitudes towards food and their effect on eating behaviour.

CHAPTER IV

Study 2: Implicit attitudes towards food and ego depletion

The results of Study 1 suggested that a discrepancy between implicit and explicit self-esteem was present in a sub-clinical sample of women with elevated levels of ED symptomatology. However, this discrepancy was not found to contribute significantly to explaining variance in pathology. As a result, research into the role of implicit self-esteem was abandoned in favour of exploring other implicit attitudes which could potentially contribute to ED symptomatology and eating behaviour. Study 2 was focused on taking the first steps in exploring the role of implicit attitudes towards food.

Although some research has already addressed individual differences in implicit food attitudes in restrained eaters and in clinical populations, few studies have directly addressed the effect which they may have on eating behaviour and on ED pathology. The present study is grounded in research (previously discussed in Chapter I) which suggests that implicit attitudes may drive behaviour which is more impulsive and less consciously controlled – in contrast to explicit attitudes, which are more closely associated with rational, consciously controlled behaviour. Consistently with this assertion, implicit attitudes towards food may be expected to drive eating behaviour which is more impulsive, or automatic. An example of a state in which behaviour can be expected to be less consciously controllable is ego depletion: a state of diminished self-control capacity following periods of self-restraint, such as dietary restraint. Study 2 was therefore designed to assess the hypotheses that people with elevated ED pathology may a) act on positive implicit attitudes towards high-fat, high-calorie foods in a state of ego depletion, and/or b) are more susceptible to ego depletion following periods of dietary restraint, which could partially explain why dietary restriction is frequently unsuccessful.

This chapter will begin with a clarification of terminology used within the research field, including differences between “restriction”, “restraint”, and “dieting”. Research in explicit food

attitudes and their role in ED pathology will then be introduced, following on with the concept of ego depletion and its role in eating behaviour, and a summary of existing research in implicit food attitudes in the context of disordered eating. The methods and outcomes of Study 2 will then be discussed. A pilot study designed subsequently to Study 2 in order to address some of the methodological issues will also be outlined.

1. The evolution of Restraint Theory: Restriction, restraint and dieting.

The purpose of this section is to highlight some of the difficulties involved in defining and assessing different aspects of dietary restraint. The term "restrained eater" can have variable definitions and behavioural outcomes, depending on the types of assessment used. Some confusion also exists about the distinction between "restriction" and "restraint", and also the differences between "restrained eaters" and "dieters". The evolution of restraint theory will briefly be outlined, followed by an introduction to the most common measures of restraint and restriction, and a discussion of the differences between the three terms.

1.1. RESTRAINT THEORY AND THE RESTRAINT SCALE

As research into obesity and eating behaviour began gaining more research attention from a psychological point of view in the late '60s and early '70s, Nisbett (1972) proposed the "set point" theory. Set point theory postulated that the number of fat cells in the body is greatly variable: people with more fat cells will be naturally prone to a higher "set point" weight than people with fewer fat cells. Because the number of fat cells in the body is mostly invariable and adiposity is a function of fat cell size rather than count (Goss, 1966), having more fat cells makes maintaining a lower body weight proportionately more difficult. Thus, individuals = with high set points who attempt to use dieting to maintain a lower body weight (to meet societal expectations of thinness, for example) will be prone to overeating: obese individuals have been

found to have up to three times more fat cells (hyperplasia) than people of a normal weight (Knittle & Hirsch, 1968). Nisbett also drew on animal models of hypothalamic lesions and their consequence for overeating to implicate the role of the hypothalamus in set point regulation (Hoebel & Teitelbaum, 1966; Powley & Keesey, 1970), and used the data to suggest that the hypothalamus "defends" an individual weight set point based on hereditary traits and formative nutritional experiences in childhood. A subsequent body of research has supported the role of the hypothalamus in weight regulation (Horvath, 2005), particularly its role in the regulation of leptin – a hormone responsible for the regulation of satiety.

Herman and Mack (1975) argued that the assumption that eating behaviour corresponds to two distinct weight categories (overweight and normal weight) is incorrect. In fact, people who have a high set point but artificially maintain a low body weight would be characterised by frequent attempts to lose or maintain a low weight as well as behavioural patterns not dissimilar to overweight people who nevertheless maintain a weight lower than their natural set point. There is little research to conclude how much higher a "set point" would be in this instance: i.e., are such individuals are able to maintain a weight only several pounds, or several stone, lower? To address the hypothesis of chronic (attempted) weight management, the researchers constructed a 5-item "restraint questionnaire", which assessed preoccupation with food and dieting (e.g., "Do you give too much time and thought to food?"), and weight fluctuation (e.g., "What is your maximum weight gain within a week?"). Participants scoring high on this "restraint" measure were found to eat more ice cream following a milkshake preload (in a "taste test" study), compared to participants who scored low. It was concluded that degree of restraint was a better predictor of eating behaviour in the milkshake paradigm than participants' actual weight.

In response to the findings, Herman and Polivy (1975) developed the Restraint Scale (RS). It was developed within the context of restraint theory, which proposed boundaries of "hunger" and "satiety" between which was a zone of biological indifference. As restrained eaters were initially believed to be attempting to maintain their weight well below their set

point, the zone of biological indifference was believed to be larger than in unrestrained eaters. Restrained eaters were also thought to impose an artificial "diet" boundary between hunger and satiety. When the initial restraint scale was developed, restraint was defined as the intention to diet in order to achieve or maintain a desired weight (Herman & Mack, 1975) and individuals who scored highly were considered "restrained eaters." However, examination of the 10 items of the RS reveals that it is not simply a measure of dieting; the 10 items assess dietary restriction (e.g., "How often are you dieting?") and overeating tendencies (e.g., "Do you eat sensibly in front of others and splurge alone?"), as well as weight fluctuation (e.g., "In a typical week, how much does your weight fluctuate?"). Herman and Polivy's underlying assumption was that "restrained eaters" are unsuccessful at dietary restraint, maintaining it until it fails and the diet boundary is breached – which then leads to a period of overeating (relative to the person's subjective dietary needs; not necessarily with regards to an objective metric of caloric intake needs). So, for Polivy and Herman, "restrained eaters" was synonymous with "failed restrained eaters"; the concept of a "successful" restrained eater was typically discussed in hypothetical terms, rather than something that exists. If the set point theory was correct, a successful restrained eater would need to override their physiological controls with cognitive ones; the trouble is that in doing so they became vulnerable to uninhibited overeating as the "cost" of this control (Polivy & Herman, 1985).

The Restraint Scale. A confirmatory factor analysis subsequently conducted on the RS (Allison, Kalinsky, & Gorman, 1992) indicates that the scale measures two distinct constructs: weight fluctuation and concern for dieting. This is problematic because the scale was designed as a unifactorial measure. A two-factor solution means that the scale does not differentiate between restriction and disinhibited eating – the latter of which may actually be what predicts counter-regulatory eating behaviour (Stunkard & Messick, 1985; Westenhoefer, 1991; Stroebe, Mensink, Aarts, Schut, & Kruglanski, 2008). Ogden (1993) also argues that the scale conflates attempted (or intended) dieting, and actual successful restraint. Two of the RS items pertaining to weight fluctuation were found to account for 70% of the variance in scores

(Drewnowski, Riskey, & Desor, 1982), which would suggest that "restrained eaters" identified with the RS are likely to be people who repeatedly lower their weight, but are unable to maintain the change in the long term. People identified as "restrained eaters" using the RS are therefore people who exhibit *all* the traits assumed by Restraint Theory: including not only the restriction of food intake, but also dietary restraint failure and subsequent weight fluctuation. This is supported by the finding that people who report that a high proportion of their weight loss attempts fail also score high on the RS (Ogden, 1993). Heatherton, Herman, Polivy, King and McGree (1988) argue that a two-factor solution to a single scale is not necessarily problematic, so long as both factors pertain to different aspects of the same concept. Whether or not failure (e.g., weight fluctuation) is a "necessary" aspect of restraint is debateable; thus, the multifactorial structure of the RS is a limitation. Studies which use the RS to assess "restraint" are therefore technically assessing participants' tendency to engage in repeated cycles of dietary restraint for weight loss, followed by failure and weight gain. However, other measures have since been developed with the intention of assessing restraint behaviour in its "pure" form, without interfering factors such as weight fluctuation or disinhibition.

1.2. OTHER MEASURES OF RESTRAINED EATING

Given the difficulties raised with the RS, other scales were developed in the attempt to assess restrained eating in a "purer" form, without including factors such as weight fluctuation. Notably, this includes the Three Factor Eating Questionnaire (TFEQ; Stunkard & Messick, 1985) and the Dutch Eating Behaviour Questionnaire (van Strien, Frijters, Bergers, & Defares, 1986). The TFEQ was designed to assess three distinct factors: 1) cognitive restraint of eating, 2) disinhibition, and 3) (susceptibility to) hunger. It must be noted, however, that the authors do not give a specific definition for what they consider to be "cognitive restraint"; however, the items (e.g., "Life is too short to worry about dieting" and "I consciously hold back at meals in order not to gain weight") mostly pertain to the respondent's attitudes towards weight loss and

dieting, and the tendency to exercise conscious control over their eating behaviour (the questions in this sub-scale were shown to reliably load on a single factor by Stunkard and Messick in the original paper). The scale was initially designed to assess eating behaviours and cognition in overweight individuals. The cognitive restraint subscale (TFEQ-CR) was found to be negatively correlated with BMI in a sample of obese individuals (Cappelleri et al., 2009), and the disinhibition scale (TFEQ-D) reliably differentiated between obese and non-obese women (Lindroos et al., 1997). This is in contrast to the RS, which is *positively* correlated with BMI (Tiggemann, 1994) but cannot be used to reliably discriminate obese participants from normal weight, as 90% of the former and 30% of the latter could be classified as "restrained" (Drewnowski et al., 1982). However, the TFEQ has also been found to reliably discriminate between different dietary behaviours in normal weight samples (de Lauzon et al., 2004): e.g., higher scores on both the Restraint subscale and the Disinhibition subscale were positively correlated with actual caloric (energy) intake, and participants who scored higher on the Emotional subscale also reported greater snacking frequency.

The DEBQ is a 33-item questionnaire which consists of three sub-scales:1) restrained eating (deliberately limiting food intake with the intention of weight loss), 2) emotional eating (eating in response to negative emotional states or mood) and 3) external eating (the extent to which eating behaviour is triggered by external cues). Overall, the measure was found to have good discriminant validity (Wardle, 1987) and internal consistency (Halvarsson & Sjödén, 1998). (Laessle, Tuschl, Kotthaus, and Prike (1989) found stronger correlations between the RS and the DEBQ (r=.59) than between the RS and the TFEQ (r=.35), which suggests that the array of behaviours and cognitions assessed by the DEBQ may be closer to the RS's assessment of restriction and weight fluctuation than the TFEQ.

Heatherton, Herman, Polivy, King, and McGree (1988) argued for the distinction between "restraint" and "restriction". The RS is designed to assess broader cognitive aspects of restraint, as well as its consequences, such as weight fluctuation. By contrast, the DEBQ-R and TFEQ-CR are intended as a narrower assessment of the "restriction" aspect of restraint: i.e., intended or

actual limiting of food intake for the purpose of weight loss. For example, “When I have eaten my quota of calories, I am usually good about not eating any more” (TFEQ-CR), or “Do you deliberately eat foods which are slimming?” (DEBQ-R). The scales are significantly correlated with each other (r=.66, Laessle et al., 1989). However, this could partially be due to the fact that both were loosely modelled on Pudel’s Latent Obesity Scale (Pudel, Metzdorff, & Oetting, 1975), which was designed to assess obese-like eating behaviours in normal weight individuals.

Unlike the RS, “restrained eaters” identified using the DEBQ-R or the TFEQ-CR do not show the same counter-regulatory behaviour following a caloric preload, or manipulation of negative affect (Lowe, 1993; Stroebe, 2008). Also unlike the RS, factor analyses found that while RS loaded on all three restraint factors (overeating, dieting, and body dissatisfaction), the DEBQ and TFEQ Restraint subscales loaded on the dieting factor only (van Strien, Herman, Engels, Larsen, & van Leeuwe, 2007): i.e., an exploratory factor analysis yielded a single-factor solution for the DEBQ and TFEQ, and a three-factor solution for the RS. Laessle et al. (1989) similarly found that while the RS was an appropriate measure of the “disinhibition” and “weight fluctuation” aspects of restrained eating, the TFEQ-CR and DEBQ-R were more suitable for assessment of the restriction of caloric intake.

However, the assumption that elevated scores on the TFEQ-CR and DEBQ-R are associated with a smaller caloric intake do not appear to be supported by evidence. Laessle et al. (1989) did find a significant correlation between TFEQ-CR and DEBQ-R scores, and self-reported caloric intake over a 7-day period. No such correlation was found with scores on the RS. By contrast, Stice and colleagues carried out a series of studies (Stice, Fisher, & Lowe, 2004; Stice, Cooper, Schoeller, Tappe, & Lowe, 2007; Stice, Sysko, Roberto, & Allison, 2010) in which participants’ food intake was assessed using doubly labelled water, allowing for a more accurate assessment of metabolic rate and thus caloric intake. Neither TFEQ-CR nor DEBQ-R scores were correlated with actual caloric intake, either under laboratory, or naturalistic conditions. This was true for both short-term observation (e.g., one meal) and medium-to-long term (e.g., 2 weeks). The authors propose that the scales measure caloric restriction relative to

the individual's subjective needs, rather than restriction in absolute terms. This is consistent with the "set point" theory presented by Nisbett (1972); people who score high on the TFEQ-CR or DEBQ-R can be assumed to exercise restraint over their eating, yet because their satiety boundary is high, Stice et al. (2007) argue, they do not appear to be consuming fewer calories compared to unrestrained eaters. This is corroborated by findings which suggest that restrained eaters consume more calories than the unrestrained, yet do not subjectively feel that they have (Jansen, 1996). Lowe and Levine (Lowe & Levine, 2005) also argue that homeostatic mechanisms underlie hedonic craving, as well as physiological hunger, which makes deprivation (or restriction of) palatable food as subjectively "real" as the deprivation of hunger.

The Eating Disorder Examination Questionnaire (EDE-Q), developed from the Eating Disorder Examination (Cooper & Fairburn, 1987), is another measure which includes a "restraint" subscale. The measure was developed within the context of the "transdiagnostic" model of eating disorders (Fairburn, Cooper, & Shafran, 2003) The Fairburn et al. model was developed as cognitive behavioural theory, in which the symptoms and behaviours associated with BN interact with its cognitive aspects, which together act as an obstacle to change and/or treatment. However, the authors define "dietary restraint" as "persistent attempts to restrict food intake" (Fairburn et al., 2003; p.510). This is a conflation of cognitive and behavioural restraint with caloric restriction. The term "dietary restraint" (or "restraint") is therefore used throughout to refer to, for example, periods of deprivation within the BN binge-purge cycle. This conflation is problematic, as it has contributed to the blending of the two terms and their interchangeable use in literature. For instance, in Hoiles, Egan and Kane's (2012) assessment of the model's validity, "restraint" is implied to be both the mechanism through which weight loss is achieved, and the behaviour which perpetuates the ED symptomatology – both of which can be more accurately described as caloric restriction. As a consequence of the interchangeable terminology used in the model, subsequent measures developed along side it also suffer from similar conflations.

The EDE-Q was adapted from the Eating Disorders Examination (Cooper & Fairburn, 1987), a semi-structured interview used to aid clinical eating disorder diagnosis. The EDE-Q is a 36-item questionnaire is scored on the basis of behaviour and thought frequency over the last 28 days and comprises of four sub-scales relating to different facets of ED pathology: dietary restraint, weight concern, shape concern and eating concern. The restraint subscale consists of five questions which pertain to both *attempted* restraint (e.g., "Have you *tried* to avoid eating any foods which you like in order to influence your shape or weight?"), and *actual* restraint behaviour ("Have you gone for long periods of time without eating anything in order to influence your shape or weight?"). A factor analysis carried out in a predominantly bulimic female population supports the intended factor structure of the restraint subscale: all items were found to load on a single factor (Peterson et al., 2007). Another study which carried out an exploratory factor analysis using a mixed ED sample (AN, BN, BED and EDNOS) found that all five of the Restraint items loaded on a single factor, but that the factor also included two items from the Eating Concern subscale and one from the Weight and Shape subscales (Aardoom, Dingemans, Landt, & Van Furth, 2012). Similar findings were made in a clinical study which found that four of the five Restraint items loaded on one factor, but also included three items from other subscales (Machado et al., In Press). In a study of healthy female athletes, three items from the Restraint subscale were found to comprise a single factor; another factor consisted of mostly Eating Concern subscale items, and a third of a mix of Shape and Weight Concern items (Darcy, Hardy, Crosby, Lock, & Peebles, 2013). White, Haycraft, Goodwin and Meyer (2014) also found a three-factor solution to the EDE-Q in a study of healthy adolescents, one of which included four of the Restraint sub-scale items, and one item from the Shape Concern sub-scale. Overall, factor analyses suggest that the factorial structure of the EDE-Q-R is mostly, but not completely, consistent with its intended design as a measure of restriction only.

Lowe and Thomas (2009) argue that the EDE-Q-R is not suitable for the assessment of restraint in a non-clinical population, as it was intended for diagnostic use. However, using the sub-scale has been used to assess elevated, but pre-clinical, levels of attempted restraint. For

example, Delinsky and Wilson (2008) used the EDE-Q-R to assess changes in ED pathology following weight gain in women in their first year of college. Ross and Wade (2004) also used the scale in the assessment of dietary restraint in university students to test the cognitive model of bulimia nervosa in a non-clinical sample. However, the factor structure of the sub-scale in a non-clinical sample appears to be multifactorial: an exploratory factor analysis yielded a two-factor solution: dietary restriction (accounting for 36% of the variance) and dietary restraint (accounting for 25%) (Dakanalis et al., in press); however, only the restriction factor was found to be relevant, which suggests that it is more important in the context of ED symptomatology, compared to restraint. Nevertheless, researchers should bear in mind that the EDE-Q-R and the DEBQ/TFEQ were developed for different research purposes and therefore assess different types of restraint: specifically, the EDE-Q-R assesses the types of cognitive and behavioural restriction which are common in clinical ED contexts.

1.3. "DIETERS" VS. "RESTRAINED EATERS" AND DIETING SUCCESS

Lowe (1993) argues that the terms "restrained eating" and "dieting" are often used interchangeably in literature, which should not be the case. While the term "dieting" refers specifically to restricting food intake for the purpose of weight loss, "restrained eating" is a broader term which encompasses any type of attempted or actual restriction, either for the purpose of weight loss (Lowe, 2002), or prevention of weight gain (Laessle, Tuschl, Kotthaus, & Prike, 1989). To wit, only 37% of restrained eaters (identified using the RS) reported dieting to lose weight at the time of data collection in a study by Lowe, Whitlow and Bellwoar (1991). Lowe and Timko (2004a) have highlighted some of the problems with the way the term "dieter" and "diet" have been used in literature: often the term is not defined, and can be used to refer to both people who are dieting to lose weight, and those who are trying to avoid weight gain. Furthermore, "dieting" must be contextualised within the physical and psychological well-being of an individual. For example, dieting will have different implications for someone who is

overweight or obese and dieting for health reasons, compared to someone who is verging on being underweight and is using diet modification as an expression of self-control.

Theoretical differences between "dieters" and "restrained eaters" were associated with behavioural differences in a study by Lowe and Timko (2004b). In this study, restrained dieters and restrained non-dieters were identified using a median split of scores on the RS and their responses to a question about whether they were "currently dieting to lose weight". "Restraint" in this sense refers to a trait, while "dieting" is a state at the time of the study. Restrained dieters (people who scored above the median on the RS, and reported current dieting) and restrained non-dieters (people who scored above the median on the RS but were not dieting) were compared on different measures of restraint, as well as past weight history. Restrained dieters scored higher on both the TFEQ-CR and the RS, compared to restrained non-dieters, and also had more past cycles of weight loss and gain. In another study, dieters also responded differently to a caloric preload. While "restrained eaters" as identified by the RS exhibit counter-regulatory eating behaviour following a high-calorie preload (Ruderman & Christensen, 1983), restrained dieters were actually found to eat *less* following the preload (Lowe, Whitlow, & Bellwoar, 1991).

Dieters can additionally be qualified on the basis of their success (or lack thereof). In the Lowe and Timko (2004b) study, restrained dieters exhibited traits indicating "unsuccessful" dieting: i.e., elevated scores on the RS (indicating unsuccessful restraint), as well as more weight loss cycles (the number of times they have lost different amounts of weight). Ogden (1993) used self-reported diet status ("Do you attempt to lose weight?") and self-reported diet success ("Do you regard yourself as a successful dieter?") to categorise dieters as either successful (success score higher than number of weight loss attempts), reasonable (success score equal to number of weight loss attempts), or failed (success score lower than number of weight loss attempts). In contrast to Lowe and Timko's (2004b) study, "dieting" in this case refers to a trait tendency to engage in dieting, rather than to a behavioural state at the time of the study. Failed dieters scored higher on the RS than the successful. This finding is consistent

with Heatherton et al. (1988), as people who score high on the RS can also be expected to have a propensity for disinhibition, and thus be less successful at dieting. Failed dieters also scored higher on the DEBQ-R – which suggests that they engage in higher levels of dietary restriction. Together, these findings suggest that unsuccessful dieters spend more time on attempted weight loss cycles, exert more mental and physical energy on restricting their food intake, and consequently experience greater degrees of failure, which is reflected in their high RS scores. Diet success therefore cannot be entirely attributed to effort or aptitude, but rather in terms of the biological, psychological and emotional response to food and the restriction of food. Successful dieters, by definition, find restraint manageable (in contrast to the unsuccessful): similarly to the restrained dieters in Lowe et al.'s (1991) study, successful dieters who have lost a significant amount of weight and maintained the loss over a long period of time also do not show counter-regulation tendencies following a calorie preload (Lowe & Kleinfield, 1988). This interpretation is also consistent with set-point theory: a person with a higher set point will find it significantly more difficult to maintain the body weight of a person with a low set point, despite the fact that their weights may be identical. This is consistent with more recent data from biological research (Shiiya et al., 2002), which found differences in ghrelin concentrations (the hormone implicated in satiety regulation) between normal weight, obese and anorectic participants. Concentration levels were, respectively, lower and higher in obese and anorectic participants, compared to those of a normal weight. This suggests that there may be significant differences in people's experience of hunger, which can also affect their experience of dietary restraint.

Haynos, Field, Wilfley and Tanofsky-Kraff (In Press) developed a new classification paradigm to identify different aspects (behavioural and psychological) of dieting, and how they interact to predict behavioural outcomes. According to the model, effective dieting is the product of a) a positive psychological approach to dieting (focus on specific goals, emphasis on health rather than appearance, and flexibility) and b) high behavioural commitment (reducing portion size, limiting "unhealthy" foods in diet, increasing consumption of "healthy" foods). By

contrast, ineffective dieting consists of a) negative psychological aspects (emphasis on appearance, losing motivation in the face of short-term failure, minimal emphasis on specific goals) and b) low behavioural commitment (making changes which are too small to produce an effect, attempting "fad" diets, and/or making diet changes which do not contribute to an overall caloric deficit). The model also includes Paradoxical dieting (negative psychological and low behavioural commitment) and Driven dieting (negative psychological and high behavioural commitment). The model makes an effort to systematically categorise different approaches to dieting, which can be helpful in the discussion of different "schools of thought" among people who self-identify as "dieters". However, the model is a promising development within the research area, but requires extensive empirical support and replication before it can be accepted as grounded in observable cognitive and behavioural phenomena.

1.4. CONCLUSION

There is currently some confusion in the literature with regards to the terminology used in the assessment of restrained eating, dietary restriction, and dieting. Some authors may use the terms interchangeably, while others do not; the same terminology may also be used in different ways in different studies. Research in different populations (e.g., normal weight vs. obese participants, clinical samples vs. pre-clinical "ED-like" symptomatology) also suggests that the terminology used can mean different things in different contexts: for example, caloric restriction will have different psychological implications for someone with AN compared to a psychologically healthy, overweight individual (Lowe & Timko, 2004a). The term "restrained eater" can mean different things, depending on the methodology used in assessment. The Restraint Scale is the broadest assessment of a "restrained eater", encompassing a variety of cognitive and behavioural factors, including intended or actual restriction of food intake and weight fluctuation. It also assumes that restrained eaters are, by definition, unsuccessful in their restraint. The DEBQ-R and TFEQ-CR are aimed at assessing a more specific aspect of

restraint: dietary restriction. This refers to the intended or actual limiting of a person's food intake. Despite the fact that people scoring high on the RS and the DEBQ-R/TFEQ-CR would both be referred to as "restrained eaters" in literature, the psychological implications of this term will be different, and the individuals will have different behavioural responses to caloric preloads or mood manipulation. Finally, "dieters" are typically assessed via self-reported dieting at the time of study (although occasionally according to their trait tendency to diet, as in Ogden's (1993) study), and are actively engaged in dietary restriction with the purpose (whether successful or not) of weight loss. Although this category of participants is often used interchangeably with restrained eaters, people who score high in restraint may not be dieting at all times – although people who colloquially self-identify as "dieters" are most likely to be classified as "restrained eaters".

The complications in the research stem from the fact that not only are definitions for the relevant terminology not standardised, but also because terms like "restrained eater" can refer to scores on self-report measures, theoretical cognitive or behavioural features, or actual behavioural outcomes following experimental manipulation. A more stringent standardisation of terminology in this research area is needed, however in the meantime it is necessary to clarify which definition is used in each specific context. In summary, the following definitions will be used throughout this thesis:

- **Restriction** refers to the deliberate limiting of food intake, either in net calories or food types or amounts, with the intention of weight loss, or avoidance of weight gain.
- **Restraint** encompasses the cognitive and behavioural features of people who are trying to lose weight or avoid weight gain, which can include attempted (whether successful or not) restriction, attitudes towards food and eating and actual eating behaviour in the context of weight loss/gain avoidance.

- **Dieting** is a specific, temporary modification of eating behaviour with the intention of weight loss, or avoiding weight gain, regardless of whether or not it is successful.

The definition of a "restrained eater" is somewhat variable, as it depends on which scale is used to assess it. Restraint can be considered a trait feature, as someone high on restraint may or may not be actively engaging in restriction or dieting at any time. By contrast, dieting is a state; thus a dieter is necessarily engaging in restraint, while someone scoring high on restraint may or may not be dieting.

2. Explicit food attitudes and eating disorder pathology

Eating is a complex behaviour to study. It is driven both by homeostatic functions and by higher-order psychological processes. Feelings of hunger and satiety are regulated by hormonal expression, including leptin (Farooqui & O'Rahilly, 2009) and ghrelin (Murphy, Dhillo, & Bloom, 2006). We experience basic hedonic pleasure from the taste of food and the feeling of satiety. Moreover, food is intimately linked to social and cultural meanings (Rozin, 2005), and to emotions (Macht, 2008).

The taste of food is ultimately the strongest contributing factor to whether or not we like a particular food, more so than factors such as healthiness or nutritional content (Aikman, Min, & Graham, 2006). This is particularly true of young women (Roinnen, Lähteenmäki, & Tuorila, 1999). Additionally, people are fairly similar in the types of tastes they tend to prefer. Infants start with an innate predisposition for liking sweet and salty tastes and rejecting bitter or sour ones (Birch, 1999). These preferences persist into adulthood; Drewnowski and Greenwood (1983) found that participants' hedonic response increased consistently with both the sugar and the fat content of food. However, while the subjective pleasure derived from sugar is not related to being overweight (Drewnowski, Halmi, Pierce, Gibbs, & Smith, 1987), people who are

obese prefer foods which are significantly higher in fat (>34%) compared to the preferences of those of a normal weight (20%) (Drewnowski, Brunzell, Sandle, Iverius, & Greenwood, 1985).

Dissatisfaction with one's shape or weight is very often the precursor of dieting behaviour (Dunkley, Wertheim, & Paxton, 2001; Johnson & Wardle, 2005). In some cases, it is also a precursor to disordered eating (Stice & Shaw, 2002). Dietary restriction and/or dieting is not necessarily pathological in and of itself, but longitudinal research suggests that it predicts more serious problems associated with EDs such as depression (Stice, Hayward, Cameron, Killen, & Taylor, 2000) and low self-esteem (Furnham, Badmin, & Sneade, 2002). Frequently, people engage in restrained eating in an attempt to feel better about their bodies or improve self-worth; unfortunately, research suggests that this approach is commonly unsuccessful.

Dietary restriction is the most prevalent strategy adopted by people who want to lose weight: around 90% will either decrease their caloric intake, or restrict the types of food they eat in the attempt to influence their shape or weight (Serdula et al., 1999).Elevated restriction is particularly common in groups who have an elevated risk for developing ED pathology: for example, English adolescent girls report a mean score of 2.52 out of 5 on the Restraint scale of the Dutch Eating Behaviour Questionnaire (DEBQ; van Strien et al., 1986) compared to the score of 1.94 reported by adolescent boys. People who choose restriction as their weight loss strategy typically avoid food which is high in fat and/or sugar (Tuschl, Laessle, Platte, & Pirke, 1990). This approach is seemingly logically sound: caloric intake and body mass are highly correlated (Albanes, 1987). Unfortunately, a reduction in different food types does not always imply a reduction in overall caloric intake, as people may "compensate" by increasing intake of other foods. Dietary restriction is rarely a successful weight loss strategy: in a meta-review of weight loss studies in overweight and obese participants, average weight loss after 12 months was typically just 4.6kg, which further decreased to 3.0kg at 48 months (Franz et al., 2007). In clinical obesity intervention trials, 12-month drop-out rates are commonly as high as 77% (Inelmen et al., 2005), which suggests that people find sustained weight loss challenging. For

the average person, dietary restriction appears to be simply too difficult to sustain in the long term (McGuire, Wing, Klem, Lang, & Hill, 1999).

There are many reasons why attempts at weight loss might fail. Homeostatic regulation (Farooqui & O'Rahilly, 2009) and differences in individual biology (Murphy et al., 2006) both play a role. The disinhibition effect (where restrained eaters overeat following a high-calorie preload) is also understood to play a role in restraint failure (Westenhoefer, Broeckmann, Münch, & Prudel, 1994) – to the extent that some researchers use the term "restrained eater" with the implication that restraint will eventually fail as a consequence of eating disinhibition (Heatherton, Herman, Polivy, King, & McGree, 1988). Overeating motivated by changes in mood – e.g., self-medicating a negative emotional state with the hedonic experience of high-fat, high-sugar food – can also contribute to such failure (Ruderman, 1986; Herman & Polivy, 1980). In fact, cravings have been found to be closely associated to mood states such as boredom or anxiety (Hill & Weaver, 1991). And, of course, people (and women in particular) tend to crave the very foods they try to avoid: food which is high in fat and sugar (Yanovski, 2003; Burton, Smit, & Lightowler, 2007).

Dietary restriction, by definition, changes eating behaviour. A dieter might choose a low-calorie sweetener instead of sugar (Tuschl et al., 1990), or low-fat milk instead of cream (Rideout, McLean, & Barr, 2004). The decision to engage in a diet necessarily changes attitudes towards certain foods. For instance, women who report high levels of restraint indicate weight control as a stronger motivation for their food choices than price (Steptoe, Pollard, & Wardle, 1995). Unfortunately, the new attitude (e.g., "Cake is inconsistent with my weight loss goal; cake is bad") does not appear to replace the old one (e.g., "Cake is tasty; cake is good"). Rather, dieters become more *ambivalent* about foods which are high in fat, carbohydrates or sugar. Specifically, normal-weight restrained eaters increase their *negative* attitude towards foods which are high in fat, high-sugar foods, but do not decrease the accompanying *positive* attitude (Urland & Ito, 2005). This ambivalence can also be construed as ambivalence between the desire to lose weight and the desire to eat delicious food. This is referred to as the "goal

conflict" model of diet failure (Stroebe et al., 2008): according to this model, such failure occurs when the goal of hedonic pleasure is more readily accessible than the weight loss goal. However, the key difference between the two is that the weight loss goal is a long-term one, requiring self-control and conscious decision-making, while the food goal is hedonic, short-term and more closely associated with impulsive or uncontrolled behaviour.

Impulsive behaviour plays a significant role in dietary restraint. Nederkoorn, Van Eijs and Jansen (2004) found that restrained eaters were significantly worse at inhibiting their response towards food cues in a stop-signal task, compared to unrestrained controls. Participants who had elevated eating disinhibition in a study by Yeomans, Leitch and Mobini (2008) were also more likely to behave more impulsively in a gambling task. An extreme example of the role of impulsivity in restraint failure is bulimia nervosa, which is defined by periods of uninhibited binge-eating alternating with periods of dietary restraint (Welch & Fairburn, 1996). Leitch, Morgan and Yeomans (2013) addressed specific *types* of impulsivity with regards to dietary restraint. Three types of impulsivity were identified: a) impulsive choice (accepting immediate rewards over larger future payouts), b) impulsive action (failure to inhibit an inappropriate response) and c) reflection impulsivity (failure to evaluate or collect information before making a choice). The outcome of the study suggested that disinhibition (as measured by the Disinhibited Eating subscale of the TFEQ) was associated with reflection impulsivity, rather than impulsive choice or impulsive action.

Although elevated impulsivity likely plays a role in disinhibited eating and diet failure, not all people with elevated ED pathology necessarily exhibit elevated trait impulsivity. However, the act of disinhibited eating can arguably be described as impulsive, as it conflicts with the long-term weight loss goal. The question is why restrained eaters appear to be more prone to such disinhibition than the unrestrained. One possible explanation is the phenomenon of ego depletion, according to which self-control is a limited resource.

3. Ego depletion

The term “ego depletion” refers to a state of diminished self-control capacity. It was coined in by Baumeister, Bratslavsky, Muraven and Tice (1998) who first suggested that self-control is a limited resource. In the first study investigating this, participants were presented with a plate of cookies and a plate of radishes. Those in the control condition were asked to “taste test” the cookies and not touch the radishes. Those in the ego depletion condition were asked to “taste test” the radishes and not touch the cookies. The idea was that those in the depletion condition had to exert self-control to eat the unpleasant, bland radishes in favour of the tempting cookies (the researchers went so far as to bake cookies in the lab to fill it with their appetising aroma). Participants were then given an unsolvable (unbeknownst to them) geometric tracing task. Because persisting, as opposed to giving up, is effortful, this was classified as another self-control task. As a result of the manipulation, participants in the depletion condition persisted on the solution for around 11 minutes *less* than those in the control condition, who did not previously have to exert self-control. The authors suggested that those in the depletion condition had already exerted self-control during the cookie task, and therefore had less self-control to exert during the puzzle task. This approach is known as the “strength model” of self-control, according to which we can only exert self-control for so long until we “run out” of strength to do so.

The ego depletion phenomenon has since been replicated extensively. The original Baumeister et al. (1998) series of experiments also demonstrated the effects of ego depletion following emotion suppression and making a counter-attitudinal speech. Muraven, Tice and Baumeister (1998) went on to demonstrate the consequences of emotion suppression on physical stamina, of thought suppression on performance while solving anagrams, and of thought suppression on emotion suppression. Wallace and Baumeister (2002) have similarly demonstrated that participants who performed the Stroop task (Stroop, 1935), in which they are forced to suppress the impulse to read the names of colours in favour of saying the colours

of the font, subsequently performed worse on a geometric figure-tracing task. The picture which emerged suggested that ego depletion can be generalised to different areas of self-control.

A meta-analysis by Hagger, Wood, Stiff and Chatzisarantis (2010) assessed 83 experimental studies of the ego-depletion effect and computed a mean effect size value of *d*=0.62, which represents a medium-to-large effect size. The meta-analysis also identified significant moderating variables, including the type of depleting task used. Most commonly used tasks such as thought and emotion control yielded medium-to-large effect sizes (*d*=.62 and *d*=.63, respectively), although some were considerably lower (choice and volition paradigms yielded effect sizes of *d*=.22, on average). The authors conclude that the ego depletion effect is robust and consistent. However, it must be noted that some studies have failed to replicate the ego depletion effect. For example, Wright et al. (2008) found no effect of a letter-circling task (where participants must control the impulse to circle certain letters unless they also satisfy other conditions) on subsequent Stroop task performance. However, these studies are in the minority.

3.1. EGO DEPLETION AND EATING BEHAVIOUR

Most pertinent to the present research are ego depletion studies which have specifically been focused on food and eating behaviour. Hofmann, Rauch, & Gawronski (2007) asked participants to suppress outward displays of emotion while watching a disturbing video clip, then asked them to taste candy in an ostensibly unrelated task. In control participants (who were not asked to suppress emotion), candy consumption was correlated with explicit, but not implicit, candy attitudes. However, candy consumption in participants in the ego depletion was correlated with implicit candy attitudes only. These findings are consistent with research discussed in Chapter I, which suggests that impulsive behaviour is predicted by implicit, rather than explicit, attitudes. The pattern of results obtained by Hofmann et al. (2007) can therefore

be explained as follows: participants who exert self-control in the first part of the experiment deplete the resources which would otherwise allow them to regulate their eating behaviour in a conscious, controlled manner. As a result, they are more likely to behave more impulsively, which means their eating behaviour is regulated by implicit, rather than explicit, attitudes.

Similar findings have been found by Friese, Hofmann and Wänke (2008). In Experiment 1, female participants' implicit attitudes towards fruit and chocolate were assessed using the IAT paradigm. Participants in the control condition were asked to memorise a one-digit number for the duration of the study. Those in the ego depletion condition were asked to memorise an eight-digit number. Subsequent food choices made at the end of the study were correlated with explicit food attitudes in the control condition, and with implicit attitudes in the ego depletion condition. Experiment 2 found a correlation between crisp consumption and implicit attitude towards crisps in participants who previously suppressed their emotions during an unpleasant video clip (ego depletion condition). Meanwhile crisp consumption in participants who did *not* suppress their emotions (control condition) was correlated with explicit crisp attitudes only. Experiment 3 found similar results in consumption of beer and beer attitudes. Hofmann, Gschwendner, Friese, Wiers, & Schmitt (2008) also found that candy consumption was correlated with implicit candy attitudes in participants with a low working memory capacity, but not in those with high working memory capacity. This suggests that individual differences in the cognitive capacity available to carry out controlled processes can affect the extent to which explicit behaviour is typically associated with implicit versus explicit processes.

A small number of studies have also addressed ego depletion directly in relationship to dietary restraint. Vohs and Heatherton (2000, Study 3) assessed the effects of ego depletion in a sample of "chronic dieters" (in actual fact restrained eaters, as identified by a score above 16 on the RS). Participants in the depletion condition (suppressing emotion during an emotional film clip) subsequently ate more ice cream in a "taste-testing" task. The study therefore suggests that self-restraint may affect eating behaviour in dieters; however, no control group was included for comparison. Kahan, Polivy and Herman (2003) performed a similar study but

included a control group: restrained and unrestrained eaters were assigned to either a depletion or a control condition, and then given a "taste-testing" task in which they were given the opportunity to eat cookies. Restrained eaters ate significantly more in the depletion condition compared to the control condition; however, condition did not affect intake in the unrestrained eaters. These results are encouraging, and consistent with the ego depletion paradigm. However, research has yet to address these findings in the context of implicit food attitudes and impulsive behaviour – which will be discussed in detail below.

4. Implicit food attitudes

4.1. IN RESTRAINED EATERS

Research in implicit food attitudes has addressed both a) attitudes towards food (sometimes relative to pleasant non-food stimuli), and b) attitudes towards certain food types, relative to other food types. If ego depletion can partially account for disinhibited eating in dieters or restrained eaters, then we might expect to see no differences in implicit food attitudes between restrained and unrestrained participants. Specifically, we might expect both restrained and unrestrained eaters to hold positive implicit attitudes with high-fat, high-sugar, and/or high-carbohydrate foods. In line with this explanation, dietary restraint failure would occur when self-control resources are depleted by restraint, causing the person to behave more impulsively and indulge in foods with which they hold positive automatic associations. Unrestrained eaters do not engage in dietary restraint and therefore are less likely to be in a state of ego depletion which would result in this type of impulsive eating. The empirical evidence partially supports this explanation; however, the findings have not been unequivocal.

Several studies which have contrasted restrained and unrestrained eaters found that both groups held positive implicit associations with food. Participants in a study by Veenstra and de Jong (2010) completed an Affective Simon Task to respond to high-fat and low-fat food images and "Tasty" or "Non-tasty" vocal responses. A "manikin" version of the task, in which

participants moved a mannequin figure towards or away from stimuli, was also included as a measure of automatic approach or avoidance. Participants were classified as restrained or unrestrained eaters on the basis of scoring in the top or bottom quartile, respectively, of the Restraint Scale (Herman & Polivy, 1980). Both restrained and unrestrained eaters held more positive associations with high fat, compared to low fat, food. However, restrained eaters had stronger automatic approach tendencies for high fat foods[3]. These findings are apparently consistent with the ego depletion account of dietary restraint failure. Roefs, Herman, MacLeod, Smulders and Jansen (2005) found similar results. In Experiment 1, restrained and unrestrained female participants completed an Affective Priming Task using pictures of high-fat and low-fat food, and general positive and negative words. Both participant groups held stronger positive associations with high-fat food. In Experiment 2, restrained and unrestrained participants completed the EAST using high-fat and low-fat food words, and "Palatable" or "Unpalatable" words. No differences were found between groups; however, there was also no effect of fat content on response. Papies, Stroebe and Aarts (2009) found, using an Affective Priming Task, that unrestrained eaters held a stronger preference for high-fat, compared to low-fat food. Restrained eaters did not hold a preference for either food type, although associations in both groups were positive towards both food types.

One study has carried out an experimental study of the effects of restraint on implicit attitudes. Hoefling and Strack (2008) contrasted implicit food associations using the EAST in fasting (for 15 hours) versus non-fasting, and in restrained versus unrestrained participants. A main effect of group was found; fasting participants held more positive associations with all food words compared to the non-fasting group. A marginally significant interaction between restraint status and calorie content was found; restrained participants held slightly stronger positive associations with high-calorie foods than the unrestrained. These findings suggest that the act of fasting may actually *change* the pattern of implicit food associations: i.e., inflate the positive associations with high-calorie foods. However, a longitudinal replication study with at

[3] Automatic approach and avoidance in eating behaviour is discussed in detail in Chapter V.

least two time points would be necessary to support this hypothesis (see Study 4). The ecological validity of the Hoefling and Strack (2008) study is somewhat limited because most restrained eaters do not tend to fast for extended periods of time, but rather change the amount or content of what they eat. Moreover, the fasting was motivated by study participation, rather than an internal weight loss goal.

By contrast, research which has used the IAT has not supported a universal positive implicit attitude towards high-calorie foods. Maison, Greenwald and Bruin (2001) assessed positive and negative associations with high-calorie and low-calorie foods. A main effect of calorie content was found: participants held stronger positive associations with low-calorie, compared to high-calorie, foods. Although apparently some differences between restrained and unrestrained eaters were found, these were not reported. Regardless, if a preference for high-calorie foods is not normative, then the ego depletion hypothesis cannot explain why dieters choose to binge on cake or crisps rather than, for example, celery. Similarly, Roefs and Jansen (2002) contrasted high-fat and low-fat food associations in obese versus normal weight participants using the IAT. Both groups held stronger negative associations with high-fat food. Although this may be interpreted as an absolute negative attitude, it is possible that including low-fat foods in the dataset increases the salience of health during assessment and decreases positive associations with high-fat foods. It is also worth noting that both of these studies used general "Positive" or "Negative" words for the valence category. The results can therefore be interpreted as participants' associations between food and their *global* positive or negative value; this approach would be expected to yield different results patterns than studies which assess implicit associations between different food types and tastiness, or food and healthiness.

While the findings may appear contradictory on the surface, a study by Houben, Roefs and Jansen (2010) has highlighted the importance of methodology in this type of research. Restrained eaters' attitudes towards high-calorie and low-calorie foods were assessed in two studies: one using a standard "relative" IAT assessment, and the other using a non-relative, "single category" IAT variant. The single category variant is methodologically more similar to

measures such as the AST and the EAST because they measure non-relative associations. The studies found that when the standard, relative IAT measure was used, there were no significant differences in implicit food attitudes between restrained and unrestrained eaters. However, when attitudes were assessed using the single-category variant, restrained eaters had stronger positive associations with high-fat foods, compared to the unrestrained. These findings may be explained by research on the effects of context in implicit attitude research, and by parallel distributed processing approaches to implicit cognition: including different food categories could have an effect on the types of associations which are activated (and therefore measured).

In addition to the differences in relative versus non-relative assessment, the implications of using global or specific variables as the valence stimuli are also important. The role of ambivalence towards food in restrained eaters has already been discussed; people who consciously try to restrict their diet tend to have mixed feelings about high-fat or high-calorie foods (Urland & Ito, 2005). While it has not been addressed experimentally, it is not impossible that such ambivalence might also be reflected on an implicit level. In line with the spreading activation approach to implicit cognition (such as the REC model), "cake" may be associated with *several* concepts, including those with seemingly contradictory valences – such as "tasty" and "fattening". The former is more likely to play a role in restraint failure, given that impulsive eating behaviour is thought to be driven by the anticipation of a hedonic reward. It can therefore be reasonably hypothesised that the *strength* of this association would also result in stronger craving and thus a lower rate of restraint success. Alternatively, perhaps there are individual differences in the experience of ego depletion which can lead to restraint failure in some people, but not others, despite similarities in their implicit attitudes towards food.

4.2. IN EATING DISORDERS

Perhaps surprisingly, very little research in implicit food attitudes has been carried out in clinical ED populations. One study by Roefs et al. (2005) found, using an Affective Priming Task

(high-fat vs. low-fat foods, palatable vs. unpalatable), that healthy controls held stronger implicit positive associations with high-fat food, compared to low-fat food. Those diagnosed with AN or EDNOS, by contrast, did not have stronger associations with either food type. Given how "successful" people with AN are at dietary restriction, these findings – while very preliminary – are consistent with the ego depletion account of dietary restraint success. If those with AN do not have an implicit preference for high-fat foods then they will presumably experience a less strong impulse to indulge in them, even when in a state of ego depletion. This is consistent with self-report and biological data which suggests that taste is impaired to some extent in AN (Casper, Kirschner, Sandstead, Jacob, & Davis, 1980; Simon, Bellisle, Monneuse, Samuel-Lajeunesse, & Drewnowski, 1993). Of course, anhedonia in and of itself can explain why dietary restriction is relatively easier in AN, but if similar associations are present on an implicit level they can explain why people with AN continue to be successful even when their self-control resources are depleted.

By contrast, people with BN report an enhanced hedonic experience of food, particularly of sweetness (Drewnowski, 1987; Franko, Wolfe, & Jimerson, 1994). Again, this very likely plays a role in bingeing behaviour, but it is unclear whether positive implicit attitudes towards high-calorie foods also contribute to restraint failure. Restrained eaters are behaviourally similar to those with BN in the sense that both repeatedly attempt, and fail, to restrict their dietary intake. The majority of research discussed above suggests that restrained and unrestrained eaters hold more positive associations with high-fat or high-calorie than with low-fat or low-calorie foods. The ego depletion hypothesis, if it is supported, can partially explain why restriction often fails in both BN and restrained eaters: dietary restraint leads to ego depletion, which leads to more impulsive behaviour, driven by positive associations with "forbidden" foods. In AN, this behaviour is potentially curtailed by some extent by a lack of such positive associations. In BN, it is possible that such associations are enhanced. Alternatively, there may be differences in the extent to which dietary restraint contributes to a state of ego depletion in people with AN versus in those with BN.

As discussed in section 1.4 of this chapter, the terms “restriction”, “restraint”, and “dieting” have different implications depending on the population in which they are discussed. For instance, caloric restriction in AN is a pathological and harmful behaviour, while this may not necessarily be the case for someone of who is overweight. Restraint as defined by Herman and Polivy (1980) is technically not “applicable” to AN, as anorectics are extremely successful at reducing their food intake. The present study, and subsequent studies in this Thesis, were all conducted on non-clinical participants who were, on average, of a normal weight. The terminology and discussion is therefore appropriate to those participant samples, and should not be extrapolated to clinical or obese samples. However, ED symptomatology is discussed in terms of sub-clinical, but elevated levels. High-pathology participants are typically more similar to the “unsuccessful” restriction associated with BN; however, Study 4 will also focus on “successful dieters”, whose behavioural features resemble the “success” of AN more closely than they do BN. Despite the fact that the outcomes of non-clinical studies cannot be generalised to clinical samples, EDs and ED studies are still discussed throughout, as it is helpful to consider the findings within a broader context of the full spectrum of ED pathology.

5. The present study

The present study was designed as an investigation of the role of implicit food attitudes in eating behaviour and sub-clinical ED symptomatology. Previous research carried out in restrained eaters suggests (albeit not unequivocally) that both restrained and unrestrained eaters hold positive associations with high-fat, compared to low-fat food (Roefs, Herman, MacLeod, Smulders, & Jansen, 2005; Roefs et al., 2005; Hoefling & Strack, 2008; Veenstra & de Jong, 2010; Houben, Roefs, & Jansen, 2010). Additionally, findings from studies in ego depletion suggest that when self-control resources are drained, people are more likely to behave consistently with their implicit, rather than their explicit, attitudes.

The present study is aimed at linking these two bodies of research. By their definitions (as discussed earlier in this chapter), both dietary restriction and dietary restraint constitute acts of self-control: the former being an act of physical self-regulation, with the latter also including its cognitive aspects. The classic cookie/radish paradigm is an empirical demonstration of restriction resulting in ego depletion under laboratory conditions. However, it can also be hypothesised that people who chronically engage in dietary restriction and/or restraint will likewise be in a chronic state of elevated ego depletion. The current study therefore examines a) differences in implicit food attitudes in elevated ED pathology, and b) differences in the effects of restraint-based ego depletion. This study was designed for a sub-clinical population, but with the intention of adapting it to a clinical context in the future.

5.1. RESEARCH AIMS AND HYPOTHESES

- *Hypothesis 1: Both high- and low-pathology participants will hold positive implicit associations with high-fat food.* The present study is unique in using the IAT to specifically assess implicit associations between food and *palatability.* This hypothesis is formulated to confirm that positive implicit associations with high-fat food are near-universal in non-clinical samples, as the subsequent hypotheses are predicated on this assumption. Palatability was chosen as the valence variable in the IAT on the assumption that impulsive eating behaviour is driven by a short-term hedonic reward goal. The analyses pertaining to this hypothesis will also be repeated with the EDE-Q Restraint sub-scale as the dependent variable, in order to isolate any differences in implicit attitudes which may be specific to differences in dietary restriction/restraint.

- *Hypothesis 2: There will be no significant differences in implicit attitudes between high- and low-pathology participants.* Research has previously examined implicit food attitude differences between restrained and unrestrained eaters (Papies, Stroebe, & Aarts, 2009; Veenstra & de Jong, 2010; Houben et al., 2010), obese and normal weight participants (Roefs & Jansen, 2002; Roefs et al., 2005) and in fasting and non-fasting participants (Hoefling & Strack, 2008). The present study is the first with a focus on the relationship between implicit attitudes and sub-clinical ED pathology. Analyses using the EDE-Q Restraint subscale will be conducted to eliminate the possibility that restriction and/or restraint affect implicit food attitudes.
- *Hypothesis 3: Participants scoring high on restriction and/or restraint will exhibit higher levels of disinhibition on an ego depletion task (i.e., will give up faster), following dietary restraint compared to those who score low.* If Hypotheses 1 and 2 are confirmed, Hypothesis 3 is designed to address whether chronically elevated restriction/restraint can affect the extent of ego depletion following a restriction episode. This hypothesis also extends to differences between high- and low-pathology participants, in line with the previous hypotheses.

6. Method

6.1. PARTICIPANTS

Thirty-nine female undergraduates took part in the study. Three participants failed to attend the second session and were therefore excluded from the analyses. Six participants failed to meet the minimum accuracy criterion on the IAT (>80%, see Study 1) and were therefore also excluded. Two more participants could not complete the IAT due to equipment failure. The final sample therefore consisted of 28 participants. Sample size calculations using a medium effect size (.40, based on results obtained in the following ego depletion studies: Baumeister, Bratslavsky, Muraven, & Tice, 1998; Friese et al., 2008; Hofmann et al., 2007) and assuming a repeated measures, within-between ANOVA, indicated a suggested sample size of N=20, which is lower than the actual sample size obtained. Participants' mean age was 24.79 (*SD*=8.87) and mean BMI, calculated from self-reported height and weight, was 20.85 (*SD*=2.71), which is towards the lower end of the healthy weight range (BMI 18.5-25).

Participants were categorised as high- or low-pathology via a median split on the basis of Global EDE-Q scores. The median-split approach was used because no formal conventions exist with regards to cut-off points on the EDE-Q for levels of pathology which is not clinically significant. Median splits, as well as arbitrary cut-off points, have also been used in other studies within this research area using non-clinical participant samples (Hoefling & Strack, 2008; Roefs et al., 2005; Houben et al., 2010). Participants in the high-pathology group (N=14) scored an average of 2.22 (SD=.73) on the EDE-Q overall, while low-pathology participants (N=14) scored 0.57 (*SD*=.37), $t(26)=7.471$, $p=.015$. The clinically significant cut-off for the EDE-Q is 2.3 (Mond et al., 2004); 42.9% of participants in the high-pathology group scored above this threshold, although none reported a formal ED diagnosis. High- and low-pathology participants did not differ in age, $F(1,26)=.051$, $p=.824$, or BMI, $F(1,26)=.1.036$, $p=.318$. They did, however, differ significantly on all four sub-scales of the EDE-Q (see Table 3).

The aspects of the hypotheses specific to the Restraint subscale were similarly addressed using a median split, with participants scoring above the median (.80) classified as "high

restraint" (N=17), and those scoring below as "low restraint" (N=11). These labels were selected for parsimony, although it must be reminded that the Restraint subscale of the EDE-Q may reflect aspects of both restriction and restraint. However, as the current study is interested in any dietary behaviour which constitutes self-control, it was not essential to use a "pure" measure of either restriction or restraint, as both restriction and restraint involve self control. The high- and low-restraint groups differed significantly in restraint, $t(26)=5.281$, $p<.000$, but not in age, $t(26)=-.015$, $p=.988$, or BMI, $t(26)=21.753$, $p=.603$.

Table 3
Subscale score differences on the EDE-Q[1] by group

	High Pathology (N=14)	**Low Pathology** (N=14)	***F***	**η^2_p**
EDE-Q Restraint	1.96 (1.05)	.51 (.69)	18.58	.417
EDE-Q Weight concern	2.47 (1.17)	.66 (.68)	25.13	.491
EDE-Q Shape concern	3.08 (.85)	.82 (.73)	20.66	.443
EDE-Q Eating concern	1.38 (.84)	.29 (.31)	56.79	.686

[1] EDE-Q: Eating Disorders Examination Questionnaire
All between-group comparisons are significant at the .01 level

6.2. QUESTIONNAIRES

A battery of scales was administered to assess individual differences which may contribute to variance in puzzle task persistence. In addition, participants were asked to complete a demographic questionnaire and a hunger and craving scale designed to take into account of individual differences in hunger states at the time of data collection. Filler questionnaires were also used to ensure that participants were not distracted during the ego depletion procedure.

Demographic questionnaire: Participants completed a demographic questionnaire to determine age, nationality, height and weight and time since last meal.

PPPQ-22: The Persistence, Perseveration and Perfectionism Questionnaire (PPPQ; Serpell, Waller, Fearon, & Meyer, 2009) is a 22-item scale; persistence refers to the drive to achieve a specific goal, while perseveration is the tendency to follow set rules regardless of whether a goal is being achieved. The scale has acceptable internal consistency, test-retest reliability and discriminant validity (Serpell et al., 2009). Cronbach's alphas have been in the range of .6-.7, indicating satisfactory internal consistency; no significant correlations between the scale and age or BMI lend further support for good discriminant validity (Waller et al., 2012). The scale was included to exclude the possibility that individual differences in these traits could have confounded puzzle task performance. Cronbach's alpha for the scale in the current sample was α=.844.

UPPS-P and MPS: The Perseverance subscale of the Urgency, Premeditation, Perseverance and Sensation seeking Impulsivity Scale (UPPS-P; Whiteside, Lynam, Miller, & Reynolds, 2005) and the Multidimensional Perfectionism Scale (MPS; Hewitt et al., 1991) were used as filler questionnaires to ensure that participants spent enough time on the first half of the ego depletion procedure.

EFAQ: Explicit food attitudes were assessed using an explicit food attitudes questionnaire (EFAQ). The scale was adapted for the purpose of this (and subsequent) studies and hence has not been fully validated. The aim was to "translate" the IAT, which was designed to measure strengths of associations between specific food stimuli and palatability, into an explicit measure. The EFAQ consisted of an assessment of subjective palatability, and of ambivalence towards ten different foods (five desserts and five vegetables). Consistent with the approach used by Roefs and Jansen (2002), liking was assessed using a 5-point Likert scale. If the participant was familiar with the taste of the food, its liking was scored from 1 ("Not at all") to 5 ("Very much"). Cronbach's alpha for the palatability half of the scale was α=.55. The scale included desserts and vegetables only, in order to maintain consistency with the IAT. The ambivalence scales were adapted from Urland and Ito (2005) and asked participants to separately rate how strongly they felt about the a) positive and b) the negative aspects of each

food, from 1 (“No positive/negative attitude”) to 5 (“extremely positive/negative”). Cronbach’s alpha for the ambivalence half of the scale was α=.61. Arguably these levels of reliability are not satisfactory; however, it was necessary for the measure of explicit food attitudes to reflect the stimuli used in the IAT as well as the specific hypotheses of the current study, and no validated questionnaire is available for this purpose. Time constraints did not allow for the full development and validation of an explicit food attitudes scale for use in the study, although it is acknowledged that this would be useful in future research.

Hunger and Craving Scale: At the end of each session participants also completed a Hunger and Craving Scale (HCS) in which they reported their craving for cookies and radishes on a 5-point Likert scale, hidden among filler items.

Eating disorder pathology was assessed, as in Study 1, using the Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994). Finally, filler questionnaires were included to ensure that participants spent enough time near tempting food to induce ego depletion. In a meta-analysis of ego depletion studies by Hagger, Wood, Stiff and Chatzisarantis (2010), in which participants completed filler tasks in the interim period between the first and second ego depletion task had one of the highest effect sizes: *d*=.071, on average. This approach was therefore selected as the most effective design. The filler questionnaires used were the Beck Depression Inventory (BDI; Beck, Steer, & Brown, 1996) and the Rosenberg Self-esteem Scale (RSES; Rosenberg, 1965). Half of the questionnaires (selected at random) were administered during the first session, and the other half during the second.

6.3. IMPLICIT ASSOCIATION TEST

The IAT used and the procedure followed to administer it were identical to the ones used in Study 1, albeit using a different stimulus set. The food stimuli used were selected using a pilot questionnaire, which consisted of an expanded version of the EFAQ. Female volunteers on a social networking site (N=48) were asked to rate 13 desserts and 13 vegetables for a) familiarity and b) palatability. These groups were selected (as opposed to, for example, high-fat/low-fat, or healthy/unhealthy) because the rapid responses necessary during the IAT require categories which are simple and unambiguous. However, the final stimuli selected for each category also differed significantly in fat content; for the purposes of discussion, the categories "desserts" and "vegetables" can therefore also be framed as "high-fat" and "low-fat" foods, respectively. Foods with a familiarity rating below 80% in the pilot were excluded from consideration for the final IAT stimulus set. The remaining food words were rated by average palatability; the six highest-rated desserts and the six lowest-rated vegetables were then selected. This selection was made with the intention of assessing relative preference for hedonically pleasant desserts (incompatible with weight loss goal) and hedonically unpleasant vegetables (compatible with weight loss goal), based on the hypothesis that dietary restraint failure occurs when a hedonic reward is desired. The desserts group contained *brownie, crêpe, cookie, pie, cake* and *cupcake*. The vegetable group contained *beetroot, radish, turnip, celery, cabbage* and *brussel sprout*. The two stimulus categories did not differ significantly in letter length, $t(10) = -1.795$, $p = .103$. Desserts were rated as significantly more palatable ($M = 4.03$) than vegetables ($M = 2.43$) by the pilot group $t(10) = 9.414$, $p < .000$. Average fat content as a per-cent of 100g was calculated for the foods in each group using the online resource http://caloriecount.about.com. Desserts were considerably higher in fat content compared to vegetables, $t(10) = 5.745$, $p < .000$.

The valence categories consistent of "tasty" (tasty, delicious, yummy, pleasant, succulent, appetising) and "not tasty" (tasteless, flavourless, gross, unpleasant, nasty, unappetising). The IAT was therefore intended as a measure of automatic associations between desserts (high-fat food), vegetables (low-fat food) and palatable or unpalatable qualities. The words chosen for

the valence categories represent specific associations with palatability, and are arguably less ambiguous than measures which use more global "Good"/"Bad" stimulus sets, which could hypothetically activate associations with both palatability and health concerns.

Each participant also completed the self-esteem IAT from Study 1, which was used as a dummy task in one of the sessions (chosen at random). This was done in order to control for contents of the task set within each experimental session.

6.4. THE EGO DEPLETION PROCEDURE

The ego depletion procedure was adapted from Baumeister et al.'s (1998) radish-cookie task. A within- rather than a between-participant design was used in order to account for individual differences in puzzle perseverance. Additionally, the intention was to develop a methodology which could be extended to clinical research, where recruitment of large sample sizes is often difficult. Participants therefore attended two sessions: one with a plate of radishes (control condition) and another with a plate of cookies (ego depletion condition). The order of the sessions was counterbalanced between participants. In order to induce ego depletion, participants were seated at a table with a plate of chocolate-covered cookies, but asked not to eat any – ostensibly, as a result of their experimental condition to which they were "randomly allocated". Participants therefore filled out questionnaires while in near proximity to tempting food (or, in the control condition, not very tempting food) for approximately 10 minutes. This task was designed as an act of dietary restraint: consistent with the definitions discussed in section 1 (p. 123), resisting a tempting food requires cognitive self-control – however, because participants are free to eat as much as they want upon the study's completion, it is restraint, rather than restriction which is required. The cookie task therefore constitutes a form of self-control and is assumed to result in ego depletion.

The procedure used here deviates from the original radish-cookie task in that participants were not asked to eat any of the food. Findings from an ego depletion study by

Vohs and Heatherton (2000) indicate that simply being near tempting food is sufficient to induce ego depletion.

Following the cookie-radish task, ego depletion was assessed using a puzzle task. Participants were asked to replicate a geometric figure (different in each session) without lifting their pen off the paper or tracing the same line twice. Unbeknownst to participants, the task was actually unsolvable; the "self control" element of the task was the effort to persevere at a solution in favour of giving up. Participants were asked to persevere with the task until they arrived at a solution, or simply wanted to stop. The dependent variable was therefore the amount of time participants persevered at the task before giving up. The maximum amount of time allowed for the puzzle task was 20 minutes.

6.5. PROCEDURE

The study employed a repeated-measures design. Participants attended two testing sessions, approximately one week apart. At the start of the first session participants were given an information sheet which informed them of the procedure and also stated that they may be asked to taste some food during the study – of course, this was not true for any of the participants. This was done to conceal the actual purpose of the study and give a reasonable justification for the presence of food on the table. In each session, participants then completed half of the total questionnaire set, seated either next to a plate of cookies, or a plate of radishes. Participants then completed one of the IATs (food or self-esteem; order was counterbalanced between participants) and the HCS. Participants were remunerated £3 for each session and given a debrief at the end of the second session in which the true purpose of the study was explained. Participants who did not attend the second session were sent the debrief by email.

7. Results

7.1. IMPLICIT FOOD ATTITUDES

A Shapiro-Wilk test conducted with EDE-Q group as the factor and IAT-D scores as the dependent variable was not found to be significant, p=.504, indicating that data for this measure was normally distributed. Hence data was not transformed and parametric statistics were used. The IAT-D in the overall sample was significantly different from zero, as found using a one-sample t-test, t(27)=2.100, p=.045, d=.810, which suggests stronger positive implicit associations with desserts compared to vegetables. Consistent with Hypothesis 2, no significant differences in IAT performance were found using a univariate ANOVA between the high-pathology[4] (M=.302) and the low-pathology (M=.612) group, F(1,26)=.495, p=.488, η^2_p=.019. However, a different pattern was observed when IAT data was analysed independently within each group. Low pathology participants reported an IAT-D value significantly different from zero, t(13)=2.683, p=.019, which suggests a relative preference for desserts. However, high-pathology participants had no such preference; the IAT-D value was not significantly different from zero t(13)=.805, p=.435 suggesting no preference for desserts amongst high pathology participants. Therefore Hypothesis 2 was supported, as no differences between high- and low-pathology participants were found, but hypothesis 1 was *not* supported, as only low-pathology participants had positive implicit associations with desserts. Furthermore, a linear regression predicting IAT-D scores from EDE-Q Total scores was not significant, β=–.011, p=.954, hence there was no relationship between ED pathology and implicit preference for deserts.

Marginally significant differences on the IAT-D were found between high- (M=.162) and low-restraint (M=.910) participants, F(1,26)=3.041, p=.093. IAT-D scores in the low-EDE-Q-Restraint group were significantly higher than zero, t(10)=4.394, p=.001, indicating a significant

[4] For the sake of clarity, "high/low pathology" refers to participants' scores on the EDE-Q-Total, while "high/low restraint" refers to the EDE-Q-Restraint subscale (although, as mentioned previously, it actually constitutes a measure of both restriction and restraint).

implicit preference for desserts. No such preference was found in the high-pathology group, as the IAT-D was not significantly different from zero, $t(16)=.513$, $p=.615$. However, a linear regression predicting IAT-D scores from EDE-Q-Restraint was not significant, $\beta=-.314$, $p=.104$, contradicting the findings from the median split analyses and suggesting no relationship between EDE-Q Restraint and the implicit preference for deserts.

Further to findings pertaining to Hypothesis 1, post-hoc analyses were carried out in order to discount alternative explanations for why high-pathology participants did not apparently have an implicit food preference (i.e., their IAT-D score was not significantly different from zero). First, it was possible that people in the high-pathology group could have manipulated the IAT to respond in a socially desirable way (i.e., vegetables are good and desserts are bad). As discussed in Chapter I, although most studies suggest that people are not very good at faking IAT responses (Banse et al., 2001; Kim, 2003; Karpinski & Steinman, 2006), they are at least somewhat aware of what the task is measuring (Monteith et al., 2001). The way to fake an IAT response is to slow down responses on the congruent trial, which would result in similar or slower response latencies as the incongruent trial. Faking can therefore be detected by comparing overall response latencies between groups. If participants in the high-pathology group are faking, we would expect an overall longer task completion time. Response latencies for both the congruent and the incongruent block were therefore summed and contrasted using an independent-measures ANOVA. No significant differences were found between participants, $F(1,27)=.161$, $p=.691$, which suggests that faking was unlikely.

A second alternative explanation refers to the methodological limitations of the IAT. If a participant's IAT-D score is not significantly different from zero, the task does not inherently discriminate between a person who has no strong associations between the target stimulus and each valence category (such as someone who doesn't have strong feelings about cake either way), and someone who has strong, ambivalent associations with the target stimulus (such as someone who really likes the taste of cake but feels like they shouldn't). A way to assess this is to contrast response latencies within the congruent trial only; someone with true neutral

associations should respond at a normal speed (as responding to a neutral object as positive or negative is equally easy). By contrast, someone with strong ambivalent attitudes should experience interference whether they are responding to the stimulus as positive or as negative and thus take longer to respond. A one-way ANOVA was therefore conducted between high- and low-pathology groups using response latencies within the congruent block only. No significant differences were found between the groups, $F(1,27)=.010$, $p=.921$, which suggests that neither group was experiencing stronger ambivalence on an implicit level. On the basis of the analyses conducted to address alternative explanations, it can therefore be concluded that high-pathology participants did not have an implicit preference for either desserts (high-fat), or vegetables (low-fat).

7.2. EXPLICIT FOOD ATTITUDES

A repeated-measures ANOVA was conducted using a 2 x 2 design (depletion condition x pathology group) to assess differences in self-reported hunger. The interaction was not significant, $F(1,25)=.063$, $p=.804$, nor was there a main effect of group, $F(1,25)=.024$, $p=.879$, which suggests that there were no differences in hunger between groups or between trials which could have affected the explicit food ratings. The depletion x group interaction was also not significant in the assessment of time since last meal, $F(1,26)=.026$, $p=.872$. The main effect of group was also not significant, $F(1,26)=.579$, $p=.453$, which suggests that high- and low-pathology participants did not differ in the amount of time since their last food intake. There were no significant correlations between EDE-Q-Restraint scores and hunger in either the cookie condition, $r=–.055$, radish condition, $r=.061$. Similarly, no differences were found in the time since last meal in the cookie, $r=–.055$, or radish, $r=.018$, conditions (all p values >.1).

Average ratings of desserts and vegetables were calculated for each participant. Participants in the overall sample rated desserts ($M=4.163$) as better tasting than vegetables ($M=2.973$), $t(26)=-5.319$, $p<.000$. A food x pathology group interaction assessed using a

repeated-measures ANOVA was not significant, $F(1,25)=.000$, $p=.996$. As expected, there was a significant main effect of food, $F(1,25)=27.166$, $p=.000$; however, there was no effect of pathology group, $F(1,25)=.383$, $p=.542$. This suggests that participants in both the high-pathology and the low-pathology groups explicitly reported a preference for the taste of desserts compared to vegetables. To confirm the hedonic experience of this distinction, cravings for cookies and radishes (reported on the HCS at the end of each session) were compared. Consistent with explicit ratings, participants reported craving cookies more than radishes across all trials: $t(27)=3.06$, $p=.005$. A repeated-measures ANOVA of craving x pathology found a main effect of craving, $F(1,26)=9.114$, $p=.006$ (cravings were higher for cookies, M=5.00, than radishes, M=3.5), but no main effect of group, $F(1,26)=233.32$, p=.258. The craving x group interaction was not significant, $F(1,26)=.186$, $p=.670$, $\eta^2_p=.007$, which suggests that there was no significant difference in the pattern of food craving between those with high or low pathology. High- and low-restraint participants similarly did not differ in their explicit ratings of either desserts, $F(1,25)=.005$, $p=.945$, or vegetables, $F(1,25)=.000$, $p=.983$.

Ambivalence ratings were calculated using the unipolar attitude scales from the EFAQ. Positive (P) and Negative (N) ratings were used to calculate ambivalence using a formula adapted from Thompson, Zanna and Griffin (1995): $[(P+N)/2] - |P-N| + 3.5$ (the adjustments reflect that fact that a 5-point, rather than a 7-point, scale was used). A higher ambivalence score therefore indicates greater attitude intensity on both the positive and negative scale. Post-hoc tests using a Bonferroni correction[5] were conducted following a repeated-measures ANOVA with Global EDE-Q as the independent variable and vegetable and dessert ratings and ambivalence as the outcome variable. The tests revealed that high- and low-pathology groups did not differ in their ambivalence towards vegetables, $F(1,25)=.000$, $p=.991$, $\eta^2_p<.000$. However, high-pathology participants were significantly more ambivalent towards desserts ($M=5.09$) compared to low-pathology participants ($M=3.69$), $F(1,25)=5.41$, $p=.028$, $\eta^2_p=.178$.

[5] Bonferroni corrections were used in all post-hoc analyses here and in subsequent studies, unless stated otherwise.

This difference in dessert ambivalence was specifically qualified by enhanced negative attitudes, rather than enhanced positive ones: high-pathology participants had significantly stronger negative attitudes towards desserts (*M*=2.87) compared to low-pathology participants (*M*=1.90), *F*(1,25)=5.89, *p*=.023, η^2_p=.191. At the same time, the groups did not differ in the strength of their positive attitudes towards desserts, *F*(1,25)=1.709, *p*=.203.

The results therefore suggest an inconsistency between implicit and explicit food attitudes in the high-pathology group. Low-pathology participants held positive implicit associations with desserts and, consistently reported a stronger explicit liking for their taste compared to vegetables. By contrast, high-pathology participants reported a similar explicit preference for the taste of desserts, but this preference was not reflected on an implicit level. High-pathology participants did, however, express stronger explicit ambivalence towards desserts than vegetables.

7.3. EGO DEPLETION

Hypothesis 3 was designed to assess the effects of ego depletion between the restraint and the pathology groups. Ego depletion was assessed using perseverance time (in seconds) on the puzzle task. A repeated-measures condition x pathology group ANOVA interaction was carried out and was found to be significant, *F*(1,26)=6.625, *p*=.016, η^2_p=.203. A main effect of condition was found, *F*(1,26)=5.081, *p*=.033, η^2_p=.163, but in the opposite direction to the one hypothesised: participants persevered significantly longer in the depletion (cookie) condition (M=611) compared to the control (radish) condition (M=460), *F*(1,26)=5.081, *p*=.033. However, there was no significant effect of pathology group, *F*(1,26)=1.144, *p*=.295, indicating that puzzle task perseverance was not different between high-pathology and low-pathology participants.

These analyses were repeated using the restraint groups in order to directly assess the hypothesised effects of chronically elevated restriction/restraint and ego depletion. A repeated-measures condition x restraint group ANOVA interaction was carried out and was not found to

be significant, $F(1,26)=2.465$, $p=.129$. A main effect of condition was found, $F(1,26)=5.726$, $p=.024$; however, this effect was again in the opposite direction to the one hypothesised: participants persevered on the puzzle for longer in the cookie condition ($M=638$) compared to the radish condition ($M=462$).

A significant correlation between overall cookie and radish condition puzzle times was found, $r=.410$, $p=.030$, which suggests that puzzle performance was associated with individual ability, regardless of pathology. A linear regression predicting puzzle time from EDE-Q-Restraint scores in the cookie condition was found to be marginally significant, $\beta=-.342$, $p=.075$. This suggests that higher levels of restraint were associated with lower perseverance times. The identical regression for the radish condition was not significant, $\beta=-.147$, $p=.454$, which is also consistent with the hypothesis.

The results of the interaction analyses indicated that puzzle times were greater in the cookie (depletion) condition, than in the radish (control) condition. This suggests that the ego depletion procedure used in the present study may not have correctly induced an effect of ego depletion, as this would have led to the opposite pattern of results. Further analyses were therefore conducted to assess the methodological validity of the ego depletion procedure. A paired-samples t-test did not find a significant difference in puzzle perseverance between the cookie and the radish trial, $t(28)=1.625$, $p=.115$, $d=.614$. This suggests that the ego depletion task (resisting the cookies placed nearby) had failed to induce ego depletion in the participants. This explanation was further supported by a contrast of self-reported cookie craving in the cookie (ego depletion) versus radish (control) condition. No differences in craving were found between conditions, $t(27)=.250$, $p=.805$, $d=.096$, which suggests that participants were simply not tempted to eat the cookies in the depletion condition.

A significant difference in perseverance was also found between session 1 and session 2 using a paired-samples t-test. Participants persevered significantly longer in the first session ($M=659$) compared to the second ($M=416$), $t(28)=3.73$, $p=.001$, $d=1.410$, even though the order of sessions (cookies or radishes) was counterbalanced across participants. Order effects may

therefore have masked the group x condition interaction. Scores on the PPPQ and the UPPS-P were also not significant as covariates in puzzle task performance; $F(1,24)=.447$, $p=.510$ and $F(1,24)=.102$, $p=.753$, respectively.

8. Discussion

8.1. RESULTS OVERVIEW

The purpose of the present study was to assess preliminary evidence in support of the possibility that implicit food attitudes could affect eating behaviour through ego depletion. It was hypothesised that positive implicit attitudes towards high-fat food would be unaffected by individual differences in ED pathology. Such positive associations may partially explain impulsive eating following periods of dietary restraint. In contrast to previous research, the current study specifically assessed implicit associations between food and palatability. Participants were also assigned to groups on the basis of overall ED symptomatology, rather than, for example, dietary restraint or overweight. Regressions and correlational analyses were also conducted to examine relationships between eating disorder pathology (measured by EDE-Q Global), restraint/restriction (measured using the EDE-Q Restraint subscale) and implicit and explicit associations with desserts and vegetables.

Hypothesis 1 was not confirmed; although low-pathology participants had stronger positive associations with desserts than vegetables, such a preference was absent in high-pathology participants. Post-hoc analyses suggest that this finding cannot be attributed to either faking or implicit ambivalence in the high-pathology group. A similar pattern was found for participants scoring high on the EDE-Q-Restraint subscale. Nevertheless, Hypothesis 2 was supported: no group differences in implicit food attitudes were found, despite the results of the one-sample t-tests conducted for each group's IAT-D values. Finally, Hypothesis 3 was designed to assess group differences in ego depletion susceptibility as a consequence of dietary restraint.

Regression analyses indicated that restriction/restraint as assessed using the EDE-Q-R was a significant predictor of puzzle time perseverance in the cookie, but not in the radish, condition. This is consistent with Hypothesis 3 and supports the assertion that people chronically engaged in restriction/restraint may also be in a state of chronic ego depletion as a result. A significant condition x pathology group interaction was also found; however, the effect of condition was in the opposite direction to the one hypothesised. Further analyses indicated that the ego depletion procedure failed to induce a state of ego depletion, which rendered further analyses of the data impossible. Significant order effects were found despite counterbalancing the conditions between participants; in that participants were significantly less likely to persevere in session 2, regardless of the type of food present. This may be due to the unsolvable nature of the task, which some of the participants may have worked out during their first session. If significant differences in ego depletion were present between groups, these were most likely masked by the order effects. However, analyses of participants' cravings in each condition also suggest that participants did not find the cookies significantly more tempting than radishes, which means that they were unlikely to exert more self-control in the depletion condition compared to the control condition. Because the ego depletion procedure was unsuccessful, further analyses of the role of additional variables (persistence, perseveration and perfectionism) in ego depletion was not possible.

Self-reported food attitudes revealed participants' overall preference for the taste of desserts compared to vegetables. This preference was not different between high-pathology and low-pathology participants. However, high-pathology participants reported a stronger ambivalence towards desserts, which was qualified by a stronger negative attitude compared to the low-pathology group. These results suggest that participants who exhibit elevated ED symptoms – including, for example, elevated restriction/restraint and/or body dissatisfaction – are prone to having a more complex relationship with high-fat foods. While low-pathology participants express an unambiguous liking for desserts, those with concerns about their eating

or weight develop an additional negative attitude (presumably towards the high-fat foods' fattening/unhealthy properties), but retain the positive one (presumably towards their taste)

8.2. EXPLICIT AND IMPLICIT FOOD ATTITUDES

Results from the explicit food attitude measures confirm previous research which suggests that people have a particular hedonic liking for food which is high in fat and/or sugar (Drewnowski & Greenwood, 1983; Drewnowski et al., 1985; Birch, 1999): participants reported liking the taste of desserts significantly more than vegetables. This pattern of preferences did not appear to be affected by participants' eating pathology status; the liking of foods higher in fat and sugar content was not significantly higher or lower in the high-pathology compared to the low-pathology group, nor in the high-restraint versus low-restraint groups.

However, the two pathology groups did differ significantly in their ambivalence towards different food types. Urland and Ito (2005) previously addressed this in a study which found that restrained eaters (assessed using the RS)were more ambivalent towards foods high in fat or carbohydrates, which was specifically qualified by an increased negative attitude. In the present sample, high-pathology participants (high restraint, as well as high body and shape concern, and eating concern) were also found to score higher on ambivalence towards desserts. High- and low-pathology participants did not differ in their positive attitudes towards desserts, but those with elevated pathology had significantly more negative attitudes. This is consistent with the goal conflict model of food attitudes, although the present research suggests that it applies more broadly than just restrained eating behaviour to pathologies including body dissatisfaction and eating concern. These findings suggest that people with elevated ED pathology retain their positive attitudes towards certain foods, even when they are inconsistent with long-term weight loss goals. Although the current study did not address this directly, the findings also suggest that the participants likely have at least a rudimentary understanding of

the relationship between the fat and sugar content of food and body mass (Albanes, 1987), based on the increased negative associations with fattening foods in the high-pathology group.

It would appear that the pleasure we derive from foods high in fat or sugar is difficult to subvert through other negative qualities of the food, such as its implications for health or weight gain. It is worth noting however that despite the fact that participants reported a preference for the taste of desserts, they did not report a higher craving for cookies relative to radishes. This may be a methodological flaw; perhaps these two options covered an insufficient scope of foods to find a difference, or maybe the phrasing of the HSC, which has not been validated, made the purpose of the study too transparent and resulted in socially desirable responding.

The findings from the implicit attitude measure are somewhat more complex to interpret. Previous findings from non-relative measures such as the EAST and the affective priming task suggest that both restrained and unrestrained eaters hold positive implicit attitudes towards high-fat, high-calorie food (Roefs et al., 2005; Hoefling & Strack, 2008; Papies et al., 2009; Veenstra & de Jong, 2010). However, it is worth noting that these studies used either the RS or the TFEQ to classify participants as “restrained” or “unrestrained”. To some extent these results were replicated with regards to a broader spectrum of ED symptoms: no significant differences were found between high- and low-pathology participants. However, analyses of implicit attitudes within each group suggest that while low-pathology participants held a preference for desserts relative to vegetables, such a preference was absent in those with elevated pathology levels. Echoing the findings in discrepant self-esteem from Study 1, these results suggest that people with elevated ED symptoms may be experiencing a discrepancy between their explicit attitudes and automatic associations with high-fat foods. The consequences of this are not clear from the present study. However, they are consistent with research in implicit attitude change, which suggests that automatic associations can be changed using conditioning paradigms (Olson & Fazio, 2001; Baccus et al., 2004). Based on the current findings, it could be hypothesised that a lack of implicit preference for desserts in the high-

pathology sample could be attributed to the effects of classical conditioning. People with elevated ED symptoms (including body dissatisfaction and dietary restraint) are likely to change how they think about and behave towards food, or the types of cues they attend to; for example, while fast food may have had the primary connotation of "tasty" prior to restraint, its fattening or unhealthy qualities are likely to become more salient once the weight loss goal is activated. These changes could potentially affect automatic association patterns. However, this hypothesis would require a longitudinal study design.

It is worth noting that the present findings appear inconsistent with the two other studies which have assessed implicit attitudes towards food using the IAT. However, the apparent differences can be accounted for by differences in methodology and sampling. Maison et al. (2001) found more positive associations with low-calorie compared to high-calorie foods in a non-clinical participant sample. However, the associations assessed were global (positive/negative); the result pattern could therefore reflect interference between different associative processes (e.g., tasty, good – fattening, bad). This is different from the present study, which assessed specific associations with palatability only. Similarly, Roefs and Jansen (2002) found a negative association with low-fat, compared to high-fat foods, but this research was conducted in an overweight participant sample. The present study was conducted in a healthy weight sample, and was designed to assess associations with palatability because, arguably, it is the hedonic associations with food, and the anticipation of a hedonic reward, which have the potential to drive impulsive eating behaviour.

Findings from the implicit attitude measure do not overall support the hypothesised role of ego depletion in elevated ED pathology. Contrary to expectations, high-pathology participants did not have stronger associations with high-fat compared to low-fat food. If impulsive behaviour in a state of ego depletion is motivated by implicit, rather than explicit, attitudes, then the current findings would suggest that implicit associations with food may actually be *conducive* rather than damaging, to the weight loss goal. A person who does not hold a strong implicit preference for high-fat food might be less likely to eat it impulsively in a

state of ego depletion. Further research comparing actual food choices in a state of depletion in high- and low-pathology participants would be necessary to confirm or reject this hypothesis.

8.3. THE EGO DEPLETION PROCEDURE

The analyses of the ego depletion procedure (self-reported experiences of the radish and cookie conditions) and performance on the subsequent puzzle task suggest that the methodology used failed to induce ego depletion in the participants. There are several reasons why this might be the case. First of all, participants persevered for significantly longer in the first session compared to the second session. This suggests that perseverance in the second session was motivated by something other than the experimental condition. Some participants informally reported having figured out that the task was unsolvable, or simply being demotivated by their failure to solve a similar puzzle in the first session. Of course, it is possible that ego depletion did occur, but was masked by other interfering variables. However, analyses of cookie cravings between conditions suggest that participants were simply not tempted to eat the cookies, which would have been necessary to exert self-control.

Second, the stimuli could have been at fault. Perhaps the cookies used were simply not appetising enough, or not to the liking of the participants, or just not appealing to those without much of a sweet tooth. Finally, some elements of the procedure could have been flawed. For example, the experimenter was in the room with the participants at the time of data collection. The feeling of surveillance could have diminished the self-control needed to resist eating the cookies. The questionnaires may have also been too much of a distraction. Although it was assumed that participants would be at least peripherally aware of the nearby plate of (appetising, presumably) cookies, the questionnaires may have been too engrossing. This design was initially adopted because it was not desirable to include a taste test element to the procedure and not having any distractions during the ego depletion procedure (e.g., being left alone with the cookies for a short time) would have likely seemed conspicuous.

Additionally, most people, when left alone, would likely entertain themselves with a smartphone, rather than solemnly contemplate the tempting cookies in front of them. The lack of a taste test is also a key difference between the procedure used and the design of the original Baumeister et al. (1998) study. Perhaps the act of eating an unpleasant food within reach of a forbidden pleasant food is integral to inducing a state of ego depletion.

In light of these problems which could have affected the outcome of Study 2, a second version of the ego depletion procedure was designed and piloted and is described below. The intention was to solve the key issues identified, but keep the design suitable for clinical research. This meant a) retaining the repeated-measures design, and b) circumventing the original taste test procedure.

8.4. LIMITATIONS AND FURTHER DIRECTIONS

Although the current study used a pilot survey to design the stimulus set for both the explicit and implicit food attitude assessments, ideally the stimuli should have been tailored to the tastes and preferences of each individual participant. This would have allowed for better ecological validity as it would have reflected personal eating habits of each participant. Second, the stimuli selected consisted of the most hedonically pleasant desserts and the most hedonically unpleasant vegetables. This decision was made with the intention of assessing attitudes towards foods which are likely or unlikely to motivate impulsive eating when seeking a hedonic reward. However, it also may not adequately reflect real-world decisions if people prefer to indulge in foods they like, even when engaging in dietary restraint. This would suggest that hedonically pleasant desserts should have been compared with hedonically pleasant vegetables. On the other hand, some studies suggest that people associate healthiness with unpleasantness (Raghunathan, Naylor, & Hoyer, 2006) and that many restrained eaters have a tendency to follow strict diets which ban their favourite foods (Kayman, Bruvold, & Stern,

1990). Nevertheless, this limitation was corrected in Study 3 and did not appear to have a significant effect on the measure outcome.

The main limitation of the study was that the ego depletion task failed to induce a state of ego depletion in the participants. To address this, a second version of the ego depletion procedure was designed with reference to the potential problems and piloted. It is worth noting that the findings from the ego depletion trial cannot be reasonably used to argue against ego depletion as a recognised phenomenon. Ego depletion has been extensively studied and replicated, while the design used here (adapted for ethical reasons linked to planned testing in a clinical population) had flaws, which were supported empirically.

Further research is needed to clarify the findings of the present study. The results suggest that people with elevated, though subclinical ED pathology may not hold positive implicit associations with high-fat food, relative to low-fat food. Further research is needed to clarify whether this difference reflects individual differences in cognition, or if the associations change as a consequence of body dissatisfaction or restrained eating behaviour. Study 4 was designed to address these questions. Findings from a clinical population are also necessary to determine whether the pattern continues consistently with the severity of pathology. Although there are some relevant findings in a mixed AN/EDNOS sample (Roefs et al., 2005), more research is needed in BN, as it is unclear whether implicit attitudes play a role in the relatively extreme binge/purge cycle seen in this disorder.

9. Version 2 of the Ego Depletion Procedure

Some of the limitations of the ego depletion design used in Study 2 were addressed by designing a new version of the procedure, with reference to the possible problems which were identified. However, the aim was still to design a procedure which would be suitable for use in a clinical setting (retaining the repeated-measure procedure for use in a small participant sample, and not requiring any taste tests as part of the measure). The preliminary study described

below was intended as a small-scale pilot to ascertain the feasibility of the new procedure, with the intention of expanding to a full-scale study if the results appeared promising. The following key changes were made to the procedure used in Study 2:

a) *Experimenter presence.* The experimenter was no longer present in the room during the first part of the ego depletion procedure (the induction of ego depletion) to remove any external influence on self-restraint.
b) *Increased focus on the food.* Participants in Study 2 may have been too distracted by the questionnaires to fully focus (and therefore be tempted by) the cookies in the depletion condition. An alternative paradigm was therefore adopted. Participants were presented with the food and asked to fill out a "sensory perceptions questionnaire", in which they were asked to report their impressions of the non-taste properties of the food, such as its appearance, smell and texture.
c) *Increased variety of food.* In the depletion condition, participants were given five bowls of diverse dessert-type foods (cookies, brownies, shortbread, etc.). In the control condition, the bowls contained various vegetables (radish, cabbage, celery, etc.). The aim of this change was to account for the fact that some participants may not have found the cookies tempting.
d) *Alternative ego depletion measurement.* In Study 2, participants' ego depletion was assessed using their perseverance on an unsolvable puzzle task. This was problematic as participants persevered significantly less in the second session, possibly due to feelings of demoralisation or boredom because participants realised that the task was unsolvable. The Stroop task (Stroop, 1935) was used instead. In this task, participants must override the impulse to read the names of colours in favour of saying the colour of the font in which they are printed. For example, the word BLUE written in green requires the response "green".

9.1. PARTICIPANTS

Twelve female undergraduates took part in the study. Of these, four did not attend the second session. The final sample size therefore consisted of eight participants. Demographic data was not collected for this pilot study. No control group was included, as the aim was to assess the new ego depletion procedure, rather than collect empirical data.

9.2. MATERIALS

Sensory perceptions questionnaire. The questionnaire contained qualitative dummy questions pertaining to the appeal of the different foods (e.g., "Please comment on the visual appearance of [this] food", "Does the food smell more artificially-scented or natural?") which were irrelevant to the study. The questionnaire also included 5-point Likert scales of food liking, including a) visual appeal, b) appeal of smell, and c) desire to consume. These ratings (15 in total; three for each of the five foods) were averaged for each participant to derive an overall "appeal" score.

Stroop task. The Stroop task used consisted of 96 colour words (*red, blue, green, orange, purple* and *yellow*) printed in incongruent colours. Errors were recorded, as well as completion time (in seconds).

9.3. PROCEDURE

Participants attended two sessions, approximately one week apart. Each session lasted approximately 15 minutes. The study was framed as research on the sensory perceptions of food "in the absence of the ability to taste". Participants were therefore instructed to not taste any of the food, as this would ostensibly interfere with the data. Participants were left alone for 10 minutes to complete the sensory perceptions questionnaire. Most did not complete it in its entirety; however, given its purpose (to ensure the participant is focusing on the food) this was

not necessarily problematic. However, it did mean that the number of appeal ratings made was not uniform across all participants. After the questionnaire phase, participants completed the Stroop task. Participants read their responses aloud while the experimenter marked down their answers. The procedure was identical in session 2, only with a different assortment of food, and condition order was counterbalanced between participants. At the end of the second session participants were debriefed as to the true nature of the study, thanked and remunerated £3. Participants who did not attend the second session were debriefed via email.

9.4. RESULTS

Independent-sample t-test analyses of appeal ratings suggested that participants found the desserts (*M*=3.45) more appealing than the vegetables (*M*=2.50), *t*(7)=6.778, *p*=*.000, d*=5.123. This is more consistent with previous studies than the results of Study 2, in which participants did not report craving cookies any more in the depletion condition than in the control condition.

Only completion time data was used in Stroop analyses, as participants made very few errors. No differences were found in performance between the first and second session using a paired-samples t-test, *t*(7)=.640, *p*=.543*, d=.048*, in comparison to study 2, which showed significant order effects. However, the key ANOVA of Stroop performance between conditions was not significant. Participants did not perform any faster in the vegetable condition (*M*=100) than in the dessert condition (*M*=93), *t*(7)=–1.440, *p*=.193*, d=.478*.

9.5. DISCUSSION

The second ego depletion pilot was marginally more successful than the procedure used in Study 2: participants found the larger selection of food more tempting, and the Stroop task was not susceptible to order effects in contrast to the puzzle task. This suggests that the Stroop

may be more suitable for ego depletion studies with a repeated-measure design. Nevertheless, this version of the procedure also failed to induce ego depletion in participants.

Some participant feedback collected informally during the debrief procedure suggests that some participants simply do not find sweet foods very appealing. A greater variety of sweet and savoury food during the ego depletion phase could therefore increase the temptation to eat. It is also worth noting that self-restraint in the study was also externally imposed; participants would not eat the food on instruction from the experimenter, but were still free to indulge in anything they liked as soon as the study was finished. This is qualitatively different from the kind of chronic restraint exercised by those with eating disorders, or people with elevated ED pathology. However, the same can be said of other ego depletion studies which have used dietary restraint as a paradigm. The key difference appears to be the consumption of bland food when much more tempting food is available. However, using "taste test" paradigms in clinical ED samples may lead to difficulties in recruiting participants.

An alternative explanation for the results is that the Stroop task was insufficiently long or complex in order to detect the effects of ego depletion. Ego depletion studies which have used the Stroop task typically use around 150 words (Inzlicht, McKay, & Aronson, 2006; Webb & Sheeran, 2003; Wallace & Baumeister, 2002), which is somewhat more than the 96 used in the present study. However, the effect has been successfully replicated with as few as 50 (Job, Dweck, & Walton, 2010). The measure can also be made more complex e.g. by including a) more words and b) greater complexity. To achieve the latter, Job et al. (2010) interspersed incongruent words (i.e., font colour different from word) in their Stroop task with congruent words (i.e., font colour the same as word).

Although the second version of the ego depletion procedure removed some of the methodological issues of the procedure used in Study 2, it was still not sufficient to induce, or detect, the effects of ego depletion in the participants. At this stage practical constraints did not lend themselves to further adapting the methodology. Instead, Study 3 was focused on what is

arguably the mediating step between ego depletion and impulsive eating (or dietary restraint failure): automatic approach and avoidance.

10. Conclusions

Results of Study 2 suggest that non-clinical participants with elevated ED symptoms explicitly prefer the taste of high-fat, high-sugar foods compared to low-fat, low-sugar ones. However, this preference was not found on an implicit level within the high-pathology group, and regression analyses did not support an association between pathology levels and implicit food attitudes The results of the study therefore do not support the hypothesis that positive implicit associations with high-fat food could play a role in dietary restraint failure via ego depletion.

Results from explicit food assessment suggest that high-pathology participants hold positive associations with high-fat food on an explicit level, despite an absence of such a preference on an implicit level. Similar to the results of Study 1, there appears to be a discrepancy between implicit and explicit attitudes in participants with elevated ED pathology. Explicit food attitudes in this group were also marked by greater ambivalence.

Analysis of the ego depletion procedure suggested methodological flaws, which could not be rectified in a second version piloted in a small sample of participants. Although the results of the study were not sufficient to reject the hypothesis that positive implicit food attitudes contribute to impulsive eating behaviour in a state of ego depletion, the findings from the implicit measure are not consistent with the paradigm proposed. Study 3 was designed to address some of the methodological issues of the present study.

CHAPTER V

Study 3: Implicit attitudes towards food and dietary restraint success

Study 2 was designed to investigate the potential role of implicit food attitudes in disordered eating behaviour. People with elevated ED pathology (and indeed those with clinical eating disorders) commonly (and often unsuccessfully) attempt to modify their eating behaviour with the intention of weight loss (Franz et al., 2007). The low-success rate of attempted weight loss suggests that people are not able to regulate their eating behaviour effectively. In Study 2 it was hypothesised that this failure in self-regulation could be partially attributed to the role of positive implicit associations with high-fat foods, and the diminished self-control capacity in a state of ego depletion. Consistent with this hypothesis, no significant differences were found between high- and low-pathology participants. Unfortunately the ego depletion procedure used did not induce a state of ego depletion in the participants and the results were not able to either support or reject the paradigm.

The current study was designed to take an alternative approach to the questions raised in Study 2. Although the current study does not include a measure of ego depletion, it was designed to assess the implied behavioural outcomes of positive implicit associations with high-fat food in a state of ego depletion: automatic approach or avoidance tendencies towards food. If people do indeed act on implicit food attitudes when their self-control capacity is diminished, we might expect those with elevated restraint to have stronger impulses to approach high-fat food (and/or avoid low-fat food) when the higher-order diet goal cannot override them. If such tendencies exist, it may help explain why dietary restraint frequently fails: namely, dietary restraint contributed to diminished self-control capacity, which increases automatic approach

tendencies towards high-fat food, which then leads to an increased probability of restraint failure.

Because this paradigm is focused on specifically eating behaviour, Study 3 focused specifically on people with elevated restraint, rather than elevated ED pathology in general. This chapter will introduce automatic approach and avoidance, its role in dietary restraint and methodological approaches to its measurement, followed by Study 3, which will assess differences in implicit attitudes and the (hypothesised) differences in automatic approach and avoidance tendencies towards high-fat and low-fat foods between restrained and unrestrained eaters.

1. Automatic approach and avoidance

Automatic approach and avoidance play a fundamental role in species' survival. Zajonc (1984) has argued that the ability to translate perception (e.g., presence of predator) into activation of the sensorimotor system (e.g., flight), without the "stop-over" for meaningful encoding is vitally necessarily for effective functioning in an environment. Approach and avoidance can be conceptualised as a behavioural expression of attitudes (Elliot & Covington, 2001): positive stimuli elicit physiological approach readiness, while unpleasant ones elicit preparedness for withdrawal. Behaviourally, this manifests as the decreasing or increasing distance between oneself and a (respectively) pleasant or unpleasant stimulus (Krieglmeyer, Deutsch, De Houwer, & De Raedt, 2010). For example, people are faster to pull a lever towards a positive or pleasant stimulus and away from a negative or unpleasant stimulus than the other way around (Solarz, 1960; Chen & Bargh, 1999). Elliot and Covington (2001) define the distinction between approach and avoidance in terms of valence: approaching the positive and avoiding the negative.

Similarly to attitudes, approach and avoidance behaviour can be either automatic or controlled. Positive or desirable stimuli will automatically evoke a positive implicit attitude and

subsequently a behavioural approach tendency. However, this tendency can be overridden by a conflicting goal. Elliot and Covington (2001) give the example of an approach tendency for chocolate cake being overridden by the deliberate activation of a "lose 15 pounds" goal (p.80). Empirical evidence suggests that approach and avoidance tendencies can indeed be activated automatically. In Chapter I the assessment of automaticity was discussed with reference to a) goal-independence and b) efficiency. Goal-independence refers to uncontrollability, or people's inability to (effectively) control or fake their responses. Efficiency, on the other hand, refers to a low demand on cognitive resources and relatively quick response times. Empirical evidence supports both of these qualities in automatic approach and avoidance. Goal-independence has been supported by response-compatibility tasks, in which automatic approach and avoidance tendencies interfere with the task goal. For example, Rinck and Becker (2007) found that when participants are instructed to push or pull a lever depending on whether they see a landscape- or a portrait-oriented image, they are slower to "pull" an image containing a spider (an unpleasant stimulus) than a neutral image. Approach and avoidance responses also appear to be efficient; for instance, approach or avoidance responses in the Chen and Bargh lever pull study (1999, Study 2) study were made in under 1,500ms. While this is higher than typical response times on implicit attitude measures (for example, participants' responses on food IAT trials in Study 2 were typically <1,000ms), this is consistent with a cognitive response precipitating a behavioural one.

The conceptualisation of automatic approach and avoidance is consistent with dual-process models. Given the evidence that explicit processes drive rational, conscious behaviour and implicit ones drive impulsive, automatic ones, automatic approach and avoidance behaviour can be conceptualised as a behavioural expression of implicit attitudes. This behavioural extension of dual-process cognition was explicitly included in the Strack and Deutsch (2004) *reflective-impulsive* model, which was specifically designed as a model of behavioural determinants. Within the context of this model, implicit attitudes act as precursors of automatic behaviour, and explicit ones as precursors of behaviour which is consciously

controlled. In the context of the present research, automatic approach and avoidance is therefore conceptualised as a behavioural outcome of implicit attitudes.

1.1. MEASURES OF APPROACH AND AVOIDANCE

The joystick task (Chen & Bargh, 1999; Rinck & Becker, 2007; Heuer, Rinck, & Becker, 2007), often referred to as simply the "approach avoidance task" (AAT), is commonly used in the assessment of approach and avoidance behaviour. Its design is similar to priming tasks used in implicit attitude assessment. Participants are asked to push or pull a joystick based on a valence-irrelevant feature of the stimulus (picture orientation or frame colour). A behavioural response consistent with the correct response would be expected to facilitate response time. Conversely, an inconsistent behavioural response would inhibit it. For example, if a person is instructed to "push away" landscape-oriented photos and "pull" portrait-oriented photos, they may perform quicker when "pushing" a landscape picture of a spider than when "pushing" a landscape picture of cake. In this example, an automatic avoidance tendency for spiders would facilitate the correct "push away" response.

One of the criticisms of the AAT is the interpretation of the movements made by the participants. Studies typically instruct participants to push the joystick to indicate avoidance ("pushing away" the image) or pull the joystick to indicate approach ("pulling" the image towards them). However, the movements could also be interpreted in a different way. Pushing the joystick could indicate approach if interpreted as "reaching towards" the image and pulling it as "pulling away" from it, the way one might jerk a hand away from a snake.

Seibt, Neumann, Nussinson and Strack (2008, Study 3) found evidence to support this criticism. When participants were instructed to use a joystick to "push" negative words and "pull" positive words (body-reference condition) the response-compatibility effect was seen as in the Chen and Bargh (1999) study. However, when the instructions were reversed ("pull away" from negative, "push towards" positive), participants adopted an object-reference

interpretation; here, they were faster to push positive and pull negative words than vice versa. Rinck and Becker (2007, Study 2) also addressed this problem in the context of spider phobia. Participants were given object-reference instructions to "pull away" from spider images and "push towards" neutral images. Consistently with Seibt et al.'s (2008) findings, non-spider fearful participants could adhere to these instructions. However, spider-fearful participants continued to perform faster in the push-negative/pull-positive condition. This suggests that while the cognitive interpretation approach and avoidance behaviour is malleable, it may be more difficult to override a body-reference response for more salient stimuli.

Krieglmeyer et al. (2010) suggest that the criticism of movement interpretation can be overcome with the "manikin" task. The manikin task, designed by De Houwer (2001) is an adaptation of the Affective Simon Task (De Houwer & Eelen, 1998). Participants are instructed to press the up or down key on the keyboard to move a "manikin" (figurine) up or down on the screen. Stimuli appear in the centre while the manikin is placed at the bottom of the screen, creating the illusion of "approaching" or "avoiding". This removes the need for explicit instruction for approach to approach and avoidance response labels and creates and unambiguous visual representation of the response made. Participants' responses result in either increasing or decreasing the distance between the manikin and the stimulus – this is consistent with the motivational conceptualisation of approach and avoidance as a behavioural response to stimulus valence. Krieglmeyer et al (2010) have demonstrated empirically that participants' responses on the manikin task were facilitated by compatible responses (i.e., moving the manikin towards positive stimuli and away from the negative) and inhibited by the incompatible (i.e., away from the positive and towards the negative). This effect was still present when stimulus valence was task-irrelevant, which suggests that the manikin task is an effective measure of automatic approach and avoidance.

1.2. APPROACH/AVOIDANCE IN EATING DISORDERS AND IN RESTRAINED EATING

In the context of the present research, automatic approach and avoidance is relevant to understanding dietary restraint failure, which frequently manifests as disinhibition (Westenhoefer et al., 1994; Stunkard & Messick, 1985). Impulsivity and impulsive eating behaviour are the common catalysts of disinhibition, and are prevalent in both restrained eaters (Nederkoorn et al., 2004) and in those with bulimic symptoms (Claes et al., 2006). However, implicit food associations and impulsivity, as it might be expected, do not appear to play the same role in AN. Veenstra and de Jong (2011) found that healthy controls had stronger automatic approach tendencies towards high-fat than neutral stimuli, but no difference in their approach towards low fat and neutral stimuli. However, participants with AN did not show this stronger approach towards high fat foods. Furthermore, BMI was negatively correlated with the tendency for automatic approach towards high-fat food in the clinical sample. Explicitly, participants with AN also reported less craving for high-fat foods compared to controls. These results suggest that people with AN (especially those with lower weights) may not experience automatic approach tendencies towards food, which could contribute to the maintenance of low body weight. These results are consistent with Roefs et al.'s (2005) research in implicit food attitudes in AN, which suggests that people with AN do not have an implicit preference for high-fat, compared to low-fat food. It could therefore be hypothesised that people with AN do not have positive implicit associations with high-fat foods, which inhibits automatic approach tendencies towards these foods, and reduces the probability of disinhibited eating and dietary restraint failure.

In people engaging in dietary restraint (either via elevated restraint, caloric restriction, or dieting – as all three qualify as acts of self control), we might expect a pattern opposite to the one observed in AN: 1) restrained eaters hold positive implicit associations with high-fat foods; 2) dietary restraint results in a state of ego depletion, which 3) increases automatic approach tendencies towards these foods and ultimately 4) results in restraint failure. The

empirical findings to support this model have been somewhat mixed. Study 2 did not find differences in implicit food attitudes between high-pathology and low-pathology participants, which supports the first aspect of the model: both groups held similarly positive attitudes towards high-fat foods. Veenstra and de Jong (2010) assessed automatic approach tendencies for high-fat and low-fat food in restrained and unrestrained eaters using the manikin version of the Affective Simon Task. Restrained eaters had enhanced approach tendencies towards both high- and low-fat foods, compared to the unrestrained – which is also consistent with the model proposed above. Seibt, Häfner and Deutsch (2007) also assessed approach and avoidance tendencies towards food in a clinical (mixed BN/AN) group and in healthy controls. Both groups were faster to approach than to avoid food stimuli; however, both groups were also faster to approach food if they were hungry (tested before lunch) than if they were satiated (tested after lunch). This suggests that hunger could enhance automatic approach tendencies towards food.

Fishbach and Shah (2006, Study 2) found a somewhat conflicting result pattern using a joystick design in which restrained and unrestrained eaters approached and avoided "food" stimuli or "fitness" stimuli. Restrained eaters were faster to avoid (push) food words than fitness words compared to the unrestrained. However, it must be noted that the study assessed approach and avoidance tendencies towards food relative to another stimulus, rather than contrasting approach and avoidance tendencies for different food types.

2. The present study

Study 3 follows on from the findings of Study 2. Study 2 was designed to assess whether differences in implicit food attitudes or in susceptibility to ego depletion were associated with elevated ED symptomatology. No differences were found in implicit food attitudes between the high-ED and low-ED group – however, participants with elevated ED symptomatology did not have an implicit preference for desserts (high fat) compared to vegetables (low fat). The ego

depletion procedure did not successfully induce a state of ego depletion, and a further adaptation of the methodology was unsuccessful. Study 3 was therefore designed to approach the role of implicit food attitudes from a different direction, by assessing implicit food attitudes and automatic approach and avoidance tendencies in elevated dietary restriction/restraint (as both constitute an act of self-control and can therefore be expected to contribute to ego depletion), and specifically in diet failure. However, the hypotheses have remained consistent with the role of ego depletion in restraint hypothesised in Study 2.

2.1. RESEARCH AIMS AND HYPOTHESES

- *Hypothesis 1. Current dieters will not differ from current non-dieters in their implicit attitudes towards high-fat and low-fat foods*. This is a replication of Study 2 findings within participants who self-identify as "being on a diet".
- *Hypothesis 2*. *Current dieters will have stronger approach tendencies for high-fat foods compared to current non-dieters*. Current dieters (i.e., people who report "dieting" at the time of the study) can be expected to be in a state of ego depletion It is hypothesised that positive implicit associations with high-fat food will therefore enhance automatic approach tendencies towards it, as a consequence of this state. This hypothesis also draws on findings by Seibt et al. (2007), which suggest that hunger enhances automatic approach tendencies towards high-fat food.
- *Hypothesis 3*. *Unsuccessful dieters will have more positive implicit attitudes towards high-fat food compared to successful dieters.* If diet failure is predicated on the tendency to engage in impulsive eating behaviour, then stronger positive implicit associations with high-fat food should contribute to a stronger tendency for disinhibition, and therefore unsuccessful restraint, in a state of ego depletion (i.e., following dietary restraint).

- *Hypothesis 4*. *Successful dieters will be more likely to automatically approach low-fat foods than unsuccessful dieters*. As an extension of Hypothesis 3, positive implicit attitudes towards high-fat food would be expected to manifest as automatic approach and avoidance towards that food type, and vice versa for low-fat food.

3. Method

3.1. PARTICIPANTS

Female participants (N=157) were recruited through a university subject pool. Study advertisements stated an interest in participants who either have, or haven't, been on a "diet" within the last year (see *Terminology* section below). Because this yielded unbalanced group recruitment (more non-dieters had responded), the advertisement was subsequently altered to recruit current dieters only. Of the participants recruited, 17 were excluded for failing to meet minimum accuracy criteria on the IAT; 10 were excluded due to equipment malfunction and a further 4 were excluded for failing to follow instructions. The final participant sample therefore consisted of 126 women. Sample size calculations using a mean effect size of d=.48 (based on the following implicit food attitude studies: Seibt, Häfner, & Deutsch, 2007; Veenstra & de Jong, 2010; Veenstra & de Jong, 2011) and a 3 x 2 x 2 (group x stimulus x approach/avoidance) design indicated a minimum sample size of N=80, which is below the actual number of participants recruited. Mean age in the sample was 23.3 (SD=8.0) and mean BMI 21.2 (SD=3.1). The majority of the participants (87%) spoke English as their native language and the remainder were fluent in English (have obtained at least a C in GCSE English, or international equivalent, as per university admissions requirements). Most (51%) were of UK origin, followed by China (21%). Three participants reported an eating disorder diagnosis in the past. Excluding them from

analyses did not make any significant differences to the results, and they were therefore included in the sample.

Terminology. In contrast to Study 2, the present study assesses cognitive and behavioural differences of "dieters" and "non dieters", rather than "restrained" and "unrestrained" eaters. The terminology used throughout this study draws on research by Lowe and Timko (2004b) and Ogden (1993) in identifying current dieters and successful/unsuccessful dieters, respectively. "Dieting" encompasses aspects of both dietary restriction and cognitive restraint – while a restrained eater can be dieting or not dieting, a dieter is, by definition, engaging in behaviour and cognitions which they believe will result in weight loss. In the context of ego depletion, this is arguably a more naturalistic (and therefore ecologically valid) approach, as it allows us to study the outcomes of the "dieting" behaviours in which people naturally engage (whatever these may be). "Dieting" is used throughout the section to refer to cognitive or behavioural changes associated with self-identifying as a "dieter": i.e., self-imposed changes perceived by the person to contribute to weight loss, including caloric restriction, restriction of the types of food consumed, and/or cognitive restraint. The sections below explain the recruitment and grouping process in more detail.

Current dieters and non-dieters. In order to address Hypotheses 1 and 2, participants were classified on the basis of their dieting status at the time of data collection. Participants who responded "yes" to the relevant question on the eating habits questionnaire ("Are you currently dieting?") were classified as current dieters (N=44). Those who responded "no" were classified as current non-dieters (N=82). This classification method reflects the one used by Lowe and Timko (2004b) to identify people who were "dieters" at the time of data collection. Current dieters scored significantly higher, M=2.61 (SD=1.09) on the restraint subscale of the EDE-Q compared to current non-dieters, M=1.09 (SD=1.09), $t(124)=7.43$, $p=.000$, which suggests that the self-reported classification was consistent with self-reported dietary

behaviour. The current dieters in this study were therefore more likely to be restrained eaters, but cannot be classified as such because group assignment was not done on the basis of the EDE-Q-Restraint subscale.

It must be noted that participant recruitment was specifically targeted towards dieters (i.e., by outlining inclusion requirements for each group) to allow for recruitment of sufficient participants within each group. For this reason the proportion of dieters and non-dieters cannot be considered to be representative of the general population.

Successful and unsuccessful dieters. To address Hypotheses 3 and 4, participants were re-classified as successful dieters (N=30), unsuccessful dieters (N=28), and non-dieters (N=35). The criteria used in the classification were partially adapted from van Strien's (1997) research in dietary restraint success (see *Questionnaires* below for more details) and Ogden's (1993) study in successful and unsuccessful dieters. Originally, there had been an intention to use the Dutch Eating Behavior Questionnaire to corroborate self-reported diet success/failure (consistently with van Strien's (1997) study); however this could not be put into practice as its inclusion resulted in insufficiently large participant groups for statistical analysis (N<10). However, one of the aims of the study was to assess the cognitive consequences of naturalistic dieting behaviour, and the small outcome sample size would suggest that this selection strategy yields very rare behavioural/cognitive profiles. Because the participant sample is already predominantly composed of young, educated, slim women (see *Limitations* section in Chapter VII), this approach was abandoned in favour of self-reported diet status.

Participants were classified as "successful dieters" if they a) reported having dieted at least once in the past 12 months, b) reported dieting skill above the median (on the question "How well are you able to sustain a diet?", on a scale of 1 to 5), and c) must not have reported weight gain in the past 6 or 12 months. Criterion (c) was used as an objective corroboration of the participants' self-reported claims. Participants were classified as "unsuccessful dieters" if they a) reported having dieted at least once in the past 12 months, b) reported dieting skill

below the median, and c) must not have deliberately lost weight in the past 6 or 12 months. Participants were classified as "non-dieters" if they reported not having dieted in the past 12 months. In total, 33 participants were excluded from this portion of the analyses; 22 were excluded on the basis of the median split pertaining to dieting skill. The rest (N=11) were excluded for failing to satisfy inclusion criteria for any group. It is important to note that, in contrast to the "current dieter" and "current non-dieter" classifications, these groups referred to *trait* success as subjectively reported by participants – rather than *state* diet status at the time of data collection.

In support of the group classification criteria used, a significant main effect of group was found on both the Restraint subscale of the EDE-Q, $F(2,90)=27.703$, $p<.000$, and on the Restraint subscale of the DEBQ, $F(2,90)=32.160$, $p<.000$. Multiple comparisons (Scheffe correction) indicated that non-dieters scored significantly differently from the successful dieters, 95% CIs [-2.33,-1.12], $p<.000$, and from the unsuccessful dieters, 95% CIs [-2.02, -.77], $p<.000$, on the Restraint scale of the EDE-Q. However, no differences were found between successful and unsuccessful dieters, 95% CIs [-.97, .31], $p=.447$, indicating similar levels of restraint in these groups. Similar patterns emerged within the Restraint subscale of the DEBQ. This suggests that both dieter groups were more likely to engage in restrained eating behaviour than the non-dieters; however, as with Hypotheses 1 and 2, neither of the diet groups can be necessarily qualified as "restrained eaters".

3.2. QUESTIONNAIRES

Questionnaire order was randomised within each participant's set. The set consisted of a demographic questionnaire, the EDE-Q, the Dutch Eating Behavior Questionnaire (van Strien et al., 1986) an explicit food attitudes questionnaire (EFAQ, adapted from Study 2), and an eating habits questionnaire. The demographic questionnaire, EFAQ and EDE-Q were identical to those used in Study 2. Chronbach's alpha for the EDE-Q in the current sample was $\alpha=.906$.

The DEBQ is designed to assess eating style, or the extent to which eating behaviour is emotionally triggered. The questionnaire consists of 33 questions on three sub-scales: restrained eating (deliberately limiting food intake with the intention of weight loss), emotional eating (eating in response to negative emotional states or mood) and external eating (the extent to which eating behaviour is triggered by external cues). The measure has good discriminant validity (Wardle, 1987) and internal consistency (Halvarsson & Sjödén, 1998), and has been successfully used in the research of dietary restraint failure (van Strien, 1997). An analysis of its factor structure yielded a clean, 3-factor solution, which accounted for 87.3% of the variance (Wardle, 1987). Chronbach's alpha ranged between .80 and .95 for the subscales in van Strien's (1986) development and validation analyses. Chronbach's alpha in the current sample was α=.904 for the Restrained Eating subscale, α=.942 for the Emotional subscale, and α=.794 for the External. Shapiro-Wilk test was not significant for the DEBQ or EDE-Q, using diet group as the independent variable, *p*=.341 and *p*=.606, respectively.

The eating habits questionnaire was adapted from van Strien's (1997) research in dietary restraint success. The questionnaire assessed participants' current diet status and consisted of the following questions: ("Are you currently dieting?"), dieting history ("How often have you dieted over the past year?"), subjective diet success ("How well are you able to sustain a diet during these times?"), weight over the past 6 and 12 months (weight loss, gain, fluctuation or no fluctuation) and whether any changes in weight had been deliberate[6].

3.3. IMPLICIT ATTITUDE TEST (IAT)

The IAT used to assess implicit food attitudes was identical to the one used in Study 2. However, the stimulus set was adjusted to reflect the new focus on successful and unsuccessful dieting. While previously the stimuli used were the more palatable desserts and the less palatable vegetables, the stimuli used in Study 3 were the desserts and vegetables the highest

[6] See Appendix IV for full questionnaire

rated for taste in the pilot questionnaire used in Study 2 stimulus development. All stimuli had a minimum 80% familiarity rating in the pilot. The new stimulus set consisted of 6 vegetables (broccoli, cucumber, lettuce, radish, brussel sprout, and celery) and 6 desserts (brownie, cookie, cake, ice cream, pancake, and cupcake). The reason for the adjustment was to reflect the reality of dieting. Weight loss success is dependent on the *choice* of food made (as not-eating is not a viable long term option). Dieters are therefore more likely to face the choice between palatable low-fat and palatable high-fat foods. Target stimulus categories did not differ in word length $t(10)=-1.246$, $p=.241$. However, they did differ significantly in estimated fat content (grams of fat per 100g), $t(10)=6.08$, $p=.000$ and estimated caloric density (calories per 100g), $t(10)=7.484$, $p=.000$. The valence stimuli set (tasty/not tasty) was unchanged. The Shapiro-Wilk test of normality using diet group as the independent variable and IAT-D scores as the dependent variable was not significant, $p=.647$, indicating normal distribution within the IAT for this sample.

3.4. APPROACH AVOIDANCE TASK (AAT)

The AAT was adapted from Papies, Barsalou and Custers (2012). The task is a response-compatibility task using key presses (rather than a joystick) to make responses, following a visual illusion of moving towards, or away from, the stimulus. During the task, participants see a series of photographs outlined with a border of one of two colours (blue or purple). Participants are asked to press an “approach” or “avoid” key on the basis of the outline colour, ostensibly ignoring the contents of the photograph: e.g., “approach” key (up arrow) for blue frames and “avoidance” key (down arrow) for purple frames. Following an avoidance response, the photograph physically shrinks on the screen, simulating moving away from the stimulus. Following an approach response, the photograph grows on the screen, simulating approach.

Automatic approach or avoidance tendencies are assessed on the basis of mean response latencies towards a stimulus supposedly “compatible” or “incompatible” with making

an approach or avoidance response. For example, pressing an “approach” key in response to a picture of a radish would be expected to create more dissonance (and therefore a longer response time) than it would in response to a picture of a cake. A participant with stronger approach tendencies towards high-fat, than low-fat, food should therefore have longer response time latencies when pressing an “avoid” key in response to an image of cake than to an image of celery (and vice versa).

Three sets of 10 stimuli were used: desserts, vegetables and animals (positive, but not food-relevant). Food stimuli were adapted from the IAT stimulus set. Two images exemplifying each food type were used to reduce any potential effects of each photo’s subjective appeal. However, all images were selected to look objectively appealing. The animal images were selected for the purpose of post-hoc analyses of approach tendencies towards food stimuli versus pleasant non-food stimuli. If no differences are found in approach and avoidance tendencies for high-fat and low-fat foods, these can still be contrasted against neutral objects. The animal set consisted of rabbits, hamsters, kittens, puppies, and baby seals. As with the food stimuli, these images were selected to be objectively appealing.

Following a 10-picture practice trial using unrelated images, participants completed two experimental blocks of the 30 food and animal images presented in a random order (5 animals, 5 desserts and 5 vegetables, with two exemplars of each stimulus – one exemplar for each block). Photograph and border colour combination (blue or purple) was counterbalanced between blocks. If participants responded incorrectly or did not make a response within a 500ms response window, the trial for that particular stimulus was repeated at the end of the block until a correct response was made.

3.5. PROCEDURE

Data was collected individually in a private testing cubicle; each session lasted approximately 30 minutes. Participants completed one of the computerised measures (either

IAT or AAT), followed by the questionnaires and then the second computerised measure (AAT or IAT, respectively). The order in which computerised measures were completed was counterbalanced within participants. Questionnaire order was also randomised to account for the possibility that eating behaviour salience may influence explicit food attitudes, or vice versa. Participants were remunerated £3 for participation and debriefed.

4. Results

4.1. DESCRIPTIVE RESULTS

Mean total score on the DEBQ was 2.94 (SD=.61), and mean Global EDE-Q score was 1.89 (SD=1.20). The DEBQ scores are somewhat higher than the normative score of 2.41 in a sample of healthy women studied by van Strien et al. (1986). Scores on the EDE-Q were also slightly higher than the mean score of 1.42 obtained in a female participant sample by Mond, Hay, Rodgers, Owen and Beumont (2004), but considerably below the clinical mean of 3.09. The two measures were significantly correlated, r=.621, p<.000. The elevated levels of pathology are most likely the consequence of restrained eater over-representation in the sample.

Correlation analyses indicated that body mass index (BMI) was positively associated with scores on the DEBQ, r=.24, p=.008, and the EDE-Q, r=.29, p=.001. Other correlations between BMI, DEBQ, EDE-Q, IAT-D and explicit food taste ratings can be found in Table 3.

Participants in the overall sample reported a significant explicit preference for the taste of desserts, M=3.87 (SD=0.72) compared to the taste of vegetables, M=3.33 (SD=0.57), t(125)= –6.22, p=.000. Ambivalence towards desserts was marginally higher, M=2.80 (SD=1.52) than towards vegetables, M=2.39 (SD=1.02), t(125)=2.56, p=.010. The IAT-D effect in the overall sample (M=.11) was also significantly different from zero, t(124)=2.43, p=.016, which suggests that participants had stronger implicit associations in the congruent trial block (dessert-

tasty/vegetable-not tasty) than in the incongruent trial block (dessert-not tasty/vegetable-tasty).

A paired-samples t-test of average approach and avoidance response time latencies across all trials suggested that participants were on average faster to approach (M=398) than avoid (M=403) stimuli. This pattern of results was true for animal images, $t(125)=-2.578$, $p=.011$, $d=.461$, and marginally true for dessert images, $t(125)=-1.769$, $p=.079$, $d=.316$. However, this was not the case for images of vegetables, which participants were equally fast to both approach (M=400) and avoid (M=402), $t(125)=-.766$, $p=.445$, $d=.137$.

Table 3
Study 3 Correlations

	1	2	3	4	5	6	7	8	9
1. BMI	1								
2. Diet skill	.024	1							
3. IAT-D	.076	-.058	1						
4. Explicit Vegetable taste	-.077	-.150	-.213*	1					
5. Explicit Dessert taste	.085	.132	.126	-.122	1				
6. Vegetable ambivalence	-.027	.095	.168	-.587**	.154	1			
7. Dessert ambivalence	.102	.211*	-.154	-.005	-.164	.061	1		
8. DEBQ total	.235**	.145	-.095	-.141	.035	.046	.221*	1	
9. EDE-Q total	.287**	-.103	-.164	.017	-.121	-.121	.281**	.621**	1

p<.05; **p<.01
BMI = Body Mass Index; IAT-D = Implicit Association Test D; DEBQ = Dutch Eating Behavior Questionnaire; EDE-Q = Eating Disorders Examination Questionnaire

4.2. CURRENT DIETERS VS. CURRENT NON-DIETERS

Current dieters reported higher levels of pathological behaviours and cognitions compared to non-dieters. Dieters scored higher on the EDE-Q Global, M=2.71 (SD=1.03), compared to non-dieters, M=1.45, (SD=1.05), $F(1,124)=41.87$, $p=.000$. Dieters and non-dieters did not differ on the External sub-scale of the DEBQ, $F(1,124)=.02$, $p=.849$, but dieters scored significantly higher (M=3.01) on the Emotional sub-scale, compared to non-dieters (M=2.58), $F(1,124)=5.54$, $p=.020$. The two groups did not differ in their explicit taste ratings for desserts, $F(1,124)=1.08$, $p=.302$, or vegetables, $F(1,124)=2.16$, $p=.144$. There were also no significant differences in ambivalence towards desserts, $F(1,124)=1.50$, p=.223, or vegetables, $F(1,124)=1.98$, $p=.162$.

Univariate analyses of variance indicated that current non-dieters had higher IAT-D scores, M=.25 (SD=.46) compared to current dieters, M= –.14 (SD=.49), $F(1,123)=19.41$, $p=.000$. Post-hoc one-sample t-tests indicated that IAT-D was significantly greater than zero in non-dieters, $t(80)=4.8$, $p=.000$, $d=1.073$. In current dieters, IAT-D scores were marginally lower than zero, $t(43)= –1.94$, $p=.059$, $d=.591$. Overall, these results suggest that current dieters had marginally stronger positive implicit attitudes towards vegetables, compared to desserts – in contrast to the current non-dieter group, in which the preference was reversed. This is in contrast to the results from the explicit food attitudes, which did not differ between the two groups.

A 3 (stimulus) x 2 (approach/avoidance) x 2 (group) interaction was carried out to determine approach and avoidance tendencies (i.e., reaction times) between the groups. The overall interaction was not significant, $F(2,248)=.291$, $p=.748$, $n^2_p=.004$. There was, however, a marginally significant main effect of group: current dieters (M=406) were significantly slower to make responses overall, compared to current unrestrained eaters (M=399), $F(1,124)=3.562$, p=.061, $\eta_p^2=.028$. The main effect of stimulus was also marginally significant, $F(2,248)=2.906$,

p=.057, η_p^2=.025. Post-hoc comparisons indicated that participants were significantly slower to respond to desserts (M=403) compared to animals (M=401), 95% CIs [-5.670, -.383], p=.025, and marginally slower compared to vegetables (M=401), 95% CIs [-.326, 4.685], p=.088. Current dieters were slower to approach desserts (M=407) compared to the current non-dieters (M=397), F(1,124)=4.399, p=.040, η_p^2=.034, but no other between-group comparisons were significant.

4.3. SUCCESSFUL VS. UNSUCCESSFUL DIETERS VS. NON-DIETERS

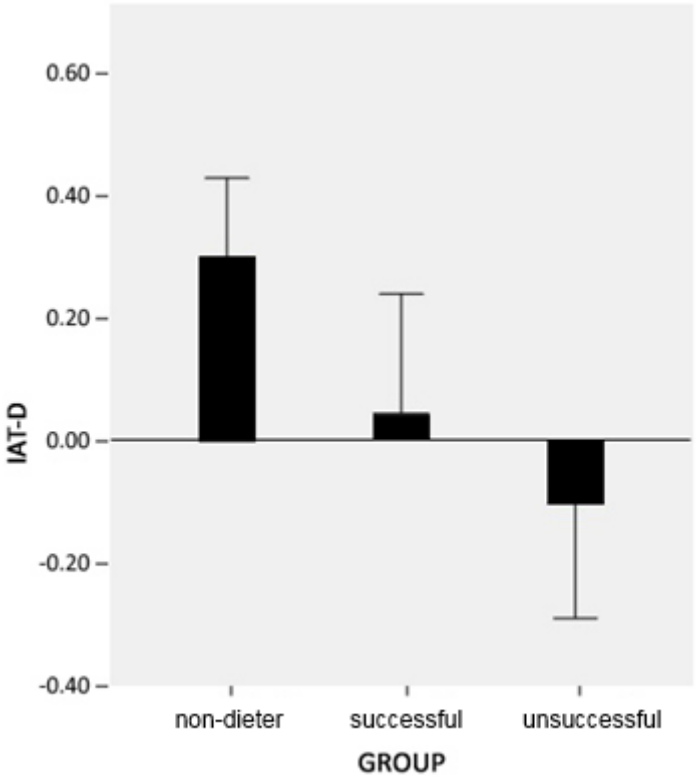
A significant main effect of group was found in the univariate ANOVA in both DEBQ and EDE-Q scores, F(2,90)=9.47, p=.000 and F(2,90)=17.66, p=.000, respectively. However, post-hoc tests found significant differences on the EDE-Q only between the successful dieter and non-dieter groups, 95% CIs [-2.02, -.74], p<.000, and between the unsuccessful dieter and the non-dieter group, 95% CIs [-1.87, -.57], p<.000. No differences were found between the successful and unsuccessful dieter groups, 95% CIs [-.52, .84], p=.842. An identical pattern of results emerged in the post-hoc analysis of the DEBQ. However, simple contrasts of the DEBQ subscales found higher scores on the External Eating subscale in the unsuccessful dieter group (M=3.47) compared to the successful dieters(M=3.12) 95% CIs [-.68, -.01], p=.042. This suggests that unsuccessful dieters were more likely to eat as a consequence of external triggers compared to the successful.

Analyses of variance in explicit food attitudes yielded a significant main effect of group for desserts F(2,89)=4.38, p=.015 η^2_p=.096, and a marginally significant main effect for vegetables, F(2,89)=2.42, p=.095, η^2_p=.049. Multiple comparisons of dessert taste ratings suggest that the non-dieter group rated the taste of desserts higher, M=4.14 (SD=.12) than the successful dieter group, M=3.66 (SD=.13), 95% CIs [.05, .91], p=.026. However, the comparison between successful and unsuccessful dieters was non-significant, both for vegetables, 95% CIs [-.16, .64], p=.339, and desserts, 95% CIs [-.54, .37], p=.900.

A significant main effect of group was also found for the IAT-D effect, $F(2,89)=5.81$, $p=.004$. However, post hoc comparisons suggest that this effect was primarily driven by the difference between the unsuccessful dieter and the non-dieter group, 95% CIs [.10, .70], $p=.005$. Descriptively, successful dieters had a stronger implicit preference for desserts (M=.043) compared to unsuccessful dieters (M= -.102), but this comparison did not reach statistical significance, 95% CIs [–.04, .55], $p=.103$ (see Figure 2)

One-sample t-tests indicate that IAT-D values in the non-dieter group were significantly different from zero, M=0.297 (SD=.38), $t(33)=4.58$, $p=.000$, $d=1.594$, which suggests stronger positive associations with desserts compared to vegetables. However, IAT-D values were not different from zero in either the successful or the unsuccessful dieter group.

Figure 2
Performance on the Food IAT in Study 3. Non-dieters vs. successful dieters vs. unsuccessful dieters.



A 3 (stimulus) x 2 (approach/avoidance) x 3 (group) interaction analysis was conducted to determine the effects of stimulus on automatic approach and avoidance tendencies. Differences between stimulus and approach/avoidance variables were assessed using repeated-measures analyses; the group variable was between-participants. This interaction was not found to be significant, $F(4,180)=1.207$, $p=.309$. The main effect of stimulus was also not significant, $F(2,180)=2.039$, $p=.133$. Post-hoc comparisons between groups designed to assess specific successful/unsuccessful dieter differences in responding did not yield significant results, 95% CIs [-13.303, 9.189], $p=.717$ (LSD pairwise comparison).

5. Discussion

The current study was designed to follow on from Study 2. The results of Study 2 were ambiguous. Both high-pathology and low-pathology participants reported an explicit preference for desserts. Consistent with the explicit preference and with the hypothesis, no group differences were found in implicit attitudes towards food. However, high-pathology participants, unlike the low-pathology participants, showed no implicit preference for desserts compared to vegetables. The ego depletion procedure was also found insufficient to induce a state of ego depletion, and these findings therefore could not be discussed in the context of the hypothesis that acting impulsively on positive associations with high-fat food in a state of ego depletion could play a role in pathological eating behaviour.

Study 3 was specifically focused on the role of implicit food attitudes in dieters. Hypotheses 1 and 2 were relevant to differences between current dieters (at the time of the study) and current non-dieters (at the time of the study). Hypotheses 3 and 4 were focused on the potential role of implicit attitudes and automatic approach/avoidance behaviour in diet success and failure. The approach and avoidance task was used to assess participants' automatic approach and avoidance tendencies towards high-fat (dessert), low-fat (vegetables) and neutral (animals) stimuli. The task was designed to assess automatic approach and avoidance tendencies in a context where participants would not be motivated to suppress or modify them (Elliot & Covington, 2001), as the food stimuli were not real.

Similarly to Study 2, the current study was broadly aimed at assessing the hypothesis that dieting results in a state of ego depletion, which then leads to impulsive eating behaviour (presumably of high-fat foods which are incompatible with the weight loss goal).

5.1. CURRENT DIETERS VS. CURRENT NON-DIETERS

It was hypothesised that, similarly to the high-pathology and low-pathology groups in Study 2, no differences would be found in explicit or implicit food attitudes between current

dieters and non-dieters. Indeed, both groups explicitly reported a preference for the taste of desserts compared to vegetables. However, dieters scored significantly lower on the IAT-D compared to non-dieters. This finding does not support Hypothesis 1; dieters, in contrast to non-dieters, did not have an implicit preference for desserts. To some extent these findings have clarified the results of Study 2. In Study 2, despite no group differences in the IAT-D, high-pathology participants also did not have an implicit preference for either food type. One possibility is that this implicit preference may decrease as a consequence of restriction and/or restraint, but not as a consequence of other aspects of ED pathology, such as body dissatisfaction. If this is the case, the ambiguous findings of Study 2 could be attributed to the fact that not all people in the high-pathology group were necessarily dieting.

Hypothesis 2 was also not supported. Dieters were slower to make responses on the AAT compared to non-dieters – and were specifically slower to approach desserts. However, these findings are consistent with the results from the IAT. If dieters do not have an implicit preference for desserts, their automatic behaviour would be consistent with this preference; in this case, a delayed approach response compared to people who do have such an implicit preference. This result is not consistent with findings by Veenstra and de Jong (2010), who found enhanced approach tendencies for both high-fat and low-fat food in restrained eaters. However, the dieters in the study also had positive implicit attitudes towards high-fat food, so their behavioural response was consistent. Results similar to the ones obtained in the present study were found by Fishbach and Shah (2006, Study 2), who found that restrained eaters were faster to avoid high-fat food stimuli than fitness stimuli.

It must be noted that the design of the current study was cross sectional. The findings suggest the presence of group differences between dieters and non-dieters: namely, attenuated implicit preferences and slower automatic approach tendencies for high-fat food in dieters. However, these findings are insufficient to conclude that dieting is responsible for these changes. A prospective design would be needed to test this hypothesis. The alternative explanation is that people with this cognitive profile are *a priori* more susceptible to engaging in

dieting. Results from the DEBQ suggested that dieters are more prone to eat while emotionally aroused, which suggests that they may experience greater difficulties in self-control when they experience such states. It could also be argued that this finding is consistent with the ego depletion hypothesis, as the self-control required for regulating a negative emotional state would be unavailable for successful diet control. However, if this were the case we would also expect to see differences in susceptibility to external cues for eating, which was not the case in the present study.

Perhaps a connection could also be made to the role of implicit-explicit discrepancy discussed in Study 1; dieters explicitly prefer desserts, but do not uphold that preference on an implicit level. However, the current understanding of the underlying mechanisms is insufficient to speculate how this could be translated into restrained eating behaviour. The alternative, however (that restraint causes cognitive changes), can be assessed more easily: by measuring implicit food attitudes before and after engaging in dietary restraint.

5.2. SUCCESSFUL VS. UNSUCCESSFUL DIETERS VS. NON-DIETERS

Hypotheses 3 and 4 addressed the possibility that differences in implicit food attitudes, and subsequent automatic approach and avoidance tendencies, could contribute to relative success or failure of dieting. If this is the case it could be hypothesised that successful dieters would hold implicit food attitudes which can facilitate automatic behaviour: namely, an attenuation of the normative preference for high-fat foods. In absence of such a preference, the impulse to indulge in high-fat food would hypothetically also be diminished. However, neither hypothesis was supported, as no differences in either implicit food attitudes, nor automatic approach and avoidance, was found between successful and unsuccessful dieters. This suggests that alternative mechanisms are likely to be involved in the dieting success of successful dieters. Nevertheless, a possible pattern did emerge: successful dieters had lower IAT-D scores than the unrestrained, and unsuccessful dieters descriptively scored even lower

than the successful. It could be speculated that implicit food preference may be correlated with the subjective experience of dietary restraint difficulty. The causal direction, however, is difficult to establish from this cross-sectional finding alone. Further research could address whether there are significant differences in implicit food attitudes in childhood, and whether these change over time (once the cultural meaning of restraint and weight becomes salient). A proportionate decrease in the implicit preference for high-fat foods following an unsuccessful restraint attempt would also support the hypothesis that behaviour precipitates the cognitive change (rather than vice versa).

It must also be noted that the unsuccessful dieter group scored higher on the External Eating subscale of the DEBQ, suggesting that individuals in this group were more susceptible to eating as a consequence of external triggers. Together with the findings from Hypothesis 2, this suggests that a) dieters are overall more prone towards emotional eating, and b) dieters who are additionally more prone to external eating are more likely to be unsuccessful. This is consistent with literature which addresses the role of impulsivity in dietary restraint failure and in ED pathology (Welch & Fairburn, 1996; Nederkoorn et al., 2004; Claes et al., 2006; Nederkoorn, Smulders, Havermans, Roefs, & Jansen, 2006). However, the finding that successful dieters reported liking desserts less than non-dieters also suggests that the elevated impulsivity could be a consequence of the subjective experience of temptation, hunger, and/or craving. In other words, dieters may be more likely to indulge in high-fat food compared to non-dieters, but this could be a consequence of significantly greater salience of these foods. This hypothesis could be addressed in future research, either by analysing diary entries recording subjective temptation on a Likert scale, perhaps using an Ecological Momentary Assessment methodology (Moskowitz & Young, 2006), or experimentally by recording subjective temptation in response to stimuli presented to participants in a lab setting.

5.3. LIMITATIONS AND FURTHER DIRECTIONS

While current dieters and non-dieters were either engaging or not engaging in dieting at the time of data collection (a "state" identification), successful and unsuccessful dieters were classified on the basis of their "trait" behaviours and tendencies. This was done primarily as a consequence of the practical limitations in collecting data from a significantly larger sample. It is possible that diet success is fluid rather than stable and that the same person could experience considerable difficulty in maintaining restraint diet at one point, but not at another – perhaps owing to circumstances (e.g. exposure) or changes in personal attitudes or lifestyle. As a consequence, it is necessary to replicate current findings in a sample of successful and unsuccessful current dieters: i.e., people who are struggling (or not struggling) to maintain a diet at the point of data collection. More stringent criteria could also be adopted to a) assess diet success more objectively, and b) recruit more extreme examples of very successful or very unsuccessful dieters. It could be suggested that these tendencies are exhibited at their most extreme in AN and BN, respectively. Replicating the study in these populations could also yield clearer findings.

The criteria adopted for the classification of successful and unsuccessful dieters could also have had an impact on the results. Although the approach used here is similar to one successfully used by Ogden (1993), there currently is no single concrete convention for the assessment of diet success and failure. Final conclusions therefore shouldn't be drawn until the results can be replicated using a) more stringent criteria (this could be achieved through the development and validation of a quantitative measure specifically designed to assess diet success/failure), b) more objective assessment to reduce reliance on self-report and participants' subjective assessment (e.g., by using historical "diet attempt" vs. "weight lost" data).

Approach and avoidance tasks have been criticised for their susceptibility of subjective interpretation of the instructions: either body-reference ("push away" to avoid or "pull towards" to approach) or object-reference ("push towards" to approach or "pull away" to

avoid). Rinck and Becker (2007) found that participants could indeed adopt an object-reference interpretation when prompted (so long as the stimulus was not too salient). For this reason, Krieglmeyer et al. (2010) have suggested using the manikin task for a visual representation of the action. The AAT used in the current study used the visual representation of a "shrinking" or "growing" image to simulate approach and avoidance, but could still be criticised for not using a procedure which physically mimics approach and avoidance behaviour in the way that a joystick task does. However, there is little evidence to suggest that the task did not work, or worked incorrectly, as the results of the AAT were consistent with some previous research, and with the results of the IAT.

It is also possible that the lack of group differences on the AAT could be attributed to insufficient sensitivity of the task. A very short (500ms) response window criterion was used to ensure that all responses were made as automatically and with as little conscious input as possible. However, the limitation of this is that it could have masked some group differences. Future studies may wish to consider using two variations of the task with different response windows, or using an intermediate response window (e.g., 1,000ms).

6. Conclusions

The four hypotheses proposed in Study 3 were not supported by the results. However, the findings served to replicate some of the findings in Study 2 (e.g., an explicit preference for desserts across all groups) in a sample of dieters and non-dieters, but also to clarify some of its ambiguities. The current results suggest that people engaging in dieting do not have an implicit preference for desserts (high-fat) compared to vegetables (low fat), which also manifests as an attenuation of automatic approach tendencies for desserts. Overall, the findings suggest that the ego depletion account of diet failure is an unlikely explanation. However, the results indicate that there may be possible differences in implicit food attitudes (and therefore

automatic approach and avoidance tendencies) between very successful and very unsuccessful dieters

The present findings do not make it clear whether the implicit attitude pattern in dieters is a trait which precipitates the behaviour, or is a consequence of the dieting behaviour. Study 4 was designed to disambiguate these interpretations.

CHAPTER VI

Study 4: Implicit attitude change following dietary restraint

In Study 3, participants who were dieting at the time of data collection had an explicit and an implicit preference for high-fat, high-sugar foods (desserts) compared to low-fat, low-sugar foods (vegetables). Conversely, dieters who took part in the study reported an explicit preference for the taste of desserts but did not hold an implicit preference for either food type. The results of Study 3 were insufficient to determine whether these differences were premorbid, or the consequence of dieting. One possibility is that an implicit preference for high-fat foods is normative, but becomes attenuated as a consequence of dieting. The other possibility is that a lack of implicit preference for high-fat foods is part of a cognitive profile which can predispose a person to dieting behaviour. Study 4 was designed to replicate the findings of Study 3 and disambiguate these two potential explanations.

1. Implicit measures and test-retest reliabilities

The present study used a longitudinal design. In order to assess whether the lack of implicit preference for high fat foods in dieters was a cognitive trait or a consequence of behavioural change, participants were assessed before commencing a weight loss diet, and approximately two weeks after starting one. This design involved data collection across two sessions, including the administration of two IATs in order to assess any changes in participants' implicit attitudes. The nature of this particular methodological design means that the test-retest reliability of implicit attitude assessment must be taken into account.

The test-retest reliabilities of different implicit measures have already been briefly discussed in Chapter II. The stability of implicit measures varies dramatically depending on the methodology used and the research area in which it is being used. Split-half reliabilities of the Extrinsic Affective Simon Task (De Houwer, 2003), for example, have been found to be very low, at *r*=.35, .16 and -.20, depending on the stimuli used (De Houwer & De Bruycker, 2007). Test-retest reliabilities for the Implicit Relational Assessment Procedure (Barnes-Holmes et al., 2006) appears slightly better at *r*=.49 over a 24-hour period in one study (Cullen, Barnes-Holmes, Barnes-Holmes, & Stewart, 2009). Affective priming paradigms have similar parameters, at *r*=.56 (Kawakami & Dovidio, 2001). Median test-retest of the IAT has been reported at *r*=.56 in a meta-review by Egloff et al. (2005). This is a level comparable to affective priming and the IRAP, and descriptively the best of the available measures. However, the meta-review notes that test-retest reliability in IAT studies has varied dramatically, from .3 to .75 – depending on the specific methodology, stimuli and research area.

Compared to self-report measures, implicit measures do not appear to be as stable. For example, the test-retest reliability of the Restraint subscale of the EDE-Q over two weeks has been found to be *r*=.81 in one study (Luce & Crowther, 1999). The DEBQ similarly has test-retest reliability of *r*=.85 (Banasiak, Wertheim, Koerner, & Voudouris, 2001). As discussed in Chapter II, it is debatable whether this suggests that implicit measures are less methodologically robust, or if the lower levels of stability over time reflect a less stable cognitive construct. Nevertheless, the IAT appears to be the most structurally robust implicit measure for use in a repeated-measures design out of the available options. There still remains the possibility of the (relatively) low reliability masking group differences and therefore increasing the possibility of a Type II error in analysis. However, based on the relatively superior psychometric parameters, and in order to maintain consistency with previous studies, the IAT was used in Study 4.

2. The present study

The study was designed to prospectively assess the effects of dieting on implicit food attitudes. The design of the study mimicked that of Study 3, but participants were assessed prior to starting a weight loss diet as well as after approximately 2 weeks of self-reported dieting. Participants in the control group (non-dieters) did not report the intention to restrain their food intake, or (retrospectively), having engaged in a diet over the course of the study. As a result, all participants in session 1 were expected to be non-dieters. In session 2, participants in the control condition remained non-dieters, while those in the diet group would have been actively engaging in restraint diet for approximately two weeks. Although two different explanations for the outcomes of Study 3 have been put forth, the current study was predominantly designed to assess the hypothesis that the act of dieting affects implicit food attitudes. Specifically, it is hypothesised that dieting decreases the implicit preference for desserts (high fat) compared to vegetables (low fat). The specific hypotheses were as follows:

- *Hypothesis 1.* There will be no differences in implicit food attitudes between groups in session 1.
- *Hypothesis 2.* In session 2, dieters will have a decreased implicit preference for desserts, compared to the non-dieters. Dieters will therefore have a lower mean IAT-D score compared to non-dieters.
- *Hypothesis 3*. If implicit food attitudes indeed change as a consequence of dieting, dieters' IAT-D scores will be significantly decreased in session 2, relative to non-dieters. A significant session x group interaction should therefore be observed.

3. Method

3.1. PARTICIPANTS

Fifty-four women were recruited for participation in the study. The study was advertised on the university's online participant subject pool. Each participant was emailed and completed a screening questionnaire before taking part. The screening questionnaire asked whether the participant was a) currently on a weight loss diet, b) currently on any other diet, c) has been on a weight loss diet in the past 12 months, d) had an intention of starting a weight loss diet in the next fortnight, and e) height and weight. Participants were recruited into the (prospective) dieter group if they a) were not currently on a weight loss diet, or another highly restrictive diet, b) had an intention of starting a diet, and c) did not have a BMI below 18.0. The BMI cut-off was chosen because it was not deemed ethical to encourage further weight loss in participants who are already underweight. Participants were recruited into the non-dieter group if they a) were not currently on a weight loss diet, or another highly restrictive diet, b) had not been on a weight loss diet in the past 12 months, and c) did not have an intention of starting a diet. Any women who did not meet either set of criteria (N=7) were not included in the study; however, because the criteria were made clear in the study description, this mostly reflects a failure to follow directions.

Of the 54 women recruited, six did not attend the second session and therefore were not included in the final sample. Nine more participants were excluded for failing to reach the minimum accuracy criteria on both Food IATs (<80%). Two more were excluded due to equipment failure. Five participants who were recruited as (prospective) dieters subsequently reported that they had not been on a weight loss diet between session 1 and session 2, and were therefore also not included. One participant had stopped their diet before attending session 2 and was excluded as she did not qualify as a dieter for the whole duration of the study. Thirty-one participants were therefore included in the final sample. Of these, 17 were

non-dieters and 14 were dieters. Sample size calculations using G*Power for a repeated measures F-test with two groups, two measurements, a measure test-retest correlation of r=.56 and an effect size of .8 yielded a total sample size of N=6, which suggests that the number of participants recruited should be sufficient. (Prospective) dieters were not on a weight loss diet at the time of data collection in session 1, but *were* on a weight loss diet at the time of session 2. Non-dieters were not on any kind of restrictive diet for the duration of the study. Within the dieter group, session 2 was scheduled on average 16.36 (SD=4.51) days after the intended diet start, or 19.36 (SD=4.36) days after session 1. Within the non-dieter group, session 2 was scheduled on average 15.41 days (SD=5.78) after session 1. The number of days elapsed since the first session was significantly longer in the restrained group, $t(29)=2.106$, p=.044. The reason for this difference is that it was not possible to predict how soon after session 1 dieters would choose to start their diets, and the corresponding time scale for the non-dieters had to be estimated before all data was collected.

3.2. MEASURES

Questionnaires. With the exception of the Eating Habits Questionnaire, all questionnaires were identical between session 1 and session 2. These included a demographic questionnaire, the Dutch Eating Behaviour Questionnaire (DEBQ) and the Eating Disorder Examination Questionnaire (EDE-Q), all of which were identical to those used in Study 3. Chronbach's alpha for the DEBQ in the current sample was α=.89. For the EDE-Q the value was α=.918. The Food Attitudes Questionnaire was also adapted from Study 3, but included only familiarity ratings ("Do you know what this food tastes like? yes/no") and 5-point Likert scales to assess how much each participant likes the taste of each food. Unipolar positive and negative attitude scales were not included as they were not relevant to the research aims of the present study. Cronbach's alpha for the scale was α=.753 in the current sample.

The Three Factor Eating Questionnaire (TFEQ; Stunkard & Messick, 1985) was also included. The TFEQ is designed to measure three dimensions of eating behaviour: cognitive restraint (of eating), disinhibition, and hunger. The questionnaire consists of 51 items. The first 26 are true/false statements, such as "When I feel anxious, I find myself eating" and "I consciously hold back at meals in order not to gain weight". The remainder of the questions in part two comprise of 4-point Likert scales tailored to each question, such as "How often do you feel hungry? (Only at mealtimes, sometimes between meals, often between meals, almost always" and "How likely are you to consciously eat less than you want? (Unlikely, slightly likely, moderately likely, very likely)". Scores on the TFEQ have been found to adequately discriminate between different self-reported eating behaviours, such as amount of energy intake and emotional eating (de Lauzon et al., 2004). The scale was included to supplement the DEBQ and EDE-Q and to facilitate the discussion of results (implicit and explicit food attitudes) in the context of self-reported eating behaviour. Reliability in one psychometric analysis was found to range from α=.78 to .84 within the subscales (de Lauzon et al., 2004). Alpha in the current sample was α=.894 for the overall scale.

In session 1, the Eating Habits Questionnaire replicated the screening questionnaire, to ensure that no significant changes have taken place between screening and session 1. The questionnaire consisted of nine questions, including intention to start a weight loss diet, history of restraint ("How many times have you started a weight loss diet in the past year?"; never, once, twice, three times, more than three times) and weight in the past year ("How constant has your weight been over the past six months/year?"; my weight has not changed, I have lost weight, my weight has fluctuated, I have gained weight) and subjective restraint success ("How well are you able to stick with the diet during [times when you start a weight loss diet]?"), and hunger ("How hungry do you feel right now?"). In session 2, the questionnaire was slightly modified to reflect changes over the course of the study: i.e., whether the participant had actively engaged in restraint, any weight changes since session 1 ("How constant has your

weight been over the course of this study?"), and hunger. The primary purpose of the Eating Habits Questionnaire was for assessing participants' eligibility for the group criteria.

Implicit Association Test: Food. The Food IAT was identical to that used in Study 3.

Implicit Association Test: Insect. A "known group" Insect/Flower IAT was included in the study. The relatively unambiguous dichotomy between flowers and insects was first used by Greenwald et al. (1998) in the development of IAT in order to illustrate its methodology and procedure. Flowers, to most people, are more pleasant than insects. Unlike some research areas, such as prejudice, alcohol abuse or food attitudes, there is little reason to expect interference from confounding variables (such as context, motivation or faking) on the Insect IAT. Both children (Baron & Banaji, 2006) and adults (Karpinski & Hilton, 2001) have a relatively unambiguous implicit preference for flowers, compared to insects. As a result, the Insect IAT is frequently used as the neutral control alongside the experimental IAT to ensure that the experimental design is working as expected (Baron & Banaji, 2006), or when assessing psychometric properties of the measure, rather than a specific attitude (Govan & Williams, 2004). In the current study, the results of the Insect IAT were used as a baseline "index" of measure stability, practice effects and possible changes to participants' skill or attention as a consequence of dietary restraint, in comparison to the Food IAT.

The design and procedure of the IAT was identical to the Food IAT. The *insect* category consisted of beetle, wasp, ant, cockroach, centipede and mosquito. The *flower* category consisted of daisy, rose, orchid, daffodil, sunflower and tulip. Word length was not different between the categories, $t(10)=.252$, $p=.806$. The *positive* category included good, lovely, pleasant, love, happy, and nice. The *negative* category included bad, horrible, death, pain, evil, and awful. These also did not differ significantly in worth length, $t(10)=.347$, $p=.736$ In the congruent trial block, participants used one key to respond to *flower* and *positive* words and

another key to *insect* and *negative* words. In the incongruent trial block, key assignments were switched, and one key was used to respond to *flower* and *negative* words, and another to *insect* and *positive* words. The IAT-D value was calculated in such a way that a positive IAT-D value reflects a stronger positive association with flowers, while a negative IAT-D value reflects a stronger positive association with insects.

3.3. PROCEDURE

Participants who were approved for participation following completion of the screening questionnaire attended two sessions. In each session participants completed a) the Food IAT, b) the questionnaires, and c) the Insect IAT. The questionnaires were identical between sessions, with the exception of the Eating Habits Questionnaire, which was modified to assess changes over the course of the study. At the end of session 1 participants were asked to schedule a convenient time for attending session 2. For participants in the unrestrained group, session 2 was scheduled approximately two weeks after session 1. For participants in the restrained group, session 2 was scheduled approximately two weeks after their intended date of starting restrained eating. In session 2 participants completed the Food IAT, questionnaires and Insect IAT again, were thanked, debriefed and remunerated £6. Participants who did not attend session 2 were debriefed via email.

4. Results

4.1. DEMOGRAPHIC VARIABLES

One participant reported a diagnosis of anorexia nervosa five years prior, but self-identified as an unrestrained eater for the purpose of the study. One more participants reported having seen mental health practitioners six years ago with regards to eating difficulties, but did not receive an official diagnosis. Her BMI at the time of the study was within a healthy range, and she was therefore included in the study. Removing these participants' data did not significantly affect results and they were therefore retained in the final sample.

Average age in the sample was 27.39 years (SD=13.27). There were no significant age differences between (prospective) dieters (M=23.07) and non-dieters (M=30.94), $t(29)= -1.694$, $p=.101$. Average BMI self-reported at session 1 was within the healthy range of 18.5 to 25 (M=22.30, SD=5.02). Dieters had a marginally higher BMI (M=24.12) compared to non-dieters (M=20.81), $t(29)=1.903$, $p=.067$. Changes in BMI between session 1 (M=22.30) and session 2 (M=22.38) were not significant in the overall sample, $t(30)= -.781$, $p=.441$. The session x group interaction was not significant, $F(1,29)=.761$, $p=.390$, which suggests that there was no significant weight decrease (or increase) in the dieter group between session 1 and session 2 compared to the non-dieter group. Of the 12 dieters who reported their weight in session 2, 50% reported no change, 25% reported weight loss, 17% reported weight fluctuation (both weight gain and weight loss within the specified time period) and 8% reported weight gain. By contrast, 60% of non-dieters reported no change to their weight, 13% had lost weight and 27% had gained weight.

4.2. EATING DISORDER PATHOLOGY

In session 1, (prospective) dieters scored significantly higher on all three measures of pathology and eating behaviour. Shapiro-Wilk tests were carried out for the EDE-Q Total for session 1 and session 2, and were both found not to be significant, p=.635 and p=.925, respectively. Based on the outcome of a one-way ANOVA, dieters scored higher (M=2.10) on the EDE-Q Total compared to non-dieters (M=.90), $F(1,29)=18.44$, $p<.000$, $n^2_p=.179$. The dieter group also scored higher (M=34.79) on the TFEQ in session 1 compared to non-dieters (M=20.47), $F(1,29)=18.55$, $p<.000$, $n^2_p=.177$. The same was also true for the DEBQ (M=3.14 and 2.64, respectively), $F(1,29)=10.30$, $p=.003$, $n^2_p=.335$. Dieters also reported more attempted weight loss diets in the past year (M=.929) compared to the non-dieters (M=.235), $t(29)=2.439$, p=.021. Sub-scale means in Session 2 for all three measures can be found in Table 4.

Table 4
Mean scores on measures of eating behaviour and cognition.

Measure		Dieters Mean (S.D.)		Non-dieters Mean (S.D.)	
		Session 1	**Session 2**	**Session 1**	**Session 2**
EDE-Q Total		**2.01 (.82)**	**2.29 (1.27)**	**.91 (.73)**	**1.59 (1.18)**
	Restraint	1.14 (.98)	2.2 (.136)	.49 (.76)	1.32 (1.18)
	Weight	2.98 (1.01)	2.55 (1.66)	1.22 (1.19)	1.94 (1.44)
	Eating	1.30 (.63)	1.73 (.89)	.42 (.53)	1.11 (1.21)
	Shape	2.97 (1.23)	2.67 (1.61)	1.49 (1.16)	2.01 (1.34)
TFEQ Total		**34.78 (7.33)**	**36.36 (6.68)**	**20.47 (10.48)**	**20.78 (10.51)**
	Restraint	5.15 (2.60)	6.91 (2.47)	3.11 (2.47)	3.86 (3.08)
	Disinhibition	8.53 (2.88)	8.63 (2.97)	5.29 (2.25)	6.14 (2.74)
	Hunger	7.30 (2.87)	7.18 (2.96)	4.64 (3.28)	4.50 (3.18)
DEBQ Total		**3.13 (.32)**	**3.24 (.31)**	**2.64 (.49)**	**2.55 (.63)**
	Restraint	3.02 (.73)	3.44 (.62)	2.04 (.69)	2.20 (.84)
	Emotional	2.98 (.67)	2.97 (.96)	2.74 (.93)	2.34 (.82)
	External	3.40 (.49)	3.32 (.48)	3.16 (.50)	3.12 (.70)

EDE-Q: Eating Disorder Examination Questionnaire
TFEQ: Three Factor Eating Questionnaire
DEBQ: Dutch Eating Behaviour Questionnaire

In order to assess changes in restriction/restraint behaviour within the dieter group, a session x group analysis of variance was carried out with the EDE-Q Restraint subscale as the dependent variable. While the main effect of group was significant, $F(1,26)=6.897$, p=.014,

n^2_p=.210, the interaction was not, *F*(1,26)=.935, *p*=.342, n^2_p=.035. This suggests that dieters consistently scored higher than non-dieters on the subscale, but did not *increase* their restraint between session 1 and session 2. The same pattern emerged when the session x group interaction was carried out using the Restraint subscale of the DEBQ. While the main effect of group was significant, *F*(1,29)=6.518, *p*=.016, n^2_p=.428, the interaction was not, *F*(1,29)=2.783, *p*=.106, n^2_p=.088. Dieters also consistently scored higher on the Restraint sub-scale of the DEBQ, compared to non-dieters (see Table 4 for means). A repeated-measures ANOVA of the TFEQ Cognitive Restraint subscale found a significant main effect of group, *F*(1,26)=9.792, *p*=.004, but not a significant group x restraint interaction, *F*(1,26)=2.821, *p*=.105, which is consistent with the other measures and suggests that neither the dieters nor the non-dieters changed their levels of cognitive restraint between sessions.

To assess any changes in pathology which might have taken place within groups between session 1 and 2, a repeated-measures ANOVA with a session x group interaction was carried out on the EDE-Q Global, but was not found to be significant, *F*(1,26)=.797, *p*=.380, n^2_p=.030. The main effect of session was also not significant, *F*(1,26)=1.771, *p*=.195, n^2_p=.064. This suggests that EDE-Q Global did not significantly change between sessions, in either the dieter or the non-dieter group. However, because the EDE-Q refers to behaviour within the last 28 days, some overlap between sessions 1 and 2 can be expected. The same pattern was true for the session x group interaction for the DEBQ, *F*(1,29)=1.728, *p*=.199, and for the TFEQ, *F*(1,28)=.265, *p*=.610. This suggests that dieting did not result in a significant increase or decrease in ED pathology in the dieter group, compared to the non-dieter group.

4.3. EXPLICIT FOOD ATTITUDES

Self-reported hunger was not different in the overall sample between session 1 (M=1.284) and session 2 (M=1.326), as assessed using a repeated-measures ANOVA

F(1,29)=.055, *p*=.816. The hunger x group interaction was also not significant, *F*(1,29)=.316, *p*=.578, n^2_p=.011 which suggests that hunger did not differ between session as a function of group. There was also no main effect of group, *F*(1,29)=.009, p=.924, n^2_p<.000, which suggests that there were no group differences in self-reported hunger. A repeated-measures ANOVA with time since last meal found no main effect of group, *F*(1,29)=.287, *p*=.597. The session x group interaction was also not significant, *F*(1,29)=.936, *p*=.341, which indicates that there were no differences in food intake frequency between sessions as a function of diet status. This suggests that increasing the time between meals (e.g., cutting down on snacks) is not likely a common strategy adopted by dieters. The differences pertaining to eating behaviour between groups can be found in Table 5.

A repeated-measures ANOVA with a three-way food x session x group interaction was carried out to assess differences in food taste preferences within groups and between sessions. In contrast to the findings of Study 3, there was no main effect of food, *F*(1,29)=1.569, *p*=.220, n^2_p=.016, which suggests that participants did not overall rate desserts as more tasty than vegetables. However, the overall interaction was found to be significant, *F*(1,29)=6.259, *p*=.018, n^2_p=.178. Post-hoc analyses of session 1 indicated that dieters rated desserts significantly higher compared to non-dieters, *F*(1,29)=6.346, *p*=.018. However, the groups did not differ in their ratings of vegetables, *F*(1,29)=.304, *p*=.437. In session 2, there were no group differences in either dessert, *F*=(1,29)=1.692, *p*=.204, or vegetable ratings, *F*(1,29)=.045, *p*=.834. However, the session x group interaction did not reach significance, *F*(1,29)=.831, *p*=.369, n^2_p=.028, which suggests that any changes in dieters' food preferences between session 1 and 2 were descriptive only. Mean ratings for each food type within each group can be found in Table 5.

Table 5
Mean and (Standard Deviation) differences in eating behaviour differences between restrained and unrestrained participants.

	Session 1		Session 2	
	Dieters	Non-dieters	Dieters	Non-dieters
EDE-Q Restraint	1.27 (1.00)	.53 (.78)	2.30 (1.35)	1.15 (1.19)
Hunger	1.21 (.80)	1.35 (1.22)	1.36 (1.28)	1.29 (1.36)
Last meal (hrs)	2.50 (1.57)	3.65 (5.35)	2.18 (1.30)	4.76 (5.42)
Dessert rating	3.99 (.58)	3.25 (.93)	3.72 (.81)	3.31 (.91)
Vegetable rating	3.20 (.47)	3.40 (.84)	3.30 (.51)	3.35 (.77)

4.4. IMPLICIT FOOD ATTITUDES

Shapiro-Wilk test was not significant for either session 1 or 2 with the IAT-D as the independent variable, p=.744 and .742, respectively. Session 1 Food IAT-D (M=.470) was modestly, but significantly, correlated with session 2 Food IAT-D (M=.382), r=.497, p=.004. Food IAT performance was not significantly different between session 1 and session 2 in the overall sample t(30)=.755, p=.456. One-sample t-tests revealed that in session 1, Food IAT-D was significantly different from zero, t(30)=4.227, p=.000, d=1.543, as it was in session 2, t(30)=3.226, p=.003. This indicates that in both sessions participants overall had stronger positive implicit associations with desserts, compared to vegetables.

Consistently with Hypothesis 1, there were no significant group differences on the Food IAT-D in session 1, t(29)=-.571, p=.572, d=.212. In both dieters and non-dieters IAT-D scores were significantly above 0, t(16)=3.116, p=.007, d=1.558 and t(13)=2.856, p=.013, d=1.584, respectively. This suggests that both groups had significantly more positive implicit associations with desserts, compared to vegetables.

In session 2, non-dieters (M=.562) scored marginally higher on the IAT-D compared to dieters, (M=.164), t(29)=-1.723, p=.095, d=.640. This finding is consistent with Hypothesis 2, although the result did not reach significance. As in session 1, non-dieters' scores were significantly above 0, t(16)=3.227, p=.005, d=1.614. Non dieters' scores did not significantly change between sessions 1 and 2, t(16)=-.194, p=.848, d=.097. However, dieters' IAT-D in session 2 was *not* significantly different from 0, t(13)=1.167, p=.264, d=.647, which suggests

that (in contrast to session 1) participants in this group did not have a significant implicit preference for either desserts or vegetables.

In order to address Hypothesis 3, a session x group interaction was carried out to assess relative changes to the IAT-D across groups. This interaction did not reach significance, $F(1,29)=1.360$, $p=.253$, $\eta^2_p=.045$. This suggests that any changes to dieters' implicit food attitudes over the course of the study were not significantly greater than those of the unrestrained eaters.

4.5. INSECT IAT

Due to equipment failure, one participant failed to complete both Insect IATs. Their overall data was still included in the sample, as differences in Insect IAT performance were not the primary objective of the study. However, the difference in the degrees of freedom is reflected in the statistical reporting in this section.

The Insect IAT-D in the overall sample was significantly different from zero in session 1, $t(29)=5.769$, p=.000, and session 2, $t(30)=7.685$, p=.000. This indicates that participants had more positive implicit associations with flowers, compared to insects. A session x group interaction was carried out to assess any group differences on the Insect IAT between sessions. There was no main effect of session $F(1,28)=.004$, $p=.951$, indicating that performance did not differ significantly between sessions. There was also no significant session x group interaction, $F(1,28)=.001$, $p=.977$, which suggests that there were no significant changes in performance on the Insect IAT in either group.

Performance on the Food IAT was not significantly correlated with the Insect IAT in session 1, $r=.220$, $p=.242$. However, there was a significant positive correlation in session 2, $r=.385$, $p=.032$. Insect IAT-D in session 1 was also only marginally correlated with the Insect IAT-D in session 2, $r=.312$, $p=.093$.

5. Discussion

5.1. IMPLICIT AND EXPLICIT FOOD ATTITUDES

The hypothesis that dieting may affect implicit food associations was partially supported. There were no group differences in implicit attitudes towards food in session 1, in which none of the participants reported being on any kind of restrictive diet. In both groups, IAT-D scores were significantly above zero, which indicates stronger positive associations with desserts compared to vegetables in both groups. Replicating findings from Study 3, dieters in session 2 no longer held an implicit preference for desserts: their IAT-D scores were not significantly different from zero. This is consistent with the hypothesis that the act of dieting may affect implicit attitudes towards food. However, the fact that the session x group interaction was not significant suggests that these changes are not statistically significant. Nevertheless, the alternative hypothesis for the results obtained in Study 3 was that differences in implicit food attitudes between dieters and non-dieters are chronic, and not the consequence of dieting The results of the present study fail to support this hypothesis, as there were no differences in IAT-D scores between groups in session 1.

The pattern of explicit food attitudes in the present study deviates from the results of Study 2 and Study 3. In Study 2, both high-pathology and low-pathology participants preferred the taste of desserts to the taste of vegetables. In Study 3, both current dieters and current non-dieters also preferred the taste of desserts. By contrast, there were no differences in the self-reported liking of desserts compared to vegetables in the current study. In session 1, dieters reported higher ratings for desserts than non-dieters. This difference was no longer present in session 2. This suggests that dieters' liking for desserts decreased on *both* an implicit and an explicit level over the course of the study. This is inconsistent with the findings of Study 3, in which the explicit preference for desserts persisted despite changes to the dieters' implicit attitude. It is worth noting that the explicit Food Attitudes Questionnaire specifically assessed participants' liking of the *taste* of the different foods. A change in global attitude could reflect

goal-directed behaviour: i.e., it is sensible for a person to perceive a high-fat food as less "good" after making the decision to lose some weight. However, explicit changes in perceived *taste* suggests that participants are either a) experiencing actual changes to their hedonic experience of food, b) experiencing a change in salience of the "negative" qualities of high-fat food, which then affects hedonic perception, c) responding in a self-enhancing way in the knowledge that the experimenter is aware of their status as a restrained eater. These explanations could be disambiguated by replicating the study using more detailed measures of food liking and taste perception administered at closer intervals over the course of a weight loss diet. A measure of social desirability, such as the Crowne Social Desirability Scale (Crowne & Marlowe, 1960) could help determine its confounding effects on the results. However, differences in explicit food attitudes were only found in the current study, and not in Study 2 or 3. The finding should therefore be interpreted with caution until it can be replicated.

5.2. EATING BEHAVIOUR AND PATHOLOGY

Dieters consistently scored higher on the EDE-Q, the DEBQ and the TFEQ compared to the non-dieting group. Specifically, dieters reported higher levels of restraint on the Restraint subscale of the EDE-Q and the Cognitive Restraint subscale of the TFEQ, compared to non-dieters, despite reporting not being on any kind of restrictive diet at the time of session 1. The range of elevated pathology also involved body, shape and weight dissatisfaction (EDE-Q), and the tendency to eat in response to emotional triggers or external stimuli (DEBQ)Based on the analyses conducted in session 1, the results suggest that differences in eating behaviour and related cognitions could be chronic, as participants in the diet group (who were predominantly identified by their intention to start a weight loss diet in the near future) reported higher levels of disordered eating tendencies. Dieters also reported higher levels of restriction and restraint in session 1, despite subjectively reporting that they were not on any diet at the time of data collection. This suggests that prospective dieters may be prone to chronic levels of restraint

with some discrete periods of "dieting"; prospective dieters reported dieting more frequently over the past 12 months compared to non-dieters.

The differences in explicit dessert attitudes also support the hypothesis that there are trait differences in the subjective experience of food and eating behaviour. Although not supported by Study 2 and 3, dieters in the current sample rated desserts more positively than non-dieters. This could be indicative of baseline differences in the hedonic experience of food. In other words, people who experience food as more pleasant are more likely to consume more, and therefore gain weight, which subsequently contributes to the intention to engage in dieting behaviour. This is consistent with research which suggests that being overweight is associated with an elevated hedonic response to food fat content (Drewnowski et al., 1987). Restrained eaters also scored higher on the DEBQ, which suggests that they are more prone to eat when triggered by stimuli other than hunger. However, it must be noted that dieters in the current sample only had a marginally higher BMI compared to non-dieters. This could partially be explained by the relatively young age of the participants (27 years on average), which may mean that the baseline differences in the experience of food simply have not yet manifested as significant weight gain. The study could be replicated in an older population to assess the effect of trait differences in food attitudes and eating behaviour on long-term weight changes.

The primary aim of the current study was to assess differences in implicit cognition before and after a period of dieting. In the interests of ethics, participants were not instructed to follow any specific diet plan or eating pattern. Neither were they required to report their food intake over the course of the study. The advantage of this design is that it allows for a naturalistic assessment. Participants were asked in session 2 if they had been on a weight loss diet: they were free to interpret this term in a way which was subjectively appropriate. As a result the differences in implicit cognition and explicit food attitudes observed in the current study are the consequences of the participants' *typical* self-reported attempts at weight loss. Unfortunately whatever strategies were adopted by the dieters did not appear to be very effective, as there were no significant BMI changes between session 1 and session 2 within the

group. There were also no differences between sessions on measures of pathology, which suggests that dieters did not explicitly change their attitudes towards food or their bodies during the restraint period. However, it must be noted that the primary measure of pathology, the EDE-Q, addresses behaviours and cognition over the past 28 days, which in most cases was shorter than the interval between session 1 and 2.

In the discussion of Study 3 it was suggested that if implicit food attitudes change as a following dietary restraint then this may be a consequence of adopting different eating behaviour. However, the results of the current study do not support this assertion. Dieters did not report any significant changes to their eating habits or cognitions associated with eating or their body image. In fact, there is little evidence to suggest that their eating behaviour changed at all: in session 2, dieters were neither hungrier, nor had they gone longer without eating compared to non-dieters. Analyses of the Restraint subscales of the EDE-Q, TFEQ or DEBQ also suggest that participants in the restrained eating group were not actually controlling their eating behaviour more in session 2 than in session 1. It is beyond the scope of the current study to speculate on potential weight loss strategies typically adopted by dieters, but the lack of BMI change also suggests that any weight loss strategies adopted had not been successful. Only 25% of the dieters who reported their weight in session 2 had actually lost weight since session 1. Thus, the current data does not support *behavioural* change as the source of changes to dieters' implicit food attitudes.

An alternative explanation for the differences in implicit food attitudes is that the changes take place as a consequence of changes in goal accessibility. Assuming participants were truthful about their intentions to start a weight loss diet, even if behavioural changes did not take place, there could still be differences on a cognitive level. Stroebe et al. (2008) discussed restraint failure in terms of a goal conflict: the goal to lose weight and the goal of experiencing the hedonic pleasure of eating. The authors qualify both goals as "chronically accessible", which is consistent with restrained eaters' elevated restraint levels and enhanced liking of desserts in session 1. One possible explanation is that periods of acute dietary restraint

shift goal salience, which subsequently affects which automatic associations with food are activated. This is consistent with the Strack and Deutsch (Strack & Deutsch, 2004) and the Iterative-Reprocessing (Cunningham et al., 2007) models of implicit cognition; both suggest that implicit attitudes are not binary associations, but rather constitute a mode complex network of different associations. The connections between target stimuli and associated concepts may become stronger or weaker, depending on motivation or context. It could be hypothesised that it is the *context* of dietary restraint (or even the intention to engage in dietary restraint) which changes implicit attitude accessibility and therefore performance on the IAT.

The possibility that contextual cues alone could result in implicit attitude change can be addressed empirically. It must be noted that no significant group x session interaction was found in the present study, which indicates that even if participants in the dieter group did significantly modify their diet goals between session 1 and session 2, in doing so they did not significantly change their implicit food attitudes. However, the current study was not designed to assess differences in goal activation, so further conclusions cannot be made at this stage. Further research could focus on specifically assessing implicit attitude change within the context of a behavioural change model, such as the Theory of Reasoned Action (TRA; Fishbein, 1979) or the Transtheoretical Model of behavioural change (TTM; Prochaska & DiClemente, 1983). Studies could be conducted in the short-term, as well as long-term. An example of a short-term study would include assessing implicit food attitudes before and after a contextual manipulation: e.g., after reading a pamphlet on healthy eating and the health risks of overweight, versus a control pamphlet containing diet-irrelevant information. Long term studies could focus on the assessment of implicit food attitudes in prospective dieters, current dieters, and non-dieters, relative to their position in the TRA: e.g., behavioural intention vs. behaviour. Such studies can either be cross-sectional (i.e., classifying participants based on the stage they are in at the time of recruitment and using the classifications to compare implicit food attitudes) or longitudinal (carrying out implicit food attitude assessment at different time points as the participant progresses through the stages of TTM, from contemplation, to intention, to

behaviour). If contextual cues are sufficient to induce implicit attitude change, we may expect to see differences in the IAT (or any other implicit attitude assessment) at the intention, or contemplation, stage. However, if actual behavioural change is necessary then differences will emerge only in the behaviour/action stages.

5.3. THE INSECT IAT

No significant differences in Insect IAT performance were found between sessions 1 and 2, which suggests that any practice effects between the sessions did not make a significant impact on the results. The session x group interaction was also not significant, which suggests that significant changes in non-food related IAT performance do not take place as a consequence of dietary restraint. However, questionnaire results also suggested that dieters did not make significant changes to their restraint behaviour in session 2, compared to session 1, so this interpretation may not generalise to other contexts.

The Insect IAT was only moderately correlated between sessions 1 and 2 (r=.312), with the correlation reaching only marginal significance. This finding further supports the assertion that the IAT may not be the best measure for use in repeated-measure designs. Surprisingly, the correlation between session 1 and session 2 Food IAT-D was higher (r=.497) than the Insect IAT-D, despite the fact that differences between sessions were anticipated in the former, but not in the latter. The current results are insufficient to disambiguate whether a) implicit attitudes are highly variable over short periods of time, b) the IAT is not a very reliable measure for longitudinal implicit attitude assessment, or c) the specific IAT used in the current study is not a very reliable measure for longitudinal implicit attitude assessment. As discussed previously, other measures of implicit attitudes are also susceptible to poor test-retest correlations. The development of a new measure with more stable psychometric properties is necessary for future implicit attitude research with a repeated-measures design.

The initial inclusion of the Insect IAT in the study design was made with the intention of contrasting its outcome with the results from the Food IAT. This inclusion was made provisionally, on the assumption that the session x group interaction analysis of the Food IAT will be significant. However, because it was not, no further contrasts between the Food IAT and the Insect IAT were made.

5.4. LIMITATIONS

The primary limitation of the present study is that participants in the diet group did not appear to be actively engaging in dieting behaviour between sessions 1 and 2. Restraint scores on the EDE-Q, TFEQ and the DEBQ did not increase in the group, the majority of participants did not report weight loss, and there were no differences in self-reported hunger or the frequency of food intake between the groups in session 2. The hypotheses of the study were made about the outcomes of dieting; however, it appears that any restriction or restraint which did take place was minimal, despite participants reporting that they had been dieting. This has an obvious effect on the interpretation of the results. The primary hypothesis of the current study was whether implicit food attitudes change following a period of dieting. While group differences in the Food IAT-D were found in session 2, but not in session 1, the session x group interaction failed to reach significance. While this could indicate that the changes which do take place are not statistically significant, the outcomes of post-hoc comparisons indicate that this result was most likely the consequence of the fact that the dieter group was simply not sufficiently restrained/engaged in dietary restriction over the course of the study to yield statistically significant differences.

Further research should address the methodological issue of consistency between participants' anticipated and actual dieting behaviour. Although participants were asked in Session 2 whether they had engaged in dieting over the course of the study, the majority of those in the dieter group responded affirmatively despite evidence to the contrary. This is likely

the consequence of social desirability (not wanting to disappoint the experimenter, feeling embarrassed about their own failure, shame about not living up to expectations, etc.) It is unclear how many participants in the dieter group never had the intention to start a diet, versus how many *did* have the intention at the time of recruitment but a) reconsidered, or b) failed by the time Session 2 took place. In either case, the results of this study suggest that relying on self-report for this type of research is insufficient to ensure that participants meet the required criteria. Unfortunately it is not practical or cost-efficient to collect objective evidence of participants' eating behaviour (e.g., through video recording or double-labelled water). Other strategies may include asking participants to keep daily food diaries, or to issue participants in the dieter group with a structured diet plan which would specify their intake allowance. The study can also be criticised for an over-reliance on self-report in other aspects. For instance, participants self-reported their weight and their diet adherence over the course of the study. Given the sensitive nature of the topic and the cultural norms which can be expected to have an effect on participants, the data could have been more susceptible than average to the effects of social desirability. It would be advisable for future studies to take extra measures to reassure participants that their responses are confidential and to emphasise the importance of honesty in their responses. Alternatively, the experimenter could check weight at each session.

Another methodological problem is the interval selected between session 1 and session 2. Restrained participants took part in session 2, on average, two weeks after session 1 or two weeks after starting their diet. This period was selected for practical reasons (as drop-out rates could be expected to increase following a larger time period). With the exception of experimental designs which use conditioning paradigms to induce attitude change, there is no research which addresses the speed with which implicit attitudes change in a naturalistic setting. The timescale selected could have therefore been too short or too long to adequately register the hypothesised changes. Until more findings emerge to address this, research can be

expected to rely on sensible, but arbitrary, time scales. However, future studies could examine implicit attitude change over a longer timescale.

6. Conclusions

The primary hypothesis of the study was not supported, as the group interaction in Food IAT scores between session 1 and session 2 failed to reach significance. Nevertheless, the findings of Study 3 were replicated on a longitudinal scale. Dieters did not differ in their implicit food attitudes from non-dieters in session 1, but had significantly lower IAT-D scores in session 2, indicating a reduced preference for desserts, compared to vegetables. While the results of the study could indicate that implicit food attitudes do not change significantly following dieting behaviour (including various levels of dietary restriction and/or cognitive restraint, depending on individual approach and preference), they could also reflect the consequences of moderate restraint. Dieters did not report higher levels of restraint, hunger, or weight loss in session 2, which suggests that the levels of restraint in this group did not change significantly between sessions 1 and 2. Nevertheless, some implicit attitude change was observed, although this was non-significant. Due to the fact that dieters' eating behaviour was not reported as significantly different between sessions, it is hypothesised that the changes may have occurred as a consequence of a shift in goal salience, rather than in behaviour. Future studies within this research area should adopt more stringent measures to ensure that dieters are adhering to a restricted dietary plan, and avoid relying on self-report for measures of weight and BMI.

CHAPTER VII

General Discussion

This research conducted within this thesis was designed to assess some pertinent questions in the role of implicit attitudes in eating behaviour and in eating disorder pathology. Chapters I and II introduced existing theoretical approaches in implicit cognition and some common methodologies used in the assessment of implicit attitudes. Chapters III, IV, V and VI consisted of an empirical assessment of implicit self-esteem and implicit attitudes towards food, and a brief discussion of each study's findings. The current chapter will summarise the theoretical context in which the research was conducted, review the research findings, and discuss the results in the broader context of prior research and existing theories. Finally, limitations of the current research will be discussed and proposals will be made for further research directions.

1. Implicit attitudes: a summary of the theoretical approach

Research in implicit cognition is grounded in challenging the assumptions made by, for example, reasoned action theories (Fishbein, 1979; Ajzen, 1991), which suggest the majority of human behaviour is grounded in conscious cost/benefit analysis and rational planning. Instead, it adopts the perspective that behaviour is conscious and rational only when there is motivation and resources to reconsider our spontaneous behavioural responses (Fazio, 1990; Fazio, 2001). In this approach, implicit attitudes are conceptualised as one of the factors which can affect impulsive behaviour.

Chapter I introduced several existing theoretical models of implicit cognition, from earlier dual-process models, such as Epstein's (1994) experiential/rational model or Petty and Cacioppo's (1986) heuristic/systematic model, to later integrative ones such as the Motivation and Opportunity as Determinants of Behaviour (MODE; Fazio, 1990) and the Associative-Propositional Evaluation (APE; Gawronski & Bodenhausen, 2007) models. While some models were better supported by empirical research than others, no single model was selected as the definitive theoretical context in which to ground the present research. However, the theoretical elements which were consistent with prior findings were used in the development of the hypotheses and research methodology. Specifically, the following properties of implicit attitudes were assumed:

- *Introspection*: people have some level of awareness of the implicit attitudes they hold (Monteith et al., 2001). In lay terms this can be referred to as a '*gut feeling*' (Jordan et al., 2007). However, they may not always be aware of its source (Olson & Fazio, 2001).
- *Stability*: there is little evidence to suggest that implicit attitudes are significantly more stable or resistant to change than explicit ones. However, the process of change differs: while explicit attitudes can be changed through conscious persuasion (e.g., new information), implicit attitudes can be changed through conditioning procedures (Dijksterhuis, 2004; Ebert et al., 2009; Hollands et al., 2011). Presumably, these findings from a laboratory setting could be generalised to the process of attitudinal change in a naturalistic environment.
- *Automaticity*: the 'hallmark' property of implicit attitudes common to both theoretical and methodological approaches, and also the least ambiguous (De Houwer, 2006). This refers to the activation of spontaneous attitudes (i.e., valenced associations) following exposure to a stimulus, and is supported by

neuroimaging data (Kawasaki et al., 2001; Krolak-Salmon et al., 2004; Phelps et al., 2000).

- *Goal independence*: while people can be taught to 'cheat' *measures* of implicit attitudes with specific instructions (Steffens, 2004), there is little evidence that people are able to fake the implicit attitude itself (Banse et al., 2001; Kim, 2003; Gregg et al., 2006). This is consistent with the automatic activation of implicit attitudes.
- *Effortlessness*: implicit attitudes appear to operate with little demand on resources, effort, or motivation (Hermans et al., 2000; Friese et al., 2008). This further supports implicit attitude activation as an automatic, spontaneous process.

Secondary to establishing the properties of implicit attitudes is establishing their relationship to explicit attitudes. Some researchers have suggested that implicit associations are less susceptible to the effects of social desirability and therefore reveal an individual's "true" attitude. This interpretation is not entirely correct. Although measures of implicit attitudes are less susceptible to "faking" than explicit ones, classical conditioning studies suggest that implicit attitudes are formed through repeated exposure to stimulus-valence pairs (e.g., cake-delicious or spider-nasty) (Dijksterhuis, 2004; Olson & Fazio, 2001; Baccus et al., 2004). As a consequence, implicit attitudes may be the product of not only personal experience, but also the sociocultural norms of the individual's environment. For example, a non-racist person may still hold negative associations with a particular ethnicity if they live in a racist environment (Dovidio et al., 2002; Lowery et al., 2001). Dual-process models tend to conceptualise implicit and explicit attitudes as two sides of the same coin: the same attitude measured through qualitatively different means. However, integrative models such as MODE, APE and the Iterative-Reprocessing model (IR; Cunningham et al., 2007) argue that implicit and explicit attitudes are different types of response processes. While most behaviour typically does not

require much conscious input, a discrepancy between an implicit and an explicit attitude creates a state of dissonance, which is then reconciled on an explicit level (i.e., consciously and deliberately). In the racism example, a person may internalise pervasive prejudiced messages on an implicit level, but still be aware of the content of their implicit attitudes. This will allow them to explicitly assess the validity of these attitudes and, if necessary, modify their behavioural response. Alternatively, if no conflict arises between the implicit and explicit response, behaviour can proceed with little conscious interference. Implicit and explicit attitudes are therefore best conceptualised as different attitudinal responses to the same concept: interactive, but qualitatively distinct.

The final key question in conceptualising implicit attitudes is what, exactly, is activated. Most dual-process models describe implicit attitudes as a binary connection: stimulus to valence. In some cases this is likely done for the sake of simplicity; many studies have a specific interest in association strengths between a concept and positivity or negativity. As a result, studies which have demonstrated implicit attitude change as a consequence of changing the response context (Dasgupta & Greenwald, 2001; Tourangeau et al., 1989) have been interpreted as testament to the instability of implicit attitudes. However, these results can better be explained through parallel distributed processing. Strack and Deutsch (2004) argue that implicit attitudes consist of more than a simple stimulus-valence association. Rather, they constitute a more complex semantic network of associations (Smith, 1996). The IR model, which is grounded in computational neuroscience and supported by neuroimaging data (Bunge & Zelazo, 2006; Zelazo et al., 2008), also suggests a more intricate associative network. Individual differences in associations could exist as a product of personal experience or social norms. However, individual association strengths are also thought to change on the basis of context, information prime, salience or on-line behavioural goals. According to this approach, implicit attitude change could be the consequence of temporary changes in processing distribution, rather than a “reprogramming” of existing connections.

The present body of research was therefore designed with the assumptions that implicit attitudes a) are automatic, effortless and goal-independent in their activation, b) are formed and changed through repeated exposure to target-valence pairs, c) underlie automatic behaviour unless a conflict with explicit attitudes occurs, in which case the discrepancy is addressed explicitly, and d) consist of a complex semantic network of associations, rather than a simple target-valence pairing.

2. Research overview

2.1. STUDY 1

Study 1 was designed to a) replicate previous research which suggests that self-esteem discrepancy is associated with elevated ED pathology, b) determine whether self-esteem discrepancy is a better predictor of ED pathology than explicit self-esteem alone, and c) develop a structural equation model to determine if perfectionism acts as a moderator between discrepant self-esteem and ED pathology. Only one other study has addressed implicit self-esteem in a non-clinical sample (Hoffmeister et al., 2010); however, it was focused on dietary restraint only. A significant group x self-esteem interaction study 1 supported the hypothesis that self-esteem discrepancy is associated with several aspects of elevated ED pathology (including dietary restraint, weight concern, shape concern and eating concern) – even at sub-clinical levels. However, in contrast to previous studies, high-pathology participants had significantly lower implicit – as well as explicit – self-esteem. Further analyses of self-esteem discrepancy as a predictor of ED pathology failed to result in significant R square change, which suggests that self-esteem discrepancy has limited predictive or diagnostic value, at least at sub-clinical levels. Finally, perfectionism was not correlated with ED pathology in the sample, which did not allow for the development of a structural equation model.

2.2. STUDY 2

Studies 2 and 3 were designed to assess an "ego depletion" model of implicit food attitudes and eating pathology. Research suggests that implicit attitudes are more closely associated with impulsive, automatic behaviour. It was hypothesised that people with high ED pathology are more likely to engage in dietary restriction and/or restraint, which would diminish their self-control capacity, resulting in a state of ego depletion (Baumeister et al., 1998; Hofmann et al., 2007). Because behaviour is less controlled and more automatic in a state of ego depletion, positive implicit associations could then be expected to have a stronger influence on behaviour. This hypothesis rested on the assumption that most people hold positive implicit associations with high-fat, high-calorie food. Study 2 was therefore designed to test this assumption as the first step to assessing the ego depletion model of eating behaviour. It was hypothesised that a) both high- and low-pathology participants would hold positive implicit associations with high-fat foods, relative to low-fat foods, b) there would be no group differences in implicit food attitudes between the groups, and c) high-pathology participants would be more susceptible to ego depletion following a dietary restraint task. Consistent with the second hypothesis, no group differences in IAT-D performance were found between the high-pathology and the low-pathology group. However, contrary to Hypothesis 1, only low-pathology participants had a significant implicit preference for desserts compared to vegetables; high-pathology participants did not have such a preference. It was not possible to assess differences in ego depletion, as the results of the study suggest that the manipulation failed to induce ego depletion. A follow-up pilot using an adapted methodology also failed to yield satisfactory results. However, unexpected group differences in implicit attitudes did not support the ego depletion model as an account of eating behaviour in elevated ED pathology, thus it was unlikely that any group differences in ego depletion, even if they had been found, could have accounted for differences in eating behaviour. Nevertheless, Study 3 was designed to take an alternative methodological approach to assessing the link between implicit food

attitudes and automatic eating behaviour, as well as more ecologically valid recruitment criteria.

2.3. STUDY 3

Methodological flaws in Study 2 made it impossible to carry out an assessment of differences in ego depletion between high- and low-pathology participants. As a follow-on, Study 3 was still designed as an assessment of the ego depletion model, but focused on measuring the hypothesised behavioural effect of implicit food attitudes on behaviour. Automatic approach and avoidance tendencies towards high-fat and low-fat food were assessed as precursors of impulsive eating – which is the hypothetical outcome of ego depletion. The findings of Study 2 could be attributed to the wide spectrum of the pathology criteria included in the high-pathology group, Study 3 was focused on dieters as a group which is a) a more naturalistic representation of behaviour outside the lab, and b) a more specific behavioural, rather than cognitive, criterion. Finally, the study assessed the potential role of implicit food attitudes and automatic approach/avoidance tendencies in dietary restraint failure. It was hypothesised that a) there would be no differences in implicit food attitudes between dieters and non-dieters, b) dieters would have stronger approach tendencies towards high-fat foods as a consequence of chronic ego depletion, c) unsuccessful dieters would hold stronger positive implicit associations with high-fat food compared to the successful, and d) as a result, successful dieters would be more likely to approach low-fat foods than the unsuccessful. None of the hypotheses were supported by the results. Only non-dieters held an implicit preference for high-fat foods, and dieters were *slower* to approach desserts than non-dieters. No significant differences in IAT-D or in approach/avoidance tendencies were found between successful and unsuccessful restrained eaters. However, descriptively, unsuccessful restrained eaters had a stronger implicit preference for low-fat food compared to the successful. These findings serve to further reject the hypothesis that the ego depletion model could be used to

explain the dietary behaviour associated with dieting. Differences in implicit food attitudes also did not appear to explain why some dieters are relatively more successful than others.

2.4. STUDY 4

The results of Studies 2 and 3 suggest that people with elevated ED pathology and dieters may not have typical implicit preferences for high-fat over low-fat foods. Study 4 was a longitudinal study designed to address whether these differences are chronic, or whether they develop as a consequence of restrained eating. Implicit food attitudes in the dieter group were assessed before and after a self-reported dieting period. Although significant differences between dieters and non-dieters were found in session 2, but not in session 1, the session x group interaction failed to reach significance, which suggests that dieters did not change their implicit food attitudes over the course of the study. However, further analyses suggested that participants in the diet group did not engage in higher levels of restriction or restraint between sessions 1 and 2, despite reporting having dieted. The results of Study 4 are therefore most likely attributable to insufficiently rigorous control of dieting participants' eating behaviour, rather than a demonstrable lack of implicit attitude change.

2.5. THEORETICAL AND PRACTICAL IMPLICATIONS OF IMPLICIT SELF-ESTEEM RESEARCH

Within the context of clinical ED pathology, implicit attitude research has the potential to be a useful diagnostic tool, for reasons discussed in Chapter I: namely, the mostly non-conscious nature of implicit attitudes could be used to circumvent some of the difficulties associated with ED diagnosis and treatment, such as social desirability, denial, reluctance to be treated and the likelihood of relapse. Study 2, for example, was designed with the intention of clinical replication. It was hypothesised that high-pathology participants would retain positive implicit associations with high-fat food, which would then affect impulsive behaviour in a state

of ego depletion. The hypothesis was not supported, however these results cannot be generalised to a clinical population. Further studies could assess, for example, differences in implicit associations between food and palatability in bulimic populations compared to healthy controls, which could partially account for the binge-purge cycle. If this is the case, further assessments could be made of whether conditioning changes to these associations in a laboratory setting could have an effect on actual behaviour. However, ultimately the results of Study 2 and Study 3 suggest that, in a non-clinical population, the ego depletion model is an unlikely explanation for the eating behaviours associated with sub-clinical levels of ED pathology.

Study 1 was similarly designed as an assessment of whether discrepancy between implicit and explicit self-esteem could potentially be used as a risk-assessment tool when identifying people at risk for developing elevated levels of ED pathology. While the results supported the presence of a self-esteem discrepancy in the high-pathology group (relative to the low-pathology group), it was not found to be a significant predictor of pathology. Thus, compared to other risk factors for developing ED symptoms (e.g., internalising the thin ideal, history of dieting, or demographic factors such as age and gender), implicit self-esteem does not appear to be a particularly useful or practical diagnostic tool. Nevertheless, research in implicit self-esteem within this area is significant for understanding the cognitive mechanisms involved in ED pathology.

Studies 3 and 4 had a more theoretical focus, with the aim of understanding the relationship between dieting behaviour (and particularly diet "success") and implicit food attitudes. In Study 3 it was hypothesised, within the context of the ego depletion model, that dieters and non-dieters would have similar implicit attitudes towards food. This hypothesis was not supported, and no implicit food attitude differences were found between successful and unsuccessful dieters. However, both Study 3 and Study 4 found that dieters did not hold positive implicit attitudes towards high-fat foods, in contrast to non-dieters. This finding opens up a new research avenue, towards a better understanding of how implicit attitudes can change

and evolve as a consequence of changes in dietary behaviour or cognition. Study 4 was designed to address whether implicit attitude differences between dieters and non-dieters were *a priori*, or the consequence of the diet itself. Although the methodology of the study was unsuccessful (participants in the dieter group did not, apparently, diet between sessions), the results raised questions about whether implementation intentions alone could be sufficient in inducing implicit attitude change. Further research (outlined in the *Discussion* section of Study 4) in this area could disambiguate how implicit attitudes change under naturalistic settings, and shed further light on our understanding of how implicit mechanisms interact with conscious cognitions and behaviour. However, it must also be noted that the results of Study 2 and 3 suggest that the behavioural effects of implicit food attitudes on food-related behaviour (e.g., approach and avoidance), if it exists at all, is minimal.

3. Self-esteem and eating disorder pathology

Some research had previously addressed the role of implicit self-esteem in clinical ED pathology, with most findings suggesting that it is associated with *discrepant* self-esteem: low explicit, but high implicit. Differentiations between self-esteem which is "genuine" or "not genuine" already exist in explicit self-esteem research. For example, models of "defensive" self-esteem (e.g., Schneider & Turket, 1975) suggest that some "high" self-esteem is, in fact, a defensive mechanism to buffer against ego threat, rather than a "true" positive attitude towards the self. However, little research has addressed discrepant self-esteem in sub-clinical ED pathology. The results of Study 1 suggest that even at sub-clinical levels there are differences in the interaction between explicit and implicit self-esteem.

The role of low explicit self-esteem in eating pathology is fairly well understood. Body dissatisfaction can initially lead to a decrease in self-esteem, which the person may attempt to "solve" through dietary restraint. This will frequently be met with failure, and reinforce low self-esteem. This pattern is exacerbated by the fact that people with low self-esteem tend to

experience personal failure more severely (Stotland et al., 1957) and are more likely to attribute it to internal causes (Fitch, 1970). Every failure (such as a lapse in dietary restraint or weight loss falling short of expectations) contributes to a chronic, negative self-evaluation, which then moulds expectations about future performance (McFarlin & Blascovich, 1981).

Given that people with elevated ED pathology are prone to low self-esteem, it appears inconsistent for them to report high levels of implicit self-esteem. Research in implicit attitudes suggests that people are, at least to some extent, aware of their implicit associations. The "glimmer of hope" explanation (Spencer, Jordan, Logel, & Zanna, 2005; Zeigler-Hill & Terry, 2007) suggests that people with high explicit/low implicit self-esteem possess an "unconscious optimism": positive self-associations which are nevertheless "overridden" by conscious introspection. It has further been hypothesised that this discrepancy creates a state of dissonance, which manifests as psychological distress, including ED pathology (Cockerham et al., 2009). The "glimmer of hope" hypothesis is arguably consistent with both the MODE model of implicit cognition (Fazio & Towles-Schwen, 1999), and with the Sociometer model of explicit self-esteem (Leary & Downs, 1995). Implicit attitudes are thought to form through repeated stimulus-valence presentations, either in close spatial or temporal proximity. Explicit attitudes, on the other hand, develop and change as a consequence of information processing. This would suggest that people with elevated ED pathology are exposed to similar self-relevant stimuli (leading to high implicit self-esteem) to those with low ED pathology; however, those with high pathology reject these associations through deliberative processes. The MODE model was largely developed within the context of social psychology, and as a model of social behaviour. Its authors (Fazio, 1990; Fazio & Towles-Schwen, 1999) argue that automatic processes will typically guide behaviour and cognition unless there is motivation and opportunity to engage in deliberative processes to override them. It would appear that people with elevated pathology are doing just that. The Sociometer theory of self-esteem posits that self-esteem is socially constructed as an indicator of our own competence relative to other people in society – it may therefore be possible that the feelings of positive self-worth which people with elevated ED

pathology retain on an implicit level are constructed subjectively, through personal experiences and self-relevant stimuli. Their explicit self-esteem, by contrast, reflects an "objective" comparison with others. As discussed in Chapter III, the presence of positive self-evaluation could act as a motivating factor for engaging in further pathological behaviour; the "glimmer of hope" that one could eventually objectively measure up to one's subjective feelings. Perhaps if people with high explicit self-esteem are more resilient to stress and ego threat (Dumont & Provst, 1999), then similar cognitive effects can be seen in those with high implicit self-esteem.

These interpretations of self-esteem discrepancy are consistent with the evidence available to date, including the results of Study 1; however, significantly more research is required before it can be confirmed. There is no definitive theory to address the function of self-esteem, and its effects on cognition and pathology are not yet well understood. Further research is necessary in people with low explicit and low implicit self-esteem, to assess relevance to incidence and severity of ED pathology. Longitudinal research should also address the question of whether self-esteem discrepancy precipitates pathology, or is a symptom thereof. However, the fact that self-esteem discrepancy failed to predict pathology levels in Study 1 suggests that, at least at sub-clinical levels, it may not be as important in the development and maintenance of ED symptoms as previously thought. The current understanding of its role and function are insufficient to consider practical uses of these findings in screening or diagnostic procedures at this stage.

4. Implicit food attitudes and eating behaviour

Studies 2 and 3 were designed to address the potential role of implicit food attitudes in, respectively, elevated ED pathology and in dieting. The overarching premise was an "ego depletion" model, aimed at explaining disinhibited eating following diet failure. Although many factors play a role in dietary restraint failure (including homeostatic mechanisms and emotions), this model addressed potential cognitive underpinnings which could also be

relevant. The model proposes that most people hold positive implicit associations with high-fat, high-calorie food. The act of dietary restraint induces a state of ego depletion, in which self-control capacity is diminished and behaviour becomes less controlled and more impulsive. This results in an increased probability of acting on implicit associations with high-fat food by indulging in it, therefore resulting in dietary restraint failure. Further hypotheses were designed to assess whether individual differences in susceptibility to ego depletion, or in implicit food attitudes, could contribute to dietary restraint failure.

Contrary to expectations, the first premise of the model was not supported. People high in ED pathology, or in restraint, consistently exhibited attenuated positive associations with high-fat food. It must be noted that despite the fact that the phenomenon of ego depletion is well established and has been extensively replicated (Hagger, Wood, Stiff, & Chatzisarantis, 2010), the ego depletion paradigm used in Study 2 was not successful. Nevertheless, the results from the implicit attitude measure do not support the hypothesised model. If people with elevated pathology do not hold an implicit preference for high-fat food, such associations cannot, by definition, drive impulsive eating behaviour in a state of ego depletion. The model is therefore unlikely to be a suitable account for the cognitive processes which underlie disinhibited eating following dietary restraint.

Possible explanations for this pattern of results can be derived from either the APE model, or the IR model. The APE model suggests that implicit attitude change occurs when a novel affective reaction to an old stimulus takes place. If group differences in implicit food attitudes are the result of implicit attitude *change* (i.e., high-fat food preference is attenuated as a consequence of dietary restraint or increased body dissatisfaction), then they could be explained by changes in affective response. Presumably, once a person begins dietary restraint, certain food change in subjective valence – e.g., cake becomes “fattening” rather than “tasty”. This hypothesis was supported by increased ambivalence towards high-fat foods in the high-pathology group in Study 2. However, the APE model posits that implicit attitude change can only take place if the novel affective response is also endorsed by propositional reasoning.

Participants in Studies 2 and 3 maintained positive explicit associations with high-fat foods, which indicates a lack of such endorsement. This dissonance between the implicit and the explicit attitude is similar to that observed in Study 1, which assessed self-esteem. Perhaps the discrepancy reflects differences in the mechanisms of attitude change on an implicit and explicit level. Restrained participants may be engaging in a self-imposed type of operant conditioning, in an attempt to change the way they think about foods which are inconsistent with their weight loss goal. However, there is no research which definitively supports or rejects this explanation, so further research is necessary to obtain better insight into thought processes common during dietary restraint. Furthermore, the results of Study 4 did not fully support implicit attitude change as a consequence of restraint, so evidence to support the APE model account is currently limited.

An alternative explanation can be derived from the IR model. The IR model suggests that implicit attitudes consist of complex semantic networks. Parallel distributed processing allows for different associations to be activated under different contexts. It is possible that, instead of attitude *change*, the context of dietary restraint temporarily activates a different set of implicit associations, such as "*cake – fattening*" rather than "*cake – tasty*". Changes to motivation and salience under the new diet goal could mean that different stimuli are attended to in the everyday environment (e.g., gym advertisements rather than fast food deals), or attended to from a different perspective. Some research indeed supports the idea that context can change the outcomes of implicit measures (Sherman et al., 2003; Mitchell et al., 2003). However, the IR model is strongly based in neuroimaging data, and this explanation is therefore best explored through, for example, fMRI research, in order to detect any functional differences in response to food words in a state of dietary restraint, and not.

Overall, the findings of Study 2 and 3 suggest that ego depletion is not likely to play a significant role in eating disinhibition following dieting. In fact, the results were contrary to expectations: people with elevated ED pathology appear to have less positive associations with high-fat food. Further research is required to disambiguate what causes changes in implicit food

attitudes. Future studies may assess changes in such attitudes following a) changes in goal salience, b) changes in context (e.g., after reading a tasty recipe versus after reading a pamphlet on the dangers of obesity), or c) changes in eating behaviour. Study 4 was designed to assess implicit attitude change following changes to eating behaviour. Although the results failed to reach significance, the results were consistent with implicit attitude change, rather than chronic cognitive differences between restrained and unrestrained eaters. Analyses of dieters' behaviour suggested that they did not actively engage in dietary restraint: there were no differences in the frequency of food intake, hunger levels, self-reported restraint, or weight loss. The descriptive differences could have therefore taken place as a result of activating the diet goal alone, even if behaviour was unchanged. If this is the case, the result is consistent with the IR model, as a change in context (from not dieting to dieting) would have been sufficient to result in changes to implicit associations with high-fat food. Longitudinal research which disambiguates participants who change their behaviour from those who merely change their intentions is therefore necessary to track how this, respectively, affects implicit food attitudes.

5. An evaluation of the IAT for implicit attitude assessment

The reasons for using the IAT over the course of this Thesis have already been outlined in Chapter II (good psychometric properties; extensive body of supporting research), Chapter III (allows for comparison of relative associations strengths between stimuli; commonly used, which allows for comparison to other study outcomes), and Chapter VI (superior test-retest reliability compared to other implicit measures). However, the conceptual relevance of the IAT in the context of theoretical models of implicit attitudes had not yet been discussed in detail. The IAT can be arguably be considered to be consistent with the IR model. If implicit attitudes are formed within a semantic network, with different connections active based on context or on-line goals, then the IAT is the most appropriate measure to assess such changes within the

context of eating pathology. Unipolar measures can assess positive and negative associations with a single target variable, such as "food". The IAT, however, can detect changes in associations in one target concept *relative* to another; e.g., has liking for high-fat foods changed relative to low-fat foods? Has liking for food changed relative to fitness? If changes to association strengths take place as a result of context, the IAT can essentially use one target variable as an anchor point for comparison of another. This is particularly pertinent for Study 4, which was specifically concerned with implicit attitude change. It must be noted, however, that the IAT's sensitivity to changes in context could also be considered a limitation. It is unclear how fast context can change implicit attitude activation. Some studies suggest that the "re-wiring" is instant (Sherman et al., 2003; Mitchell et al., 2003); however, the results of Study 4 suggest that two weeks of change in goal salience could have been an insufficient time period to yield statistically significant group differences. Further studies tracking implicit attitude change at several time points (for example, after an hour, a day, a week, two weeks, and a month) is necessary to develop a clearer picture of how implicit attitudes change under a naturalistic setting.

Some of the criticisms which have been applied to the IAT are also relevant to the present body of research. For instance, it has been argued that salience symmetries could have an affect the IAT-D (Rothermund & Wentura, 2001). In Study 2, the "dessert" category included desserts which were highest-rated for taste, while the "vegetable" category included vegetables which were the lowest-rated for taste. This could potentially introduce an external bias to participants' responses. However, this criticism is dependent on whether the IAT procedure is considered feature-relevant (each stimulus is processed independently) or feature-irrelevant (each stimulus is encoded as an "exemplar" of its category). Although this issue is still open to debate, it must be noted that Study 3 included vegetables highest-rated for taste in the IAT, and found very similar result patterns to Study 2.

Susceptibility to the effects of stimulus familiarity is another criticism of the IAT (Dasgupta et al., 2003). Indeed, explicit food ratings indicate that not all participants were

familiar with the taste of all the foods used in the stimulus set. This could have potentially affected the results, as the IAT is designed to measure existing implicit associations with familiar stimuli. Ideally, stimuli used in implicit food attitude research should be tailored to each individual participant's preferences and experiences. Unfortunately this was not feasible to implement in the current research due to practical constraints.

Finally, the test-retest correlation of the Food IAT (r=.497), although comparable to the IAT median of r=.56 obtained by Egloff et al. (2005), and considerably higher than the lowest value of r=.16, was still not at a level desirable for a repeated measures design. There are two possibilities to explain the relatively low correlation: a) the IAT is susceptible to a large amount of residual error, b) implicit attitudes are not very stable over time. These explanations are difficult to disambiguate, since it is impossible to measure implicit attitudes without using an implicit attitude measure; thus, any quantitative index of implicit attitudes will be, by default, an artefact of using an implicit attitude measure. Some studies have suggested that implicit attitudes are fairly malleable and can be changed over the course of one experimental study (Baccus et al., 2004; Olson & Fazio, 2001). However, little research has addressed the naturalistic conditions under which implicit attitudes do or do not change, contextual influences on change, and the time scales in which such change can take place. Alternatively, a methodological assessment of the IAT is necessary to explain the large variability in effect sizes (Greenwald et al., 2009) and correlations with explicit measures (Hofmann et al., 2005) which can be found across different IAT studies.

Alternatives. Although alternatives to the IAT exist, many of them have various conceptual or methodological problems of their own. Test-retest reliabilities tend to be lower in other measures than in the IAT. The IRAP is a promising measure, but is derived from the REC model, which means that it places emphasis on language comprehension and semantic relationships, but not necessarily cognitive models of implicit cognition. Furthermore, the majority of the research in its support has been conducted by a single research team;

replication from other research labs would be desirable. The EAST is a commonly used measure in implicit attitude research, but its predictive validity and other psychometric properties fall short of the IAT (De Houwer & De Bruycker, 2007). Nevertheless, it is a unipolar measure which can be used as an alternative to the IAT in studies which are specifically interested in single, rather than relative, implicit associations. De Houwer (2006) argues that subliminal affective priming paradigms (e.g., Klauer et al., 2003; Wentura et al., 2005) are the best available approach to implicit attitude assessment. However, as noted in Chapter II, there are issues with ecological validity, as we are usually aware of stimuli to which we react. Second, it is another unipolar measure, which may not be appropriate for studies which are specifically interested in relative association strengths. Nevertheless it is a strong candidate for implicit attitude assessment in future research.

One of the problems with the available implicit attitude measures is that, despite the fact that they are all designed to measure implicit attitudes, convergent validity is rather low (Bosson et al., 2000). However, the reasons for this are not very well understood. Few studies assess the same concept using an array of different implicit measures; this makes it difficult to discuss possible differences in the different measures' outcomes. Furthermore, the available measures currently assess either a) unipolar associations between target variable and valence, or b) relative associations between two target variables and valence. If a semantic network proposed in the IR model is valid, then a measure assessing the strengths of *all* immediately relevant associations may be necessary to develop. Ideally, such a measure would allow for variations to the number and types of variables assessed, and yield a spider-web-like output, indicating different connection strengths between the different stimuli. Such a measure will allow to measure differences in association strengths following changes in context, behaviour, goal salience, or experimental manipulation. However, such a measure may be overly complex to structure and analyse.

6. Limitations

Participants. The reasons for including females only in the studies have been outlined in Chapter III; predominantly, this sample reflects the type of people most likely to experience elevated ED symptoms, as well as engage in dieting behaviours. However, these issues are certainly not *restricted* to this demographic only, and a sample consisting predominantly of young, slim, educated women still limits the generalizability of the findings. Previous research has indicated that social messages about dieting and weight loss are different for men than they are for women (Gough, 2007). Given that implicit attitudes are thought to develop as a consequence of repeated target-valence pairings, we could also expect men to hold different implicit attitudes towards foods compared to women. Further studies should address the role of implicit food attitudes in eating behaviour in men, with reference to gender differences in social norms, cultural messages and subjective weight and diet goals (e.g., weight loss vs. muscle gain). Differences in age (Drewnowski & Shultz, 2001) and socioeconomic status (Sobal & Stunkard, 1989; Roos, Lahelma, Virtanen, Prättälä, & Pietinen, 1998) are also associated with differences in explicit food attitudes and weight, and may therefore also be associated with corresponding changes in implicit attitudes towards food. The hypotheses addressed over the course of this thesis therefore cannot be generalised to all populations until further converging evidence from other populations emerges. That said, while we may expect *some* differences in implicit attitudes based on demographic variables, many social norms can be generalised to the Western population as a whole (e.g., thin is generally perceived as "better" than fat; self-control is generally "better" than lack thereof, regardless of gender, age, socioeconomic status, or education).

Stimuli. The IATs used in Studies 2-4 used a rather simple *dessert-vegetable* dichotomy as a proxy for high-fat vs. low-fat foods. This was necessary within the methodology of the IAT, which requires target categories to be simple to categorise in order to ensure rapid responses from the participants. Nevertheless, this dichotomy is a very small aspect of the complexity of

the types of food which are available in modern Western society. The "desserts" category also only pertains to *sweet* high-fat foods. Although research suggests that a liking for sugar is biologically innate (Birch, 1999; Drewnowski & Greenwood, 1983), it is possible that some participants simply do not have a strong liking for sugary foods, which could have affected the data. Indeed, some participants in the second ego depletion pilot (Study 2) have informally reported that a broader array of foods would have been more to their liking. Ideally, future studies should collect food preference data from participants prior to data collection, and tailor the IAT stimuli for each individual. This would result in findings which are more reflective of the individual experience and have more ecological validity.

Design. Some of the methodological approaches used over the course of this Thesis did not prove to be successful. The ego depletion methodology designed in Study 2 failed to actually induce ego depletion, despite the fact that it was based on well replicated methodology (Hagger et al., 2010). The differences made to classical ego depletion manipulations were made with the intention of replicating Study 2 in a clinical sample, and therefore were subject to ethical considerations of data collection in this context. Because no suitable methodology was found, a clinical replication could not take place. However, further results from Study 3 suggested that the ego depletion model was not a viable explanation for disinhibited eating behaviour in elevated ED pathology. Nevertheless, a different pattern of results might be expected in clinical populations. One study has already found an attenuated implicit preference towards high-fat food in people with AN (Roefs et al., 2005); however, implicit food attitudes have not yet been assessed in bulimia nervosa.

Methodology used in Study 4 also relied on self-report to identify restrained eaters. However, post-hoc analyses of eating behaviour suggested that restrained eaters did not actually engage in more restraint during the study than at baseline. This suggests that more stringent measures should be taken by future studies to ensure that behaviour which is central to the hypotheses of the study is adhered to. Further assessment of implicit attitude change

under naturalistic conditions should also yield better parameters for the amount of time between sessions which should be sufficient for such change to take place.

7. Conclusions

The present Thesis was designed to assess the role of implicit attitudes towards food and the self in sub-clinical eating disorder pathology. Theoretical approaches to conceptualising implicit attitudes have been discussed, as well as different approaches towards implicit attitude measurement. Although no single theoretical model has been used in the discussion of the findings, the APE model and the IR model have been particularly appropriate in the development of possible explanations to account for the results. The IAT has been consistently used in the measurement of implicit attitudes. Although the measure has several limitations, it was the most appropriate given the relativistic nature of the majority of the hypotheses. The results of the empirical research suggest that discrepant self-esteem is prevalent in elevated ED pathology, but perhaps not integral to determining symptom severity, at least in a non-clinical sample. The hypothesis that implicit food attitudes underlie impulsive eating in a state of ego depletion was not supported. Contrary to expectations, people with elevated ED symptoms appear to have attenuated positive associations with high-fat food, with some indication that this tendency may be even more pronounced in unsuccessful restrained eaters. Finally, some indication was found that dietary restraint – or even the mere intention to engage in dietary restraint – could have an effect on implicit food attitudes. Research into the role of implicit cognition in eating disorder pathology is still in its infancy; a number of different assumptions and hypotheses must be addressed experimentally before a clear understand of the role of implicit attitudes in eating behaviour can emerge. Implicit measures themselves are prone to methodological flaws, and refining the available methodology is necessary to minimise error in the research results.

Although implicit cognition is a young and promising field of research, findings from the current studies suggest that it may not play as significant a role in eating disorder pathology as previously hypothesised. Nevertheless, there are many future avenues for research to be undertaken in the field. A better understanding of implicit attitude change is needed, including whether (and how easily) such change occurs as a consequence of changes in implementation intentions, goal salience, or behaviour. The time scale of such changes is also not yet well understood. The IAT procedure could be improved with regards to test-retest stability, as its current psychometric properties do not lend themselves well to longitudinal design. Future studies in implicit food attitudes should consider tailoring stimuli to participants' individual preferences in order to simulate real life experiences as closely as possible. Replications of the findings should also be made in male populations, with reference to gender differences in eating behaviours and ED pathology.

Finally, the results could be extended to clinical ED contexts. Although the results of Study 1 did not support a practical application for implicit self-esteem assessment, it may still be adapted for screening or progress assessment in clinical patients. Very few studies have assessed implicit food attitudes in AN or BN, which could help understand the cognitive changes which take place on an implicit level following pathological changes to behaviour. Longitudinal research is also necessary to ascertain if changes to implicit food attitudes take place between sub-clinical and clinical levels of pathology, and if such changes do exist if they can be used in predicting treatment outcomes or likelihood of relapse. Although hypotheses on the role of implicit cognition in clinical EDs are, at this stage, tentative, further research in this area could help the development of a better understanding of the cognitive mechanisms underlying behaviour which is less controlled, or attitudes which are less consciously accessible.

References

Aardoom, J. J., Dingemans, A. E., Landt, M., & Van Furth, E. F. (2012). Norms and discriminative validity of the Eating Disorder Examination Questionnaire. *Eating Behaviors, 13,* 305-309.

Aikman, S. N., Min, K. E., & Graham, D. (2006). Food attitudes, eating behavior, and the information underlying food attitudes. *Appetite, 47,* 111-114.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes., 50,* 179-211.

Ajzen, I. & Fishbein, M. (1977). Attitude-behavior relations: A theoretical analysis and review of empirical research. *Psychological Bulletin, 84,* 888-918.

Albanes, D. (1987). Total calories, body weight, and tumor incidence in mice. *Cancer Research,* 1987-1992.

Allison, D. B., Kalinsky, L. B., & Gorman, B. S. (1992). A comparison of the psychometric properties of three measures of dietary restraint. *Psychological Assessment, 4,* 391-398.

Allport, G. W. (1935). Attitudes. In C.Murchinson (Ed.), *A handbook of social psychology.* (pp. 798-844). Worcester, MA: Clark University Press.

American Psychiatric Association (2013). *The Diagnostic and Statistical Manual of Mental Disorders: DSM 5*. London, England: American Psychiatric Publishing.

Anthony, D. B., Wood, J. V., & Holmes, J. G. (2007). Testing sociometer theory: Self-esteem and the importance of acceptance for social decision-making. *Journal of Experimental Psychology, 43,* 425-432.

Arcelus, J., Mitchell, A. J., Wales, J., & Nielsen, S. (2011). Mortality rates in patients with anorexia nervosa and other eating disorders. *Archives of General Psychiatry, 68,* 724-731.

Armor, D. A. & Taylor, S. E. (2002). When predictions fail: The dilemma of unrealistic optimism. In T.Gilovich, D. Griffin, & D. Kahneman (Eds.), (pp. 334-347). Cambridge: Cambridge University Press.

Asendorpf, J. B., Banse, R., & Mücke, D. (2002). Double dissociation between implicit and explicit personality self-concept: The case of shy behavior. *Journal of Personality and Social Psychology, 83,* 380-393.

Baccus, J. R., Baldwin, M. W., & Packer, D. J. (2004). Increasing implicit self-esteem through classical conditioning. *Psychological Science, 15,* 498-502.

Bagley, C. & Mallick, K. (2001). Normative data and mental health construct validity for the Rosenberg Self-Esteeem Scale in British adolescents. *International Journal of Adolescence and Youth, 9,* 117-126.

Banaji, M. R. (2001). Implicit attitudes can be measured. In H.L.Roediger, J. S. Nairne, I. Neath, & A. Surprenant (Eds.), *The nature of remembering: Essays in remembering Robert G. Crowder* (pp. 117-150). Washington, DC: American Psychological Association.

Banasiak, S. J., Wertheim, E. H., Koerner, J., & Voudouris, N. J. (2001). Test-retest reliability and internal consistency of a variety of measures of dietary restraint and body concerns in a sample of adolescent girls. *International Journal of Eating Disorders, 29,* 85-89.

Banse, R., Seise, J., & Zerbes, N. (2001). Implicit attitudes towards homosexuality: Reliability, validity and controllability of the IAT. *Experimental Psychology, 48,* 145-160.

Bardone, A. M., Vohs, K. D., Abramson, L. Y., Heatherton, T. F., & Joiner, J. (2000). The confluence of perfectionism, body dissatisfaction, and low self-esteem predicts bulimic symptoms: Clinical implications. *Behavior Therapy, 31,* 265-280.

Bargh, J. A., Chaiken, S., Govender, R., & Pratto, F. (1992). The generality of the automatic atttiude activation effect. *Journal of Personality and Social Psychology, 62,* 893-912.

Barkow, J. H. (1980). Prestige and self-esteem: A biosocial interpretation. In D.R.Omark, F. Strayer, & D. G. Freedman (Eds.), *Dominance relations: An ethnological view of human conflict and social interaction.* (pp. 319-332). New York: Garland STPM.

Barnes-Holmes, D., Barnes-Holmes, Y., & Cullinan, V. (2000). Relational Frame Theory and Skinner's Verbal Behavior: A possible synthesis. *The Behavior Analyst, 23,* 69-84.

Barnes-Holmes, D., Barnes-Holmes, Y., Powers, P. S., Hayden, E., Milne, R., & Stewart, I. (2006). Do you really know what you believe? Developing the Implicit Relational Assessment Procedure (IRAP) as a direct measure of implicit beliefs. *The Irish Psychologist, 32,* 169-177.

Barnes-Holmes, D., Barnes-Holmes, Y., Stewart, I., & Boles, S. (2010). A sketch of the Implicit Relational Assessment Procedure (IRAP) and the Relational Elaboration and Coherence (REC) model. *The Psychological Record, 60,* 527-542.

Barnes-Holmes, D., Murphy, A., Barnes-Holmes, Y., & Stewart, I. (2010). The Implicit Relational Assessment Procedure (IRAP): Exploring the impact of private versus public contexts and the response latency criterion on pro-white and anti-black stereotyping among white Irish individuals. *The Psychological Record, 60,* 57-80.

Barnes-Holmes, D., Murtagh, L., Barnes-Holmes, Y., & Stewart, I. (2010). Using the Implicit Association Test and the Implicit Relational Assessment Procedure to measure attitudes toward meat and vegetables in vegetarians and meat-eaters. *The Psychological Record, 60,* 287-306.

Baron, A. S. & Banaji, M. R. (2006). The development of implicit attitudes: Evidence of race evaluations from ages 6 and 10 and adulthood. *Psychologial Science, 17,* 53-58.

Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology, 74,* 1252-1265.

Baumeister, R. F., Heatherton, T. F., & Tice, D. M. (1993). When ego threats lead to self-regulation failure: Negative consequences of high self-esteem. *Journal of Personality and Social Psychology, 64,* 141-156.

Baumeister, R. F., Smart, L., & Boden, J. M. (1996). Relation of threatened egotism to violence and aggression: The dark side of high self-esteem. *Psychological Review, 103,* 5-33.

Baumeister, R. F. & Tice, D. M. (1985). Self-esteem and responses to success and failure: Subsequent performance and intrinsic motivation. *Journal of Personality, 53,* 450-467.

Beck, A. T. (1976). *Cognitive therapy and the emotional disorders.* New York: Meridian.

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *Beck Depression Inventory manual*. (2 ed.) San Antonio, TX: Psychological Corporation.

Becker, E. (1962). *The birth and death of meaning: A perspective in psychiatry and anthropology.* New York: Free Press.

Becker, E. (1973). *The denial of death.* New York: Academic Press.

Beer, J. S., Heerey, E., Keltner, D., Scabini, D., & Knight, R. T. (2003). The regulatory function of self-conscious emotion: Insights from patients with orbitofrontal damage. *Journal of Personality and Social Psychology, 85,* 604.

Berridge, K. C. & Winkielman, P. (2003). What is an unconscious emotion? *Cognition and Emotion, 17,* 181-211.

Berry, D. S. (1990). Taking people at face value: Evidence for the kernel of truth hypothesis. *Social Cognition, 8,* 343-361.

Birch, L. L. (1999). Development of food preferences. *Annual Review of Nutrition, 19,* 41-62.

Birgegard, A., Björck, C., Norring, C., Sohlberg, S., & Clinton, D. (2009). Anorexic self-control and bulimic self-hate: Differential outcome prediction from initial self-image. *International Journal of Eating Disorders, 42,* 522-530.

Blair, I. V. (2002). The malleability of automatic stereotypes and prejudice. *Personality and Social Psychology Review, 6,* 242-261.

Blascovich, J. & Tomaka, J. (1991). Measures of self-esteem. In J.P.Robinson, L. S. Wrightsman, & F. M. Andrews (Eds.), *Measures of personality and social psychological attitudes* (pp. 115-160). London: Academic Press.

Blechert, J., Ansorge, U., Beckmann, S., & Tuschen-Caffier, B. (2010). The undue influence of shape and weight on self-evaluation in anorexia nervosa, bulimia nervosa and restrained eaters: a combined ERP and behavioral study. *Psychological Medicine, 41,* 185-194.

Bluemke, M. & Friese, M. (2006). Do features of stimuli influence IAT effects? *Journal of Experimental Social Psychology, 42,* 163-176.

Bluemke, M. & Friese, M. (2008). Reliability and validity of the Single-Target IAT (ST-IAT): Assessing automatic affect towards multiple attitude objects. *European Journal of Social Psychology, 38,* 977-997.

Bohner, G., Siebler, F., González, R., Haye, A., & Schmidt, E. A. (2008). Situational flexibility of in-group-related attitudes: A single category IAT study of people with dual national identity. *Group Processes & Intergroup Relations, 11,* 301-317.

Bosson, J. K., Swann, W. B., & Pennebaker, J. W. (2000). Stalking the perfect measure of implicit self-esteem: The blind men and the elephant revisited? *Journal of Personality and Social Psychology, 79,* 631-643.

Bower, G. H. (1991). Mood congruity of social judgments. In J.Forgas (Ed.), *Emotion and Social Judgments.* (pp. 31-53). Oxford: Pergamon.

Bowlby, J. (1977). The making and breaking of affectional bonds. I. Aetiology and psychopathology in the light of attachment theory. An expanded version of the Fiftieth Maudsley Lecture, delivered before the Royal College of Psychiatrists, 19 November 1976. *The British Journal of Psychiatry, 130,* 201-210.

Bradley, M. M., Cuthbert, B. N., & Lang, P. J. (1990). Startle reflex modification: Emotion or attention? *Psychophysiology, 27,* 513-522.

Brand, P. A., Rothblum, E. D., & Solomon, L. J. (1992). A comparison of lesbians, gay men, and heterosexuals on weight and restrained eating. *International Journal of Eating Disorders, 11,* 253-259.

Brockmeyer, T., Holtforth, M. G., Bents, H., Kämmerer, A., Herzog, W., & Friederich, H. C. (2012). The thinner the better: Self-esteem and low body weight in anorexia nervosa. *Clinical Psychology and Psychotherapy*.

Buhrmester, M. D., Blanton, H., & Swann, W. B. Jr. (2011). Implicit self-esteem: Nature, measurement, and a new way forward. *Journal of Personality and Social Psychology, 100,* 385.

Bunge, S. A. & Zelazo, P. D. (2006). A brain-based account of the development of rule use in childhood. *Current Directions in Psychological Science, 15,* 118-121.

Burton, P., Smit, H. J., & Lightowler, H. J. (2007). The influence of restrained and external eating patterns on overeating. *Appetite, 49,* 191-197.

Buunk, A. P. & Gibbons, F. X. (2007). Social comparison: The end of a theory and the emergence of a field. *Organizational Behavior and Human Decision Processes., 102,* 3-21.

Cai, H., Greenwald, A. G., & McFarland, S. G. (2004). The Implicit Association Test's D measure can minimize a cognitive skill confound: Comment on McFarland and Crouch (2002). *Social Cognition, 22,* 673-684.

Campbell, J. D. (1990). Self-esteem and clarity of the self-concept. *Journal of Personality and Social Psychology, 59,* 538-549.

Campbell, J. D. & Lavallee, L. F. (1993). Who am I? The role of self-concept confusion in understanding the behavior of people with low self-esteem. In R.F.Baumeister (Ed.), *Self-esteem: The puzzle of low self-regard.* (pp. 3-20). New York, NY: Plenum Press.

Cappelleri, J. C., Bushmakin, A. G., Gerber, R. A., Leidy, N. K., Sexton, C. C., Lowe, M. R. et al. (2009). Psychometric analysis of the Three-Factor Eating Questionnaire-R21: results from a large diverse sample of obese and non-obese participants. *International Journal of Obesity, 33,* 611-620.

Casper, R. C., Kirschner, B., Sandstead, H. H., Jacob, R. A., & Davis, J. M. (1980). An evaluation of trace metals, vitamins, and taste function in anorexia nervosa. *American Journal of Clinical Nutrition, 33,* 1801-1808.

Cattarin, J. A., Thompson, K., Thomas, C., & Williams, R. (2000). Body image, mood, and televised images of attractiveness: The role of social comparison. *Journal of Social and Clinical Psychology, 19,* 220-239.

Chaiken, S. & Trope, Y. (1999). *Dual process theories in social psychology*. New York, NY: The Guilford Press.

Chase, P. N. & Danforth, J. S. (1991). The role of rules in concept learning. In L.J.Hayes & P. N. Chase (Eds.), *Dialogues on Verbal Behavior* (pp. 205-225). Reno, NV: Context Press.

Chen, M. & Bargh, J. (1999). Consequences of automatic evaluation: Immediate behavioral predispositions to approach or avoid the stimulus. *Personality and Social Psychology Bulletin, 25,* 215-223.

Claes, L., Nederkoorn, C., Vandereycken, W., Guerrieri, R., & Vertommen, H. (2006). Impulsiveness and lack of inhibitory control in eating disorders. *Eating Behaviors, 7,* 196-203.

Cockerham, E., Stopa, L., Bell, L., & Gregg, A. (2009). Implicit self-esteem in bulimia nervosa. *Journal of Behavior Therapy and Experimental Psychiatry, 40,* 265-273.

Cohen, A. R. (1959). Some implications of self-esteem for social influence. In C.I.Hovland & I. L. Janis (Eds.), *Personality and Persuasibility* (pp. 102-120). Oxford: Yale University Press.

Conner, T. & Feldman-Barrett, L. (2005). Implicit self-attitudes predict spontaneous affect in everyday life. *Emotion, 5,* 476-488.

Cools, J., Schotte, D. E., & McNally, R. J. (1992). Emotional arousal and overeating in restrained eaters. *Journal of Abnormal Psychology, 101,* 348-351.

Cooper, Z. & Fairburn, C. G. (1987). The eating disorder examination: A semi-structured interview for the assessment of the specific psychopathology of eating disorders. *International Journal of Eating Disorders, 13,* 385-389.

Crowne, D. P. & Marlowe, D. (1960). A new scale of social desirability independent of psychopathology. *Journal of Consulting Psychology, 24,* 349-354.

Cullen, C., Barnes-Holmes, D., Barnes-Holmes, Y., & Stewart, I. (2009). The Implicit Relational Assessment Procedure (IRAP) and the malleability of ageist attitudes. *The Psychological Record, 59,* 591-620.

Cunningham, W. A. & Zelazo, P. D. (2007). Attitudes and evaluations: A social cognitive neuroscience perspective. *Trends in Cognitive Sciences, 11,* 97-104.

Cunningham, W. A. & Zelazo, P. D. (2010). The development of iterative reprocessing: Implications for affect and its regulation. In P.D.Zelazo, M. Chandler, & E. Crone (Eds.), *Developmental Social Cognitive Neuroscience* (pp. 81-98). Hove: Taylor and Francis.

Cunningham, W. A., Zelazo, P. D., Packer, D. J., & Van Bavel, J. J. (2007). The Iterative Reprocessing Model: A multilevel framework for attitudes and evaluation. *Social Cognition, 25,* 736-760.

Dakanalis, A., Timko, C. A., Carrà, G., Clerici, M., Zanetti, M. A., Riva, G. et al. (2014). Testing the original and the extended dual-pathway model of lack of control over eating in adolescent girls: A two-year longitudinal study. *Appetite*.

Darcy, A. M., Hardy, K. K., Crosby, R. D., Lock, J., & Peebles, R. (2013). Factor structure of the Eating Disorder Examination Questionnaire (EDE-Q) in male and female college athletes. *Body Image, 10,* 399-405.

Dasgupta, N. & Greenwald, A. G. (2001). On the malleability of automatic attitudes: Combating automatic prejudice with images of admired and disliked individuals. *Journal of Personality and Social Psychology, 81,* 800-814.

Dasgupta, N., Greenwald, A. G., & Banaji, M. R. (2003). The first ontological challenge to the IAT: Attitude or mere familiarity? *Psychological Inquiry, 14,* 238-243.

Dasgupta, N., McGhee, D. E., & Greenwald, A. G. (2000). Automatic preference for white Americans: eliminating the familiarity explanation. *Journal of Experimental Social Psychology, 36,* 316-328.

De Houwer, J. (2001). A structural and process analysis of the Implicit Association Test. *Journal of Experimental Social Psychology, 37,* 443-451.

De Houwer, J., Beckers, T., & Moors, A. (2007). Novel attitudes can be faked on the Implicit Association Test. *Journal of Experimental Social Psychology, 43,* 972-978.

De Houwer, J. & De Bruycker, E. (2007). The Implicit Association Test outperforms the Extrinsic Affective Simon Task as an implicit measure of inter-individual differences in attitudes. *British Journal of Social Psychology, 46,* 401-421.

De Houwer, J. & Eelen, P. (1998). An affective variant of the Simon Paradigm. *Cognition and Emotion, 12,* 45-61.

De Houwer, J., Geldof, T., & De Bruycker, E. (2005). The Implicit Association test as a general measure of similarity. *Canadian Journal of Experimental Psychology, 59,* 228-239.

De Houwer, J. & Moors, A. (2007). How to define and examine the implicitness of implicit measures. In B.Wittenbrink & N. Schwarz (Eds.), *Implicit measures of attitudes.* (pp. 179-194). New York, NY: Guilford Press.

De Houwer, J. (2003). The Extrinsic Affective Simon Task. *Experimental Psychology, 50,* 77-85.

De Houwer, J. (2006). What are implicit measures and why are we using them? In R.W.Wiers & A. W. Stacy (Eds.), *Handbook of implicit cognition and addiction* (Thousand Oaks, CA: Sage Publications.

de Jong, P. J., Wiers, R. W., van de Braak, M., & Huijding, J. (2007). Using the Extrinsic Affective Simon Test as a measure of implicit attitudes towards alcohol: Relationship with drinking behavior and alcohol problems. *Addictive Behaviors, 32,* 881-887.

De Jong, R., Liang, C. C., & Lauber, E. (1994). Conditional and unconditional automaticity: a dual process model of effects of spatial stimulus-response correspondence. *Journal of Experimental Psychology: Human Perception and Performance, 20,* 750.

de Lauzon, B., Romon, M., Deschamps, V., Lafay, L., Borys, J.-M., Karlsson, J. et al. (2004). The three-factor eating questionnaire-R18 is able to distinguish among different eating patterns in a general population. *Journal of Nutrition, 134,* 2372-2380.

De Raedt, R., Schacht, R., Dranck, E., & De Houwer, J. (2006). Self-esteem and depression revisited: Implicit positive self-esteem in depressed patients? *Behaviour Research and Therapy, 44,* 1017-1028.

Deci, E. L. & Ryan, R. M. (1995). Human agency: The basis for true self-esteem. In M.H.Kernis (Ed.), *Efficacy, agency, and self-esteem.* (pp. 31-50). New York: Plenum.

DeHart, T., Pelham, B. W., & Murray, S. (2004). Implicit dependency regulation: Self-esteem, erlationship closeness, and implicit evaluations of close others. *Social Cognition, 22,* 126-146.

DeHart, T., Pelham, B. W., & Tennen, H. (2006). What lies beneath: Parenting style and implicit self-esteem. *Journal of Experimental Social Psychology, 42,* 1-17.

Delinsky, S. S. & Wilson, G. T. (2008). Weight gain, dietary restraint, and disordered eating in the freshman year of college. *Eating Behaviors, 9,* 82-90.

Devine, P. G. (1989). Stereotypes and Prejudice: Their Automatic and Controlled Components. *Journal of Personality and Social Psychology, 56,* 5-18.

Díaz-Marsá, M., Carrasco, J. L., & Sáiz, J. (2000). A study of temperament and personality in anorexia and bulimia nervosa. *Journal of Personality Disorders, 14,* 352-359.

Diener, E. & Diener, M. (1995). Cross-cultural correlates of life satisfaction and self-esteem. *Journal of Personality and Social Psychology, 68,* 653-663.

Dijksterhuis, A. (2004). I like myself but I don't know why: Enhancing implicit self-esteem by subliminal evaluative conditioning. *Journal of Personality and Social Psychology, 86,* 345-355.

Dovidio, J. F., Kawakami, K., & Gaertner, S. L. (2002). Implicit and explicit prejudice and interracial interaction. *Personality and Social Psychology Bulletin, 82,* 62-68.

Dovidio, J. F., Kawakami, K., Johnson, C., Johnson, B., & Howard, A. (1997). On the nature of prejudice: Automatic and controlled processes. *Journal of Experimental Social Psychology, 33,* 510-540.

Drewnowski, A. (1987). Taste and bulimia. *Physiology & Behavior, 41,* 621-626.

Drewnowski, A., Brunzell, J. D., Sandle, K., Iverius, P. H., & Greenwood, M. R. C. (1985). Sweet tooth reconsidered: Taste responsiveness in human obesity. *Physiology & Behavior, 35,* 617-622.

Drewnowski, A. & Greenwood, M. R. C. (1983). Cream and sugar: Human preferences for high-fat foods. *Physiology & Behavior, 30,* 629-633.

Drewnowski, A., Halmi, K. A., Pierce, B., Gibbs, J., & Smith, G. P. (1987). Taste and eating disorders. *American Journal of Clinical Nutrition, 46,* 442-450.

Drewnowski, A., Riskey, D., & Desor, J. A. (1982). Feeling fat yet unconcerned: Self reported overweight and the restraint scale. *Appetite, 3,* 273-279.

Drewnowski, A. & Shultz, J. M. (2001). Impact of aging on eating behaviors, food choices, nutrition, and health status. *Journal of Nutrition, Health and Aging, 5,* 75-79.

Dumont, M. & Provst, M. A. (1999). Resilience in adolescents: Protective role of social support, coping strategies, self-esteem, and social activities on experience of stress and depression. *Journal of Youth and Adolescence, 28,* 343-363.

Dunkley, T. L., Wertheim, E. H., & Paxton, S. J. (2001). Examination of a model of multiple sociocultural influences on adolescent girls' body dissatisfaction and dietary restraint. *Adolescence, 36,* 265-279.

Dutton, D. G. & Aron, A. P. (1974). Some evidence for heightened sexual attraction under conditions of high anxiety. *Journal of Personality and Social Psychology, 30,* 510-517.

Ebert, I. D., Steffens, M. C., von Stülpnagel, R., & Jelenec, P. (2009). How to like yourself better, or chocolate less: Changing implicit attitudes with one IAT task. *Journal of Experimental Psychology: General, 45,* 1098-1104.

Egloff, B., Schwerdtfeger, A., & Schmukle, S. C. (2005). Temporal stability of the Implicit Association Test - Anxiety. *Journal of Personality Assessment, 84,* 82-88.

Eiser, J. R. (1996). Attitudes, attraction and influence. In *Social psychology: Attitudes, cognition and social behaviour.* (pp. 11-52). Cambridge: Cambridge University Press.

Elliot, A. J. & Covington, M. V. (2001). Approach and avoidance motivation. *Educational Psychology Review, 13,* 73-92.

Ellwart, T., Becker, E. S., & Rinck, M. (2005). Activation and measurement of threat associations in fear of spiders: an application of the Extrinsic Affective Simon Task. *Journal of Behavior Therapy and Experimental Psychiatry, 36,* 281-299.

Epstein, S. (1994). Integration of the cognitive and the psychodynamic unconscious. *American Psychologist, 49,* 709-724.

Fairburn, C. G. & Beglin, S. J. (1994). Assessment of eating disorders: interview or self-report questionnaire? *International Journal of Eating Disorders, 16,* 363-370.

Fairburn, C. G., Cooper, Z., & Shafran, R. (2003). Cognitive behaviour therapy for eating disorders: A "transdiagnostic" theory and treatment. *Behaviour Research and Therapy, 41,* 509-528.

Fairburn, C. G., Shafran, R., & Cooper, Z. (1998). A cognitive behavioural theory of anorexia nervosa. *Behaviour Research and Therapy, 37,* 1-13.

Farnham, S. D., Greenwald, A. G., & Banaji, M. R. (1999). Implicit self-esteem. In D.Abrams & M. A. Hogg (Eds.), *Social cognition and social identity* (pp. 230-237). Oxford: Blackwell.

Farooqui, S. & O'Rahilly, S. (2009). Leptin: a pivotal regulator of human energy homeostasis. *The American Journal of Clinical Nutrition, 89,* 9805-9845.

Fazio, R. H. (1990). Multiple processes by which attitudes guide behavior: The MODE model as an integrative framework. In M.P.Zanna (Ed.), *Advances in Experimental Social Psychology* (Volume 23 ed., San Diego, CA: Academic Press.

Fazio, R. H. (2001). On the automatic activation of associated evaluations: An overview. *Cognition and Emotion, 15,* 115-141.

Fazio, R. H., jackson, J. R., Dunton, B. C., & Williams, C. J. (1995). Variability in automatic activation as an unobtrusive measure of racial attitudes: A bona fide pipeline? *Journal of Personality and Social Psychology, 69,* 1013-1027.

Fazio, R. H. & Olson, M. A. (2003). Implicit measures in social cognition research: Their meaning and use. *Annual Review of Sociology, 54,* 297-327.

Fazio, R. H., Sanbonmatsu, D. M., Powell, M. C., & Kardes, F. R. (1986). On the automatic activation of attitudes. *Journal of Personality and Social Psychology, 50,* 229-238.

Fazio, R. H. & Towles-Schwen, T. (1999). The MODE model of attitude-behavior processes. In S.Chaiken & Y. Trope (Eds.), *Dual-process theories in social psychology.* (New York, NY: The Guilford Press.

Festinger, L. (1962). Cognitive dissonance. *Scientific American, 207,* 93-107.

Fiedler, K. & Bluemke, M. (2005). Faking the IAT: Aided and unaided response control on the implicit association tests. *Basic and Applied Social Psychology, 27,* 307-316.

Fishbach, A. & Shah, J. Y. (2006). Self-control in action: Implicit dispositions toward goals and away from temptations. *Journal of Personality and Social Psychology, 90,* 820-832.

Fishbein, M. (1979). A theory of reasoned action: Some applications and implication. *Nebraska Symposium on Motivation, 27,* 65-116.

Fiske, S. T. (1982). Schema-triggered affect: Applications to social perception. In M.S.Clark & S. T. Fiske (Eds.), *Affect and cognition: The 17th annual Carnegie symposium on cognition.* (pp. 55-78). Hillsdale, NJ: Erlbaum Associates.

Fitch, G. (1970). Effects of self-esteem, perceived performance, and choice on causal attributions. *Journal of Personality and Social Psychology, 16,* 311-315.

Fox, E. (2006). Constructing a pragmatic science of learning and instruction with functional contextualism. *Educational Technology Research and Development, 54,* 5-36.

Franco-Paredes, K., Mancilla-Díaz, J. M., Vázquez-Arévalo, R., López-Aguilar, X., & lvarez-Rayón G. (2005). Perfectionism and eating disorders: A review of the literature. *European Eating Disorders Review, 13,* 61-70.

Franko, D. L., Wolfe, B. E., & Jimerson, D. C. (1994). Elevated sweet taste pleasantness ratings in bulimia nervosa. *Physiology & Behavior, 56,* 969-973.

Franz, M. J., vanWormer, J. J., Crain, A. L., Boucher, J. L., Histon, T., Caplan, W. et al. (2007). Weight-loss outcomes: A systematic review and meta-analysis of weight-loss clinical trials with a minimum 1-year follow-up. *Journal of the American Diet Association, 107,* 1755-1767.

Freund, T., Kruglanski, A. W., & Shpitzajzen, A. (1985). The freezing and unfreezing of impressional primacy: Effects of the needed for structure and the fear of invalidity. *Personality and Social Psychology Bulletin, 11,* 479-487.

Friedman, M. (1976). *Price theory.* Chicago: Aldine.

Friese, M., Hofmann, W., & Wänke, M. (2008). When impulses take over: Moderated predictive validity of explicit and implicit attitude measures in predicting food choice and consumption behaviour. *British Journal of Social Psychology, 47,* 397-419.

Fronza, S., Galimberti, E., Fadda, E., Fanini, F., & Bellodi, L. (2011). Implicit associations in eating disorders: An experimental study with the "self-esteem" Implicit Associations Test. *European Psychiatry, 26,* 719.

Frost, R. O., Marten, P., Lahart, C., & Rosenblate, R. (1990). The dimensions of perfectionism. *Cognitive Therapy and Research, 14,* 449-468.

Furnham, A., Badmin, N., & Sneade, I. (2002). Body image dissatisfaction: Gender differences in eating attitudes, self-esteem, and reasons for exercise. *The Journal of Psychology: Interdisciplinary and Applied, 136,* 581-596.

Gawronski, B. & Bodenhausen, G. V. (2007). Unraveling the processes underlying evaluation: Attitudes from the perspective of the APE model. *Social Cognition, 25,* 687-717.

Gawronski, B. & Bodenhausen, G. V. (2011). The Associative-Propositional Evaluation model: Theory, evidence, and open questions. *Advances in Experimental Social Psychology, 44,* 59-127.

Gawronski, B., Bodenhausen, G. V., & Becker, A. P. (2007). I like it, because I like myself: Associative self-anchoring and post-decisional change of implicit evaluations. *Journal of Experimental Social Psychology, 43,* 221-232.

Gawronski, B., Peters, K. R., & LeBel, E. P. (2008). What makes mental associations personal or extra-personal? Conceptual issues in the methodological debate about implicit attitude measures. *Social and Personality Psychology Compass, 2,* 1002-1023.

Gawronski, B. & Strack, F. (2003). On the propositional nature of cognitive consistency: Dissonance changes explicit, but not implicit attitudes. *Journal of Experimental Social Psychology, 40,* 535-542.

Gawronski, B., Walther, E., & Blank, H. (2005). Cognitive consistency and the formation of interpersonal attitudes: Cognitive balance affects the encoding of social information. *Journal of Experimental Psychology, 41,* 618-626.

Gawronski, B., Hofmann, W., & Wilbur, C. J. (2006). Are "implicit" attitudes unconscious? *Consciousness and Cognition, 15,* 485-499.

Gawronski, B., LeBel, E. P., & Peters, K. R. (2007). What do implicit measures tell us? *Perspectives on Psychological Science, 2,* 181-193.

Geller, J., Cassin, S. E., Brown, K. E., & Srikameswaran, S. (2009). Factors associated with improvements in readiness for change: Low vs. normal BMI eating disorders. *International Journal of Eating Disorders, 42,* 40-46.

Geller, J., Johnston, C., & Madsen, K. (1997). The role of shape and weigh in self-concept: The shape and weight based self-esteem inventory. *Cognitive Therapy and Research, 21,* 5-24.

Geller, J., Zaitsoff, S. L., & Srikameswaran, S. (2005). Tracking readiness and motivation for change in individuals with eating disorders over the course of treatment. *Cognitive Therapy and Research, 29,* 611-625.

Geller, J., Johnston, C., Madsen, K., Goldner, E. M., Remick, R. A., & Birmingham, C. L. (1998). Shape- and weight-based self-esteem and the eating disorders. *International Journal of Eating Disorders, 24,* 285-298.

Geller, J., Srikameswaran, S., Cockell, S. J., & Zaitsoff, S. L. (2000). Assessment of shape- and weight-based self-esteem in adolescents. *International Journal of Eating Disorders, 28,* 339-345.

Gigerenzer, G. (2008). Why heuristics work. *Perspectives on Psychological Science, 3,* 20-29.

Goss, R. J. (1966). Hypertrophy versus hyperplasia. *Science, 153,* 1516-1620.

Gough, B. (2007). "Real men don't diet": An analysis of contemporary newspaper representations of men, food and health. *Social Science and Medicine, 64,* 326-337.

Govan, C. L. & Williams, K. D. (2004). Changing the affective valence of the stimulus items influences the IAT by re-defining the category labels. *Journal of Experimental Social Psychology, 40,* 357-365.

Greenberg, J., Pyszczynski, T., & Solomon, S. (1986). The causes and consequences of a need for self-esteem: A terror management theory. In R.F.Baumeister (Ed.), *Public self and private self.* (pp. 189-212). New York: Springer-Verlag.

Greenwald, A. G. (1990). What cognitive representations underlie social attitudes? *Bulletin of the Psychonomic Society, 28,* 254-260.

Greenwald, A. G. & Banaji, M. R. (1995). Implicit social cognition: Attitudes, self-esteem, and stereotypes. *Psychological Review, 102,* 4-27.

Greenwald, A. G., Nosek, B. A., Banaji, M. R., & Klauer, K. C. (2005). Validity of the salience symmetry interpretation of the implicit association test: Comment on Rothermund and Wentura (2004). *Journal of Experimental Psychology: General, 134,* 420-425.

Greenwald, A. G., Poehlman, T. A., Uhlmann, E. L., & Banaji, M. R. (2009). Understanding and using the Implicit Association Test: III. Meta-analysis of predictive validity. *Journal of Personality and Social Psychology, 97,* 17-41.

Greenwald, A. G. & Farnham, S. D. (2000). Using the Implicit Association Test to measure self-esteem and self-concept. *Personality and Social Psychology Bulletin, 79,* 1022-1038.

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Personality and Social Psychology Bulletin, 74,* 1464-1480.

Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the Implicit Association Test: I. An improved scoring algorithm. *Journal of Personality and Social Psychology, 85,* 197-216.

Gregg, A. P., Seibt, B., & Banaji, M. R. (2006). Easier done than undone: Asymmetry in the malleability of implicit preferences. *Journal of Personality and Social Psychology, 90,* 1-20.

Griffiths, R. A., Beumont, P. J. V., Giannakopoulos, E., Russell, J., Schotte, D., Thornton, C. et al. (1999). Measuring self-esteem in dieting disordered patients: The validity of the Rosenberg and Coopersmith contrasted. *International Journal of Eating Disorders, 25,* 227-231.

Grumm, M., Nestler, S., & von Collani, G. (2009). Changin explicit and implicit attitudes: The case of self-esteem. *Journal of Experimental Social Psychology, 45,* 327-335.

Haeffel, G. J., Abramson, L. Y., Brazy, P. C., Shah, J. Y., Teachman, B. A., & Nosek, B. A. (2007). Explicit and implicit cognition: A preliminary test of a dual-process theory of cognitive vulnerability to depression. *Behaviour Research and Therapy, 45,* 1155-1167.

Hagger, M. S., Wood, C., Stiff, C., & Chatzisarantis, N. L. D. (2010). Ego depletion and the strength model of self-control: A meta-analysis. *Psychological Bulletin, 136,* 495-525.

Hall, C. S. & Lindzey, G. (1978). *Theories of personality*. (3rd ed.) New York: Wiley.

Halmi, K. A., Casper, R. C., Eckert, E., Goldberg, S. C., & Davis, J. M. (1979). Unique features associated with age of onset on anorexia nervosa. *Psychiatry Research, 1,* 209-215.

Halmi, K. A., Eckert, E., Marchi, P., Sampugnaro, V., Apple, R., & Cohen, J. (1991). Comorbidity of psychiatric diagnoses in anorexia nervosa. *Archives of General Psychiatry, 48,* 712-718.

Halmi, K. A., Sunday, S. R., Strober, M., Kaplan, A., Woodside, B., Fichter, M. et al. (2000). Perfectionism in anorexia nervosa: Variation by clinical subtype, obsessionality, and pathological eating behavior. *American Journal of Psychiatry, 157,* 1799-1805.

Halvarsson, K. & Sjödén, P. O. (1998). Psychometric properties of the Dutch Eating Behaviour Questionnaire (DEBQ) among 9-10-year-old Swedish girls. *European Eating Disorders Review, 6,* 115-125.

Hart, A. J., Whalen, P. J., Shin, L. M., McInerney, S. C., Fischer, H., & Rauch, S. L. (2000). Differential response in the human amygdala to racial outgroup vs ingroup face stimuli. *Neuroreport, 11,* 2351-2354.

Hasher, L. & Zacks, R. T. (1979). Automatic and effortful processes in memory. *Journal of Experimental Psychology, 108,* 356-388.

Hausmann, L. R. M. & Ryan, C. S. (2004). Effects of external and internal motivation to control prejudice on implicit prejudice: The mediating role of efforts to control prejudiced responses. *Basic and Applied Social Psychology, 26,* 215-225.

Hayes, S. C., Barnes-Holmes, D., & Roche, B. (2001). *Relational frame theory: A post-Skinnerian account of human language and cognition.* New York, NY: Plenum.

Haynos, A. F., Field, A. E., Wilfley, D. E., & Tanofsky-Kraff, M. (2014). A novel classification paradigm for understanding the positive and negative outcomes associated with dieting. *International Journal of Eating Disorders*.

He, Y., Johnson, M. K., Dovidio, J. F., & McCarthy, G. (2009). The relation between race-related implicit associations and scalp-recorded neural activity evoked by faces from different races. *Social Neuroscience, 4,* 426-442.

Heatherton, T. F., Herman, C. P., Polivy, J., King, G. A., & McGree, S. T. (1988). The (mis)measurement of restraint: An analysis of conceptual and psychometric issues. *Journal of Abnormal Psychology, 97,* -28.

Heine, S. J., Lehman, D. R., Markus, H. R., & Kitayama, S. (1999). Is there a universal need for positive self-regard? *Psychological Review, 106,* 766-794.

Helmreich, R. & Stapp, J. (1974). Short forms of the Texas Social Behavior Inventory (TSBI), an objective measure of self-esteem. *Bulletin of the Psychonomic Society, 4,* 473-475.

Herman, C. P. & Mack, D. (1975). Restrained and unrestrained eating. *Journal of Personality, 43,* 647-660.

Herman, C. P. & Polivy, J. (1975). Anxiety, restraint, and eating behavior. *Journal of Abnormal Psychology, 84,* 666-672.

Herman, C. P. & Polivy, J. (1980). Restrained eating. In A.J.Stunkard (Ed.), *Obesity* (pp. 208-225). Philadelphia: Saunders.

Hermans, D., Crombez, G., & Eelen, P. (2000). Automatic attitude activation and efficiency: The fourth horseman of automaticity. *Psychologica Belgica, 40,* 3-22.

Hermans, D., De Houwer, J., & Eelen, P. (1994). The affective priming effect: Automatic activation of evaluative information in memory. *Cognition and Emotion, 8,* 515-533.

Hermans, D., De Houwer, J., & Eelen, P. (1996). Evaluative decision latencies mediated by induced affective sales. *Behaviour Research and Therapy, 34,* 483-488.

Herwig, U., Kaffenberger, T., Jäncke, L., & Brühl, A. B. (2010). Self-related awareness and emotion regulation. *NeuroImage, 50,* 734-741.

Hess, E. H. (1965). Attitude and pupil size. *Scientific American, 212,* 46-54.

Hetts, J. J. & Pelham, B. W. (2001). A case for the nonconscious self-concept. In G.B.Moskowitz (Ed.), *Cognitive social psychology: The Princeton symposium on the legacy and future of social cognition.* (pp. 105-123). Mahwah, NJ: Erlbaum.

Heuer, K., Rinck, M., & Becker, E. S. (2007). Avoidance of emotional facial expressions in social anxiety: The approach-avoidance task. *Behaviour Research and Therapy, 45,* 2990-3001.

Hewitt, P. L. & Flett, G. L. (1991). Perfectionism in the self and social contexts: Conceptualization, assessment, and association with psychopathology. *Journal of Personality and Social Psychology, 60,* 456-470.

Hewitt, P. L. & Dyck, D. G. (1986). Perfectionism, stress, and vulnerability to depression. *Cognitive Therapy and Research, 10,* 137-142.

Hewitt, P. L., Flett, G. L., Turnbull-Donovan, W., & Mikail, S. F. (1991). The Multidimensional Perfectionism Scale: Reliability, Validity, and Psychometric Properties in Psychiatric Samples. *Psychological Assessment: A Journal of Consulting & Clinical Psychology A Journal of Consulting and Clinical Psychology., 3,* 464-468.

Hill, A. J. & Weaver, C. F. L. (1991). Food craving, dietary restraint and mood. *Appetite, 17,* 187-197.

Hing, L. S. S., Chung-Yan, G. A., Hamilton, L. K., & Zanna, M. P. (2008). A two-dimensional model that employs explicit and implicit attitudes to chracterize prejudice. *Journal of Personality and Social Psychology, 94,* 971-987.

Hixon, J. G. & Swann, W. B. Jr. (1993). When does introspection bear fruit? Self-reflection, self-insight and interpersonal choices. *Journal of Personality and Social Psychology, 64,* 35-43.

Hoebel, B. G. & Teitelbaum, P. (1966). Weight regulation in normal and hypothalamic hyperphagic rats. *Journal of Comparative and Physiological Psychology, 61,* 189-193.

Hoefling, A. & Strack, F. (2008). The tempting effect of forbidden foods. High calorie content evokes conflicting implicit and explicit evaluations in restrained eaters. *Appetite, 51,* 681-689.

Hoffmeister, K., Teige-Mocigemba, S., Blechert, J., Klauer, K. C., & Tuschen-Caffier, B. (2010). Is implicit self-esteem linked to shape and weight concerns in restrained and unrestrained eaters? *Journal of Behavior Therapy and Experimental Psychiatry, 41,* 31-38.

Hofmann, W. & Baumert, A. (2010). Immediate affect as a basis for intuitive moral judgment: An adaptation of the affect misattribution procedure. *Cognition and Emotion, 24,* 522-535.

Hofmann, W., Gawronski, B., Gschwendner, T., Le, H., & Schmitt, M. (2005). A meta-analysis on the correlation between the Implicit Association Test and explicit self-report measure. *Personality and Social Psychology Bulletin, 31,* 1369-1385.

Hofmann, W., Gschwendner, T., Friese, M., Wiers, R. W., & Schmitt, M. (2008). Working memory capacity and self-regulatory behaviour: Toward an individual differences perspective on behaviour determination by automatic versus controlled processes. *Journal of Personality and Social Psychology, 95,* 962-977.

Hofmann, W., Gschwendner, T., & Schmitt, M. (2004). On implicit-explicit consistency: The moderating role of individual differences in awareness and adjustment. *European Journal of Personality, 19,* 25-49.

Hofmann, W., Rauch, W., & Gawronski, B. (2007). And deplete us not into temptation: Automatic attitudes, dietary restraint, and self-regulatory resources as determinants of eating behavior. *Journal of Experimental Social Psychology, 43,* 497-504.

Hoiles, K. J., Egan, S. J., & kane, R. T. (2012). The validity of the transdiagnostic cognitive behavioural model of eating disorders in predicting dietary restraint. *Eating Behaviors, 13,* 123-126.

Hollands, G. J., Prestwich, A., & Marteau, T. M. (2011). Using aversive images to enhance healthy food choices and implicit attitudes: An experimental test of evaluative conditioning. *Health Psychology, 30,* 195-203.

Horesh, N., Zalsman, G., & Apter, A. (2000). Internalized anger, self-control, and mastery experience in inpatient anorexic adolescents. *Journal of Psychosomatic Research, 49,* 247-253.

Horvath, T. L. (2005). The hardship of obesity: a soft-wired hypothalamus. *Nature Neuroscience, 8,* 561-565.

Houben, K., Roefs, A., & Jansen, A. (2010). Guilty pleasures. Implicit preferences for high calorie food in restrained eating. *Appetite, 55,* 18-24.

Houben, K. & Wiers, R. W. (2006a). A test of the salience asymmetry interpretation of the alcohol-IAT. *Experimental Psychology, 53,* 292-300.

Houben, K. & Wiers, R. W. (2006b). Assessing implicit alcohol associations with the IAT: Fact or artifact? *Addictive Behaviors, 31,* 1346-1362.

Hudson, J. I., Hiripi, E., Pope Jr, H. G., & Kessler, R. C. (2007). The prevalence and correlates of eating disorders in the national comorbidity survey replication. *Biological Psychiatry, 61,* 348-358.

Hughes, S. & Barnes-Holmes, D. (2011). On the formation and persistence of implicit attitudes: New evidence from the Implicit Relational Assessment Procedure (IRAP). *The Psychological Record, 61,* 410.

Hughes, S., Barnes-Holmes, D., & De Houwer, J. (2011). The dominance of associative theorizing in implicit attitude research: Propositional and behavioral alternatives. *The Psychological Record, 61,* 465-496.

Hummert, M. L., Garstka, T. A., O'Brien, L. T., Greenwald, A. G., & Mellott, D. S. (2002). Using the Implicit Association Test to measure age differences in implicit social cognitions. *Psychology and Aging, 17,* 482-495.

Ickes, W. J., Wicklund, R. A., & Ferris, C. B. (1973). Objective self awareness and self esteem. *Journal of Experimental Social Psychology, 9,* 202-219.

Inelmen, E. M., Toffanello, E. D., Enzi, G., Gasparini, G., Miotto, F., Sergi, G. et al. (2005). Predictors of drop-out in overweight and obese outpatients. *International Journal of Obesity, 29,* 122-128.

Inzlicht, M., McKay, L., & Aronson, J. (2006). Stigma as ego depletion: How being the target of prejudice affects self-control. *Psychological Science, 17,* 262-269.

Jacobi, C., Hayward, C., de Zwaan, M., Kraemer, H. C., & Agras, W. S. (2004). Coming to terms with risk factors for eating disorders: Application of risk terminology and suggestions for a general taxonomy. *Psychological Bulletin, 130,* 19-65.

Jansen, A. (1996). How restrained eaters perceive the amount they eat. *British Journal of Clinical Psychology, 35,* 381-392.

Job, V., Dweck, C. S., & Walton, G. M. (2010). Ego depeltion - is it all in your head? Implicit theories about willpower affect self-regulation. *Psychological Science, 21,* 1686-1693.

Johnson, F. & Wardle, J. (2005). Dietary restraint, body dissatisfaction, and psychological distress: A prospective analysis. *Journal of Abnormal Psychology, 114,* 119-125.

Johnson, M. K., Hashtroudi, S., & Lindsay, D. S. (1993). Source monitoring. *Psychological Bulletin, 114,* 3-28.

Johnstone, M.-J. (2012). Bioethics, cultural differences and the problem of moral disagreements in end-of-life care: A Terror Management Theory. *Journal of Medicine and Philosophy, 37,* 181-200.

Joiner Jr, T. E., Heatherton, T. F., Rudd, D. M., & Schmidt, N. B. (1997). Perfectionism, perceived weight status, and bulimic symptoms: Two studies testing a diathesis-stress model. *Journal of Abnormal Psychology, 106,* 145-153.

Jones, D. C. (2001). Social comparison and body image: Attractiveness comparisons to models and peers among adolescent girls and boys. *Sex Roles,* 645-664.

Jones, J. T., Pelham, B. W., Mirenberg, M. C., & Hetts, J. J. (2002). Name letter preferences are not merely mere exposure: Implicit egotism as self-regulation. *Journal of Experimental Social Psychology, 38,* 170-177.

Jordan, C. H., Whitfield, M., & Zeigler-Hill, V. (2007). Intuition and the correspondence between implicit and explicit self-eteem. *Journal of Personality and Social Psychology, 93,* 1067-1079.

Joukamaa, M., Heliövaara, M., Knekt, P., Aromaa, A., Raitsalo, R., & Lehtinen, V. (2001). Mental disorders and cause-specific mortality. *British Journal of Psychiatry, 179,* 498-502.

Kahan, D., Polivy, J., & Herman, C. P. (2003). Conformity and dietary disinhibition: A test of the ego-strength model of self-regulation. *International Journal of Eating Disorders, 33,* 165-171.

Kane, T. A., Loxton, N. J., Staiger, P. K., & Dawe, S. (2004). Does the tendency to act impulsively underlie binge eating and alcohol use problems? An empirical investigation. *Personality and Individual Differences, 36,* 83-94.

Karpinski, A. (2004). Measuring self-esteem using the Implicit Association Test: The role of the other. *Personality and Social Psychology Bulletin, 30,* 22-34.

Karpinski, A. & Hilton, J. (2001). Attitudes and the Implicit Association Test. *Journal of Personality and Social Psychology, 81,* 774-788.

Karpinski, A. & Steinman, R. B. (2006). The single category Implicit Association Test as a measure of implicit social cognition. *Personality and Social Psychology Bulletin, 91,* 16-32.

Kawakami, K. & Dovidio, J. F. (2001). The reliability of implicit stereotyping. *Personality and Social Psychology Bulletin, 27,* 212-225.

Kawasaki, H., Adolphs, R., Kaufman, O., Damasio, H., Damasio, A. R., Graner, M. et al. (2001). Single-neuron responses to emotional visual stimuli recorded in human ventral prefrontal cortex. *Nature Neuroscience, 4,* 15-16.

Kayman, S., Bruvold, W., & Stern, J. S. (1990). Maintenance and relapse after weight loss in women: behavioral aspects. *American Journal of Clinical Nutrition, 52,* 800-807.

Kihlstrom, J. F. (2004). Implicit methods in social psychology. In C.Sansone, C. Morf, & A. Panter (Eds.), *The Sage handbook of methods in social psychology.* (pp. 195-212). Thousand Oaks, CA: Sage.

Kim, D.-Y. (2003). Voluntary controllability of the Implicit Association Test (IAT). *Social Psychology Quarterly, 66,* 83-96.

Kirkpatrick, L. A. & Navarrette, C. D. (2006). Reports of my death anxiety have been greatly exaggerated: A critique of Terror Management Theory from an evolutionary perspective. *Psychological Inquiry, 17,* 288-298.

Kitayama, S. & Rarasawa, M. (1997). Implicit self-esteem in Japan: Name letters and birthday numbers. *Personality and Social Psychology Bulletin, 23,* 736-742.

Klauer, K. C. & Mierke, J. (2005). Task-set inertia, attitude accessibility, and compatibility-order effects: New evidence for a task-set switching account of the Implicit Association Test effect. *Personality and Social Psychology Bulletin, 31,* 208-217.

Klauer, K. C., Mierke, J., & Musch, J. (2003). The positivity proportion effect: A list context effect in masked affective priming. *Memory and Cognition, 31,* 953-967.

Klauer, K. C. & Musch, J. (2008). Affective priming: Findings and theories. In J.Musch & K. C. Klauer (Eds.), *The Psychology of Evaluation: Affective Processes in Cognition and Emotion.* (pp. 9-50). Mahwah, NJ: Lawrence Erlbaum Associates.

Kling, K. C., Hyde, J. S., Showers, C. J., & Buswell, B. N. (1999). Gender differences in self-esteem: A meta-analysis. *Psychological Bulletin, 125,* 470-500.

Knittle, J. L. & Hirsch, J. (1968). Effect of early nutrition on the development of rat epididymal fat pads: Cellularity and metabolism. *Journal of Clinical Investigation, 47,* 2091.

Komori, M. & Murata, K. (2008). Implicit egotism in Japan: Preference for first and family name initials. *Hitotsubashi Journal of Social Studies, 40,* 101-109.

Koole, S. L., Dijksterhuis, A., & van Knippenberg, A. (2001). What's in a name: Implicit self-esteem and the automatic self. *Journal of Personality and Social Psychology, 80,* 669-685.

Krieglmeyer, R., Deutsch, R., De Houwer, J., & De Raedt, R. (2010). Being moved: Valence activates approach-avoidance behavior independently of evaluation and approach-avoidance intentions. *Psychological Science, 21,* 607-613.

Kringelbach, M. L. (2005). The human orbitofrontal cortex: Linking reward to hedonic experience. *Nature Reviews Neuroscience, 6,* 691-702.

Krolak-Salmon, P., Hénaff, M.-A., Vighetto, A., Bertrand, O., & Mauguière, F. (2004). Early amugdala reaction to fear spreading in occipital, temporal and frontal cortex: A depth electrode ERP study in human. *Neuron, 42,* 665-676.

Kruglanski, A. W. & Dechesne, M. (2006). Are associative and propositional processes qualitatively distinct? Comment on Gawronski and Bodenhausen (2006). *Psychological Bulletin, 132,* 736-739.

Laessle, R. G., Tuschl, R. J., Kotthaus, B. C., & Prike, K. M. (1989). A comparison of the validity of three scales for the assessment of dietary restraint. *Journal of Abnormal Psychology, 98,* 504-507.

Laessle, R. G., Tuschl, R. J., Waadt, S., & Pirke, K. M. (1989). The specific psychopathology of bulimia nervosa: A comparison with restrained and unrestrained (normal) eaters. *Journal of Consulting & Clinical Psychology December 1989;57(6):772-775,* 772-775.

Lawrence, M. (1979). Anorexia nervosa: The control paradox. *Women's Studies International Quarterly, 2,* 93-101.

Leary, M. R. (2004). The function of self-esteem in Terror Management Theory and Sociometer Theory: Comment on Pyszczynski et al. (2004). *Psychological Bulletin, 130,* 478-482.

Leary, M. R. & Baumeister, R. F. (2000). The nature and function of self-esteem: Sociometer theory. *Advances in Experimental Social Psychology, 32,* 1-62.

Leary, M. R. & Downs, D. L. (1995). Interpersonal functions of the self-esteem motive: The self-esteem system as a sociometer. In M.Kernis (Ed.), *Efficacy, agency, and self-esteem.* (pp. 123-144). New York: Plenum.

Leary, M. R. & MacDonald, G. (2003). Individual differences in self-esteem: A review and theoretical integration. In M.R.Leary & J. P. Tangney (Eds.), *Handbook of self and identity.* (pp. 401-418). New York: Guilford Press.

Leary, M. R., Rice, S. C., & Schreindorfer, L. S. (2005). Distinguishing the effects of social exclusion and low relational evaluation on reactions to interpersonal rejection. *Manuscript submitted for publication*.

Leitch, M. A., Morgan, M. J., & Yeomans, M. R. (2013). Different subtypes of impulsivity differentiate uncontrolled eating and dietary restraint. *Appetite, 69,* 54-63.

Lemm, K. M., Lane, K. A., Sattler, D. N., Khan, S. R., & Nosek, B. A. (2008). Assessing implicit cognitions with a paper-format Implicit Association Test. In T.G.Morrison & M. A. Morrison (Eds.), *The psychology of modern prejudice.* (pp. 123-146). Hauppauge, NY: Nova Science.

Lieberman, M. D. (2010). Social cognitive neuroscience. In S.T.Fiske, D. T. Gilbert, & G. Lindzey (Eds.), *Handbook of social psychology* (5th ed., pp. 143-193). New York: McGraw-Hill.

Lindroos, A. K., Lissner, L., Matthiassen, M. E., Karlsson, J., Sullivan, M., Bengtsson, C. et al. (1997). Dietary intake in relation to restrained eating, disinhibition, and hunger in obese and nonobese Swedish women. *Obesity Research, 5,* 175-182.

Link, B. G., Struening, E. L., Neese-Todd, S., Asmussen, S., & Phelan, J. C. (2001). Stigma as a barrier to recovery: The consequences of stigma for the self-esteem of people with mental illnesses. *Psychiatric Services, 52,* 1621-1626.

Lowe, M. R. (1993). The effects of dieting on eating behavior: a three-factor model. *Psychological Bulletin, 114,* 100.

Lowe, M. R. (2002). Dietary restraint and overeating. In C.G.Fairburn & K. D. Brownell (Eds.), *Eating disorders and obesity: A comprehensive handbook 2* (pp. 88-92). New York: Guilford Press.

Lowe, M. R. & Kleinfield, E. I. (1988). Cognitive restraint, weight suppression, and the regulation of eating. *Appetite, 10,* 159-168.

Lowe, M. R. & Levine, A. S. (2005). Eating motives and the controversy over dieting: Eating less than needed versus less than wanted. *Obesity Research, 13,* 797-806.

Lowe, M. R. & Thomas, J. G. (2009). Measures of restrained eating: Conceptual evolution and psychometric update. In D.Allison & M. L. Baskin (Eds.), *Handbook of Assessment Methods for Obesity and Eating Behaviors.* (pp. 137-185). New York: Sage.

Lowe, M. R. & Timko, C. A. (2004a). Dieting: Really harmful, merely ineffective or actually helpful? *British Journal of Nutrition, 92,* S19-S22.

Lowe, M. R. & Timko, C. A. (2004b). What a difference a diet makes: Towards an understanding of differences between restrained dieters and restrained nondieters. *Eating Behaviors, 5,* 199-208.

Lowe, M. R., Whitlow, J. W., & Bellwoar, V. (1991). Eating regulation: The role of restraint, dieting, and weight. *International Journal of Eating Disorders, 10,* 461-471.

Lowery, B. S., Hardin, C. D., & Sinclair, S. (2001). Social influence effects on automatic racial prejudice. *Journal of Personality and Social Psychology, 81,* 842-855.

Luce, K. H. & Crowther, J. H. (1999). The reliability of the eating disorder examination: Self-report questionnaire version. *International Journal of Eating Disorders, 25,* 349-351.

Machado, P. P., Martins, C., Vaz, A. R., Conceiçao, E., Bastos, A. P., & Gonçalves, S. (2014). Eating Disorder Examination Questionnaire: Psychometric properties and norms for the Portuguese population. *European Eating Disorders Review.*.

Macht, M. (2008). How emotions affect eating: A five-way model. *Appetite, 50,* 1-11.

Macrae, C. N., Milne, A. B., & Bodenhausen, G. V. (1994). Stereotypes as energy-saving devices: A peek inside the cognitive toolbox. *Journal of Personality and Social Psychology, 66,* 37-47.

Maison, D., Greenwald, A. G., & Bruin, R. (2004). Predictive validity of the Implicit Association Test in studies of brands, consumer attitudes, and behavior. *Journal of Consumer Psychology, 14,* 405-415.

Maison, D., Greenwald, A. G., & Bruin, R. (2001). The Implicit Association Test as a measure of implicit consumer attitudes. *Polish Psychological Bulletin, 32,* 61-69.

Marinelli, R. P. & Kelz, J. W. (1973). Anxiety and attitudes towards visibly disabled persons. *Rehabilitation Counseling Bulletin, 16,* 198-205.

Markus, H. R. & Kitayama, S. (1991). Culture and the self: Iplications for cognition, emotion, and motivation. *Psychological Review, 98,* 224-253.

Marsh, B., Todd, P. M., & Gigerenzer, G. (2004). Cognitive heuristics: Reasoning the fast and frugal way. In J.P.Leighton & R. J. Sternberg (Eds.), *The nature of reasoning.* (pp. 273-287). New York: Cambridge University Press.

Martinot, D. & Redersdorff, S. (2006). The variable impact of upward and downward social comparisons on self-esteem: When the level of analysis matters. In S.Guimond (Ed.), *Social comparison and social psychology: Understanding cognition, intergroup relations and culture.* (pp. 127-150). Cambridge: Cambridge University Press.

McCauley, C., Stitt, C. L., & Segal, M. (1980). Stereotyping: From prejudice to prediction. *Psychological Bulletin, 87,* 195-208.

McFarland, S. G. & Crouch, Z. (2002). A cognitive skill confound on the Implicit Association Test. *Social Cognition, 20,* 483-510.

McFarlin, D. B. & Blascovich, J. (1981). Effects of self-esteem and performance feedback on future affective preferences and cognitive expectations. *Journal of Personality and Social Psychology, 40,* 521-531.

McGuire, M. T., Wing, R. R., Klem, M. L., Lang, W., & Hill, J. O. (1999). What predicts weight regain in a group of successful weight losers? *Journal of COnsulting and Clinical Psychology, 67,* 177-185.

McKenna, I. M., Barnes-Holmes, D., Barnes-Holmes, Y., & Stewart, I. (2007). Testing the fake-ability of the Implicit Relational Assessment Procedure (IRAP): The first study. *International Journal of Psychology and Psychological Therapy, 7,* 253-268.

Micali, N., Hagberg, K. W., & Treasure, J. (2013). Incidence of eating disorders in the UK: findings from the UK General Practice Research Database. *The Lancet, 381,* S75.

Mierke, J. & Klauer, K. C. (2001). Implicit association measurement with the IAT: Evidence for effects of executive control processes. *Experimental Psychology, 48,* 107-122.

Mitchell, J. P., Nosek, B. A., & Banaji, M. R. (2003). Contextual variations in implicit evaluation. *Journal of Experimental Psychology: General, 132,* 455-469.

Monahan, J. L., Murphy, S. T., & Zajonc, R. B. (2000). Subliminal mere exposure: Specific, general and diffuse effects. *Psychologial Science, 11,* 462-466.

Mond, J. M., Hay, P. J., Rodgers, B., Owen, C., & Beumont, P. J. V. (2004). Validity of the Eating Disorder Examination Questionnaire (EDE-Q) in screening for eating disorders in community samples. *Behaviour Research and Therapy, 42,* 551-567.

Monteith, M. J., Voils, C. I., & Ashburn-Nardo, L. (2001). Taking a look underground: Detecting, interpreting, and reacting to implicit racial bias. *Social Cognition, 19,* -395.

Morgan, J. F., Reid, F., & Lacey, J. H. (1999). The SCOFF questionnaire: assessment of a new screening tool for eating disorders. *British Medical Journal, 319,* 1467.

Moskowitz, D. S. & Young, S. N. (2006). Ecological momentary assessment: What it is and why it is a method of the future in clinical psychopharmacology. *Journal of Psychiatry and Neuroscience, 31,* 13-20.

Muraven, M., Tice, D. M., & Baumeister, R. F. (1998). Self-control as a limited resource: Regulatory depletion patterns. *Journal of Personality and Social Psychology, 74,* 774-789.

Murphy, K. G., Dhillo, W. S., & Bloom, S. R. (2006). Gut peptides in the regulation of food intake and energy homeostasis. *Endocrine Reviews, 27,* 719-727.

Murphy, S. T. & Zajonc, R. B. (1993). Affect, cognition and awareness: Affective priming with optimal and suboptimal stimulus exposures. *Journal of Personality and Social Psychology, 64,* 723-739.

Nederkoorn, C., Smulders, F. T. Y., Havermans, R. C., Roefs, A., & Jansen, A. (2006). Impulsivity in obese women. *Appetite, 47,* 253-256.

Nederkoorn, C., Van Eijs, Y., & Jansen, A. (2004). Restrained eaters act on impulse. *Personality and Individual Differences, 37,* 1651-1658.

Neumann, R., Hülsenbeck, K., & Seibt, B. (2004). Attitudes towards people with AIDS and avoidance behavior: Automatic and reflective bases of behavior. *Journal of Experimental Social Psychology, 40,* 543-550.

Nicholson, E. & Barnes-Holmes, D. (2012). The Implicit Relational Assessment Procedure (IRAP) as a measure of spider fear. *The Psychological Record, 62,* 263-278.

Nisbett, R. E. (1972). Hunger, obesity, and the ventromedial hypothalamus. *Psychological Review, 79,* 433-453.

Nosek, B. A. (2007). Implicit-explicit relations. *Current Directions in Psychological Science, 16,* 65-69.

Nosek, B. A., Banaji, M. R., & Greenwald, A. G. (2002). Harvesting implicit group attitudes and beliefs from a demonstration website. *Group Dynamics: Theory, Research and Practice, 6,* 101-115.

Nosek, B. A., Greenwald, A. G., & Banaji, M. R. (2005). Understanding and using the Implicit Association Test: II. Method variables and construct validity. *Personality and Social Psychology Bulletin, 31,* 166-180.

Nosek, B. A. & Smyth, F. L. (2007). A multitrait-multimethod validation of the Implicit Association Test: Implcit and explicit attitudes are related but distinct constructs. *Experimental Psychology, 54,* 14-29.

Nuttin, J. M. (1985). Narcissism beyond Gestalt and awareness: The name letter effect. *European Journal of Social Psychology, 15,* 353-361.

Nuttin, J. M. (1987). Affective consequences of mere ownership: The name letter effect in twelve European languages. *European Journal of Social Psychology, 17,* 381-402.

Ogden, J. (1993). The measurement of restraint: Confounding success and failure? *International Journal of Eating Disorders, 13,* 69-76.

Olson, A. M. & Fazio, R. H. (2004). Reducing the influence of extrapersonal associations on the Implicit Association Test: Personalising the IAT. *Journal of Personality and Social Psychology, 86,* 653-667.

Olson, M. A. & Fazio, R. H. (2001). Implicit attitude formation through classical conditioning. *Psychological Science, 12,* 413-417.

Oya, H., Kawasaki, H., Howard, M. A., & Adolphs, R. (2002). Electrophysiological responses in the human amygdala disctiminate emotion categories of complex visual stimuli. *Journal of Neuroscience, 22,* 9502-9512.

Palgi, P. & Abramovitch, H. (1984). Death: A cross-cultural perspective. *Annual Review of Anthropology, 13,* 385-417.

Papies, E. K., Barsalou, L. W., & Custers, R. (2012). Mindful attention prevents mindless impulses. *Social Psychological and Personality Science, 3,* 291-299.

Papies, E. K., Stroebe, W., & Aarts, H. (2009). Who likes it more? Restrained eaters' implicit attitudes towards food. *Appetite, 53,* 279-287.

Paulhus, D. L. & Trapnell, P. D. (1997). Terror Management Theory: Extended or overextended? *Psychological Inquiry, 8,* 40-43.

Payne, B. K., Cheng, C. M., Govorun, O., & Stewart, B. D. (2005). An inkblot for attitudes: Affect misattribution as implicit measurement. *Journal of Personality and Social Psychology, 89,* 277-293.

Perugini, M. (2005). Predictive models of implicit and explicit attitudes. *British Journal of Social Psychology, 44,* 29-45.

Peterson, C. B., Crosby, R. D., Wonderlich, S. A., Joiner, T., Crow, S. J., Mitchell, J. E. et al. (2007). Psychometric properties of the eating disorder examination-questionnaire: Factor structure and internal consistency. *International Journal of Eating Disorders, 40,* 386-389.

Peterson, J. L. & DeHart, T. (2013). Regulating connection: Implicit self-esteem predicts positive non-verbal behavior during romantic relationship-threat. *Journal of Experimental Social Psychology, 49,* 99-105.

Petty, R. E. & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. In L.Berkowitz (Ed.), *Advances in experimental social psychology, Vol.19* (pp. 123-205). New York: Academic.

Phelps, E. A., O'Connor, K. J., Cunningham, W. A., Funayama, E. S., Gatenby, J. C., & Gore, J. C. (2000). Performance on indirect measures of race evaluation predicts amygdala activation. *Journal of Cognitive Neuroscience, 12,* 729-738.

Polivy, J., Heatherton, T. F., & Herman, C. P. (1988). Self-esteem, restraint, and eating behavior. *Journal of Abnormal Psychology, 97,* 354-356.

Polivy, J. & Herman, C. P. (1985). Dieting and binging: A causal analysis. *American Psychologist, 40,* 193-201.

Polivy, J. & Herman, C. P. (1999). Distress and eating: Why do dieters overeat? *International Journal of Eating Disorders, 26,* 153-164.

Popper, K. R. (1963). Science as falsification. *Conjectures and refutations,* 33-39.

Posner, M. I. & Snyder, C. R. R. (1975). Attention and cognitive control. In R.L.Solso (Ed.), *Information processing and cognition: The Loyola symposium.* (pp. 153-175). Hillsdae, NJ: Erlbaum.

Power, P., Barnes-Holmes, D., Barnes-Holmes, Y., & Stewart, I. (2009). The Implicit Relational Assessment Procedure (IRAP) as a measure of implicit relative preferences: A first study. *The Psychological Record, 59,* 621-640.

Powley, T. L. & Keesey, R. (1970). Relationships of body weight to the lateral hypothalamic feeding syndrome. *Physiological Psychology, 1970,* 25-36.

Prochaska, J. O. & DiClemente, C. C. (1983). Stage and processes of self-change of smoking: Toward an integrative model of change. *Journal of Consulting & Clinical Psychology, 51,* 390-395.

Pronin, E. (2007). Perception and misperception of bias in human judgment. *Trends in Cognitive Sciences, 11,* 37-43.

Pruessner, J. C., Hellhammer, D. H., & Kirschbaum, C. (1999). Low self-esteem, induced failure and the adrenocortical stress response. *Personality and Individual Differences, 27,* 477-489.

Pudel, V., Metzdorff, M., & Oetting, M. (1975). Zur personlichkeit adiposer in psychologischen tests unter berucksichtigung latent fettsuchtiger. *Zeitschrift fur Psychosomatische Medizin und Psychoanalyse, 21,* 345-361.

Pyszczynski, T., Greenberg, J., & Solomon, S. (1999). A dual-process model of defense against conscious and unconscious death-related thoughts: An extension of terror management theory. *Psychological Review, 106,* 835-845.

Pyszczynski, T., Greenberg, J., Solomon, S., Arndt, J., & Schimel, J. (2004). Why do people need self-esteem? A theoretical and empirical review. *Psychological Bulletin, 130,* 435-468.

Raghunathan, R., Naylor, R. W., & Hoyer, W. D. (2006). The unhealthy = tasty intuition and its effects on taste inferences, enjoyment, and choice of food products. *Journal of Marketing, 70,* 170-184.

Raskin, R., Novacek, J., & Hogan, R. (1991). Narcissism, self-esteem, and defensive self-enhancement. *Journal of Personality, 59,* 19-38.

Rideout, C. A., McLean, J. A., & Barr, S. I. (2004). Women with high scores for cognitive dietary restraint choose foods lower in fat and energy. *Journal of the American Dietetic Association, 104,* 1154-1157.

Rinck, M. & Becker, E. S. (2007). Approach and avoidance in fear of spiders. *Journal of Behavior Therapy and Experimental Psychiatry, 38,* 105-120.

Roddy, S., Stewart, I., & Barnes-Holmes, D. (2009). Anti-fat, pro-slim, or both? Using two reaction-time based measures to assess implicit attitudes to the slim and overweight. *Journal of Health Psychology, 15,* 416-425.

Roefs, A., Herman, C. P., MacLeod, C. M., Smulders, F. T. Y., & Jansen, A. (2005). At first sight: how do restrained eaters evaluate high-fat palatable foods? *Appetite, 44,* 103-114.

Roefs, A. & Jansen, A. (2002). Implicit and explicit attitudes towards high-fat foods in obesity. *Journal of Abnormal Psychology, 111,* 517-521.

Roefs, A., Stapert, D., Isabella, L. A. S., Wolters, G., Wojciechowski, F., & Jansen, A. (2005). Early associations with food in anorexia nervosa patients and obese people assessed in the affective priming paradigm. *Eating Behaviors, 6,* 151-163.

Roinnen, K., Lähteenmäki, L., & Tuorila, H. (1999). Qualification of consumer attitudes to health and hedonic characteristics of food. *Appetite, 33,* 71-88.

Roos, E., Lahelma, E., Virtanen, M., Prättälä, R., & Pietinen, P. (1998). Gender, socioeconomic status and family status as determinants of food behaviour. *Social Science and Medicine, 46,* 1519-1529.

Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press.

Rosenberg, M., Schooler, C., & Schoenbach, C. (1989). Self-esteem and adolescent problems: modeling reciprocal effects. *American Sociological Review, 54,* 1004-1018.

Rosenberg, M., Schooler, C., Schoenbach, C., & Rosenberg, F. (1995). Global self-esteem and specific self-esteem: Different concepts, different outcomes. *American Sociological Review, 60,* 141-156.

Ross, M. & Wade, T. D. (2004). Shape and weight concern and self-esteem as mediators of externalized self-perception, dietary restraint and uncontrolled eating. *European Eating Disorders Review, 12,* 129-136.

Roth, M., Decker, O., Herzberg, P. Y., & Brähler, E. (2008). Dimensionality and norms of the Rosenberg Self-Esteem Scale in a German general population sample. *European Journal of Psychological Assessment, 24,* 190-197.

Rothermund, K. & Wentura, D. (2001). Figure-ground asummetries in the Implicit Association Test (IAT). *Experimental Psychology, 48,* 94-106.

Rothermund, K., Wentura, D., & De Houwer, J. (2005). Validity of the salience asymmetry account of the Implicit Association Test: Reply to Greenwald, Nosek, Banaji, and Klauer (2005). *Journal of Experimental Psychology: General, 134,* 426-430.

Rothermund, K. & Wentura, D. (2004). Underlying processes in the Implicit Association Test: Dissociating salience from associations. *Experimental Psychology, 133,* 139-165.

Rozin, P. (2005). The maning of food in our lives: A cross-cultural perspective on eating and well-being. *Journal of Nutrition Education and Behavior, 37,* 107-112.

Rozin, P. & Fallon, A. (1988). Body image, attitudes to weight, and misperceptions of figure preferences of the opposite sex: A comparison of men and women in two generations. *Journal of Abnormal Psychology, 97,* 342-345.

Ruderman, A. J. (1986). Dietary restraint: A theoretical and empirical review. *Psychological Bulletin, 99,* 247-262.

Ruderman, A. J. & Christensen, H. (1983). Restraint Theory and its applicability to overweight individuals. *Journal of Abnormal Psychology, 92,* 210-215.

Rudman, L. A. (2004). Sources of implicit attitudes. *Current Directions in Psychological Science,* 79-82.

Rudman, L. A., Dohn, M. C., & Fairchild, K. (2007). Implicit self-esteem compensation: Automatic threat defense. *Journal of Personality and Social Psychology, 93,* 798-813.

Rydell, R. J., McConnell, A. R., & Mackie, D. M. (2008). Consequences of discrepant explicit and implicit attitudes: Cognitive dissonance and increased information processing. *Journal of Experimental Social Psychology, 44,* 1526-1532.

Salancik, G. R. & Conway, M. (1975). Attitude inferences from salient and relevant cognitive content about behavior. *Journal of Personality and Social Psychology, 32,* 829-840.

Schafer, J. L. & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods, 7,* 147-177.

Schmitt, D. P. & Allik, J. (2005). Simultaneous administration of the Rosenberg Self-esteem Scale in 53 nations: Exploring the universal and culture-specific features of global self-esteem. *Journal of Personality and Social Psychology, 89,* 623-642.

Schneider, D. J. & Turket, D. (1975). Self-presentation following success or failure: Defensive self-esteem models. *Journal of Personality, 43,* 127-135.

Schröder-Abé, M., Rudolph, A., & Schütz, A. (2007). High implicit self-esteem is not necessarily advantageous: discrepancies between explicit and implicit self-esteem and their relationship with anger expression and psychological health. *European Journal of Personality, 21,* 319-339.

Schwarz, N. & Clore, G. L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *Journal of Personality and Social Psychology, 45,* 513-523.

Schwarz, N. & Strack, F. (1991). Context effects in attitude surveys: Applying cognitive theory to social research. *European Review of Social Psychology, 2,* 31-50.

Schwitzgebel, E. (2008). The unreliability of naive introspection. *Philosophical Review, 117,* 245-273.

Seibt, B., Häfner, M., & Deutsch, R. (2007). Prepared to eat: How immediate affective and motivational responses to food cues are influenced by food deprivation. *European Journal of Social Psychology, 37,* 359-379.

Seibt, B., Neumann, R., Nussinson, R., & Strack, F. (2008). Movement direction or change in distance? Self- and object-related approach-avoidance motions. *Journal of Experimental Social Psychology, 44,* 713-720.

Sen, A. K. (1977). Rational fools: A critique of the behavioral foundations of economic theory. *Philosophy and Public Affairs, 6,* 317-344.

Serdula, M. K., Mokdad, A. H., Williamson, D. F., Galuska, D. A., Mendlein, J. M., & Heath, G. W. (1999). Prevalence of attempting weight loss and strategies for controlling weight. *Journal of the American Medical Association, 282,* 1353-1358.

Serpell, L., Neiderman, M., Roberts, V., & Lask, B. (2007). The shape and weight based self-esteem inventory (SAWBS) in adolescent girls with eating disorders and adolescent controls. *Psychotherapy Research, 17,* 321-327.

Serpell, L., Waller, G., Fearon, P., & Meyer, C. (2009). The roles of persistence and perseveration in psychopathology. *Behavior Therapy, 40,* 260-271.

Shanks, D. R. & St John, M. F. (1994). Characteristics of dissociable human learning systems. *Behavioral and Brain Sciences, 17,* 367-447.

Sherman, S. J., Rose, J. S., Koch, K., Presson, C. C., & Chassin, L. (2003). Implicit and explicit attitudes toward cigarette smoking: The effects of context and motivation. *Journal of Social and Clinical Psychology, 22,* 13-39.

Shiiya, T., Nakazato, M., Mizuta, M., Date, Y., Mondal, M. S., Tanaka, M. et al. (2002). *The Journal of Clinical Endocrinology & Metabolism, 87,* 240-244.

Simon, J. R. & Rudell, A. P. (1967). Auditory SR compatibility: the effect of an irrelevant cue on information processing. *The Journal of Applied Psychology, 51,* 300.

Simon, Y., Bellisle, F., Monneuse, M. O., Samuel-Lajeunesse, B., & Drewnowski, A. (1993). Taste responsiveness in anorexia nervosa. *The British Journal of Psychiatry, 162,* 244-246.

Smith, E. R. (1996). What do connectionism and social psychology offer each other? *Journal of Personality and Social Psychology, 70,* 912.

Smith, E. R. & DeCoster, J. (2000). Dual-process models in social and cognitive psychology: Conceptual integration and links to underlying memory systems. *Personality and Social Psychology Review, 4,* 108-131.

Sobal, J. & Stunkard, A. J. (1989). Socioeconomic status and obesity: A review of the literature. *Psychological Bulletin, 105,* 260-275.

Solarz, A. K. (1960). Latency of instrumental responses as a function of compatibility with the meaning of eliciting verbal signs. *Journal of Experimental Psychology, 59,* 245.

Spalding, L. R. & Hardin, C. D. (1999). Unconscious unease and self-handicapping: Behavioral consequences of individual differences in implicit and explicit self-esteem. *Psychological Science, 10,* 535-539.

Spencer, S. J., Jordan, C. H., Logel, C. E. R., & Zanna, M. P. (2005). Nagging doubts and a glimmer of hope: The role of implicit self-esteem in self-image maintenance. In A.Tesser, J. V. Wood, & D. A. Stapel (Eds.), *On building, defending and regulating the self: A psychological perspective* (pp. 153-170). New York: Psychology Press.

Sritharan, R. & Gawronski, B. (2010). Changing implicit and explicit prejudice: Insights from the Associative-Propositional Evaluation model. *Social Psychology, 41,* 113-123.

Stangor, C., Sullivan, L. A., & Ford, T. E. (1991). Affective and cognitive determinants of prejudice. *Social Cognition, 9,* 359-380.

Steele, C. M. (1988). The psychology of self-affirmation: Sustaining the integrity of the self. In L.Berkowitz (Ed.), *Advances in Experimental Social Psychology* (Vol. 21 ed., pp. 261-299). London: Academic Press.

Steffens, M. C. (2004). Is the Implicit Association Test immune to faking? *Experimental Psychology, 51,* 165-179.

Steptoe, A., Pollard, T. M., & Wardle, J. (1995). Development of a measure of the motives underlying the selection of food: the Food Choice Questionnaire. *Appetite, 25,* 284.

Stice, E., Cooper, J. A., Schoeller, D. A., Tappe, K., & Lowe, M. R. (2007). Are dietary restraint scales valid measures of moderate-to long-term dietary restriction? Objective biological and behavioral data suggest not. *Psychological Assessment, 19,* 449-458.

Stice, E., Fisher, M., & Lowe, M. R. (2004). Are dietary restraint scales valid measures of acute dietary restriction? Unobtrusive observational data suggest not. *Psychological Assessment, 16,* 51-59.

Stice, E. & Shaw, H. E. (2002). Role of body dissatisfaction in the onset and maintenance of eating pathology: A synthesis of research findings. *Journal of Psychosomatic Research, 53,* 985-993.

Stice, E., Sysko, R., Roberto, C. A., & Allison, S. (2010). Are dietary restraint scales valid measures of dietary restriction? Additional objective behavioral and biological data suggest not. *Appetite, 54,* 331-339.

Stice, E., Hayward, C., Cameron, R. P., Killen, J. D., & Taylor, C. B. (2000). Body-image and eating disturbances predict onset of depression among female adolescents: A longitudinal study. *Journal of Abnormal Psychology, 109,* 438-444.

Stotland, E., Thorley, S., Thomas, E., Cohen, A. R., & Zander, A. (1957). The effects of group expectations and self-esteem upon self-evaluation. *Journal of Abnormal and Social Psychology, 54,* 55-63.

Strack, F. & Deutsch, R. (2004). Reflective and Impulsive Determinants of Social Behavior. *Personality and Social Psychology Review, 8,* 220-247.

Striegel-Moore, R. H., Silberstein, L. R., & Rodin, J. (1986). Toward and understanding of risk factors for bulimia. *American Psychologist, 41,* 246-263.

Stroebe, W. (2008). Restrained eating and the breakdown of self-regulation. In W.Stroebe (Ed.), *Restrained eating and the breakdown of self-regulation* (pp. 115-139). Washington, DC: American Psychological Association.

Stroebe, W., Mensink, W., Aarts, H., Schut, H., & Kruglanski, A. W. (2008). Why dieters fail: Testing the goal conflict model of eating. *Journal of Experimental Social Psychology, 44,* 26-36.

Stromer, S. M. & Thompson, J. K. (1996). Explanations of body image disturbance: A test of maturational status, negative verbal commentary, social comparison, and sociocultural hypotheses. *International Journal of Eating Disorders, 19,* 193-202.

Stroop, J. R. (1935). Studies of interference in serail verbal reactions. *Journal of Experimental Psychology, 18,* 643-662.

Stunkard, A. J. & Messick, S. (1985). The three-factor eating questionnaire to measure dietary restraint, disinhibition and hunger. *Journal of Psychosomatic Research, 29,* 71-83.

Sutandar-Pinnock, K., Woodside, D. B., Carter, J. C., Olmsted, M. P., & Kaplan, A. S. (2003). Perfectionism in anorexia nervosa: A 6-24-month follow-up study. *International Journal of Eating Disorders, 33,* 225-229.

Svaldi, J., Zimmermann, S., & Naumann, E. (2012). The impact of an implicit manipulation of self-esteem on body dissatisfaction. *Journal of Behavior Therapy and Experimental Psychiatry, 43,* 581-586.

Tafarodi, R. W. & Swann, W. B. Jr. (1995). Self-liking and self-competence as dimensions of global self-esteem: Initial validation of a measure. *Journal of Personality Assessment, 65,* 322-342.

Taylor, S. E. & Brown, J. D. (1988). Illusion and well-being: A social psychological perspective on mental health. *Psychological Bulletin, 116,* 193-210.

Teige, S., Schnabel, K., Banse, R., & Asendorpf, J. B. (2004). Assessment of multiple implicit self-concept dimensions using the Extrinsic Affective Simon Task (EAST). *European Journal of Personality, 18,* 495-520.

Teige-Mocigemba, S., Klauer, K. C., & Rothermund, K. (2008). Minimizing method-specific variance in the IAT. *European Journal of Psychological Assessment, 24,* 237-245.

Thompson, M. M., Zanna, M. P., & Griffin, D. W. (1995). Let's not be indifferent about (attitudinal) ambivalence. In R.E.Petty & J. A. Krosnick (Eds.), *Attitude strength: Antecedents and consequences.* (pp. 361-386). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Tiggemann, M. (1994). Gender differences in the interrelationships between weight dissatifaction, restraint, and self-esteem. *Sex Roles, 30,* 319-330.

Tiggemann, M. (2005). Body dissatisfaction and adolescent self-esteem: Prospective findings. *Body Image, 2,* 129-135.

Tiggemann, M. & McGill, B. (2004). The role of social comparison in the effect of magazine advertisements on women's mood and body dissatisfaction. *Journal of Social and Clinical Psychology, 23,* 23-44.

Tourangeau, R., Rasinski, K. A., & Bradburn, N. (1989). Belief accessibility and context effects in attitude measurement. *Journal of Experimental Social Psychology, 25,* 401-421.

Troop, N. A., Allan, S., Treasure, J., & Katzman, M. (2003). Social comparison and submissive behaviour in eating disorder patients. *Psychology and Psychotherapy: Theory, Research and Practice, 76,* 237-249.

Trzesniewski, K. H., Donnellan, M. B., & Robins, R. W. (2003). Stability of self-esteem across the life span. *Journal of Personality and Social Psychology, 84,* 205-220.

Tuschl, R. J., Laessle, R. G., Platte, P., & Pirke, K. M. (1990). Differences in food-choice frequencies between restrained and unrestrained eaters. *Appetite, 14,* 9-13.

Twenge, J. M., Baumeister, R. F., Tice, D. M., & Stucke, T. S. (2001). If you can't join them, beat them: Effects of social exclusion on aggressive behavior. *Journal of Personality and Social Psychology, 81,* 1058-1069.

Uhlmann, E., Dasgupta, N., Elgueta, A., Greenwald, A. G., & Swanson, J. (2002). Subgroup prejudice based on skin color among hispanics in the United States and Latin America. *Social Cognition, 20,* 198-225.

Urland, G. R. & Ito, T. A. (2005). Have Your Cake and Hate It, Too: Ambivalent Food Attitudes Are Associated With Dietary Restraint. *Basic and Applied Social Psychology, 27,* 343-360.

van Strien, T. (1997). The concurrent validity of a classification of dieters with low versus high susceptibility toward failure of restraint. *Addictive Behaviors, 22,* 587-597.

van Strien, T., Frijters, J. E. R., Bergers, G. P. A., & Defares, P. B. (1986). The Dutch Eating Behavior Questionnaire (DEBQ) for assessment of restrained, emotional and external eating behavior. *International Journal of Eating Disorders, 5,* 295-315.

van Strien, T., Herman, C. P., Engels, R. C. M. E., Larsen, J. K., & van Leeuwe, J. F. J. (2007). Construct validation of the restraint scale in normal-weight and overweight females. *Appetite, 49,* 109-121.

Van Tongeren, D. R., Green, J. D., Davis, D. E., Worthington, E. L., & Reid, C. A. (2013). Till death do us part: Terror management and forgiveness in close relationships. *Personal Relationships*.

Vancleef, L. M., Gilissen, S. M., & de Jong, P. J. (2007). Understanding the role of injury/illness sensitivity in (automatic) pain processing: an examination using the Extrinsic Affective Simon Task. *Journal of Pain, 8,* 563-572.

Vanderlinden, J., Kamphuis, J. H., Slagmolen, C., Wigboldus, D., Pieters, G., & Probst, M. (2009). Be kind to your eating disorder patients: the impact of positive and negative feedback on the explicit and implicit self-esteem of female patients with eating disorders. *Eating and Weight Disorders, 14,* 237-242.

VanderZee, K. I., Buunk, B. P., & Sanderman, R. (1995). Social comparison as a mediator between health problems and subjective health evaluations. *British Journal of Social Psychology, 34,* 53-65.

Vanman, E. J., Saltz, J. L., Natahan, L. R., & Warren, J. A. (2004). Racial discrimination by low-prejudiced whites: Facial movements as implicit measures of attitudes related to behavior. *Psychologica Belgica, 15,* 711-714.

Vartanian, L. R., Polivy, J., & Herman, C. P. (2004). Implicit cognitions and eating disorders: Their application in research and treatment. *Cognitive and Behavioral Practice, 11,* 160-167.

Veenstra, E. M. & de Jong, P. J. (2010). Restrained eaters show enhanced automatic approach tendencies towards food. *Appetite, 55,* 30-36.

Veenstra, E. M. & de Jong, P. J. (2011). Reduced automatic motivational orientation towards food in restricting anorexia nervosa. *Journal of Abnormal Psychology,* 708-718.

Vermeulen, N., Corneille, O., & Luminet, O. (2007). A mood moderation of the Extrinsic Affective Simon Task. *European Journal of Personality, 21,* 359-369.

Vitousek, K. B., Daly, J., & Heiser, C. (1991). Reconstructing the internal world of the eating-disordered individual: Overcoming denial and distortion in self-report. *International Journal of Eating Disorders, 10,* 647-666.

Vohs, K. D., Bardone, A. M., Joiner, T. E., & Abramson, L. Y. (1999). Perfectionism, perceived weight status, and self-esteem interact to predict bulimic symptoms: A model of bulimic symptom development. *Journal of Abnormal Psychology, 108,* 695-700.

Vohs, K. D. & Heatherton, T. F. (2000). Self-regulatory failure: A resource-depletion approach. *Psychological Science, 11,* 249-254.

Wade, T. C. & Lowes, J. (2002). Variables associated with disturbed eating habits and overvalued ideas about the personal implications of body shape and weigh in a female adolescent population. *International Journal of Eating Disorders, 32,* 39-45.

Wallace, H. M. & Baumeister, R. F. (2002). The effects of success versus failure feedback on further self-control. *Self and Identity, 1,* 35-41.

Waller, G., Shaw, T., Meyer, C., Haslam, M., Lawson, R., & Serpell, L. (2012). Persistence, perseveration and perfectionism in the eating disorders. *Behavioural and Cognitive Psychotherapy, 40,* 462-473.

Wardle, J. (1987). Eating style: A validation study of the Dutch Eating Behaviour Questionnaire in normal subjects and women with eating disorders. *Journal of Psychosomatic Research, 31,* 161-169.

Webb, T. L. & Sheeran, P. (2003). Can implementation intentions help to overcome ego-depletion? *Journal of Experimental Social Psychology, 39,* 279-286.

Weise, D. R., Arciszewski, T., Verlhiac, J.-F., & Pyszczynski, T. (2012). Terror management and attitudes towards immigrants: Differential effects of mortality salience for low and high right-wing authoritarians. *European Psychologist, 17,* 63-72.

Welch, S. L. & Fairburn, C. G. (1996). Impulsivity or comorbidity in bulimia nervosa: A controlled study of deliberate self-harm and alcohol and drug misuse in a community sample. *British Journal of Psychiatry, 169,* 451-458.

Wentura, D., Kulfanek, M., & Greve, W. (2005). Masked affective priming by name letters: Evidence for a correspondence of explicit and implicit self-esteem. *Journal of Experimental Social Psychology, 41,* 654-663.

Wesolowki, M. D. & Deichman, J. (1980). Physiological activity and attitudes towards disabled persons. *Rehabilitation Counseling Bulletin, 23,* 218-226.

Westenhoefer, J. (1991). Dietary restraint and disinhibition: Is restraint a homogenous construct? *Appetite, 16,* 45-55.

Westenhoefer, J., Broeckmann, P., Münch, A. K., & Prudel, V. (1994). Cognitive control of eating behavior and the disinhibition effect. *Appetite, 23,* 27-41.

Whalen, P. J., Rauch, S. L., Etcoff, N. L., McInerney, S. C., Lee, M. B., & Jenike, M. A. (1998). Masked presentations of emotional facial expressions modulate amygdala activity without explicit knowledge. *The Journal of Neuroscience, 18,* 411-418.

White, H. J., Haycraft, E., Goodwin, H., & Meyer, C. (2014). Eating Disorder Examination Questionnaire: Factor Structure for Adolescent Girls and Boys. *International Journal of Eating Disorders, 47,* 99-104.

Whiteside, S. P., Lynam, D. R., Miller, J. D., & Reynolds, S. K. (2005). Validation of the UPPS Impulsive Behaviour Scale: A four-factor model of impulsivity. *European Journal of Personality, 19,* 559-574.

Wilksch, S. & Wade, T. D. (2004). Differences between women with anorexia nervosa and restrained eaters on shape and weight concerns, self-esteem, and depression. *International Journal of Eating Disorders, 35,* 571-578.

Wills, T. A. (1981). Downward comparison principles in social psychology. *Psychological Bulletin, 90,* 245-271.

Wilson, T. D., Lindsey, S., & Schooler, T. Y. (2000). A model of dual attitudes. *Psychological Review, 107,* 101-126.

Wood, A., Waller, G., Miller, J., & Slade, P. (1992). The development of eating attitude test scores in adolescence. *International Journal of Eating Disorders, 11,* 279-282.

Wright, R. A., Stewart, C. C., & Barnett, B. R. (2008). Mental fatigue influence on effort-related cardiovascular response: Extension across the regulatory (inhibitory)/non-regulatory performance dimension. *International Journal of Psychophysiology, 69,* 127-133.

Yamaguchi, S., Greenwald, A. G., Banaji, M. R., Murakami, F., Chen, D., Siomura, K. et al. (2007). Apparent universality of positive implicit self-esteem. *Psychologial Science, 18,* 498-500.

Yanovski, S. (2003). Sugar and fat:Cravings and aversions. *Journal of Nutrition, 133,* 8355-8375.

Yeomans, M. R., Leitch, M., & Mobini, S. (2008). Impulsivity is associated with the disinhibition but not restraint factor from the Three Factor Eating Questionnaire. *Appetite, 50,* 469-476.

Zajonc, R. B. (1980). Feeling and thinking: Preferences need no inferences. *American Psychologist, 35,* 151-175.

Zajonc, R. B. (1984). On the primacy of affect. *American Psychologist, 39,* 117-123.

Zald, D. H. (2003). The human amygdala and the emotional evaluation of sensory stimuli. *Brain Research Reviews, 41,* 88-123.

Zeigler-Hill, V. & Terry, C. (2007). Perfectionism and explicit self-esteem: The moderating role of implicit self-esteem. *Self and Identity, 6,* 137-153.

Zelazo, P. D., Carlson, S. M., & Kesek, A. (2008). Development of executive function in childhood. In C.A.Nelson & M. Luciana (Eds.), *Handbook of developmental cognitive neuroscience* (2nd edition ed., pp. 553-574). Cambridge, MA: MIT Press.

Glossary of terms

AAT	Approach Avoidance Task
AN	Anorexia nervosa
APE	Associative-Propositional Evaluation
AST	Affective Simon Task
BED	Binge Eating Disorder
BN	Bulimia nervosa
DEBQ	Dutch Eating Behaviour Questionnaire
D-IRAP	An algorithm for calculating performance on the IRAP
DTS	Differential task-switching
EAST	Extrinsic Affective Simon Task
ED	Eating disorder
EDE-Q	Eating Disorder Examination Questionnaire
EDNOS	Eating Disorder Not Otherwise Specified
EFAQ	Explicit food attitudes questionnaire (Study 2)
HCS	Hunger and craving scale (Study 2)
IAT	Implicit Association Test
IAT-D	An algorithm for calculating performance on the IAT
IR	Iterative Reprocessing
IRAP	Implicit Relational Assessment Procedure
MODE	Motivation and Opportunity as Determinants of Behaviour
MPS	Multidimensional Perfectionism Scale
NLE	Name Letter Effect
NLT	Name Letter Test
PFC	Prefrontal cortex
PPPQ	Persistence, Perseveration and Perfectionism Questionnaire
RE	Restrained eater
REC	Relational Elaboration and Coherence
REP	Relational Evaluation Procedure
RSES	Rosenberg Self-Esteem Scale
SAWBS	Shape- and Weight-based Self-esteem
SC-IAT	Single-category Implicit Association Test
SE-IAT	Self-esteem Implicit Association Test
TFEQ	Three Factor Eating Questionnaire
TMT	Terror Management Theory
unRE	Unrestrained eater
UPPS-P	Urgency, Premeditation, Perseverance and Sensation seeking Impulsivity Scale

Appendices

Appendix I: Study 1 information sheet

Information Sheet

You will be given a copy of this information sheet.

Title of the Project: Implicit cognition and eating behaviours

This study has been approved by the UCL Research Ethics Committee CEHP/2010A/018

Researcher contact details:

Alisa Anokhina
1-19 Torrington Place
London WC1E 7HB
e-mail: alisa.anokhina.10@ucl.ac.uk
tel.: 0207 679 8275

Lucy Serpell
1-19 Torrington Place
London WC1E 7HB
e-mail: l.serpell@ucl.ac.uk
tel.: 0207 679 8275

We would like to invite you to participate in this research project. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, it is important for you to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or you would like more information.

The purpose of this study is to look at the relationship between people's beliefs and their eating behaviours. By studying these patterns we hope to better understand how eating disorders can develop and how people with eating disorders can be better helped.

The study should take no more than half an hour. You will be asked to complete a computerised task and to fill in some questionnaires. Some of the questions are related to your eating habits and the beliefs you have about eating and weight. Your responses are completely confidential and your responses will be identified only by a participant number which, after the completion of the study, will not be connected to you in any way. It will be helpful if you can complete the questionnaires in full, however, if you feel uncomfortable answering any of the questions, you are not required to give a response.

Finally, we will ask to take your measurements (height and weight).

It is up to you to decide whether or not to take part. If you choose not to participate it will involve no penalty or loss of benefits to which you are otherwise entitled. If you decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason.

All data will be collected and stored in accordance with the Data Protection Act 1998.

Appendix I: Study 1 informed consent form

Participant _____

Informed Consent Form

Title of the Project: Implicit cognition and eating behaviours

This study has been approved by the UCL Research Ethics Committee CEHP/2010A/018

Participant's Statement:

I, _____

agree that I have

- **read the information sheet and/or the project has been explained to me orally;**
- **had the opportunity to ask questions and discuss the study;**
- **received satisfactory answers to all my questions or have been advised of an individual to contact for answers to pertinent questions about the research and my rights as a participant and whom to contact in the event of a research-related injury.**

I understand that I am free to withdraw from the study without penalty if I so wish and I consent to the processing of my personal information for the purposes of this study only and that it will not be used for any other purpose. I understand that such information will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998.

Signed: Date:

_____ _____

Investigator's Statement:

I, _____

confirm that I have carefully explained the purpose of the study to the participant and outlined any reasonably foreseeable risks or benefits (where applicable).

Signed: Date:

_____ _____

Appendix I: Study debrief sheet

Debrief Sheet

You will be given a copy of this debriefing sheet.

Title of the Project: Implicit cognition and eating behaviours

This study has been approved by the UCL Research Ethics Committee CEHP/2010A/018

The purpose of study was to find the way self-esteem, perfectionism and eating behaviour are related. Some studies show that eating disorder symptomatology (such as chronic dieting) is related to "discrepant self-esteem": reflective feelings of low self-worth (measured using a questionnaire) coupled with intuitive feelings of positive self-worth (measured using the computer task). Research also suggests that discrepant self-esteem is also related to high perfectionism, which tends to be elevated in disordered eating. We are trying to explain these associations and untangle the relationship between these three components.

If you are worried about your eating behaviour, your relationship with food or have any concerns about your body image, you should contact your GP. Alternatively, you can contact Beat, a UK-based eating disorders charity. Their website (www.b-eat.co.uk) contains information about eating disorders and getting help for yourself or anyone you might be concerned about. Their helpline number is 0845 634 1414. You can also email help@b-eat.co.uk

If you would like to contact the researchers, please email Alisa Anokhina on alisa.anokhina.10@ucl.ac.uk or call 02076798275.

Thank you for taking part!

Appendix I: Study 1 demographic questionnaire

Participant _____

Demographic questionnaire

Age: _____

Ethnicity:

White	☐
Asian or Asian British	☐
Black or Black British	☐
Mixed	☐
Chinese	☐
Other _____	

Nationality: _____

Have you ever been diagnosed with an eating disorder?

Yes ☐ No ☐ Prefer not to say ☐

If yes, which?

Anorexia nervosa	☐
Bulimia nervosa	☐
EDNOS	☐
Binge Eating Disorder	☐
Other _____	

When were you diagnosed?

_____

Height: _____

Weight: _____

BMI: _____

Appendix II: Study 2 information sheet

Information Sheet for Participants in Research Studies

You may request a copy of this information sheet.

"Personality, food attitudes and eating disorders"
This study has been approved by the UCL Research Ethics Committee as Project ID Number: CEHP/2011/039

Alisa Anokhina
1-19 Torrington Place
London WC1E 7HB
alisa.anokhina.10@ucl.ac.uk
020 7679 8275

Lucy Serpell
1-19 Torrington Place
London WC1E 7HB
lucy@serpell.com
020 7679 1256

We would like to invite you to participate in a research project. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, please read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or you would like more information.

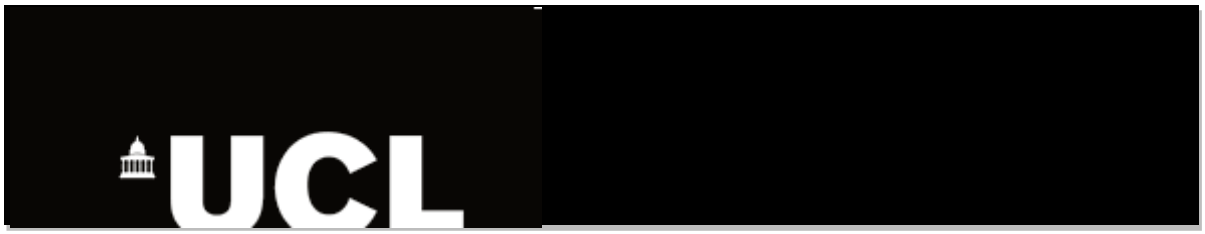
The aim of the study is to assess people's eating habits and beliefs about food and eating. You will be asked to come in for two sessions, approximately one week apart. In each session you will be asked to fill out some questionnaires about your eating habits and attitudes towards different foods, work on a puzzle and complete a computer task where you will be asked to respond to different food words. Each session should last under 30 minutes.

It is up to you to decide whether or not to take part. If you choose not to participate, you won't incur any penalties or lose any benefits to which you might have been entitled. However, if you do decide to take part, you will be given this information sheet to keep and asked to sign a consent form. Even after agreeing to take part, you can still withdraw at any time and without giving a reason.

Please note that, for precautionary reasons, you are not eligible to take part in the study if you are allergic to nuts.

All data will be collected and stored in accordance with the Data Protection Act 1998.

Appendix II: Study 2 informed consent form



Consent Form for Participants in Research Studies

"Personality, food attitudes and eating disorders"
This study has been approved by the UCL Research Ethics Committee as Project ID Number: CEHP/2011/039

Participant's Statement

I, _____
agree that I have

read the information sheet and/or the project has been explained to me verbally;
had the opportunity to ask questions and discuss the study; and
received satisfactory answers to all my questions or have been advised of an individual to contact for answers to pertinent questions about the research and my rights as a participant and whom to contact in the event of a research-related injury.

I understand that I am free to withdraw from the study without penalty if I so wish, and I consent to the processing of my personal information for the purposes of this study only and that it will not be used for any other purpose. I understand that such information will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998.

I understand that the information I have submitted will be published as a report and I will be sent a copy. Confidentiality and anonymity will be maintained, and it will not be possible to identify me from any publications.
I understand that if I am being paid for my assistance in this research some of my personal details will be passed to UCL Finance for administration purposes.

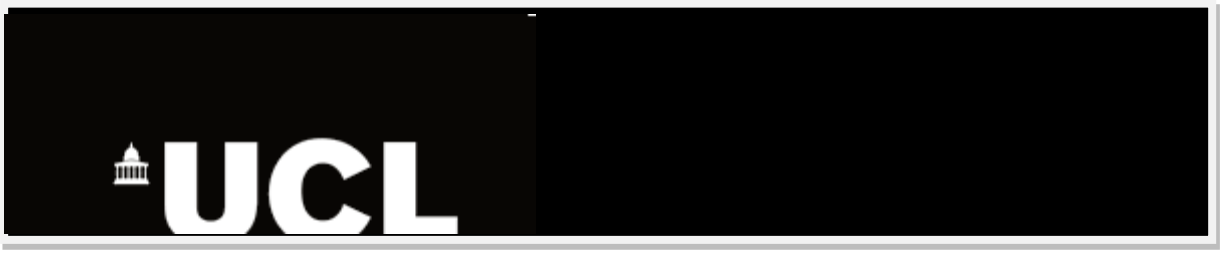
Signed: _____ Date: _____

Investigator's Statement

I, _____
confirm that I have carefully explained the purpose of the study to the participant and outlined any reasonably foreseeable risks or benefits (where applicable).

Signed: _____ Date: _____

Appendix II: Study 2 debrief sheet



12.12.2011 **version 1**

Participant Debrief Sheet

"Personality, food attitudes and eating disorders"

Thank you for taking part in our research. The aim of our study is to understand better why some people develop eating disorders and why different people develop different symptoms. The two key psychological concepts we are looking at are a) ego depletion and b) implicit food attitudes.

Ego depletion refers to the fact that our self-control is limited. Research shows that if you "use up" self-control doing something, you will then be less able to exercise self-control afterwards. When a person is "tired" from using self-control, they are said to be in a state of ego depletion. This can explain why diets often fail: the more self-control a person uses up, the more difficult it becomes to continue using it. In this study, we manipulated ego depletion using plates of tempting (cookies) and not very tempting (radishes) foods and an unsolvable puzzle task. Presumably, not eating a cookie uses up more self-control than not eating a radish – so our participants would be more ego depleted in the cookie session than in the radish session. The puzzle is another self-control task, since it's quite boring and requires perseverance. The amount of time participants spent on the puzzle task was a measure of how ego depleted they were: the more self-control they used up earlier in the session, the less they should have persevered.

We measured ego depletion because it could explain behavioural differences between people with anorexia and bulimia and people who do not have an eating disorder. We are interested in whether resisting eating food depletes people with anorexia less, and people with bulimia more, than people without eating disorders. If so, this can partially explain differences in eating behaviour between them.

A second thing we were interested in measuring were implicit attitudes towards food. Implicit attitudes are similar to intuition; they are emotional responses we automatically generate towards different stimuli, such as different food types. Most people have more positive implicit associations with high-fat, calorie-dense foods (like desserts) than low-fat, calorie-sparse ones (like vegetables). However, some studies have suggested that people with anorexia don't have implicit preferences one way or the other. Because people tend to act on their impulsive, rather than rational, beliefs in a state of ego depletion, this might explain why people with anorexia can restrict their intake.

If you have any further questions about the study, please contact Alisa Anokhina (alisa.anokhina.10@ucl.ac.uk). If you have any questions about eating disorders or would like to seek further help, contact the beat helpline on 0845 634 1414 (if over 18) or 0845 634 7650 (if 25 or under).

Appendix II: Study 2 demographic questionnaire for session 1

Study 2 **Participant _____**

Demographic questionnaire (session 1)

Age	
Which language do you speak most comfortably/fluently?	
Ethnicity	White ☐ Chinese ☐ Asian or Asian British ☐ Black or Black British ☐ Mixed ☐ Other _____
When was the last time you ate?	
Height (your best guess if you don't know)	
Weight (your best guess if you don't know)	

Appendix II: Study 2 demographic questionnaire for session 2

Study 2 **Participant _____**

Demographic questionnaire (session 2)

Nationality	
When was the last time you ate?	
Have you ever been diagnosed with an eating disorder?	Yes ☐ No ☐ Prefer not to say ☐
If yes, which?	Anorexia nervosa ☐ Bulimia nervosa ☐ EDNOS ☐ Binge Eating Disorder ☐ Prefer not to say ☐ Other _____
If yes, when were you diagnosed?	

Appendix II: Study 2 explicit food attitudes questionnaire (EFAQ)

Study 2 **Participant _____**

Food Attitudes Questionnaire

Please read the food names below. For each food type, please rate how much you **like its taste**. Some of the foods listed come in different varieties: in those cases, **rate the first variety that springs to mind.**

Beetroot	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Brownie	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Cabbage	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Celery	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Cookie	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Crêpe	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Pie	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Radish	Do you know what this food tastes like? □ Yes □ No

	If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Turnip	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much

Next, please rate how strongly you feel **overall** about the **positive** and **negative** aspects of each food (including taste, texture, nutritional content, etc.) For example, if you really like the taste of beetroot but really dislike its texture you might give a rating of '5' for both positive and negative aspects.

Beetroot	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Brownie	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Cabbage	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Celery	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Cookie	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Crêpe	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Pie	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Radish	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Turnip	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative

Appendix II: Study 2 Hunger and craving scale (HCS)

Study 2 **Participant ____ / Cond. ____**

Hunger and craving scale

Please read the statements below and circle the number on the scale which best describes how you feel right now.

How hungry do you feel right now?

Not at all 1 - 2 - 3 - 4 - 5 Very much so

How much are you craving a radish right now?

Not at all 1 - 2 - 3 - 4 - 5 Very much so

How much are you craving an apple right now?

Not at all 1 - 2 - 3 - 4 - 5 Very much so

How much are you craving a cookie right now?

Not at all 1 - 2 - 3 - 4 - 5 Very much so

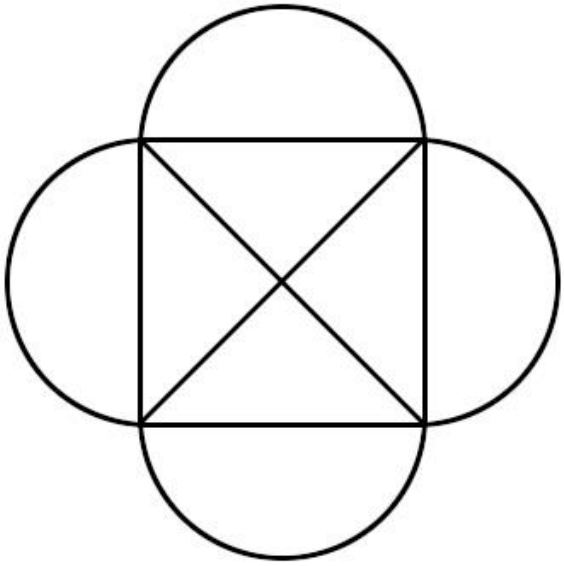
How much are you craving pasta right now?

Not at all 1 - 2 - 3 - 4 - 5 Very much so

Appendix II: Study 2 figures used in the ego depletion procedure

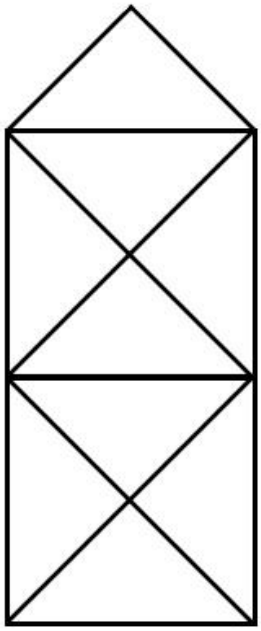
Puzzle task A

Try to draw the figure below without drawing over the same line twice or taking your pen off the paper. You are not allowed to bend or fold the paper, or use any other materials. You can have as many tries as you want, for as long as you want. Use the back of the page if you run out of space.



Puzzle task B

Try to draw the figure below without drawing over the same line twice or taking your pen off the paper. You are not allowed to bend or fold the paper, or use any other materials. You can have as many tries as you want, for as long as you want. Use the back of the page if you run out of space.



Appendix III: Version 2 of the ego depletion procedure, information sheet

Information Sheet for Participants in Research Studies

You may request a copy of this information sheet.

"Sensory food perceptions and cognitive flexibility"

This study has been approved by the UCL Research Ethics Committee as Project ID Number: CEHP/2011/039

Alisa Anokhina
1-19 Torrington Place
London WC1E 7HB
alisa.anokhina.10@ucl.ac.uk
020 7679 8275

Lucy Serpell
1-19 Torrington Place
London WC1E 7HB
lucy@serpell.com
020 7679 1256

We would like to invite you to participate in a research project. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, please read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or you would like more information.

We are interested in how people evaluate the non-taste properties of food. You will be asked to attend two sessions, approximately a week apart, each one lasting approximately 15 minutes. In each session you will be asked to give you opinion about different aspects (e.g., smell, texture, etc.) of different foods. You will then be asked to complete a Stroop task, which is a short measure of cognitive flexibility.

It is up to you to decide whether or not to take part. If you choose not to participate, you won't incur any penalties or lose any benefits to which you might have been entitled. However, if you do decide to take part, you will be given this information sheet to keep and asked to sign a consent form. Even after agreeing to take part, you can still withdraw at any time and without giving a reason.

All data will be collected and stored in accordance with the Data Protection Act 1998.

Appendix III: Version 2 of the ego depletion procedure, informed consent form

Consent Form for Participants in Research Studies

"Sensory food perceptions and cognitive flexibility"

This study has been approved by the UCL Research Ethics Committee as Project ID Number: CEHP/2011/039

Participant's Statement

I, _____
agree that I have

read the information sheet and/or the project has been explained to me verbally;
had the opportunity to ask questions and discuss the study; and
received satisfactory answers to all my questions or have been advised of an individual to contact for answers to pertinent questions about the research and my rights as a participant and whom to contact in the event of a research-related injury.

I understand that I am free to withdraw from the study without penalty if I so wish, and I consent to the processing of my personal information for the purposes of this study only and that it will not be used for any other purpose. I understand that such information will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998.

I understand that the information I have submitted will be published as a report and I will be sent a copy. Confidentiality and anonymity will be maintained, and it will not be possible to identify me from any publications.
I understand that if I am being paid for my assistance in this research some of my personal details will be passed to UCL Finance for administration purposes.

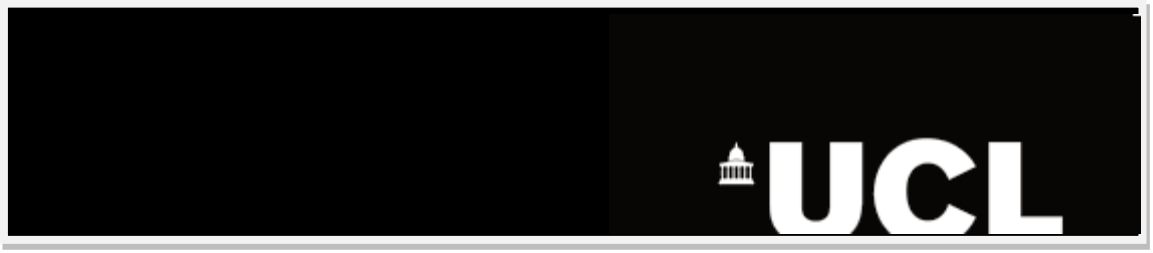
Signed: _____ Date: _____

Investigator's Statement

I, _____
confirm that I have carefully explained the purpose of the study to the participant and outlined any reasonably foreseeable risks or benefits (where applicable).

Signed: _____ Date: _____

Appendix III: Version 2 of the ego depletion procedure, debrief sheet



Participant Debrief Sheet

"Sensory food perceptions and cognitive flexibility"

Thank you for taking part in our research. The study you took part in was a pilot study for a research series on ego depletion and eating disorders.

People have a limited ability to exert self-control. When we use self-control we deplete our energy stores and become less able to use self-control on a subsequent task. We hypothesise that the "sensory perception" task should have depleted participants' self-control energy in the dessert, but not in the vegetable condition – because presumably it was difficult not to eat any of the desserts, but fairly easy to resist eating the vegetables. Participants should therefore have performed worse on the Stroop task in the dessert condition compared to the vegetable condition, as it is a task which also requires self-control.

The methodology we are developing will be used in a study with clinical eating disorder patients in order to determine how their dietary self-control differs from non eating disordered participants.

If you have any further questions about the study, please contact Alisa Anokhina (alisa.anokhina.10@ucl.ac.uk).

Appendix III: Version 2 of the ego depletion procedure, Stroop task

BLUE	RED	ORANGE	GREEN
YELLOW	ORANGE	RED	YELLOW
PURPLE	YELLOW	BLUE	ORANGE
PURPLE	BLUE	YELLOW	BLUE
BLUE	ORANGE	RED	YELLOW
GREEN	BLUE	PURPLE	GREEN
GREEN	RED	ORANGE	PURPLE
BLUE	PURPLE	RED	YELLOW
GREEN	ORANGE	RED	RED
RED	PURPLE	BLUE	YELLOW
BLUE	BLUE	PURPLE	PURPLE
GREEN	ORANGE	ORANGE	BLUE
PURPLE	BLUE	GREEN	GREEN
YELLOW	ORANGE	ORANGE	BLUE
ORANGE	YELLOW	YELLOW	RED
RED	PURPLE	GREEN	RED
BLUE	PURPLE	GREEN	ORANGE
GREEN	BLUE	RED	PURPLE
RED	YELLOW	PURPLE	BLUE
BLUE	GREEN	ORANGE	GREEN
RED	YELLOW	RED	BLUE
ORANGE	BLUE	GREEN	RED
PURPLE	RED	PURPLE	BLUE

Appendix III: Version 2 of the ego depletion procedure, "Sensory perception questionnaire" (excerpt from desserts version)

Sensory perceptions questionnaire

(A) Desserts

Thank you for taking part in our study.

We are interested in how people evaluate the sensory properties of different food types. For the purposes of this study, we are interested in the **non-taste** properties of food, so please **do not eat or otherwise taste** any of the foods you are asked to evaluate as it will bias our results.

There are **five** different foods we would like you to evaluate today. You can see these in bowls on the table in front of you, labelled 1 through 5. We would like you to carefully consider the contents of each bowl and answer the questions below about each one.

You have **ten minutes** to do this, so please take your time and try to answer as honestly as possible.

There are no right or wrong answers – we are simply interested in your opinion!

You can handle the food as you like: touch it, smell it, peel it apart, poke it, etc.

Bowl 1

Visually, how appealing does the food look to you? (please circle)

Not appealing at all	1	2	3	4	5	Extremely appealing

Please comment on the *visual appearance* of the food:

Please *smell* the food. How appealing does it smell to you?

Not appealing at all	1	2	3	4	5	Extremely appealing

Does the food smell more artificially-scented or natural?

Please *touch* the food. How do you rate the textile properties of the food?

Bearing in mind what you know about the food from its appearance, texture and smell, how would you expect it to taste? How would you expect its taste to compare to similar foods (e.g., of a different brand, home made, your preferred variety)?

How likely would you be to select this food from a platter – e.g., at a party?

Not at all likely	1	2	3	4	5	Very likely

How often do you eat this type of food?

Never	1	2	3	4	5	Often

If you were given the option to eat some of this food right now, how likely would you be to do so?

Not at all likely	1	2	3	4	5	Very likely

Please summarise your overall feelings about this food:

Appendix IV: Study 3 information sheet

Information Sheet for Participants in Research Studies

You may request a copy of this information sheet.

"Attitudes towards food and eating behaviour"
This study has been approved by the UCL Research Ethics Committee as Project ID Number: CEHP/2011/039

Alisa Anokhina
1-19 Torrington Place
London WC1E 7HB
alisa.anokhina.10@ucl.ac.uk
020 7679 8275

Lucy Serpell
1-19 Torrington Place
London WC1E 7HB
lucy@serpell.com
020 7679 1256

We would like to invite you to participate in a research project. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, please read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or you would like more information.

We are interested in people's attitudes towards different food types and how it relates to their eating habits. You will be asked to complete two computer tasks, in which you will be asked to use keys to respond to words or pictures of food or objects, and also to complete some questionnaires pertaining to your beliefs about different foods and your eating. The study should take under 30 minutes and you will be reimbursed £3 to thank you for your participation (or given a course credit equivalent).

It is up to you to decide whether or not to take part. If you choose not to participate, you won't incur any penalties or lose any benefits to which you might have been entitled. However, if you do decide to take part, you will be given this information sheet to keep and asked to sign a consent form. Even after agreeing to take part, you can still withdraw at any time and without giving a reason.

All data will be collected and stored in accordance with the Data Protection Act 1998.

Appendix IV: Study 3 informed consent form

Consent Form for Participants in Research Studies

"Attitudes towards food and eating behaviour"
This study has been approved by the UCL Research Ethics Committee as Project ID Number: CEHP/2011/039

Participant's Statement

I, _____
agree that I have

read the information sheet and/or the project has been explained to me verbally;
had the opportunity to ask questions and discuss the study; and
received satisfactory answers to all my questions or have been advised of an individual to contact for answers to pertinent questions about the research and my rights as a participant and whom to contact in the event of a research-related injury.

I understand that I am free to withdraw from the study without penalty if I so wish, and I consent to the processing of my personal information for the purposes of this study only and that it will not be used for any other purpose. I understand that such information will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998.

I understand that the information I have submitted will be published as a report and I will be sent a copy. Confidentiality and anonymity will be maintained, and it will not be possible to identify me from any publications.
I understand that if I am being paid for my assistance in this research some of my personal details will be passed to UCL Finance for administration purposes.

Signed: _____ Date: _____

Investigator's Statement

I, _____
confirm that I have carefully explained the purpose of the study to the participant and outlined any reasonably foreseeable risks or benefits (where applicable).

Signed: _____ Date: _____

Participant Debrief Sheet

"Attitudes towards food and eating behaviour"

Thank you for taking part in our research. We are interested in why some people are successful at dietary restraint (i.e., dieting) while others find it more challenging. Dieting is a very complex behaviour: when we diet we have to reconcile the body's physiological needs for nourishment with the self-restraint goal. Some research suggests that dieting can be so difficult because, over time, we form positive emotional associations with food, which then lead us to respond to food cues by impulsively approaching it.

The two computer tasks you completed were designed to assess a) positive associations with food and b) the tendency to approach or avoid different food types. We are interested to find out how different associations and approach tendencies are related to people's experiences with dietary restraint. Some studies have already suggested that people who are successful at losing weight tend to impulsively approach low-calorie, low-fat foods more than high-calorie, high-fat ones; we hypothesise that a positive emotional association with low-fat foods might underlie this tendency. People who are successful at losing weight could therefore feel less compelled to eat impulsively, despite not necessarily having a conscious preference for low-fat foods.

If you have any further questions about the study, please contact Alisa Anokhina (alisa.anokhina.10@ucl.ac.uk).

Appendix IV: Study 3 demographic questionnaire

Study 3 Participant ____

Demographic Questionnaire

Age	
Which language do you speak most comfortably/fluently?	
Nationality	
Ethnicity	White ☐ Chinese ☐ Asian or Asian British ☐ Black or Black British ☐ Mixed ☐ Other _____
When was the last time you ate?	_____ hours ago
Height (your best guess if you don't know)	
Weight (your best guess if you don't know)	
Have you ever been diagnosed with an eating disorder?	Yes ☐ No ☐ Prefer not to say ☐
If yes, which?	Anorexia nervosa ☐ Bulimia nervosa ☐ EDNOS ☐ Binge Eating Disorder ☐ Prefer not to say ☐ Other _____
If yes, when were you diagnosed?	

Appendix IV: Study 3 food attitudes questionnaire

Study 3 Participant ____

Food Attitudes Questionnaire

Please read the food names below. For each food type, please rate how much you **like its taste**.

Some of the foods listed come in different varieties: in those cases, **rate the first variety that springs to mind.**

Asparagus	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Broccoli	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Brownie	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Brussel sprouts	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Cabbage	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Cake	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Celery	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Cookie	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Corn	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much

Cucumber	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Cupcakes	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Doughnut	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Ice cream	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Lettuce	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Muffin	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Pancakes	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Pie	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Pudding	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Radish	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much
Tomato	Do you know what this food tastes like? □ Yes □ No If yes, how much do you like its taste? Not at all 1 - 2 - 3 - 4 - 5 Very much

Next, please rate in turn how strongly you feel about **the positive** and **the negative** aspects of each food.

For example, if you really **like the taste** of beetroot but really **dislike its texture** you might give a rating of '5' for both positive and negative aspects.

Asparagus	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Broccoli	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Brownie	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Brussel sprouts	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Cabbage	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Cake	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Celery	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Cookie	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Corn	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Cucumber	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Cupcakes	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative

Doughnut	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Ice cream	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Lettuce	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Muffin	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Pancakes	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Pie	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Pudding	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Radish	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative
Tomato	No positive attitude 1 - 2 - 3 - 4 - 5 Extremely positive No negative attitude 1 - 2 - 3 - 4 - 5 Extremely negative

Appendix IV: Study 3 eating habits questionnaire

Study 3 Participant ____

Eating Habits Questionnaire

Please circle the response you feel describes you best.

If a question doesn't apply to you, just leave it blank.

1. Are you currently dieting?	YES / NO
2. How often have you dieted over the past year?	-) Never [go to question 4] a) Once b) Twice c) Three times d) More than three times
3. How well are you able to sustain a diet during these times?	(Extremely well) 1 – 2 – 3 – 4 – 5 (Not at all)
4. How constant has your weight been over the past **six months**?	a) No weight fluctuation b) Loss of weight c) Weight fluctuation d) Weight gain
5. How constant has your weight been over the past **year**?	a) No weight fluctuation b) Loss of weight c) Weight fluctuation d) Weight gain
6. Have the changes in weight been deliberate?	YES / NO / Not applicable

Appendix V: Study 4 information sheet

Information Sheet for Participants in Research Studies

You may request a copy of this information sheet.

"Food attitudes in weight loss"
This study has been approved by the UCL Research Ethics Committee as Project ID Number: CEHP/2011/039

Alisa Anokhina
1-19 Torrington Place
London WC1E 7HB
alisa.anokhina.10@ucl.ac.uk
020 7679 8275

Lucy Serpell
1-19 Torrington Place
London WC1E 7HB
lucy@serpell.com
020 7679 1256

We would like to invite you to participate in a research project. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, please read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or you would like more information.

We are interested in how people's attitudes towards food are affected by weight loss dieting. In this study, we are including both people who don't diet and people who are thinking about starting a diet soon. Because we are interested in any changes that happen over time, we would like you to come in for **two sessions**, two or three weeks apart. In each session you will be asked to complete two computer tasks, in which you will sort different words into categories (including names of food), and several questionnaires about your eating habits and attitudes. Each session should last about **30 minutes** and you will be reimbursed **£6** (or 2 course credits) at the end of the study for your participation.

It is up to you to decide whether or not to take part. If you choose not to participate, you won't incur any penalties or lose any benefits to which you might have been entitled. However, if you do decide to take part, you will be given this information sheet to keep and asked to sign a consent form. Even after agreeing to take part, you can still withdraw at any time and without giving a reason.

We understand the sensitive nature of the information we are asking for. You will never be asked to divulge any information if you are not comfortable in doing so. All data will be collected and stored in accordance with the Data Protection Act 1998.

Appendix V: Study 4 informed consent form

Consent Form for Participants in Research Studies

"Food attitudes in weight loss"
This study has been approved by the UCL Research Ethics Committee as Project ID Number: CEHP/2011/039

Participant's Statement

I, _____
agree that I have

read the information sheet and/or the project has been explained to me verbally;
had the opportunity to ask questions and discuss the study; and
received satisfactory answers to all my questions or have been advised of an individual to contact for answers to pertinent questions about the research and my rights as a participant and whom to contact in the event of a research-related injury.

I understand that I am free to withdraw from the study without penalty if I so wish, and I consent to the processing of my personal information for the purposes of this study only and that it will not be used for any other purpose. I understand that such information will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998.

I understand that the information I have submitted will be published as a report and I will be sent a copy. Confidentiality and anonymity will be maintained, and it will not be possible to identify me from any publications.
I understand that if I am being paid for my assistance in this research some of my personal details will be passed to UCL Finance for administration purposes.

Signed: _____ Date: _____

Investigator's Statement

I, _____
confirm that I have carefully explained the purpose of the study to the participant and outlined any reasonably foreseeable risks or benefits (where applicable).

Signed: _____ Date: _____

Participant Debrief Sheet

"Food attitudes in weight loss"

Thank you for taking part in our research. Our study was about the way attitudes towards food may change as a consequence of starting a weight loss diet. You may have been recruited into the study either as a non-dieter (you don't usually diet) or as a dieter (you were planning on starting a diet before the study started).

The computer task you completed was designed to measure your "implicit" food attitudes: that is, positive or negative associations you hold in memory for different food types. These associations are thought to be activated automatically when you come across that particular food, and may possibly affect how you behave in response to that food in certain contexts. Previous research suggests that these implicit associations can change when a person starts a diet – that is, their associations with high-fat food become less positive than usual. It's possible that this may be especially true for people who find dieting more difficult: our study was partially designed to assess whether this is the case or not.

The questionnaires which you completed were concerned with your relationship with food, eating and your body image. If we do find differences between dieters and non-dieters (or between people who find dieting relatively easy compared to those who find it more difficult), we hope to use the questionnaire data to try and explain the kinds of relationships that may underlie these differences.

If you have any further questions about the study, please contact Alisa Anokhina (alisa.anokhina.10@ucl.ac.uk).

If you are struggling with issues around food, eating or body image, "b-eat" is a non-profit organisation which can help. Visit http://www.b-eat.co.uk, or see your GP.

Appendix V: Study 4 screening questionnaire

Study 4

Screening questionnaire

Thank you for your interest in our study. If you would like to take part, please complete this screening questionnaire and return it to alisa.anokhina.10@ucl.ac.uk. We will then be in touch shortly to let you know if you are eligible. If you have any questions, you are welcome to contact Alisa Anokhina at the above email address.

Please note that only women are eligible to take part in the study at present.

1. Are you currently on a weight loss diet?	YES / NO
2. Are you currently on any other diet (e.g., for religious or medical reasons)?	YES/NO If yes, please specify: _____
3. Have you been on a weight loss diet in the past 12 months?	YES/NO
4. Do you intend to start a weight loss diet in the near future (within 2 weeks)?	YES/NO If yes, please give approximate start date: _____ (e.g., "3rd of June")
5. Your height (your best guess if you don't know)	_____
6. Your weight (your best guess if you don't know)	_____
7. Your age	_____

Appendix V: Study 4 demographic questionnaire

Study 4 Participant ____

Demographic Questionnaire

Age _____

Which language do you speak most comfortably/fluently? _____

Nationality _____

Ethnicity

White ☐
Chinese ☐
Asian or Asian British ☐
Black or Black British ☐
Mixed ☐
Other _____

Height (your best guess if you don't know)

_____

Weight (your best guess if you don't know)

_____

Have you ever been diagnosed with an eating disorder?

Yes ☐
No ☐
Prefer not to say ☐

If yes, which?

Anorexia nervosa ☐
Bulimia nervosa ☐
EDNOS ☐
Binge Eating Disorder ☐
Prefer not to say ☐
Other _____

Appendix V: Study 4 eating habits questionnaire (session 1)

Study 4

Eating Habits Questionnaire

Session 1

Please circle the response you feel describes you best.

If a question doesn't apply to you, just leave it blank.

1. Are you currently on a weight loss diet?	YES / NO
2. How many times have you started a new weight loss diet in the past year?	a) Never b) Once c) Twice d) Three times e) More than three times
3. How well are you able to stick with the diet during these times?	Not at all Extremely well 0 – 1 – 2 – 3
4. Are you currently on any other restrictive diet (e.g., for religious or medical reasons)?	YES/NO If yes, please specify: _____
5. Do you intend to start a weight loss diet in the near future (within 2 weeks)?	YES/NO If yes, please give approximate start date: _____ (e.g., "3rd of June")
6. How constant has your weight been over the past **six months**?	a) My weight has not changed b) I have lost weight c) My weight has fluctuated d) I have gained weight
7. How constant has your weight been over the past **year**?	a) My weight has not changed b) I have lost weight c) My weight has fluctuated d) I have gained weight
8. When was the last time you ate?	_____ hours ago
9. How hungry do you feel right now?	Not at all hungry Extremely hungry 0 – 1 – 2 – 3 – 4

Appendix V: Study 4 eating habits questionnaire (session 2)

Study 4

Eating Habits Questionnaire

Session 2

Please circle the response you feel describes you best.

If a question doesn't apply to you, just leave it blank.

1. Are you currently on a weight loss diet?	YES / NO
2. Are you currently on any other restrictive diet (e.g., for religious or medical reasons)?	YES/NO If yes, please specify: _____
3. Have you been on a weight loss diet at any point during the course of this study (~1 month)?	YES/NO If yes, please give an approximate start date: _____ and, if applicable, end date: _____
4. **If** you have been on a weight loss diet during the course of this study (~1 month), how well were you able to stick with it?	Not at all Extremely well 0 – 1 – 2 – 3
5. How constant has your weight been over the course of this study (~1 month)?	a) My weight has not changed b) I have lost weight c) My weight has fluctuated d) I have gained weight
6. When was the last time you ate?	_____ hours ago
7. How hungry do you feel right now?	Not at all hungry Extremely hungry 0 – 1 – 2 – 3 – 4