The National University of Ireland

Developing an Implicit Relational Assessment Procedure (IRAP) to Assess Obese and Normal-Weight Individuals' Attitudes to Healthy and Unhealthy Foods

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Abstract

The current doctoral thesis sought to develop an IRAP that could assess obese and normal-weight individuals' attitudes to healthy and unhealthy foods. Three empirical studies directly compared the ability of IRAP and explicit measures to assess obese and normal-weight individuals' food biases in a two-hour and unrestricted food deprivation state. An additional objective of the research programme was to determine if it was possible to detect reliable differences in neurophysiological activity while participants completed a food-attitude IRAP. Finally, the research aimed to examine the malleability of implicit attitudes to healthy and unhealthy foods. All studies presented participants with an IRAP and explicit measures. The IRAP presented "pro-unhealthy" and "pro-healthy" trials. The difference in mean-response-latency between "pro-healthy" and "pro-unhealthy" trials indicated participants' bias towards healthy or unhealthy foods. The advantages of the IRAP were highlighted across the empirical investigations: (a) unlike any other implicit measure, it differentiated between the implicit responses of obese and normal-weight individuals to healthy and unhealthy foods, accounting for variance beyond that provided by a range of explicit measures; (b) the IRAP effects were relatively robust across studies; (c) a measure of neurological processing (EEGs) was successfully obtained while participants completed the IRAP, and the findings yielded some patterns that appear consistent with previous research; and (d) it revealed the malleability of implicit responses using an acceptance-based intervention, an effect that has not yet been reported in the literature on psychological acceptance or implicit attitudes. Overall, therefore the pattern of results in these studies highlighted the utility of the IRAP for future investigations of implicit food attitudes among obese and normal-weight individuals. Finally, the current research programme adds to previously published

IRAP studies showing the efficacy of the IRAP as a measure of implicit bias across a range of domains.

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Chapter 1: Explicit and Implicit Attitudes to Food among Obese and Normal-Weight Individuals: A Review

1.1 Obesity

The World Health Organisation (WHO) defines obesity as a Body Mass Index (BMI) over 30 (kg/m^2). In 2005, the WHO indicated that 1.6 million adults over the age of fifteen were overweight with at least 400 million adults being obese. Once considered a problem only in high-income countries, excessive weight and obesity are now dramatically on the rise in low- and middle-income countries, particularly in urban settings. The WHO projects that there will be more that 700 million obese adults in the world by 2015 (WHO, 2005).

Studies have shown that the intake of high-fat foods is a salient contributing factor in global obesity (Lissner & Heitmann, 1995). Furthermore, obese individuals are found to have a higher percentage of fat in-take in their diets relative to normal-weight individuals (e.g., Calpaldi, 1996; Drewnowski, 1996). Furthermore, many studies have shown that obese individuals demonstrate a taste preference for high-fat foods compared to normal-weight controls (e.g., Capaldi, 1996; Drewnowski, 1991; Drewnowski, Brunzell, Sande, Iverius, & Greenwood, 1985; Drewnowski & Greenwood, 1983; Drewnowski, Kurth, Holden-Wiltse, & Saari, 1992; Reed, Bachmanov, Beauchamp, Tordoff, & Price, 1997).

1.2 Explicit Attitudes

When individuals are asked to report their attitudes to food, these explicit reports have been found to account for a considerable amount of eating behaviour in normal-weight individuals (Dennison, & Shepherd, 1995; Woodward, Boon, Cumming, Ball, Williams, & Hornby, 1996). Attitudes to food have also been put forward as a crucial factor in the development and maintenance of obesity (Brug, Lechner & De Vries, 1995; De Bourdeaudhuij, Lefevere, Deforche, Wijndaele,

Matton, & Philippaerts, 2005; Dennison, & Shepherd, 1995). On this basis, one might predict that obese individuals' would show more positive attitudes to unhealthy high-fat foods on self-report explicit measures than normal-weight individuals. However, the very limited research available on this issue found evidence contrary to this prediction. For example, obese youngsters reported less positive attitudes towards unhealthy foods relative to normal-weight controls (Perl, Mandic, Primorac, Klapec, & Perl, 1998). On balance, this finding could well be as a result of responding in a socially desirable manner based on the current Western idealization of the slim body type (Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999). In other words, the stigmatization associated with being obese might make it difficult for obese individuals to admit to liking or eating large amounts of unhealthy high-fat foods (Puhl & Brownell, 2003; Teachmann & Brownell, 2001). As such, explicit self-report questionnaires alone may not allow psychologists to fully analyse and explain the relationship between food attitudes and behaviour among obese individuals.

1.3 Implicit Attitudes

One possible conclusion arising from the inconsistent findings in the area of attitudes to food is that the instruments used to measure those attitudes are lacking in some respects. Self-report measures (i.e. simply asking what foods you like etc.) may seem like an intuitively sensible way to assess attitudes to food among obese individuals. However, psychologists have recently become aware that that the reliability and predictive validity of self-repost measures can be unreliable. For example, responses on questionnaires can be affected by the phrasing of a question, the order of the questions or the context in which the questions are asked (Roefs, Werrij, Smulders & Jansen, 2006). Furthermore, some researchers have argued that self-report measures are also influenced by self-presentation biases as well as the fact

that individuals may have limited introspective knowledge of the processes involved in their behaviour (Greenwald, Banaji, Rudman, Farnham, Nosek, & Mellot, 2002).

Those processes to which individuals have limited access have been labelled implicit attitudes. Although the precise definition of such attitudes remains a topic of intense debate (e.g., De Houwer, 2006), a reasonable working definition was provided by Greenwald and Banaji (1995). Specifically, they defined implicit attitudes as "introspectively unidentified (or inaccurately identified) traces of past experience that mediate favourable or unfavourable feeling, thought, or action toward social objects" (p.8). The basic idea in this rapidly growing area of research is that there are two broad types of attitudes, explicit and implicit, which may influence how we behave in various contexts. Numerous models of implicit and explicit attitudes have been proposed (e.g., the Elaboration Likelihood Model [ELM] Petty & Cacioppo, 1986; the Heuristic-Systematic Model [HSM] Chaiken, 1987; the Motivation and Opportunity as Determinants [MODE]; Fazio, 1990; the Associative-Propositional Evaluation Model [APE] Gawronski & Bodenhausen, 2007), but in general explicit attitudes are seen as involving conscious and thoughtful deliberation, whereas implicit attitudes are non-deliberative and automatic. In other words, explicit attitudes reflect an individual's carefully thought out evaluation, whereas implicit attitudes reflect an individual's immediate "gut" reaction to a stimulus. Traditional self-report measures are typically used to assess explicit attitudes, because respondents have time to reflect on their views as they complete a questionnaire. In contrast, implicit attitudes are often assessed using a response-time paradigm in which rapid responses are required. The most widely used response-time test of implicit attitudes is the implicit association test (IAT; Greenwald, McGhee & Schwartz, 1998).

The central postulate underlying the IAT is that it should be easier to map a target-concept and its attribute-category onto the same response when those target-concepts and attribute-category are associated in memory than when they are not associated (De Houwer, 2002). For illustrative purposes, consider the seminal IAT study reported by Greenwald et al. (1998). In one experiment, participants were presented with two target-concepts, names of flowers (e.g., rose), and names of insects (e.g., wasp), and two attribute-categories, positive words (e.g., caress) and negative words (e.g., abuse). The researchers predicted that positive attitudes to flowers over insects would be reflected in faster response latencies when flower and positive words were allocated to the same response and insects and negative words were allocated to another response, than when the reverse was true (i.e., flower and negative words to the same response, and insects and positive words to the other response). The results of the experiment were consistent with this prediction. Since this study, IAT effects have been replicated across a wide range of domains (see Nosek, Greenwald and Banaji, 2007, for a recent review), but most notably in socially sensitive areas such as racism (e.g., Dasgupta, Greenwald, & Banaji, 2003). Furthermore, the IAT has been used to study a range of clinically relevant issues (e.g., Haeffel, Abramson, Brazy, Shah, Teachman, & Nosek, 2007; Green, Carney, Pallin, Ngo, Raymond, Iezzoni & Banaji, 2007; Teachman, Gregg, & Woody, 2001), and most relevant to the current research it has been employed in the assessment of implicit food preferences (Masion Greenwald & Bruin, 2001; Karpinski & Hilton, 2001; Olzon & Fazio, 2004; Maison, Greenwald & Bruin, 2004; Perugini & Pretwich, 2007; Hofmann, Gschwender, Friese, Wiers, & Schmitt, 2008; Hofmann & Friese, 2008).

At the time of writing, thirty-two studies had been published that had employed implicit measures of attitudes to food. Given the focus of the research reported in the current thesis, the next section will focus only on those studies that employed obese versus normal-weight individuals and/or have manipulated food deprivation as part of the study of implicit attitudes to food (A complete list of studies of implicit attitudes to food is presented in Appendix A).

1.4 IAT Obesity Studies

2.4.1 Obese and Normal-weight Participants show a Negative Bias to High-fat Foods

The first study of implicit attitudes to food that employed both obese and normal-weight participants was reported by Reofs and Jansen (2002). Specifically, the study aimed to assess implicit and explicit attitudes to high- and low-fat foods. The IAT presented six high-fat food words (French fries, chocolate etc.) and six low-fat words (popcorn, strawberries etc.) with six positive words (love) and six negative words (war). Thus, participants were required on some blocks of trials to categorise high-fat foods with positive words and low-fat foods with negative words, but on other trials to perform the opposite categorisation (i.e., high-fat with negative words and low-fat with positive words). Explicit food preferences for high and low fat foods were measured via a 9-point Likert scale anchored with (very palatable and very unpalatable at either ends). Explicit attitudes and habits concerning high-fat foods (tastiness, healthiness, I should not eat it etc.) were measured on a 7-point Likert scale. The Eating Disorder Examination Questionnaire EDE-Q; Fairburn and Beglin, 1994) was used a screen for abnormal eating behaviours and attitudes. The Social Desirability Scale (Crowne & Marlow, 1964) was used an explicit measure of desirable responding.

It was predicted that obese individuals would show a strong positive implicit bias towards high-fat foods but the normal-weight individuals would not. That is, participants should respond more quickly when categorising high-fat foods with positive words and low-fat foods with negative words than vice versa. Contrary to the researchers' predictions, both obese and normal-weight individuals produced significant negative implicit biases to high-fat foods. There was also a significant interaction effect, with no difference between the groups when categorising high-fat foods with negative words, but with the obese group responding significantly more slowly than the normal weight-group when categorising high-fat with positive words. Thus, if anything, the obese group showed an even stronger negative implicit bias to high-fat foods than the normal-weight group.

For the explicit measure, both obese and normal-weight groups showed a significant bias towards low-fat relative to high-fat foods on the explicit measures, with no significant difference between the groups, and no correlation with the IAT. Interestingly, the obese group produced a stronger effect for the statement "I do not want to eat high-fat-foods" than the normal-weight group and responses to this statement correlated with the IAT measure. The obese group scored significantly higher on the global EDE-Q than the normal-weight group. Furthermore, the global EDE-Q score, and the subscale scores for Restraint, Weight Concern, and Shape Concern all correlated significantly with the IAT measure, but the Eating Concern scores did not. The reported number of dieting attempts also correlated with the IAT effects.

This early study by Reofs and Jansen (2002) on implicit attitudes to food appeared to contradict the intuitively obvious prediction that obese individuals would show a relatively strong positive bias towards high-fat foods. Interestingly, around the

time this study was published, another implicit attitude researcher (De Houwer, 2001) had argued that the IAT effect does not reflect an attitude towards the individual target items (i.e., the individual high- versus low-fat foods), but rather an attitude to the target category itself (i.e., high-fat versus low-fat). Insofar as this is the case, it is possible that the IAT effects reflected the general belief in Western culture that high-fat foods are unhealthy and bad for you, rather than participants' actual preference for those foods. This interpretation is supported by the fact that the IAT measure did not correlate with the explicit food preference measure, but did correlate with the EDE-Q scores, responses to the explicit statement "I do not want to eat high-fat foods", and the number of dieting attempts. In other words, the IAT employed by Reofs and Jansen was sensitive to socially influenced health-related attitudes to high- and low-fat foods rather than to actual food preferences.

1.4.2 Obese and Normal-weight Individuals Respond Differently on a Self-concept IAT

In order to minimise the impact of cultural attitudes or norms on individual implicit attitudes a self-concept IAT was developed. The self-concept IAT is based on assumption that the self-concept involves the association of the concept of self with one or more (non-valenced) attribute concepts, and thus such an IAT may highlight the degree of identification an individual has toward those attribute concepts (Greenwald Banaji, Rudman, Farnham, Nosek, and Mellot, 2002, p.5). This approach to the study of implicit attitudes towards food among obese and non-obese individuals was adopted by Craeynest, Crombez, De Houwer, Deforche, and De Bourdeaudhui (2006). Specifically, these researchers used the self-concept variant of the IAT to examine whether implicit self-concept and self-report attitudes to food were related to fat versus non-fat foods among obese and normal-weight children. The self-concept

IAT presented six attribute words related to self (me, my, etc.) versus others (their, his, etc.) and six pictures of high-fat foods (French fries, chocolate etc.) and non-fat foods (fruit, yoghurt etc.). Explicit liking ("how much do you like or dislike") of each individual food picture was measured separately. It was predicted that both obese and normal-weight children and adolescents would produce positive explicit attitudes towards non-fat over fat foods, but only the obese individuals would show a positive implicit bias towards identifying themselves with fat-foods.

The results, however, were not entirely consistent with these predictions. Although the normal-weight participants showed an implicit association between self and non-fat foods on the IAT, the obese participants showed no evidence of a strong association between self and either food type. Consistent with the prediction for the explicit measure, there were no significant differences between the two groups, with both showing a slightly positive explicit attitude towards fat-food and a neutral bias towards non-fat food. Although the results did not accord precisely with the researchers' predictions, the implicit association between self and food-type did differentiate the obese from normal-weight individuals in a manner not observed when attitudes towards high and low fat foods were targeted in the Roefs and Jansen (2002) study.

1.4.3 Overweight and Normal-weight Individuals Produce Similar Effects on a Personalised IAT

Another variation on the IAT was employed in a recent study to examine overweight and normal-weight youngsters' attitudes to personally chosen palatable healthy foods versus palatable unhealthy foods (Craeynest, Crombez, Haerens, & De Bourdeaudhuil, 2007). This modified version, known as the personalised IAT (Olsen and Fazio, 2004), differed from the standard version used by Reofs and Jansen (2002)

in that the attribute labels ‘positive’ and ‘negative’ were replaced with personal labels “I like” and “I don’t like”. These two category labels were presented with words of six individually chosen palatable healthy and six palatable unhealthy foods. Explicit self-report questionnaires measured participant’s attitudes towards the target categories used in the IAT (i.e., palatable unhealthy and palatable healthy foods) on 7-point Likert scales ranging from “totally agree” to “totally disagree”. The researchers predicted that the overweight individuals would produce an implicit bias towards unhealthy over healthy foods relative to the normal-weight youngsters. The results revealed that both normal-weight and overweight groups produced significantly positive implicit and explicit attitudes towards healthy over unhealthy foods with no difference between the weight groups or interaction effects. Correlations between the IAT effects and explicit measures were non-significant.

1.5 Summary

In sum, all three obese versus normal-weight IAT studies listed above produced results counter to their researchers’ predictions. None of the studies found that obese individuals had a positive implicit bias toward high-fat unhealthy foods relative to the normal-weight individuals. Based on these findings, therefore, it appears that overweight individuals do not have a positive attitude to unhealthy and/or high-fat foods. Obviously, this conclusion offers a challenge to the argument that attitudes play some causal role in eating behaviour. On balance, the foregoing research was all conducted using the IAT, or some variant, and thus it seems important to determine if similar effects are obtained using other measures of implicit attitudes.

1.6 Possible Alternatives to the IAT

There is wide support for the reliability and validity of the IAT across numerous domains (e.g., see Fazio & Olson, 2003; Nosek, Banaji & Greenwald, 2002 for a review). Nevertheless, a number of limitations of the measure have been raised (see Arkes & Tetlock, 2004; Blanton & Jaccard, 2006; Blanton, Jaccard, Gonzales, & Christie, 2006; Cunningham, Preacher, & Banaji, 2001; De Houwer, 2002; Fiedler, Messner, & Bluemke, 2006; Nosek & Sriram, 2007). Two particular limitations will be discussed here. The first is that the IAT provides a measure of *relative* associative strength among concepts and not a measure of the valence of individual concepts (De Houwer, 2002; Nosek et al., 2005). The second limitation concerns the fact that the IAT provides a relatively *indirect* measure of implicit attitudes (discussed later).

The IAT is a relativistic measure because each IAT trial involves presenting both of the categories under investigation simultaneously (e.g., *Healthy* and *Unhealthy foods).* As such, IAT effects are based on responses that occur in the context of both categories, rather than each individually. Hence, it is possible, for example, that a pro-healthy-food/anti-unhealthy-food IAT bias indicates that a participant has a positive attitude to "healthy foods" and a neutral attitude to "unhealthy foods", or possibly a neutral attitude to "healthy food" and a negative attitude to "unhealthy foods". In short, the IAT can indicate that the concept *x* is preferred to the concept *y*, but it cannot indicate to what extent *x* and *y* are preferred, or not preferred, independently. Fortunately, two *non-relative* measures of implicit attitudes have been used to investigate attitudes to food among obese and normal-weight individuals, and it is to these studies we now turn.

1.7 Extrinsic Affective Simon Task Obesity Studies

One alternative to the IAT is known as the Extrinsic Affective Simon Task (EAST; De Houwer, 2003a). The original EAST presented white, green and blue coloured words. When the words appeared in white on the computer screen, participants were required to press the left key when the stimuli were negatively valenced (e.g., "hate", "war", and "disease") and to press the right key when they were positively valenced (e.g., "love", "peace, and "health"). When the words were presented in blue and green, participants were simply required to respond to the colour of the words rather than their valence (e.g., press left for green and right for blue). Given this learning history, it was predicted that green would become extrinsically associated with the negatively valenced words and blue would become associated with the positively valenced words. The critical test trials involved presenting positively and negatively valenced words in both blue and green colours. The assumption here was that participants would find it easier to respond to blue words when they are positively valenced and green words when they were negatively valenced than vice versa (blue as negative and green as positive). The EAST effect is thus defined as the difference in mean response latency and/or error percentages between congruent trials (i.e., blue-positive and green-negative) versus incongruent trials (i.e., blue-negative and green-positive). The study by De Houwer (2003a) and numerous subsequent studies provided evidence for the predicted EAST effect (for example, De Houwer, Crombez, Koster & De Beul, 2004; Ellwart, Becker, & Rinck, 2005; De Houwer & De Bruycker, 2007).

1.7.1 Obese youngsters reveal a positive bias, but normal-weight youngsters reveal a neutral bias, to healthy and unhealthy foods. In one study, the EAST was used to measure obese and normal-weight youngsters' attitudes to healthy and

unhealthy foods (Craeynest, Crombez, De Houwer, Deforche, Tanghe, and De Bourdeaudhuij, 2005). Participants were first asked to provide lists of personally liked and disliked food words. The EAST presented participants with these food words in white and they were required to respond left for the liked foods and right for the disliked foods. Thus liked foods were extrinsically associated with a left response and disliked foods were extrinsically associated with a right response. An additional six healthy foods (e.g., apple) and six unhealthy foods (e.g., crisps) that were pre-selected by the researchers were also employed (none of these 12 foods were presented in white). Healthy and unhealthy food words were presented in both blue and green, and participants were required to respond left for blue and right for green words. In this case, therefore, a healthy food bias was indicated when participants responded more quickly when healthy foods appeared in blue requiring a left response (the liked response) rather than when they appeared in green requiring a right response (disliked), and unhealthy foods required a right response rather than a left response. The opposite pattern indicated an unhealthy food bias. Response latencies for pro-healthy trials were subtracted from pro-unhealthy trials, and thus positive difference scores indicated a healthy bias and negative difference scores indicated an unhealthy bias. Participants' explicit food liking attitudes for the same pre-selected food words were measured using 7-point Likert scales with "dislike" and "like" at either end. The researchers predicted that the EAST would reveal an unhealthy food bias only for the obese youngsters. On the explicit measure it was expected that both groups would demonstrate a preference of healthy over unhealthy foods.

Contrary to the researchers' prediction, the obese youngsters produced positive difference scores on the healthy food trials (responding more rapidly to healthy-liked than healthy-disliked) and negative difference scores on the unhealthy

food trials (responding more rapidly to unhealthy-liked than to unhealthy-disliked). In contrast, the normal-weight youngsters produced near zero difference scores for both healthy and unhealthy foods (i.e., a neutral bias). Thus, the EAST indicated that the obese youngsters simply liked all foods and did not have a specific bias for unhealthy foods only. The results from the explicit food liking measure were also contrary to their predications with both weight groups showing a positive preference for both healthy and unhealthy foods. In sum, the EAST was successful in discriminating between obese and normal-weight youngsters, but the explicit attitude measure was not. Once again, however, the research did not indicate a specific pro-unhealthy food bias for obese individuals. It is also worth noting that a follow-up study using half of the obese participants involved a six month residential treatment programme (Creaynest, Crombez, Deforche, Tanghe, & De Bourdeaudhuil, 2008). Participants' implicit biases toward both healthy and unhealthy foods present at baseline disappeared during the course of the treatment, but the explicit measures remained stable.

In short, the results of two EAST studies revealed positive implicit biases to both unhealthy and healthy foods for obese individuals rather than a bias towards only unhealthy foods. These findings are in-line with the results from the IAT food studies described previously. Once again, these conclusions offer a challenge to the argument that attitudes are related to eating behaviour. We now turn to the second non-relative measure of implicit attitudes that has been used to index attitudes to foods among obese and normal-weight individuals.

1.8 Affective Priming Paradigm Obesity Studies

The Affective Priming Paradigm (APP; Fazio, Sanbonmatsu, Powell, Kardess, 1986) is a reaction-time measure that presents individuals with positively and

negatively valenced primes (i.e., words or pictures) followed by positively or negatively valenced target stimuli (i.e., words or pictures) in quick succession. Participants are required to ignore the prime and to categorize the target stimuli as either positive or negative by pressing the left and right response keys (e.g., left-positive, right-negative). The affective valence of the prime and target stimuli are manipulated such that the valence of the prime and target is either congruent (i.e., of the same valence, positive prime + positive target and negative prime + negative target) or incongruent (i.e., of opposite valence, positive prime + negative target and negative prime + positive target). The APP effect results from faster and/or more accurate responding to the target stimuli on congruent compared to incongruent trials. At the time of writing, three studies of implicit bias to food using the APP had been reported, and each of these will now be summarised.

1.8.1 Obese and normal-weight participants demonstrate a bias towards low-fat palatable foods. The first APP study was conducted in a hospital setting and employed obese and normal-weight female controls (Roefs, Stapert, Isabella, Wolters, Wojciechowski, Jansen, 2005, Experiment 2). The APP presented six high-fat palatable food word primes (i.e., fries); six low-fat palatable food word primes (i.e., chicken); six high-fat unpalatable food word primes (i.e., herrings); and six low-fat unpalatable food word primes (i.e., radish). Target stimuli were twenty-four generally positive words (i.e., peace) and twenty-four generally negative words (i.e., war). The researchers predicted that the obese group would show stronger priming effects for palatable relative to unpalatable foods than the normal-weight controls (e.g., palatable foods would produce more rapid responses to positive words for obese relative to normal-weight individuals). The researchers also predicted that the obese group would

show a stronger bias for high-fat palatable foods compared to the normal-weight group.

Contrary to their predictions, no priming effects were observed for palatability, fat content or group. However, both groups showed a marginally significant bias for low-fat palatable over high-fat palatable foods. If anything, therefore, a bias towards healthy foods was observed for both groups. The researchers suggested that these effects may have resulted from conducting the study in a hospital environment, which emphasises health and weight concerns. Nevertheless, yet another study had failed to find a specific pro-high-fat/unhealthy food bias for obese individuals.

1.8.2 Both obese and normal-weight participants produce a bias for palatable over unpalatable foods in a restaurant context but produce a marginal bias towards low-fat foods a health context. This APP study investigated obese and normal-weight females' implicit attitudes to food in different contexts (Roefs, Quaedackers, Werrij, Wolters, Havermans, Nederkoorn, van Breukelen & Jansen, 2006, Experiment 1), thus aiming to address some of the issues raised in the previous study. Prior to completing an APP, the participants were exposed to either a restaurant manipulation or a health manipulation. In the first condition, participants were instructed to imagine that they were a chef and had to prepare a meal for a wedding in a fancy restaurant. Participants were provided with a number of menus containing two food choices and asked to specify which food items they liked best from each menu (all menu-items were high-fat palatable foods). In the second condition, participants were given an information sheet about healthy eating habits which emphasized that high-fat foods are fattening and unhealthy. Then they were presented with sets of two menu-items.

Each set consisted of a clearly healthy and a clearly unhealthy (high-fat) menu-item. Participants were asked to indicate which menu-item they thought was the healthiest.

The APP used the prime stimuli employed by Roefs et al. (2005), but the positive and negative target words were chosen personally by each participant. An explicit measure assessed participants' healthiness ratings of the primes on a 7-point Likert scale (from "very unhealthy" to "very healthy"). The authors predicted that in the restaurant condition all participants would display a bias for palatable over unpalatable foods, with the obese showing a larger bias for palatable high-fat foods. For the health condition, the researchers predicted that participants would display a bias for low- over high-fat foods. No specific predictions were made about palatability or for weight category in the health condition.

The latency and error data from the APP were analysed separately. The latency effects were somewhat contrary to the researchers' predictions, in that no significant differences were reported between the obese and normal-weight participants in the restaurant condition based on palatability or fat content. However, in line with the researchers' predictions, both obese and normal-weight participants in the health condition produced a marginally significant bias for low-fat foods (the bias in the restaurant condition for both groups was in an unhealthy direction). Thus, no significant differences in weight category where observed. The error data were also partly in-line with the researchers predictions, in that both normal-weight and obese participants showed a significant bias for palatable over unpalatable foods in the restaurant condition with a marginally significant bias for unpalatable over palatable foods in the health condition. Once again, however, no differences between the weight categories were observed. On the explicit attitude measures both groups' rated unpalatable foods as healthier than palatable foods and low-fat foods as healthier than

high-fat foods, irrespective of context (restaurant or health). In short, the context manipulation impacted on the priming effects of foods in the restaurant, with only marginal effects in the health condition, with no evidence for any differential effects between the obese and normal-weight individuals. Yet again, obese individuals did not produce a specific implicit high-fat/unhealthy food bias.

1.8.3 Obese individuals have a positive implicit bias for high-fat-savoury foods and a negative bias for high-fat-sweet foods, whereas overweight and normal-weight participants have a positive bias for high-fat-sweet but not high-fat-savoury food; all weight groups have a negative implicit bias for low-fat foods. In this final study, the APP was used to compare implicit attitudes to different foods varying in calorific content and taste (i.e., high-calorie non-sweet HCNS, high-calorie sweet HCS, and low-calorie LC) among females with differing BMI scores (normal-weight, overweight and obese) (Czyzewska, & Graham, 2008).

The APP presented individuals with pictures of HCNS food primes (i.e., pizza etc.); HCS food primes; (i.e., ice-cream etc.); LC food primes (i.e., salad); and food related (FR) primes (i.e., utensils) respectively. The target stimuli were positively (i.e., joy) and negatively (i.e., rage) valenced words also divided into high arousal (e.g., scared) and low arousal (e.g., bored) words. Participants' explicit pleasantness ratings for the food items were measured via 7-point Likert scales. The researchers had three predictions; firstly, that higher BMI participants (obese and overweight) would produce a stronger pro-high-calorie over low-calorie food bias than the normal-weight participants, and that this effect would be moderated by food taste (sweet versus savoury); secondly, the explicit attitude measures would not differ across BMI groups with all groups expressing a pro-low-fat over high-fat food preference; finally,

there would be a larger dissociation between implicit and explicit measures for the higher BMI participants.

The results revealed a significant effect for high arousal words but not for low arousal words. For the high arousal words there was a significant interaction between the BMI groups and food category. In line with the researchers' first prediction, the obese group had a significant positive bias towards high-calorie-savoury foods and a negative bias toward high-calorie-sweet foods, whereas the over-weight and normal-weight individuals had the opposite pattern (i.e., a positive bias towards high-fat-sweet foods but a negative bias towards high-fat-savoury foods). There were no significant differences between the BMI groups for high-calorie foods combined (HCNS plus HCS). Interestingly, all BMI groups had a negative implicit attitude towards low-calorie foods, but only the normal-weight and overweight groups' biases were significant. Consistent will the researchers' second prediction, there were no differences among the BMI groups on the explicit food attitude measure. However, contrary to their second prediction, all BMI groups had positive preferences for all food categories. Furthermore, participants had a significantly higher preference for low-calorie and high-calorie sweet foods than for high-calorie-savoury foods. Contrary to the researchers' third prediction, all groups showed a large divergence between their implicit and explicit attitudes. That is, all participants, regardless of BMI status, showed a negative bias towards low-calorie food on the implicit measure and a positive bias on the explicit measure. In conclusion, the study showed that the APP successfully discriminated food attitudes among obese, overweight and normal-weight individuals, but an analogue explicit self-report measure did not. Importantly, the study revealed a significant difference between the obese group and the over-weight and normal-weight groups. However, the difference was relatively subtle in

that all groups showed a bias for high-fat foods, but with the obese showing a specific bias for savoury and the other two groups showing a bias for sweet foods.

1.9 Summary

Only one out of the seven studies reviewed above revealed any clear differences between weight categories in their preferences for unhealthy foods (Czyzewska, & Graham, 2008). However, the difference was not between healthy and unhealthy foods, but between two different types of unhealthy foods (savoury and sweet). Given all of the findings reviewed thus far it would seem that overweight/obese individuals do not possess a universally positive implicit attitude to unhealthy and/or high-fat foods. Obviously, this conclusion offers a serious challenge to the argument that food attitudes are related to actual eating behaviour. At this point, however, it is important to note that none of these studies controlled for the influence of the participants' state of food deprivation. Perhaps, obese individuals' high-fat/unhealthy food biases only become evident when they experience food craving or food deprivation. Only two studies to date have investigated the effects of food-deprivation/craving-induction on overweight/obese and normal-weight individuals' implicit attitudes to food, and it is to these studies that we now turn.

1.10 Food Deprivation Studies

1.10.1 Food Deprivation Increased Overweight Individuals' Implicit Attitudes to Food versus Furniture on the IAT

The IAT was the first implicit measure to be used to examine the effects of food deprivation on the evaluation of food stimuli among normal-weight and slightly overweight individuals (Stafford & Scheffler, 2008). Participants were randomly assigned to a pre-lunch condition (i.e., they ate food no later than 8.30am, and the study was conducted between 12.30 and 14.30pm) or to a post-lunch condition (i.e.,

they ate lunch no longer than one hour before conducting the study). Upon arrival participants completed a food diary (to check compliance) and an IAT. The IAT required participants to categorize word stimuli from four categories; food (i.e., sandwich, banana, etc.), furniture (i.e., curtains, table, etc.), pleasant, and unpleasant words. The researchers predicted that hungry individuals in the pre-lunch condition would demonstrate a more positive implicit bias towards food over furniture than the post-lunch condition.

As predicted, both groups showed a significant preference for food over furniture on the IAT, with the pre-lunch group providing a significantly stronger pro-food bias compared to the post-lunch group. The pre-lunch group also had significantly higher explicit hunger ratings compared to the post-lunch group. In short, food deprivation increased participants' implicit food biases.

1.10.2 Both Obese and Normal-weight Groups Show a Bias toward Low-fat Foods on the APP after a *Food-deprivation/craving-induction Exercise*.

The APP was used to determine the effects of a food-deprivation/craving-induction procedure on female obese and normal-weight controls' attitudes to food (Roefs, Quaedackers, Werrij, Wolters, Havermans, Nederkoorn, van Breukelen & Jansen, 2006). Participants were told to abstain from eating any foods two hours prior to the study, and the research was conducted in a hospital setting.

Participants' pre-test (baseline) cravings were recorded using a 100mm visual analogue scale prior to the craving induction procedure. The subsequent craving induction procedure involved presenting participants with a bowl of high-fat foods (chocolate, croissant, and potato chips), and getting them to smell intensely and nibble the food they liked best. After a five minute craving induction, their craving level was measured again; if it achieved the threshold criteria of seventy or above, participants

completed the APP. The APP in the current study used the same prime and target stimuli (personally chosen positive and negative words) as Roef et al. (2006, Experiment 1). Craving induction and measurement were repeated before blocks two and three of the APP with the restriction that craving levels of over seventy were required to proceed. The researchers predicted that craving induction would increase the priming effect for palatable over unpalatable foods, with obese individuals demonstrating specifically stronger effects for high-fat over low-fat palatable foods relative to the normal-weight individuals.

Contrary to the researchers' predictions, no significant priming effects for palatable versus unpalatable or high- versus low-fat foods were reported, nor were there any significant differences between the weight categories. However, a marginally significant interaction between targets, prime palatability, and prime-fat content indicated that both groups suggested a bias for low-fat palatable foods over high-fat palatable foods. Interestingly, a significant positive correlation was found between initial craving (after the 5 min craving induction task) and the APP palatability priming effect score for the obese participants only. All other craving correlation scores (i.e., pre-test, task onset, or average craving score across test blocks two and three) were non-significant with the APP scores.

In conclusion, the food-deprivation/craving-induction procedure did not achieve its goal of focusing obese more than normal-weight participants on the palatability of food. Instead, the results were in line with Roefs et al. (2005, Experiment 2), in that both obese and normal-weight individuals suggested a bias for low-fat over high-fat palatable foods. Once again, however, the health emphasizing aspects of the hospital setting may have influenced the outcome of the study. Critically, once again no differences between the obese and normal-weight

participants were observed. At the present time, therefore, there appears to be little evidence that obese individuals' implicit attitudes to food are more or less sensitive to food deprivation than those of normal-weight individuals.

1.11 Summary and Conclusion

To date, the IAT, EAST and the APP have been employed in the investigation of implicit food attitudes among obese and normal-weight individuals. Only one study out of eight found a difference in implicit attitudes towards unhealthy foods among these two groups, but the difference was between two types of unhealthy food rather than between unhealthy and healthy foods. At this point, therefore, it appears that there is no empirical evidence to support the claim that implicit attitudes are related in any meaningful way to eating behaviour, at least in terms of differentiating between normal-weight and obese individuals. In drawing this conclusion, however, it is important to note that the implicit measures that have been used in this area of research are all associative in nature. That is, the measures were designed to target mental or cognitive associations between concepts in memory. Recently, an alternative measure of implicit attitudes, known as the Implicit Relational Assessment Procedure (IRAP), has been offered. In contrast to the IAT, the EAST and the APP, which evolved from mainstream social-cognitive psychology, the IRAP was designed to target the relative strengths of relational responding, rather than mental associations. To fully appreciate the difference between the IRAP and associative measures it is necessary to examine the research tradition from which the IRAP emerged, and it is to this topic that we now turn in the next chapter.

Chapter 2: A Behaviour-Analytic Approach to the Study of Implicit Attitudes: The Implicit Relational Assessment Procedure (IRAP) and the Relational Elaboration and Coherence (REC) Model

2.1 Behaviour Analysis

Behaviour analysis is a scientific approach to studying the behaviour of organisms (Leslie & O'Reilly, 1999), and it began as a discipline with the seminal work of B.F. Skinner during 1930s with the publication of *The Behavior of Organisms* (Skinner, 1938). Skinner rejected the mainstream concept of mentalism, the idea that the unobservable mind causes behaviour and proposed instead a formulation of behaviour based on the functional relationship between behaviour (dependent variable) and environmental parameters (independent variables). It has been argued that Skinner's greatest contribution to psychology was his specification that the social and physical conditions of our environment are critically important in determining behaviour (Blackman, 1995; Nye, 1975).

According to Skinner's philosophy of science, the goal of the scientist is to predict and influence behaviour, defined as any and all activities that an organism can engage in, including both overt (i.e., observable by other people) and covert (i.e., observable only to the behaving organism; e.g., thinking, feeling). In order to be able to predict and influence behaviour, the scientist must uncover manipulable (independent) variables of which behaviour (the dependent variable [DV]) is a function). These variables are never in the unobservable and inaccessible realm of the mind. Furthermore, the independent variables must always be outside of the behavioural system, because the scientist cannot directly manipulate the DV of behaviour itself; manipulable variables are thus always in the environment.

In mainstream psychology, feelings, thoughts and other covert behaviours are seen as causing overt actions. However, from a behaviour-analytic perspective they are functionally similar to overt behaviours (i.e., responses to be targeted for prediction and influence). The task of the scientist is to uncover manipulable variables in the environment that allow prediction and control of both overt and covert behaviours. Thus, the nomenclature of behaviour analysis produces a scientific description of behaviour, without the need to rely on internal mental events or hypothetical constructs (Baum, 1994). In short, behaviour analysis allows for the application of the same experimental analyses to both overt and covert behaviours and avoids, what from a behavioural perspective, might be referred to as the "explanatory fictions" of the mind and mental states (Nye, 1975).

2.2 Relational Frame Theory

Within the last two decades, a contemporary behaviour-analytic approach to human language and cognition (verbal behaviour) has been developed known as Relational Frame Theory (RTF; Hayes, Barnes, & Roche, 2001). The core units of this theory are derived relations (Hayes et al. 2001). The phenomenon of derived (untrained) relational responding was first shown by Sidman in 1971. He trained individuals with minimal verbal repertoires across a number of related conditional matching tasks and found participants emitted a number of regular untrained effects (i.e., known as stimulus equivalence). Specifically, Sidman found that teaching participants the conditional response of choosing the arbitrary stimulus B in the presence of arbitrary stimulus A, and choosing the arbitrary stimulus C in the presence of arbitrary stimulus B, resulted in the following derived phenomena; choosing A given B, and B given C (i.e., the reserve of the taught relations known as symmetry); and choosing C given A (i.e., transitivity) and A given C (i.e., combined

symmetry and transitivity). Collectively, these effects were known as stimulus equivalence, because it appeared that participants acted on the stimuli as if they were equivalent to each other.

The effects of stimulus equivalence were interesting from a behaviour-analytic perspective because they were not readily predicted using traditional behavioural principles. Stimulus equivalence was thus a catalyst for a new wave of research activity in behaviour analysis, and some of this work indicated that there were strong links between the phenomenon and human language (Cowley, Green, & Braunling-Mc Morrow, 1992; Devany, Hayes, & Nelson, 1986; Kendall, 1983; Wulfert & Hayes, 1989). In 1994 Barnes argued that five areas of research bolster the link between stimulus equivalence and human language. First, only verbally able humans, but not nonhumans or humans who are not verbally-able can demonstrate stimulus equivalence (Barnes, McCullagh, Keenan, 1991; Devany et al., 1986; Dugdale & Lowe, 2000; Hayes, 1989; Sidman & Tailby, 1982). Second, learning to name stimuli may facilitate equivalence responding in young children (Dugdale & Lowe, 2000). Third, it is possible to treat language deficiencies in verbally disabled individuals through the equivalence paradigm (Cowley, Green, & Braunling-McMorrow, 1992). Fourth, symbolic meaning and the generative nature of grammar can be interpreted behaviour-analytically via stimulus equivalence (Barnes & Holmes, 1991; Barnes-Holmes, Barnes-Holmes, & Cullinan, 2000; Hayes & Hayes, 1989; Wulfert & Hayes, 1988). Fifth, human behaviours such as social categorisation have been explained through stimulus equivalence (e.g., Roche & Barnes, 1996; Watt, Keenan, Barnes, & Cairns, 1991) as well as logical reasoning (Barnes & Hampson, 1993). Furthermore, recent neuroscience evidence indicated that brain activation patterns during the formation of equivalence relations are similar to the semantic processing underlying

language (e.g., Dickins, Singh, Roberts, Burns, Downes, Jimmieson et al., 2001). Overall, therefore, there is substantive evidence that the control exerted over behaviour by stimuli participating in equivalence classes parallels the control that verbal stimuli exert over human behaviour (Hayes & Hayes, 1989).

The link between stimulus equivalence and human language allowed RFT researchers to use equivalence as a springboard for launching a modern behavioural account of human language and cognition. According to RFT, equivalence class formation was simply one example of a pattern of behaviour that was defined by the theory as arbitrarily applicable relational responding. According to RFT, all organisms (from insects to primates) can learn to behave based on the non-arbitrary or formal relations between and among stimuli [e.g., bigger than, smaller than; etc. see Reese, 1968], but critically the evolution of human language or verbal behaviour involved the development of another type of relational responding. Specifically, RFT posits that much of verbal behaviour involves learning from multiple exemplars to respond to arbitrarily applicable stimulus relations. These relations are not defined by the formal or physical properties of the stimuli, but by non-formal or conventional contextual cues.

For example, imagine I show a normally developing child a picture of a cow (stimulus A) and say “This is a cow” (stimulus B), and then point to the written word “cow” (stimulus C) and say this says “cow”. According to RFT, the spoken word “is” may function as a contextual cue, which brings a history of arbitrarily applicable relational responding to bear on the stimuli, such that the child may then respond to the three stimuli as “going together” without direct training. For example, if I later show the child a picture of a cow and different words and ask her “which word” goes

with the picture, she might readily point out the word "cow", even though this response had not be directly trained or instructed (i.e., novel or generative response).

According to RFT the contextual cue "is" acquires its controlling function through a history of multiple exemplars of reinforced relational responding to words, pictures, objects and events. In this case, the word "is" appears to control the pattern of relational responding known as equivalence. According to RFT, however, stimulus equivalence is only one class of such relational responding. The theory states that there are many other possible forms of relational responding, known as relational frames. For example, the frames of opposition, distinction, comparison, hierarchy, perspective, and so on have all been identified and subject to experimental analysis (see Rehfeldt & Barnes-Holmes, 2009). The frame of opposition, for instance, has the property that an opposite of an opposite is the same, an opposite of an opposite of an opposite is an opposite, and so on (Hayes et al., 2001). Hence, the scope of RFT is broader than the study of equivalence classes *per se*. Despite the diversity of patterns of relational framing possible, however, all are characterized by three fundamental attributes (i.e., mutual entailment, combinatorial entailment and transformation of function).

The bi-directionality of relational responding is accounted for by the term mutual entailment (Hayes et al., 2001). For example, if X is related to Y in a particular context, then a relationship between X and Y is entailed. This relationship between the stimuli can be symmetrical (i.e., as in the case of equivalence or coordination), but this may not always be the case. For example, if X were smaller than Y, the relationship is not symmetrical but is mutually entailed. Therefore, two relations would exist, "X is smaller than Y" and "Y is bigger than X" (Hayes et al.).

Derived stimulus relations involving two or more sets of relations is know as combinatorial entailment. Without combinatorial entailment it would not be possible to define the relevant forms of relational frames (Hayes et al., 2001). If in a given context X is related to Y and Y is related to Z, then a relation is entailed between X and Z and conversely, Z and X. For relations that are mutually entailed, the specified relationship between X and Y always entails a relationship between Y and X at the same level of specificity. However, with combinatorial entailment, the derived relationship may be less specific than the original relationship. For example, if X is different to Y and Y is different to Z, the relationship between X and Z and Z and X is unknown. Note, however, that the unspecified nature of the relationship, in and of itself, is a stimulus relation.

The final salient feature of RFT is transformation of stimulus function. When stimuli are involved in a relational frame, any psychological function attached to one of those stimuli may transform, given appropriate contextual cues, the functions of the other stimuli in accordance with the relations involved (Barnes, 1994; Hayes et al., 2001; Hayes & Wilson, 1993). For example, in a frame of comparison stimulus X may be defined as "more than" stimulus Y, and if stimulus Y is known to have a mildly aversive function, then stimulus X may acquire a relatively stronger aversive function than Y (see Dougher, Augustson, Markham, Greenway, & Wulfert, 1994 for empirical evidence).

The three defining properties of relational framing are viewed as the key process underlying both stimulus equivalence and human language (Hayes & Wilson, 1993). By specifying this process as the core of language, RFT thus provides a way of approaching and studying language, and similarly complex human behaviour, in purely functional terms. From an RFT perspective, then, verbal behaviour is the action

of framing events relationally (Hayes et al., 2001, p.43). From this perspective both the speaker and the listener engage in this process (Hayes & Hayes, 1989). When the speaker does so they are speaking with meaning, and when a listener does so, they are listening with understanding (Hayes & Wilson). Critically, it is the framing of events that indicates the behaviour is verbal for the speaker and listener. Therefore, verbal meaning is not a mental event; it is a highly specified behavioural process (Hayes & Barnes- Holmes, 2004). In the same vein, a verbal stimulus is a stimulus that has its functions, in part, because it participates in relational frames.

In sum, RFT provides a behaviour-analytic approach to language or verbal behaviour that is theoretically consistent, is built on existing principles that utilise the latest empirical evidence, and is true to the behaviour-analysis philosophy of prediction and control (Hayes and Wilson, 1993). This behavioural account of language and verbal behaviour may be extended to the investigation of a range of verbal behaviours, such as those involved in so called socially sensitive attitudes. The next section will now discuss this empirical work.

2.2.1 Relational Frame Theory and Socially Sensitive Attitudes

Attitudinal behaviour from an RFT perspective is verbal responding with respect to an attitude object that involves transformation of "evaluative functions" of that object. An example of a real life prejudicial attitude formed in this way could be as follows: Imagine that the media blame a recent terrorist attack on members of a particular foreign country (e.g., country X). Given a normal verbal learning history, the word "terrorist" probably already operates in an equivalence relation with "bad" and "dangerous". If I have little knowledge about country X, then an important part of my verbal knowledge towards that country may operate in an equivalence (or hierarchical) relation between "country X" and "terrorist". As a result, upon reading

about, hearing about, or coming into contact with someone from country X, it is highly possible the negative functions of “bad” and “dangerous” may transfer to that individual via equivalence (or hierarchy), thus causing me to view this person as suspicious.

The first behaviour-analytic study to examine socially sensitive attitudes (i.e., religious categorization) utilizing derived relational responding was carried out by Watt, Keenan, Barnes, & Cairns (1991). Individuals living in Northern Ireland and English participants not living in Northern Ireland were exposed to a matching-to-sample training procedure. This involved matching Catholic family names to nonsense syllables and matching those nonsense syllables to Protestant symbols. During the equivalence test, participants were required to match Protestant symbols directly to Catholic family names. The verbal learning history of individuals living in Northern Ireland typically establishes a strong relation of difference between Catholic and Protestant stimuli, but this history is largely absent in England. Thus for the Northern Irish participants the predicted equivalence relations (Catholic equivalent to Protestant) were in opposition to their socially established relations (Catholic different to Protestant); no such competition between stimulus relations was present for the English participants, however. The researchers thus predicted that the English participants would readily demonstrate the Catholic-Protestant equivalence relations, but the Northern Irish participants would not, and indeed this is what emerged. As such, the socially sensitive verbal relations developed as a result of living in a Northern Irish community seemed to prevent the formation of novel laboratory induced equivalence relations.

Similar stimulus equivalence-based approaches have been used to discriminate anxious from non-anxious patients (Leslie, Tierney, Robinson, Keenan, Watt, &

Barnes, 1993) and have been developed as a diagnostic tool to identify children who have been sexually abused (McGlinchey, Keenan, & Dillenburger, 2000). Participants' attitudes towards themselves have been assessed via the equivalence paradigm (Barnes, Lawlor, Smeets, & Roche, 1996) and attitudes of North Americans to Middle Easterners have been assessed using this general approach (Dixon, Dymond, Rehfeldt, Roche, & Zlomke, 2003).

2.2.2 Relational Frame Theory and the IAT

Interestingly, the abovementioned equivalence-based approach to investigating social phenomena appears to be functionally similar to the Implicit Association Test (IAT: described earlier). The basic argument is that the overall IAT effect results because participants are asked to categorize functionally similar equivalence classes as functionally equivalent during the consistent tasks (e.g., by pressing the same key for flowers and positive words), but to categorize functionally non-equivalent classes as functionally equivalent during the inconsistent task (e.g., by pressing the same key for flowers and negative words). As a result, responses are slower for the inconsistent task because they involve responding against previously established derived or verbal relations (O'Toole, Barnes-Holmes, & Smyth, 2007).

Effectively, this is the same behavioural explanation that was provided for the disruption of equivalence class formation of the mutually exclusive verbal categories Catholic and Protestant. On the IAT, and within the stimulus equivalence models, the differential performance among the various classes' results from the different learning histories attached to the stimuli within each of the classes. This behavioural interpretation is based on a comprehensive, bottom-up, account of language that is ultimately rooted in a philosophically and theoretically unified pragmatic RFT approach. This approach readily lends itself to the continued development, extension

and re-conceptualisation of potentially useful methodologies such as the IAT. Indeed, it is this flexibility that has provided the basis for the development of a new behaviour-analytic methodology, the Implicit Relational Assessment Procedure (IRAP), to which we now turn.

2.3 The Implicit Relational Assessment Procedure

The behavioural explanation for the IAT effect, combined with the empirical behavioural research on derived relations, provided the catalyst for the development of the IRAP. For example, the development of the IRAP was based in part on an earlier RFT program of research for training novel stimulus relations, the Relational Evaluation Procedure (REP; Barnes-Holmes, Healy, & Hayes, 2000). The REP requires participants to confirm or deny the applicability of particular stimulus relations to sets of stimuli (Stewart, Barnes-Holmes, & Roche, 2004). For example, two identical shapes might be presented with the relational terms "Same" and "Opposite", and participants are required to indicate that the relation is "Same". Thus, the REP has been used to train novel stimulus relations as a model of human language learning.

The IRAP is a combination of the IAT and the REP. Similar to the REP, it involves presenting specific relational terms (e.g., "Similar", "Opposite", "Better", "Worse") so that the properties of the relations among the stimuli can be ascertained. Similar to the IAT, the IRAP involves asking participants to respond both quickly and accurately to the relations between the presented stimuli in a manner that is both consistent and inconsistent with their pre-experimentally established verbal relations.

At the same time, the IRAP also differs from these two methodologies. The IRAP is different from the REP in that: (a) rather than focusing on the establishment of novel stimulus relations it was designed to assess previously established verbal

relations; and (b) the relations that it assesses are implicit in nature. Regarding the IAT (and related associative measures), the IRAP is different in that on each trial it asks participants to confirm or deny a specific attitude *directly* by responding to the relation between a label and target stimulus (Barnes-Holmes, Barnes-Holmes et al., 2010).

Furthermore, it is important to underscore the fact that the IRAP was designed to overcome a serious limitation identified with the IAT. As explained earlier, the IAT provides a measure of relative associative strength, which can conceal the exact nature of the attitudes under study. For example, in the context of attitudes towards flowers and insects, the IAT can indicate that flowers are preferred to insects, but it cannot reveal how much either stimulus is liked or disliked in isolation. Perhaps, the key advantage of the IRAP over the IAT is that it permits the non-relative assessment of socially sensitive attitudes. The IRAP overcomes this weakness by permitting the assessment of separate relational responses and thereby allowing an independent measure of attitudes toward target categories.

The basic IRAP assumption is that if a measure requires participants to alternate between response patterns that are consistent and inconsistent with previously established natural verbal relations under time pressure, an effect similar to the IAT should be observed. That is, average latencies for a group of participants should be slower for response patterns that are inconsistent rather than consistent with existing verbal relations. Furthermore, this effect should be observed even if the verbal relations involved are of a socially or a psychologically sensitive nature.

The IRAP (Barnes-Holmes et al., 2006) is a computer-based task that involves the presentation of specific relational terms in a manner that facilitates the properties of the relations between relevant stimuli to be assessed. For example, on each IRAP

trial, participants are presented with one of two label stimuli (e.g., “Pleasant” or “Unpleasant”) at the top of the computer screen. Presented in the centre of the screen is a target stimulus (e.g., “Love”, “Accident”). Participants are required to respond to the relation between the label and the target by choosing one of two relational terms (e.g., “Same” or “Opposite”), presented at the bottom left and right of the screen. Progression to the next trial is contingent on either selecting a consistent relational response (i.e., in the presence of “Pleasant” and “Love”, selecting the relational term “Same”), or an inconsistent relational response (i.e., in the presence of “Pleasant” and “Love”, select the relational term “Opposite”). The critical index is the difference in response latencies across successive presentations of consistent and inconsistent trials.

The IRAP typically presents four different trial-types that are established by presenting each of two relational cues (e.g., SAME and OPPOSITE) with each of two target objects (e.g., Flowers and Insects) and each of two label categories (e.g., Pleasant and Unpleasant). For example, if examining attitudes towards flowers and insects, two types of blocks would be presented with one type requiring responses deemed pro-flowers and anti-insects (i.e., *Flowers-Pleasant-Same; Flowers-Unpleasant-Opposite; Insects-Pleasant-Opposite; Insects-Unpleasant-Same*), and the other requiring a pro-insect/anti-flower response pattern (e.g., *Flowers-Pleasant-Opposite, Flowers-Unpleasant-Same,* etc.). If participants respond faster when emitting the former response pattern relative to the latter, this is taken to indicate a preference for flowers over insects.

Over the past five years, a growing number of studies using the IRAP have been reported in the literature. Early research indicated that the IRAP effect was difficult to fake (McKenna, Barnes-Holmes, Barnes-Holmes, & Stewart, 2007). The IRAP has also been successfully employed as a measure of implicit preferences for

social groups (Power, Barnes-Holmes, Barnes-Holmes & Stewart, 2009) and as a measure of implicit ageism (Cullen, Barnes-Holmes, Barnes-Holmes & Stewart, 2009), implicit self-esteem (Vahey, Barnes-Holmes, Barnes-Holmes, & Stewart, 2009), implicit homonegativity (Cullen & Barnes- Holmes, 2008), implicit racial stereotyping (e.g., Barnes-Holmes, Murphy et al., 2010), and implicit body-size bias (Roddy, Stewart, & Barnes-Holmes, 2010). In addition, data indicates that the IRAP could be developed into a forensic assessment tool (Dawson, Barnes-Holmes, Gresswell, Hart, & Gore, 2009), and it has been effective in measuring attitudes towards work and leisure (Chan, Barnes-Holmes, Barnes-Holmes, & Stewart, 2009), and attitudes to country versus city living (Barnes-Holmes, Waldron, Barnes-Holmes, & Stewart, 2009). Additionally, the procedure has been found to possess good internal consistency (e.g., Barnes-Holmes et al., 2009; Barnes-Holmes et al., 2009) and test-retest reliability (Cullen et al., 2009).

To date, only one study has employed the IRAP in the study of food preferences (Barnes-Holmes, Murtagh, Barnes-Holmes, & Stewart, 2010). Specifically, this study tested the validity of the IRAP by comparing it directly to the IAT using a "known-groups" approach. That is, the study sought to determine if the two measures successfully discriminated between vegetarians and meat-eaters (see De Houwer & De Bruycker, 2007). Both implicit measures involved asking participants to respond to meat and vegetable stimuli as either positive or negative. Both the IAT and IRAP discriminated at a statistically significant level between the vegetarians and meat eaters, and both measures correlated with the explicit self-report measures that were employed in the study. Both measures also provided similarly small but statistically significant increases in predictive validity over the explicit measures. In short, growing evidence indicates that the IRAP appears to function as an implicit

measure and compares well with the most widely used and well-established measure, the IAT.

2.3.1 Relational Frame Theory Explanation of the IRAP Effect.

In calling the IRAP an implicit measure, however, it is important to clearly define exactly what this means from a behaviour-analytic perspective. Recently, developers of the IRAP have proposed the relational elaboration and coherence (REC; Barnes-Holmes, Barnes-Holmes, Stewart, & Boles, 2010) model as an RFT interpretation of the typical effects demonstrated on the IRAP. This final section of the chapter will outline the REC model.

According to the REC model each IRAP trial typically produces an immediate and relatively brief relational response before the participant initiates their response selection. Imagine, for example, an IRAP trial that presents the words "Good" and "Flowers" with the two response options "True" and "False". RFT being an operant theory of human language assumes that the probability of the initial response on this trial will be determined by the verbal and non-verbal history of the participant and the current context. Given a typical English speaking learning history, the most probable response to this trial will thus be "True" (because flowers are generally defined as good by the wider verbal community). If the IRAP contingencies require the participant to emit this response (i.e., pressing "True" in the presence of "Flowers" and "Good") it will be emitted more quickly than a key press that is inconsistent with the immediate relational response (in this example, pressing "False"). Thus, across multiple trials, the average latency for consistent blocks is more likely to be shorter than for inconsistent blocks. In effect, the IRAP effect is the result of immediate and relatively brief relational (automatic) responding that occurs on most trials when

participants are required to relate stimuli under time pressure (Barnes-Holmes, Murphy et al., 2010; Vahey et al., 2009).

The IRAP effect thus provides a way of measuring particular response biases or tendencies that a participant may have based on their socio-verbal learning history. Of course, this applies not simply to inoffensive attitudes such as "Flowers are good" but also to more socially sensitive or controversial attitudes in respect of gender, appearance, ethnicity, sexual orientation, and, most relevant here, food attitudes.

According to the REC model, responses on the IRAP reflect initial relational responding, whereas responses on self-report measures, in contrast, reflect relatively elaborate and coherent relational responding. In other words, when an individual is asked to express an attitude on a particular issue using a standard self-report measure, it is likely that the person will produce a relational response that coheres with one or more other relational responses in his or her behavioural repertoire. If these relational responses also cohere with the initial relational response then implicit attitudes (as detected by the IRAP for example) and explicit attitudes will correlate; however, if there is a lack of coherence in this respect then there will be divergence between them.

Such divergence in attitudes measures is particularly relevant and has frequently been seen with respect to socially sensitive attitudes. Imagine, for example that a white participant is asked to rate pictures of white and a black men (differing with respect to race only) as "neutral" or "threatening", and the two pictures are rated equally on these rating scales. A participant's initial ratings of these pictures might indicate that the white man is higher on the "neutral" dimension and the black man is higher on the "threatening" dimension. However, other relevant information in relational networks, such as "it is wrong to discriminate on the basis of skin colour"

would not cohere with these initial responses to the pictures. Explicit measures are typically not completed under time pressure, and thus participants have sufficient time to engage in the extended relational responding that is needed to produce a response that coheres with one or more other relational responses. Thus, in the context of a questionnaire, the person's initial relational responses may be "rejected" and he or she may thus report evaluations of the pictures that are consistent with additional elaborated relational responding. In contrast, when completing a time-pressured IRAP the influence of a participant's elaborated relational responding would be absent or significantly reduced, because there is insufficient time, per trial, to engage in the elaborate relational activity that can serve to generate a relationally coherent response. Hence, there would be a divergence between responding as measured by the IRAP and the elaborated responding provided in the context of a questionnaire.

The first study to report a divergence between IRAP responses and explicit self-reports was Power et al. (2009). Since then, other IRAP studies have found similar results (e.g., Barnes-Holmes, Murphy, Barnes-Holmes & Stewart, 2009). Furthermore, the REC model predicts that the divergence between the IRAP and explicit measures of socially sensitive attitudes should increase as a function of increasing time pressure criteria on the implicit measure and this has also been shown (e.g., Barnes-Holmes, Murphy et al., 2010). As noted above, this results from the fact that participants have less time to engage in extended and elaborate relational responding.

It is worth noting that the REC model has similarities with the social-cognitive Associative-Propositional Evaluation (APE) model (Gawronski & Bodenhausen, 2006; 2007; Gawronski, LeBel, & Peters, 2007). The APE model posits that implicit and explicit attitudes are dissociated because they result from two different underlying

processes. Specifically, implicit attitudes are seen to be the result of evaluative tendencies that reside in associative processes, whereas explicit attitudes are the outcomes of evaluative tendencies that reside in propositional processes. Therefore, according to this model, evidence for the existence of attitude dissociation is misleading; these attitudes simply reflect different processes. Both the APE and REC models appear to explain a wide range of findings from implicit attitude research. Specifically, both models assume that brief immediate relational responses or automatic evaluations: (a) may be discriminated; (b) are sensitive to current contextual factors and thus may be influenced by socially desirable responses, self-presentation, and other such motivational effects; and (c) do not involve stable and enduring responses (Barnes-Holmes, Barnes-Holmes et al., 2010). However, the REC differs from the APE model in that it does not appeal to dual processes (associative and propositional), but to the single process of arbitrarily applicable relational responding, as described by RFT. In effect, the REC model views dissociation as depending on the extent to which relational responses are elaborated and cohere with each other. Furthermore, the REC model specifies that brief and immediate relational responding (automatic evaluations) is not restricted to simple associations, but may emerge based on a variety of stimulus relations (e.g., Power et al., 2009).

To conclude, the IRAP is a recently developed methodology grounded in RFT. Substantive empirical evidence supports the effectiveness of this procedure as a measure of socially sensitive attitudes or verbal relations. More, recently, the REC model has been proposed to explain the IRAP effect itself as well as the relationship between the IRAP and explicit measures.

2.4 Summary and Overall Conclusions

The discovery of the phenomenon of stimulus equivalence through the scientific framework of behaviour-analysis led to the development of Relational Frame Theory, which is a modern behaviour-analytic approach to understanding language and complex human behaviour, including attitudes. The IRAP methodology appears to facilitate a relational-frame theory approach to analyzing attitudes as verbal behaviour. According to the REC model, the patterns of brief and immediate relational responding registered on the IRAP are analogous to implicit attitudes, as defined by mainstream psychology. Furthermore, substantive empirical research has demonstrated the efficacy of the IRAP as a measure of socially sensitive verbal relations. In addition, one study has shown that the IRAP produces effects similar to the IAT in the context of food attitudes.

2.5 The Current Research Programme

The main purpose of the research presented in the current thesis was to develop an IRAP that could be used to assess implicit attitudes to healthy and unhealthy food in obese and normal-weight participants. To this end, across three empirical studies the IRAP and explicit measures were directly compared in terms of their ability to detect obese and normal-weight individuals' biases for healthy and unhealthy food in various food deprivation states. In addition, measures of neurological responding were recorded from normal-weight participants while they completed a food-attitude IRAP. Finally, a food-IRAP was used to examine the malleability of implicit attitudes to healthy and unhealthy food.

Chapter 3 presents the first empirical study of the thesis. This initial study directly compared an IRAP that aimed to measure "wanting" healthy versus unhealthy food with an explicit wanting-scale measure among obese and normal-weight

individuals in a 2 hour and in unrestricted food deprivation state. The results of the study showed no significant differences among the variables. Thus in Chapter 4 the second study employed an IRAP that aimed to target "hunger" (rather than "wanting") for healthy versus unhealthy food and compared this to an explicit hunger-scale, again among obese and normal-weight individuals in a 2 hour and in an unrestricted food deprivation state. The hunger-IRAP discriminated between the weight categories in the 2-hr food deprivation condition (i.e., the obese participants demonstrated a pro-unhealthy food bias and the normal-weight groups provided a pro-healthy food bias). In the No-Restriction condition, however, both groups produced weak healthy food biases. Similar to Study 1, the explicit measure (hunger-scale) did not differentiate among the groups with all four groups producing a healthy food bias. Logistic regression analyses found that the IRAP measure increased the predictive ability of the hunger-scale and a range of other explicit measures for the 2-hr food deprivation participants, but not for the No-Restriction condition.

The third study, reported in Chapter 5, aimed to increase the ecological validity by replicating Study 2, but changed the IRAP such that it targeted the dimension of "very-versus-slightly" hungry, rather than Hungry versus Not Hungry. This change was introduced based on the assumption that pictures of food would typically elicit at least some hunger response from participants. The findings from Study 2 were replicated, but in addition the introduction of the "very-versus-slightly" dimension produced a significant difference between the obese and normal-weight participants, and also yielded increased predictive validity over some explicit measures, in the No-Restriction condition.

In Chapter 5, the forth study explored the relationship between the normal-weight participants responses on the "very-versus-slightly" hunger-IRAP in a 2-hr

food deprivation state and neurological activity as measured by electroencephalograms EEGs. Study 4 replicated the IRAP pattern found in Study 3 (i.e., a pro-healthy-food bias in the 2-hr food deprivation condition), and significant effects consistent with the IRAP performances were obtained with the EEG measures.

The fifth study, reported in Chapter 7, examined the malleability of implicit hunger attitudes recorded by the IRAP after participants completed an Acceptance versus Indulgence of Food Urges intervention. The findings revealed that the participants exposed to the acceptance intervention showed an increased bias on the IRAP towards unhealthy food but the indulgence group showed no bias in either direction. The explicit measures indicated that hunger and cravings decreased, and resistance increased, for the acceptance group. In contrast, the indulge group reported relatively high levels of hunger and craving and low resistance. The lack of bias produced by the indulge group on the IRAP was taken to indicate a relatively high level of hunger in which participants fail to discriminate between the two food types (because they would eat anything).

The final study, reported in Chapter 8, sought to test the foregoing conclusion (i.e., would hungry participants fail to show any significant bias on the food-IRAP?). The study utilized a 4-hr-Plus versus sated food deprivation state manipulation. The basic prediction was that both conditions would fail to yield any significant bias for healthy versus unhealthy food. In effect, participants who are food-deprived or food-sated will not discriminate implicitly between food-types because in the former condition all food is appetitive and in the latter all food is neutral. The results of this final study upheld this prediction.

In the ninth and final chapter a summary of the research is provided and a range of empirical and conceptual issues are discussed.

Chapter 3: Food Deprivation and Implicit Wanting Attitudes to Food among Obese and Normal-Weight Individuals Using the IRAP

As described in the first Chapter of the current thesis, implicit measures have begun to be employed in the assessment of attitudes to food among obese and normal-weight individuals (i.e., the IAT, the EAST, and the APP). Only one study (using the APP) found a difference in the implicit attitudes to food between these two groups (Czyzewska, & Graham, 2008; See Chapter 1). Furthermore, deprivation studies failed to find significant differences in their implicit attitudes to food. In sum, it appears that there is little empirical evidence to support the claim that implicit attitudes are related in any meaningful way to eating behaviour, at least in terms of differentiating between normal-weight and obese individuals. Critically, however, all of the studies of implicit attitudes to food have been conducted using measures that were designed to target (implicit) associations.

One criticism of associative measures is that they may be sensitive to wider social or cultural associations and it is these that are reflected in the measures (Wittenbrink, & Schwarz, 2007). For example, Karpinski and Hilton (2001) noted that the IAT might measure "the extent to which various attitudinal objects are associated in the person's environment." (p. 783). In a modern western culture unhealthy foods are frequently paired or associated with health warnings and information pertaining to heart-disease, and other illnesses. Perhaps, therefore, an IAT performance pertaining to healthy and unhealthy foods reflects, in part, this type of social "conditioning" rather than the individual's actual food preferences. One way in which it might be possible to target food preferences *per se* (rather than the effects of social information) would be to employ a non-associative measure, such as the IRAP. As noted previously, the IRAP was designed to assess relations rather than "raw" or

simple associations, and thus it could be used to specify relations pertaining to wanting food or to feeling hungry. Indeed, it has been argued that overeating in the obese is related less to "liking" attitudes to food (i.e., valence) and more to "wanting" attitudes (i.e., arousal). Indeed, this is the core argument of the Incentive-Sensitization theory of addictive behaviours (see Berridge, 1996; Robinson & Berridge, 1993 for a review). Insofar as this is the case, then perhaps an IRAP that aims to target "wanting" food would produce effects that better predict eating behaviour than typical associative measures.

In attempting to assess implicit wanting (arousal) without regard to food it would seem important to control for participants' food deprivation state. That is, one would expect that increasing levels of food deprivation would increase the arousal properties of food for obese and normal-weight individuals (i.e., increasing their food-wanting attitudes). To date, only one study has investigated the effects of food deprivation state on implicit and explicit food-wanting attitudes, and this was conducted with normal-weight individuals (Finlayson, King, & Blundell, 2008). Participants completed a computer task that assessed their explicit and implicit food attitudes when hungry (i.e., in a 3-hour food deprivation state) and when sated (i.e., immediately after eating a meal until full). The implicit wanting measure presented individuals with a picture from one of the four food categories: high-fat-savoury, (i.e., French fries); low-fat-savoury, (i.e., bread roll); high-fat-sweet, (i.e., jam doughnut); low-fat-sweet, (i.e., fruit salad). In addition, a second picture was presented from one of the other three food groups. Participants were instructed to choose one of the pictures based on "which one you most want to eat now?" The participants' reaction times to each food-choice response were measured along with the frequency of selections made for each food category (i.e. a measure of relative preference). Explicit

wanting and liking attitudes to the same foods were assessed using the respective questions “How much do you want some of this food now?” and “How pleasant would it be to experience a mouthful of this food now?” Responses were recorded using a Visual Analogue Scale (VAS) anchored with “not at all” and “extremely” at either ends.

The latency data revealed a neutral bias for savoury and sweet food, regardless of fat category, when food-deprived. When sated, however, a positive bias towards both high- and low-fat sweet foods was observed, with neutral bias for savoury foods. No significant effects were recorded for the behavioural choice data. Both the explicit wanting and liking measures revealed that wanting and liking for all food categories decreased significantly when participants were sated relative to food deprived. In addition, a greater reduction in wanting and liking was observed for savoury compared to sweet foods. There were no significant correlations between the implicit and explicit measures. However, the implicit latency measure significantly correlated with the participants’ relative food preferences’ (i.e., food choices). Thus, when a food category was chosen more frequently an implicit bias was also observed for that food, independent of any change in explicit evaluation. In sum, when deprived, explicit wanting and liking increased for all foods, but implicit wanting showed the opposite effect for sweet foods only (i.e., bias increased when sated).

At the time of writing, no published study had attempted to assess implicit wanting for food among obese and normal-weight individuals, while also manipulating deprivation state. The first study reported in the current thesis aimed to investigate the effects of food deprivation on implicit wanting for healthy and unhealthy foods among obese and normal-weight individuals using the IRAP. The study presented obese and normal-weight individuals with an IRAP that was designed

to target wanting. Participants completed the study in a two-hour food deprivation state or in a condition in which food was not restricted prior to participation. The primary purpose of this first study was to determine simply if the wanting-IRAP was sensitive to individual differences in body-weight and deprivation state, and thus no specific predictions were made. Indeed, predictions were particularly difficult because no previous study had employed the IRAP in the context of food deprivation with obese and normal-weight individuals. As such, the study was almost purely exploratory, and should be seen as providing the first empirical step in the current research programme.

3.1 Method

3.1.1 Participants

Normal-weight individuals. Six screening criteria were employed. Specifically, participants (a) were required to be within a normal-weight BMI (18.5-24.9 kg/m²); (b) were required to report no gastrointestinal problems within 24hrs prior to the study; (c) to report that they ate both red and white meat; (d) to score within the normal range on the Eating Disorder Examination-Questionnaire (EDE-Q5; Fairburn & Beglin, 1994); (e) to indicate that they were fluent English speakers, and (f) to meet the practice criteria on the IRAP (described below). Twenty-four participants met these criteria and completed the study. The sample consisted of 11 females and 13 males (age M = 21 years, range, 18-24; weight, BMI, M = 21.7 kg/m²) recruited from undergraduate students attending the National University of Ireland, Maynooth. The BMI of each participant was obtained by the researcher who took measurements of height and weight at the end of the experimental session. No financial enticements were offered to the participants and all were naïve to the IRAP. Participants were assigned randomly to one of two groups, counterbalancing for

gender. The reader should note that although male-female differences may be expected on some of the measures employed in the studies reported in the current thesis, such differences were deemed tangential to the research and thus counterbalancing for gender was applied throughout the present work.

Obese individuals. Fifteen females and eight males (age *M* = 42 years; weight *M* = 50 kg/m²; all participants were in excess of 30 BMI kg/m²) attending the Diabetes and Weight Management Clinic, St., Columcilles Hospital, Loughlinstown, County Dublin volunteered to participate. The screening criteria described above were applied in recruiting the sample of obese participants except for criteria "a" and "d". The BMI for the obese participants was obtained from the hospital records, which were always up-dated every day a participant attended the clinic. Once again, participants had no previous experience with the IRAP and completed the study without financial incentives. The participants were allocated randomly to one of two groups, controlling for gender.

3.1.2 Setting

The non-obese individuals completed the study alone at a table in front of a personal computer in a quiet experimental cubicle in the Department of Psychology, at the National University of Ireland, Maynooth between 12.00pm and 4.00pm. The experimenter remained seated outside the cubicle except during the instruction phase. The obese participants conducted the study seated alone at a table in front of a personal computer, in a quiet room in the Diabetes and Weight Management Clinic between 12.00pm and 4.00pm. Except for the instruction phase the experimenter remained outside the test environment.

3.1.3 Apparatus/Materials

Food stimuli. Pictorial stimuli were selected based on descriptions of food stimuli used in previous studies of implicit attitudes to food (Roefs and Jansen, 2002; Finlayson, King, & Blundell, 2007). Specifically, six pictures of food deemed to be healthy (chicken salad, fruit, soup, green salad, nuts and a grilled fish dinner) and six pictures of food deemed to be unhealthy (hamburger and chips, donuts, chocolate, crisps, ice-cream, steak) were employed (see Figure 3.1). The pictures were culled from the internet stock photography website *www.fotosearch.ie* and were used for both implicit and explicit measures.

IRAP. The IRAP was presented on standard Pentium 4 personal computers running Windows XP (software available for download from http://psychology.nuim.ie/IRAP/IRAP_1.shtml). The IRAP software controlled the presentation of instructions and stimuli, and recorded participants' responses. All IRAP trials presented one of two label stimuli "I want to eat it NOW" and "I want to eat it LATER" with one food picture (either healthy or unhealthy) presented as a target stimulus. The response options "True" and "False" were also presented on each trial (see Figure, 3.2, for an example of an IRAP trial).

Figure 3.1. The six pictures of unhealthy and healthy foods used in the IRAP and explicit measures.

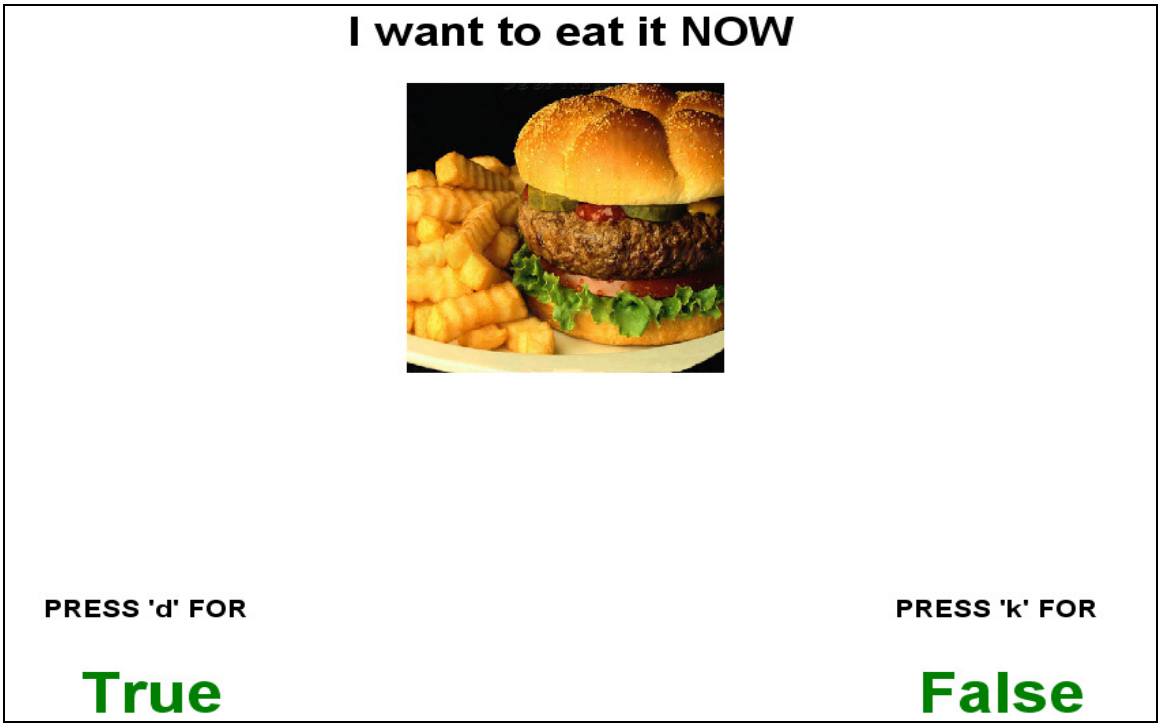


Figure 3.2. An example of an IRAP Trial-Type.

Hunger-state questionnaire. Participants completed the Hunger-State self-report questionnaire to determine the time since their last meal, their present hunger state and if they had suffered from any gastrointestinal problems in the last 48 hours (See Appendix B)?

Wanting-scale. Participants completed the wanting-scale self-report measure to assess wanting-food preferences for the same 12 food target pictures used on the IRAP. The measure comprised of a 12-item questionnaire that presented 9-point Likert scales (i.e., "On the scale below, -4 to 4, rate how much you want to eat "the 12 food items" "NOW or LATER?", "-4 (LATER)," "0 (NEUTRAL)," and "4 (NOW)" (See Appendix C).

Eating Disorder Examination -- Questionnaire. Each participant completed the Eating Disorder Examination – Questionnaire (EDE-Q5; Fairburn & Beglin, 1994), which was designed to assess for the presence of any abnormal attitudes to food or disordered eating behaviours. The questionnaire consisted of 28 items; 22 items comprising four food attitudinal subscales; restraint, weight concern, shape concern, and eating concern. The six remaining items measured frequency data on key behavioural features of eating disorders in terms of number of episodes (i.e., times or days) on which the specific behaviours occurred; objective over-eating, subjective bulimic episodes, objective and subjective bulimic episodes, purging, laxative misuse and compulsive exercise (See Appendix D for full questionnaire). Respondents rated each of the 22 attitudinal items on a 7-point rating scale indicating the number of days out of 28 on which the specific attitudes or feelings occurred (scored 0–6, with scores of four or higher considered to lie in the clinical range). Items 1 to 5, assessed Restraint, 7, 9, 19, 20 and 21 assessed Eating Concern, 6, 8, 10, 11, 23, 26, and 27 assessed Shape Concern, and 8, 12, 22, 24, 25 and 28 assessed Weight Concern.

Participants rated the key behavioural items (13, 14, 15, 16, 17, and 18) for how many times over the last 28 days they engaged in the particular behaviour. Only participants *not* possessing disordered food attitudes or abnormal eating behaviours, based on the norms of Fairburn and Beglin (1994), were included in the normal-weight groups.

Balanced Inventory of Desirable Responding. Participants completed the Balanced Inventory of Desirable Responding (BIDR; Paulhus, 1988) self-report measure (See Appendix E for full questionnaire). The BIDR measured participant's propensity to respond in a socially desirable manner. It is a 40 item scale with items 0 to 20 measuring Self-Deception (even numbers reversed scored) and items 21 to 40 assessing Impression Management (odd numbers reversed scored). Participants rated each item on a 7-point Likert scale, anchored "1 (NOT True)," "0 (SOMEWHAT True)," and "7 (VERY True)". The primary reason for including this scale was to determine if socially desirable responding and impression management correlated with the implicit and/or explicit measures (see Roefs & Jansen, 2002).

Power of Food Scale. The 21-item Power of Food scale (PFS; Lowe et al., 2009) was used to assess the psychological influence of the mere presence or availability of food in the environment on participants. It measured appetite for foods at three levels, food available, food present and food tasted. Participants rated the extent to which they agreed that the 21-items described them on a 5-point scale "1 (I don't agree at all)," "2 (I agree a little)," "3 (I agree somewhat)," "4 (I agree)," "5 (I strongly agree)," (See Appendix F for full questionnaire). Scores above 60 were deemed to lie in the clinical range (Lowe et al., 2009).

3.1.4 Procedure

Experimental sequence and participant assignment. The procedure consisted of three phases. In Phase 1, participants were asked to complete the Hunger-State

questionnaire. In Phase 2, the IRAP was presented. In Phase 3, participants completed four self-report measures; the wanting-food questionnaire; the Eating Disorder Examination – Questionnaire (EDE-Q5; Fairburn & Beglin, 1994); and the Balanced Inventory of Desirable Responding (BIDR; Paulhus, 1988), and The Power of Food Scale (PFS; Lowe et al., 2009), respectively.

Normal-weight participants were randomly assigned (counterbalancing for gender) to either the No-Restriction or 2-hr group. Similarly, the obese individuals were randomly assigned (again counterbalancing for gender) to either the No-Restriction or the 2-hr group. Participants in the normal-weight No-Restriction and obese No-Restriction groups were not instructed to control their food intake prior to commencing the study. Both the normal-weight and obese 2-hr groups were instructed upon recruitment, and reminded via SMS message 24 hours before the study, to eat a large meal until full, finishing it exactly two hours before commencing the experiment.

At the start of each experimental session the researcher thanked the participants for coming and informed them of the brief nature of the study. Participants were told that participation was voluntary, that they were completely free to with-draw at any stage, and all information they provided during the study was fully confidential. All individuals completed a written consent form (See Appendix G) followed by the Hunger-State questionnaire sitting alone at a table in the experimental booth/room.

Subsequently, each participant sat in front of the computer, which presented a short description of the procedure, an electronic consent form, instructions for completing the IRAP, as well as the IRAP task. Participants were instructed to read the IRAP instructions carefully, and contact the experimenter when finished, prior to

starting the IRAP trials. The description of the research area, consent form, and instructions for the IRAP tasks are presented subsequently.

INTRODUCTORY INSTRUCTIONS

Our research investigates cognitive processes that are used in decisions that involve memory. We are seeking to develop and test theories of cognitive processes that occur inside and outside of awareness in the routine use of memory.

Stimuli will be presented on this display screen, and your responses will be entered on the keyboard.

The research assumes that you can read English fluently, and that your vision is normal or corrected to normal. If you do not consider yourself fluent in English, or if your vision is not normal or corrected to normal, and ESPECIALLY IF YOU ARE HAVING SOME DIFFICULTY READING THIS DESCRIPTION, PLEASE ask the experimenter now whether or not you should continue.

Your identity as a subject is confidential. Further, you are free to discontinue participation at any time, without penalty.

In keeping with standard practice, your data may be retained for 5 years or so, during which time only the investigators on this or successor projects will have access to them.

PLEASE NOW READ THE STATEMENT BELOW, WHERE YOU WILL BE ASKED TO RESPOND TO A STANDARD INFORMED CONSENT QUESTION.

CONSENT STATEMENT

I have read the description of the procedure. I understand that the questions I may have about this research will be answered by Professor Barnes-Holmes or one of the other researchers working on this project.

If you consent to participate in the research that has been described on the preceding display pages you should now read the Instructions for the sorting tasks below.

[INSTRUCTION: If you wish to ask any questions first, alert the experimenter now. IF YOU WISH NOT TO PROCEED, you should inform the experimenter].

INSTRUCTIONS

Shown below are illustrations of the four different types of task that will be presented repeatedly in this part of the experiment. To help you understand the tasks each of the four illustrations is explained

immediately underneath. Please examine each illustration and then read carefully the explanation attached to it. Please make sure that you understand each task before continuing with the experiment.

IMPORTANT: From trial to trial the positioning of the response options (True and False) will vary randomly between left and right.

Illustration 1

I want to eat it NOW

Picture of Unhealthy Food

Select 'd' for **True** Select 'k' for **False**

Explanation for Illustration 1

If you select "True" by pressing the 'D' key, you are stating that "I want to eat the picture of Unhealthy food NOW."

If you select "False" by pressing the 'K' key, you are stating that "I want to eat the picture of Unhealthy food LATER."

Illustration 2

I want to eat it LATER

Picture of Healthy Food

Select 'd' for **True** Select 'k' for **False**

Explanation for Illustration 2

If you select "True" by pressing the 'D' key, you are stating that "I want to eat the picture of Healthy food LATER."

If you select "False" by pressing the 'K' key, you are stating that "I want to eat the picture of Healthy food NOW."

Illustration 3

I want to eat it NOW

Picture of Healthy Food

Select 'd' for **True** Select 'k' for **False**

Explanation for Illustration 3

If you select "True" by pressing the 'D' key, you are stating that "I want to eat the picture of Healthy food NOW."

If you select "False" by pressing the 'K' key, you are stating that "I want to eat the picture of Healthy food LATER."

Illustration 4

I want to eat it LATER

Picture of Unhealthy Food

Select 'd' for **True** Select 'k' for **False**

Explanation for Illustration 4

If you select "True" by pressing the 'D' key, you are stating that "I want to eat the picture of Unhealthy food LATER."

If you select "False" by pressing the 'K' key, you are stating that "I want to eat the picture of Unhealthy food NOW."

NOTE: During the experiment a range of different images of "Healthy Foods" and "Unhealthy Foods" will be presented.

REMEMBER: From trial to trial the positioning of the response options (True and False) will vary randomly between left and right.

FINAL INSTRUCTIONS

During the experiment you will be asked to respond as **quickly and accurately** as you can across all trials.

The relating tasks will be presented in short ***sessions*** that are separated by the appearance of instructions on the computer screen. You can take a short break if you like while the instructions are on on-screen.

During each short session the relating task follows one general rule. An incorrect response on any trial is signalled by the appearance of a red 'X' in the centre of the screen. To remove the red 'X' and move on to the next trial please press the correct response key quickly.

After each session, further instructions will appear and they will tell you that the general rule that applied in the previous session is now completely reversed. Please pay close attention to these instructions and do your best to follow them.

So, just to clarify, there will be only ***two*** general relating rules, and so the first thing you should do at the beginning of each session is to discover the rule by using the feedback you get in the form of the red 'X'.

It is very important to understand that sometimes you will be required to respond to the tasks in a way that ***agrees*** with what you believe and at other times you will be required to respond in a way that ***disagrees*** with what you believe. **This is part of the experiment**.

The first two sessions are for ***practice*** only and these are repeated until you respond accurately on at least 80% of the relating trials, and respond faster, on average, than 3000 milliseconds (i.e., 3 seconds). When you complete the practice phase, the ***test-phase*** will then start. Remember, you should try to make your responses as **accurately and quickly** as possible.

Good Luck

If you do not understand something about the foregoing instructions or have any further questions please talk to the researcher before clicking on the blue button.

After reading the IRAP instructions participants contacted the experimenter outside the experimental room. The experimenter asked the participant to explain

what each response option indicated for the four IRAP trial-types described in the instructions (see Figure 3.3 for four trial-types). If the participant appeared not to understand the trial-types, the experimenter spent some time explaining them to the participant (e.g., that responding "True" to "I want to eat it NOW" and a picture of "Unhealthy food" means that I want to eat that unhealthy food now). At no point did the experimenter state or indicate that differences in speed of responding were expected across different blocks of trials (i.e., participants were simply instructed to respond as fast and as accurately as possible across all trials). When participants fully understood the instructions for the task they proceeded with the IRAP, alone in the experimental room.

The IRAP program displayed the following instructions before each block of 24 practice trials:

IF YOU MAKE AN ERROR YOU WILL SEE A RED "X"

BELOW THE STIMULUS – WHEN THIS HAPPENS

YOU HAVE TO MAKE THE CORRECT RESPONSE TO

PROCEED

THIS IS PRACTICE - ERRORS ARE EXPECTED

PRESS THE SPACE BARE TO START

PRESS 'd' FOR PRESS 'k' FOR

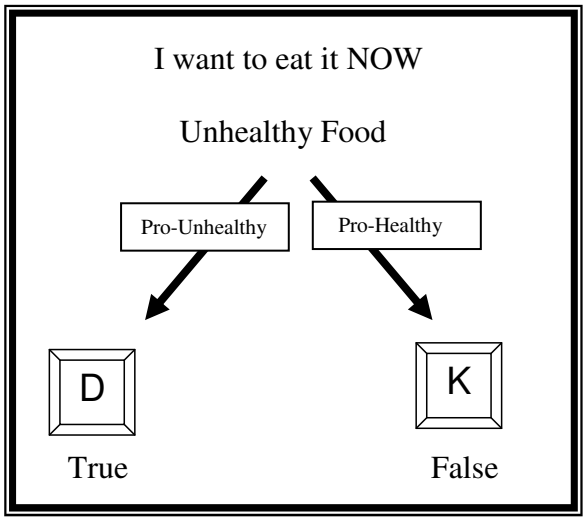
For each IRAP trial four stimuli were presented on the computer screen simultaneously. The sample stimulus, either 'I want to eat it NOW' or ' I want to eat it LATER ', appeared at the top, the food target stimulus picture appeared in the

centre, and the two response options, ‘True’ and ‘False’ appeared at the bottom left and right corners (see Figure 3.3). All four stimuli remained on screen until the participant chose one of the two options at the bottom by pressing one of the two response keys. Participants chose the term on the left by pressing the ‘d’ key with their left index finger or the term on the right by pressing the ‘k’ key with their right index finger. Participants were instructed to rest their right and left index fingers on the ‘d’ and ‘k’ keys respectively, for the duration of each block of trials. The left-right position of the response options (“True” and “False”) alternated randomly across trials.

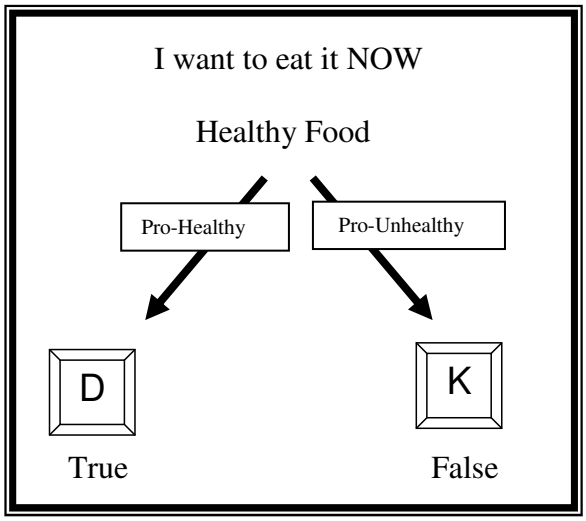
If participants emitted a correct response for a particular trial, all four stimuli were removed from the screen for a 400 ms inter-trial interval before the next trial was displayed. If participants emitted an incorrect response (or pressed any other key apart from ‘d’ and ‘k’) a red ‘X’ was presented directly under the target word. The X remained on screen until the correct response was emitted. Only when a participant emitted the correct response was the X and all other stimuli removed. After 400ms, the next trial was presented.

The IRAP consisted of a minimum of two and a maximum of eight practice blocks and a fixed set of six test blocks, each containing 24 trials (see Table 3.1). During each block, the 12 food target pictures were displayed in a quasi-random sequence, with each picture presented twice, once with each sample (see Figure 3.3).

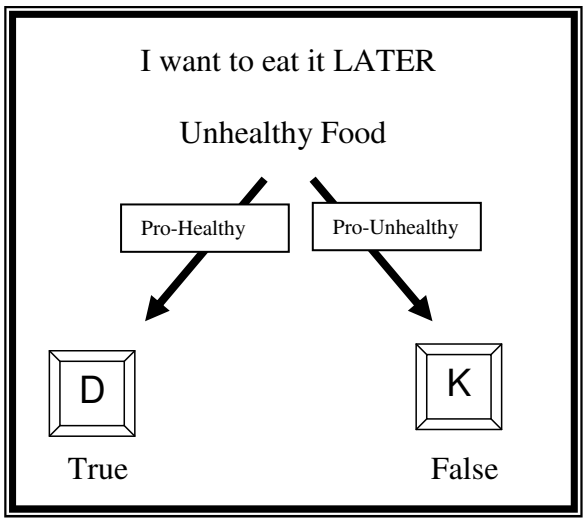
Want it NOW – Unhealthy Tasks



Want it NOW – Healthy Tasks



Want it LATER – Unhealthy Tasks



Want it LATER – Healthy Tasks

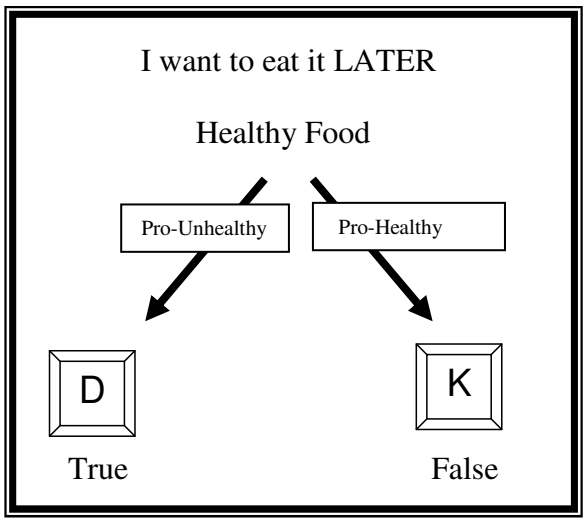


Figure 3.3.The four IRAP trial-types.The samples (I want to eat it NOW or I want to eat it LATER), target food pictures (Hamburger and chips, Chocolate, Grilled Fish Dinner, Fruit, etc., and response options (True and False) were presented on the screen at the same time. Note the superimposed arrows and Pro-Unhealthy and Pro-Healthy text boxes used to illustrate which responses were deemed Pro-Unhealthy or Pro-Healthy did not appear on the screen during the sorting tasks. IRAP sorting tasks were presented on two different test blocks. One block reinforced Pro-Unhealthy / Anti-Healthy responses. The other block reinforced Pro-Healthy – Anti-Unhealthy responses. Responses were reinforced by clearing the screen for 400ms before the next sorting task was presented. A response deemed incorrect for a particular block resulted in the presentation of a red X on screen until the participant emitting the alternative response. The IRAP consisted of a minimum of two practice blocks and only six test blocks, each containing 24 trials. During each block, the 12 food target pictures were displayed in a quasi-random sequence, with each food target picture presented twice, once with each sample 'I want to eat it NOW' and 'I want to eat it LATER). The 'True' and 'False' response options varied randomly across the screen from left to right on each sorting task.

Table 3.1. IRAP Practice and Test block Sequence

Consistent-First Sequence	Inconsistent-First Sequence
Pro-Unhealthy/Anti-Healthy Tasks First	Pro-Healthy/Anti-Unhealthy Tasks First
Practice 1 = Pro-Unhealthy	Practice 1 = Pro-Healthy
Practice 2 = Pro-Healthy	Practice 2 = Pro-Unhealthy
Block 1 = Pro-Unhealthy	Block 1 = Pro-Healthy
Block 2 = Pro-Healthy	Block 2 = Pro-Unhealthy
Block 3 = Pro-Unhealthy	Block 2 = Pro-Unhealthy
Block 4 = Pro-Healthy	Block 2 = Pro-Unhealthy
Block 5 = Pro-Unhealthy	Block 5 = Pro-Healthy
Block 6 = Pro-Healthy	Block 6 = Pro-Unhealthy

The first block of 24 practice trials required participants to emit responses that were predicted to be relationally consistent with a pro-unhealthy food bias. For example, if the sample stimulus 'I want to eat it NOW' and any of the unhealthy food target pictures appeared on screen, a correct response was defined as choosing the response option 'True'. Choosing the other term, 'False,' on this trial was defined as incorrect. Alternatively, if the sample stimulus was 'I want to eat it NOW' and a healthy food target was presented, 'False' was 'correct' and 'True' incorrect. After participants completed the 24 trials they were presented with feedback indicating the percentage of correct responses and the median response time (calculated across the 24 trials). After participants pressed the space-bar to move on to the second practice block of trials the IRAP program presented the following instructions:

> IMPORTANT: DURING THE NEXT PHASE THE PREVIOUSLY CORRECT AND WRONG ANSWERS ARE REVERSED. THIS IS PART OF THE EXPERIMENT. PLEASE TRY TO MAKE AS FEW ERRORS AS POSSIBLE -- IN OTHER WORDS, AVOID THE RED X

IF YOU MAKE AN ERROR YOU WILL SEE A RED ‘X’ BELOW THE STIMULUS – WHEN THIS HAPPENS, YOU HAVE TO MAKE THE CORRECT RESPONSE TO PROCEED.

THIS IS PRACTICE -- ERRORS ARE EXPECTED

PRESS THE SPACE BAR TO START

The second block of 24 trials required participants to emit responses that were predicted to be relationally consistent with a pro-healthy food bias. For example, given the sample ‘I want to eat it NOW’ and a healthy food picture ‘True’ was correct and ‘False’ incorrect; but if the food picture was unhealthy ‘False’ was correct and ‘True’ incorrect. After completing all 24 trials, the feedback indicating the percentage of correct responses and the median response time was presented.

If participants failed to achieve >=80% correct responses and a median response latency <=3000ms for each of the two practice blocks they were re-exposed to another pair of practice blocks, in the same sequence as above. Before re-exposure the accuracy and latency criteria were presented on screen with the participant’s accuracy and latency scores obtained for each of the two previous practice blocks. Participants were exposed to a maximum of four pairs of practice blocks with performance feedback presented after each of the first three pairs. If after the fourth pair of practice blocks a participant failed to achieve the accuracy and latency criteria, a message appeared on screen asking the participant to report to the experimenter. On the rare occasion this occurred, the participant was allowed a brief break before being

re-exposed to the IRAP program (no participant failed to achieve the practice criteria during a second exposure).

Having met the practice criteria, the computer proceeded to the six IRAP test blocks. The following instructions were presented to the participants before commencing the blocks:

> IMPORTANT: DURING THE NEXT PHASE THE PREVIOUSLY CORRECT AND WRONG ANSWERS ARE REVERSED. THIS IS PART OF THE EXPERIMENT. PLEASE TRY TO MAKE AS FEW ERRORS AS POSSIBLE -- IN OTHER WORDS, AVOID THE RED X
>
> IF YOU MAKE AN ERROR YOU WILL SEE A RED 'X' BELOW THE STIMULUS – WHEN THIS HAPPENS, YOU HAVE TO MAKE THE CORRECT RESPONSE TO PROCEED.
>
> THIS IS A TEST – GO FAST, MAKING A FEW ERROR IS OK
>
> PRESS THE SPACE BAR TO START

The first, third, and fifth test blocks required participants to emit responses that were predicted to be relationally consistent with a pro-unhealthy food bias; the second, fourth, and sixth test blocks required the opposite response pattern. Between each of the test blocks participants were informed of the percentage of correct responses and the median response time for that test block; they were also informed before each test block that the previously correct and incorrect answers would be

reversed in the next block. After completing the sixth and final test block, the screen cleared and the following message appeared on screen:

The sorting tasks are complete – Thank you.

Press the space-bar to proceed.

Pressing the space-bar displayed the final instructions:

Thank you.

This is the End of the experiment.

Please report to the Experimenter.

After the IRAP, participants completed the self-report measures; wanting-food, the EDE-Q5, BIDR and PFS alone in their booths. Having completed the questionnaires the participants were informed it was the end of the experiment, they were thanked, debriefed and any questions they had were answered by the experimenter.

3.2 RESULTS AND DICUSSION

Pre-Analysis Checks

Initial screening checks were used to determine if there were significant differences on the explicit measures (Age, BMI, EDE-Q5, BIDR, and PFS) between the deprivation states (2-hr versus No-Restriction) within each weight category (normal-weight and obese). If no differences were found, any subsequent differences on the implicit measure between the deprivation states (within each weight category) were unlikely due to individual differences. A series of independent *t*-tests performed on each explicit measure with deprivation state as the between group variable for each weight category all proved non-significant (all *ps* > .08).

3.2.1 Implicit Measures

Data Preparation

The primary datum from the IRAP was response latency defined as the time in milliseconds (ms) that elapsed between the onset of the trial and a correct response made by the participant. Errors were reflected in the response latency data because incorrect responses were followed by a correct response. In the current study, the latency data were transformed into *D*-IRAP scores (Barnes-Holmes, Murtagh et al., 2010; Barnes-Holmes, Waldron et al. 2009; Cullen & Barnes-Holmes, 2009; Vahey et al. 2009) using an adapted version of Greenwald, Nosek and Banaji's (2003) IAT *D*-algorithm. The principle behind the *D* transformation is to minimize the impact of factors such as age, motor skills, and/or cognitive ability on latency data, allowing researchers to measure differences between groups using a response-latency paradigm with reduced contamination by individual differences associated with extraneous factors (Greenwald et al., 2003).

The raw latency data for each participant were transformed using the following steps: (1) only response-latency data from the six test-blocks were used; (2) latencies above 10,000 ms were eliminated from the dataset; (3) the data from participants for whom more than 10% of test-block trials had latencies less than 300 ms were removed (no data were excluded on this basis); (4) twelve standard deviations for the four trial-types were computed: four for the response-latencies from test-blocks 1 and 2, four from the latencies from test-blocks 3 and 4, and a four from test-blocks 5 and 6; (5) twenty-four mean latencies for the four trial types in each test-block were computed; (6) difference scores for each of the four trial types for each pair of test blocks were calculated by subtracting the mean latency of the pro-unhealthy test-block from the mean latency of the corresponding pro-healthy test

block; (7) each difference score was divided by its corresponding standard deviation from step 4, yielding 12 *D*-IRAP scores; one score for each trial-type for each pair of test blocks; (8) finally, an overall *D*-IRAP score was calculated by averaging the twelve *D*-IRAP scores. The data for all 47 participants were included in the final analyses (12 normal-weight 2-hr participants, 12 normal-weight No-Restriction participants, 11 obese 2-hr participants and 12 obese No-Restriction participants).

Given the foregoing transformation, a larger *D*-IRAP score indicates a greater difference in response latencies between pro-unhealthy and pro-healthy trials. Positive scores indicate responding in accordance with pre-experimentally defined biases (i.e., within the current study, pro-unhealthy/anti-healthy food bias) and negative scores indicate the opposite (i.e., pro-healthy/anti-unhealthy food bias). Scores that approach zero indicate no discrimination between unhealthy or healthy foods.

Due to the age difference between the normal-weight (M = 21 years, SE = .63) and obese groups (M = 42 years, SE = 1.84) it was necessary to determine if there was an age by deprivation state and/or weight category interaction. If non-significant interaction effects were found, then subsequent IRAP analyses could ignore age. Due to the stark difference in age distribution between normal-weight and obese groups it was not possible to perform a single ANCOVA including both groups. For the normal-weight groups an ANCOVA was conducted on the *D*-IRAP scores with deprivation state (2-hr versus No-Restriction) as the between group variable and age as the covariate. The age by deprivation state interaction was non-significant (p = .39). After adjusting for age the main effect for deprivation condition was also non-significant (p = .41). Using the same strategy an ANCOVA was conducted on the *D*-IRAP scores for the obese groups yielding a non-significant age by deprivation state interaction (p = .68). The main effect for deprivation condition was also non-

significant after adjusting for age (p = .95). Given the absence of any significant effects for age, this variable was removed from all subsequent IRAP analyses.

IRAP Analyses

Figure 3.4 presents the overall mean *D*-IRAP scores divided by weight category and deprivation state. For the normal weight participants, the *D*-IRAP scores indicated a weak healthy bias in the No-Restriction condition and with a somewhat stronger healthy bias in the 2-hr deprivation state. The obese groups demonstrated similar healthy bias effects in both conditions. A 2x2 analysis of variance (ANOVA) was performed on the *D*-IRAP data with weight category (normal-weight versus obese) and deprivation state (2-hr versus No-Restriction) as between groups variables. All main and interaction effects were non-significant (all *ps* > .53).

Four one-sample *t*-tests were used to determine if the *D*-IRAP effects for each of the deprivation states for both weight-categories differed significantly from zero. All effects were non-significant (all *ps* > .08). Overall, therefore, the normal-weight and obese individuals showed similarly weak non-significant healthy food biases irrespective of food deprivation state.

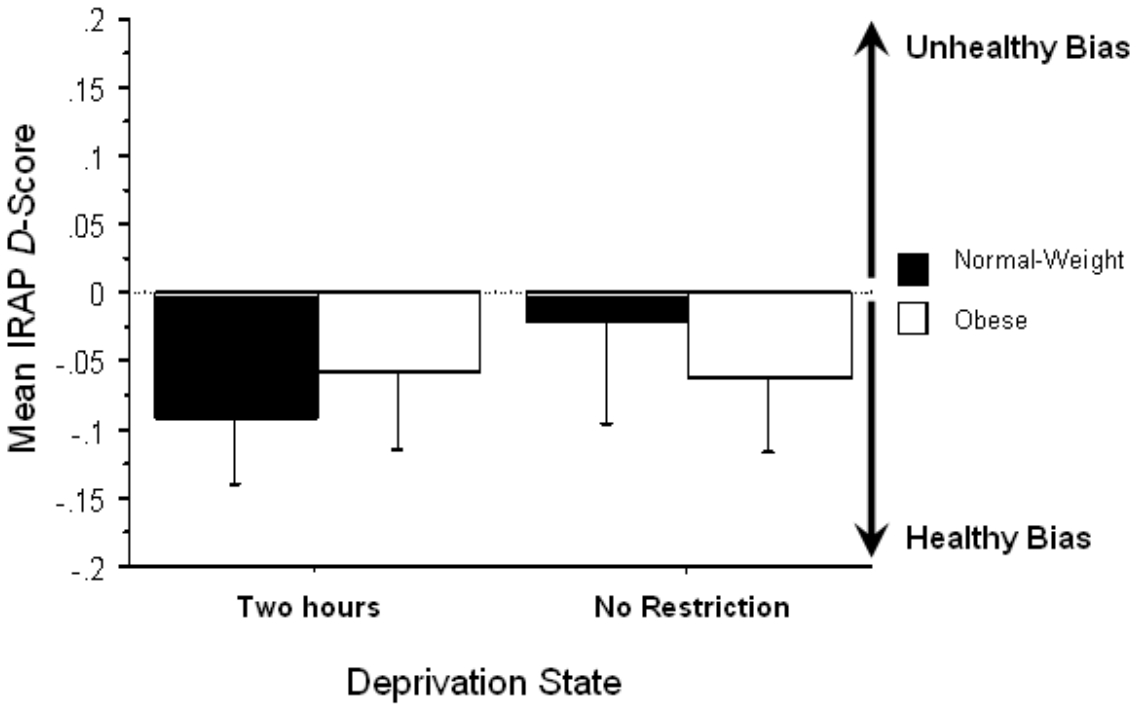


Figure 3.4. *Overall mean D-IRAP scores, with standard errors, for the normal-weight and obese groups in the 2-hr and No-Restriction food deprivation conditions.*

Split-half correlations. The split-half correlation, with a Spearman-Brown correction, was weak to moderate and marginally-significant, $r = .4$, $n = 47$, $p = .054$. These data thus provide a moderate indicator of internal consistency for the IRAP, particularly for a response-time measure (see Nosek et al., 2006).

3.2.2 Explicit Measures

3.2.3 Wanting-scale

Two mean wanting-food scores were first calculated from the 9-point Likert scales, one across the six unhealthy food pictures and the second across the six healthy food pictures; a relative wanting-food score was calculated by subtracting the mean food-wanting score for healthy food pictures from the mean score for unhealthy food pictures. Thus, a positive score indicated an unhealthy-food/anti-healthy-food bias and a negative score indicated the opposite (healthy/anti-unhealthy bias)[1]. All

[1] Given the age difference between the normal-weight and obese groups, separate analyses for the two weight categories were again conducted. An ANCOVA for the normal-weight groups found a non-

fours groups produced healthy food biases (normal-weight 2-hr group, *M* = -.76, *SE* = .48; normal-weight No-Restriction, *M* = -2.35, *SE* = .75; obese 2-hr, *M* = -1.30, *SE* = .75; obese No-Restriction, *M* = -.88, *SE* = .75). A 2x2 ANOVA with weight category and deprivation state as between-participant variables yielded no significant main effects or interactions (all *ps* >.15). Thus, like the IRAP, the wanting-scale failed to differentiate among the four different groups using the same pictorial stimuli.

3.2.4 Eating Disorder Examination Questionnaire (EDE-Q5)

Respondents rated each of the 22 attitudinal items on a 7-point rating scale, indicating the number of days out of 28 for which the specific attitudes or feelings occurred. Participants rated the key behavioural items for how many times over the last 28 days they engaged in the particular behaviour; these items do not contribute to the attitude subscale scores[2]. To obtain a particular subscale score, the ratings for the relevant items were summed together and divided by the total number of items in the subscale. An overall global score was obtained by adding the scores for the four subscales together and dividing the result by four. The means and standard deviations for the global EDE-Q score and the subscale scores are reported in Table 3.2.

Attitude items. In general, the pattern of differences between the normal-weight and obese groups on the EDE-Q was broadly similar to the norms reported in

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significant age by deprivations effect (p = 89.). After adjusting for age, there was a non-significant main effect for deprivation condition (p = .07). The ANCOVA for the obese groups indicated that the age by deprivation state interaction was also non-significant (p = .92), as was main effect for deprivation condition after adjusting for age (p = .47). Thus, age was removed from further wanting-scale analyses.

[2] The ANCOVA analyses conducted for the wanting-scale were also applied to the Global EDE-Q and EDE-Q subscales, behavioural items, Global BIDR and BIDR subscales and to the PFS data for the normal-weight and obese participants (presented subsequently). Only Shape Concern produced a significant age by deprivation state interaction F (1, 20) = 8.99, p = .007, η^2 = .31 for the normal-weight participants, all others effects and interactions were non-significant (*ps* > .11). For the obese, all effects and interactions were non-significant (*ps* > .35). Given that only one significant effect arose from 22 statistical tests and that subsequent studies would replicate (partially) the current study it was decided simply to note the current finding for the normal-weight participants and to remove age from the analysis of Shape Concern.

two previous studies (Fairburn & Beglin, 1994; Mond, Hay, Rodgers, Owen, & Beumont 2004), although the scores for both normal-weight groups tended to be lower while both obese groups were slightly higher, except for Restraint. The mean scores for each of the attitude subscales for each of the normal-weight groups were lower than for their corresponding obese groups. Within weight category, the scores for the normal-weight 2-hr deprivation state were lower than the No-Restriction condition for Restraint, Shape Concern and Global EDE-Q but higher for Eating Concern and Weight Concern. For the obese participants scores were all lower in the No-Restriction condition for each subscale. Five 2x2 ANOVAs were used to analyze the data for each subscale and for the Global EDE-Q, with weight category and deprivation state as between group variables. The results of the ANOVAs are presented in Table 3.3. In each case, significant main effects were obtained for weight category, but all other effects and interactions were non-significant (all *ps* > .28). Thus, overall, the obese groups reported higher levels of pathological attitudes to food on each of the EDE-Q subscales and Global EDE-Q relative to the normal-weight individuals.

Behavioural items. Participants rated the 6 behavioural items for how many times or days in the last 28 days they engaged in a specific pathological behaviour. A total behavioural score was calculated for each participant by summing the number of reported pathological behaviors. A mean score for each of the four groups was calculated by summing the total behavioural scores and dividing the result by the number of participants in the group. The scores for the normal-weight groups (2-hr, *M* = 1.5, *SE* = .54, No-Restriction *M* = 2.41, *SE* = 1.37) were considerably lower than for the obese

groups (2-hr, M = 21.81, SE = 6.09, No-Restriction, M = 25.75, SE = 10.03). Within groups, the normal-weight No-Restriction group had a slightly higher score than the 2-hr group; the same effect was observed for the obese groups. A 2x2 ANOVA, with weight category and deprivation state as the between group variables, yielded a significant main effect for weight category F (1, 43) = 13.61, p = .0006, η^2 = .24 (remaining ps > .68). Consistent with the attitudinal subscales, both obese groups reported significantly higher levels of pathological eating behaviours than the normal-weight groups.

Table 3.2. The Means and Standard Deviations for the Eating Disorder Examination Questionnaire (EDE-Q5) subscale items (Restraint, Eating Concern, Shape Concern and Weight Concern), and the Global EDE-Q score).

Subscale	Normal-Weight 2-hr Group Mean (SD)	Normal-Weight No-Restriction Group Mean (SD)	Obese 2-hr Group Mean (SD)	Obese No-Restriction Group Mean (SD)	Fairburn and Beglin (1994) Community Based Norms Mean (SD)	Elder, Grilo, Masheb, Rothschild, Burke-Martindale, and Brody (2006) Obese Scores Mean (SD)
Restraint	1.05 (.99)	1.28 (1.04)	2.69 (1.04)	2.15 (1.30)	1.25 (1.32)	2.8 (1.30)
Eating Concern	.450 (.57)	.20 (.33)	2.44 (1.17)	2.28 (2.05)	.62 (0.86)	1.7 (1.30)
Shape Concern	1.04 (.71)	1.28 (.86)	4.42 (1.15)	4.17 (1.16)	2.15 (1.60)	4.1 (1.30)
Weight Concern	1.05 (.81)	.92 (.68)	3.82 (1.47)	3.48 (1.05)	1.59 (1.37)	3.3 (1.00)
Global EDE-Q	.90 (.61)	.92 (.62)	3.34 (.73)	3.02 (1.12)	.1.55 (1.21)	3.0 (0.90)

Table 3.3. Results for the Five 2x2 ANOVAs for the Eating Disorder Examination Questionnaire (EDE-Q5) subscales (Restraint, Eating Concern, Shape Concern and Weight Concern) and for the Global EDE-Q, with weight category (normal-weight, and obese), deprivation state (2-hr, and No-Restriction) as between

Subscale	Effect	*df*	*F*	*p*	η^2
Restraint	Weight Category	1, 43	12.79	.00*	.23
Eating Concern	Weight Category	1, 43	32.22	.00*	.28
Shape Concern	Weight Category	1, 43	118.46	.00*	.73
Weight Concern	Weight Category	1, 43	78.11	.00*	.64
Global EDE-Q	Weight Category	1, 43	95.01	.00*	.69

*$P < .001$

3.2.5 Balanced Inventory of Desirable Responding

Participants responded to each of the Self-Deception (SDE) and Impression Management (IM) items on a 7-point Likert scale. After reversing the negatively scored items, each item was scored as either 0 (for responses from 1 to 5) or 1 (for responses 6 or 7), with the latter indicating exaggerated or extreme desirable responding. A total SDE score was calculated by summing the number of extreme responses across the first 20 items. Similarly, a total IM score was produced by adding the number of extreme responses across items 21 to 40. A global BIDR score was calculated by summing the SDE and IM scores. The means and standard deviations for each weight category and deprivation state are presented in Table 3.4. A 2x2 ANOVA with weight category and deprivation state were conducted and each produced non-significant main and interaction effects for Self-Deception, Impression Management, and Global BIDR (all *ps* >.05). Thus the normal-weight and obese groups reported similar levels of Self-Deception, Impression Management and Global BIDR.

Table 3.4. The Means and Standard Deviations for the Balance Inventory of Desirable Responding (BIDR) subscales items (Self-Deception and Impression Management) and the Overall BIDR score.

Subscale	Normal-Weight 2-hr Group Mean (SD)	Normal-Weight No-Restriction Group Mean (SD)	Obese 2-hr Group Mean (SD)	Obese No-Restriction Group Mean (SD)
Self-Deception	5.00 (2.45)	4.42 (3.54)	4.36 (2.87)	4.00 (3.59)
Impression Management	6.25 (2.42)	4.41 (4.30)	5.36 (2.77)	7.41 (3.42)
Global BIDR	11.25 (3.88)	8.83 (6.90)	9.73 (4.32)	11.58 (6.59)

3.2.6 Power of Food Scale

The Power of Food score was derived by summing the responses for the twenty-one items completed by participants on 5-point Likert scales. The scores for the normal-weight groups (2-hr, M = 37.58, SE = 3.45, No-Restriction M = 32.00, SE = 3.92) were noticeably lower than for the obese groups (2-hr, M = 68.82, SE = 5.48, No-Restriction, M = 63.58, SE = 7.92). The 2-hr deprivation states were slightly higher than the No-Restriction conditions for both weight categories. A 2x2 ANOVA, with weight category and deprivation state produced a significant main effect for weight category F (1, 43) = 32.76, p = .0001, η^2 = .43, but all other effects and interactions were non-significant (ps > .32). Thus, the obese groups reported significantly higher levels of Power of Food compared to the normal-weight groups.

3.2.7 Correlations between Implicit and Explicit Measures

A correlation matrix of implicit and explicit measures is presented in Table 3.5, which explores the relationships between the 11 explicit measures with the *D*-IRAP measure. Non-significant correlations were obtained in all cases except between the *D*-IRAP score and Global BIDR (r = -.367, p = .01). Thus the lower the *D*-IRAP score (i.e., the stronger the healthy bias) the more participants engaged in Self-Deception and Impression Management.

3.2.8 Summary and Conclusions

The IRAP performances in the current study failed to differentiate between the four groups (i.e., all four groups produced relatively weak and non-significant healthy food biases). The pattern of results for the explicit *wanting-food* measure were similar to the IRAP (i.e., all four groups produced healthy food biases). However, the EDE-Q and PFS measures both discriminated between the two weight categories, but no effects for deprivation state were observed. Correlations between the implicit and explicit measures yielded only one significant effect. Given that the IRAP effects did not differentiate between the groups, logistic regression analyses were not conducted to determine if the IRAP measures increased prediction of group status over the explicit measures. In short, the *Eat it Now* versus *Eat it Later* IRAP employed in the current study appeared to be largely unaffected by either the weight or deprivation states of the participants.

Table 3.5. Correlations between the Overall Mean *D*-IRAP score and the Wanting-scale, the Eating Disorder Examination-Questionnaire (EDE-Q5) and its subscales, the Balanced Inventory of Desirable Responding (BIDR) and its subscales, and the Power of Food, 47 observations in total.

	Overall *D*-IRAP Score
Food-Hunger	.04
Global EDE-Q	-.02
EDE-Q - Restraint	-.11
EDE-Q - Eating Concern	-.07
EDE-Q - Shape Concern	.06
EDE-Q - Weight Concern	.01
Total Behaviours	-.03
BIDR	-.37*
BIDR - SDE	-.26
BIDR - IM	-.05
PFS	.00

*$P < .05$

3.3 DISCUSSION

The current study was the first to investigate the effects of food deprivation state on implicit wanting attitudes to healthy and unhealthy foods among obese and normal-weight individuals. Obese and normal-weight participants produced similar implicit biases toward both healthy and unhealthy foods on the IRAP (i.e. all four groups demonstrated weak healthy food biases). The pattern of results for the explicit wanting-scale measure was similar to the IRAP (i.e., it did not discriminate among the groups, with all four producing weak healthy food biases). The IRAP findings reported here are consistent with most of the previous IAT, EAST and APP food attitude research, in that six out of seven studies using these measures found no differences in implicit food attitudes among obese and normal-weight individuals (Reofs & Jansen, 2002; Craeynest et al. 2006; Craeynest et al. 2005; Craeynest et al. 2007; Roefs et al. 2005, Experiment 2; Roefs et al. 2006 Experiment 1; Czyzewska, & Graham, 2008). In fact, the weak healthy food biases produced in the current study are similar to the marginally significant biases for healthy foods demonstrated by both obese and normal-weight individuals on the APP after a food-deprivation/craving-induction exercise (Roefs et al. 2006).

In contrast, the EDE-Q and PFS measures both discriminated between the two weight categories, but no effects for deprivation state were observed. The obese groups had higher levels of abnormal eating attitudes and behaviours to food on the EDE-Q compared to the normal-weight individuals. The obese had higher susceptibility to food cues in the environment compared to the normal-weight individuals as measured by the PFS scale. There were no correlations between the IRAP and explicit wanting-scale. However, one explicit measure, the BIDR, had a negative correlation with the IRAP, indicating that participants who engaged in more

Self-Deception and Impression Management showed lower unhealthy or stronger healthy implicit bias.

The present results indicate that the label stimuli *I want to eat it NOW* versus *LATER* utilized in the current IRAP failed to differentiate obese and normal-weight individuals' unhealthy and healthy food attitudes. In contrast, some of the explicit measures did discriminate between the weight categories. One possible reason for the IRAP's lack of discrimination is that the label terms targeted the "cognitive" or temporal aspects of eating attitudes rather than the "arousal" properties of food. In other words, responding to questions about wanting to eat a food item "now" versus "later" may serve to elicit reactions that are controlled, at least in part, by contextual variables unrelated to hunger. For example, the IRAP is a demanding task, which would be largely incompatible with eating anything while completing it. Furthermore, the study was conducted in small experimental cubicles in a laboratory in which food and drink were not permitted. Thus there were at least two contextual variables that may have caused participants to show a response bias towards all foods with "I want to eat it later" (i.e., after I have completed the study). Insofar as this was the case, this would explain why relatively neutral biases, with regard to healthy versus unhealthy foods, were observed on the IRAP.

If the foregoing interpretation of the neutral IRAP effects is correct, then perhaps changing the labels, so that they target hunger, would be more effective in discriminating between the conditions. In other words, a state of hunger may occur independently of wanting to eat at a particular time. Thus, participants could experience hunger while completing a task, without wanting to eat immediately. The study reported in the next chapter sought to determine if targeting hunger, rather than

wanting, with the IRAP was effective in discriminating between obese and normal-weight participants implicit responses to healthy and unhealthy foods.

Chapter 4: Food Deprivation and Implicit Hunger Attitudes to Food among Obese and Normal-Weight Individuals Using the IRAP

The second study described in the current thesis sought to differentiate the implicit attitudes of obese from normal-weight individuals to food by employing label stimuli that targeted hunger rather than wanting. To this end, the following two label stimuli were employed; *Makes Me Feel Hungry Now* and *Does Not Make Me Feel Hungry Now*. Apart from this change in the label stimuli, the current study was similar to the previous study.

4.1 Method

4.1.1 Participants

Normal-weight individuals. The same six screening criteria that were employed in Study 1 for the normal-weight participants were employed in Study 2. Thirty-two participants met these criteria and completed the study. The sample consisted of 16 females and 16 males (age M = 21 years, range, 18-23; weight, BMI, M = 22.5 kg/m²) recruited from undergraduate students attending the National University of Ireland, Maynooth. No financial enticements were offered to the participants and all were naïve to the IRAP. Participants were assigned randomly to one of two groups, counterbalancing for gender.

Obese individuals. The same screening criteria described in Study 1 for recruiting obese participants were applied. Fifteen females and ten males (age M = 41 years; range, 25-56, weight, BMI, M = 47.7 kg/m²) attending the Diabetes and Weight Management Clinic, St., Columcilles Hospital, Loughlinstown, County Dublin volunteered to participate. Once again, participants had no previous experience with the IRAP and completed the study without financial incentives. The participants were allocated randomly to one of two groups, counterbalancing for gender.

4.1.2 Setting

The settings were identical to Study 1.

4.1.3 Apparatus/Materials

The apparatus and materials were the same as those employed in Study 1 except that the two label stimuli on the IRAP were changed to "Makes Me Feel Hungry Now" and "Does Not Make Me Feel Hungry Now". Furthermore, the wanting-scale was replaced by a hunger-scale. The self-report hunger-scale measured participant's food-hunger evaluations for the same 12 food target pictures used in the IRAP. The measure comprised of a 12-item questionnaire presented on 9-point Likert scales (i.e., "On the scale below -4 to 4, rate how hungry or not hungry the 12 food items make you feel now? "-4 (NOT HUNGRY)," "0 (NEUTRAL)," and "4 (HUNGRY)"? (See Appendix H).

The final difference was the inclusion of the Mindful Attention Awareness Scale (MAAS: Brown and Ryan, 2003). This Scale is a 15-item measure used to assess participant's mindfulness for moment to moment experience. Participants were instructed to rate how frequently or infrequently they had the experiences listed in the 15-items on a 6-point Likert scale; 1 (Almost Always)," "2 (Very Frequently)," "3 (Somewhat Frequently)," "4 (Somewhat Infrequently)," "5 (Very Infrequently)," "5 (Almost Never)," (See Appendix I for full questionnaire). Higher scores reflect higher levels of dispositional mindfulness (MAAS: Brown and Ryan, 2003).

4.1.4 Procedure

The experimental sequence was identical to that used in Study 1, except, as noted above, the participants completed a hunger-scale and the MASS after completing the IRAP. The IRAP procedure was similar to that utilised in Study 1, except that different label stimuli were used ""Makes Me Feel Hungry Now" versus

"Does Not Make Me Feel Hungry Now"; see Figure 4.1). The IRAP instructions paralleled those used previously but were amended to accommodate the different label stimuli. Consistent with the previous study, the IRAP involved alternating between two different blocks of trials. All participants commenced the IRAP with a pro-unhealthy/anti-healthy block of trials, which involved the following four trial-types: "Makes Me Feel Hungry Now – Unhealthy Food – True"; "Does Not Make Me Feel Hungry Now – Unhealthy Food – False"; "Makes Me Feel Hungry Now – Healthy Food – False"; "Does Not Make Me Feel Hungry Now – Healthy – True". The next block of trials was defined as pro-healthy/anti-unhealthy and involved the following four trial-types; "Makes me feel hungry now – Unhealthy Food – False"; "Does Not Make Me Feel Hungry Now – Unhealthy Food – True"; "Makes Me Feel Hungry Now – Healthy Food – True"; "Does Not Make Me Feel Hungry Now – Healthy Food – False". Thus all odd numbered blocks of IRAP trials were pro-unhealthy/anti-healthy whereas all even numbered blocks of trials were pro-healthy/anti-unhealthy.

After the IRAP, participants completed the self-report measures; hunger-scale, EDE-Q5; the PFS; MAAS, and the BIDR alone in their booths. Having completed the questionnaires the participants were informed it was the end of the experiment, they were thanked, debriefed and any questions they had were answered by the experimenter.

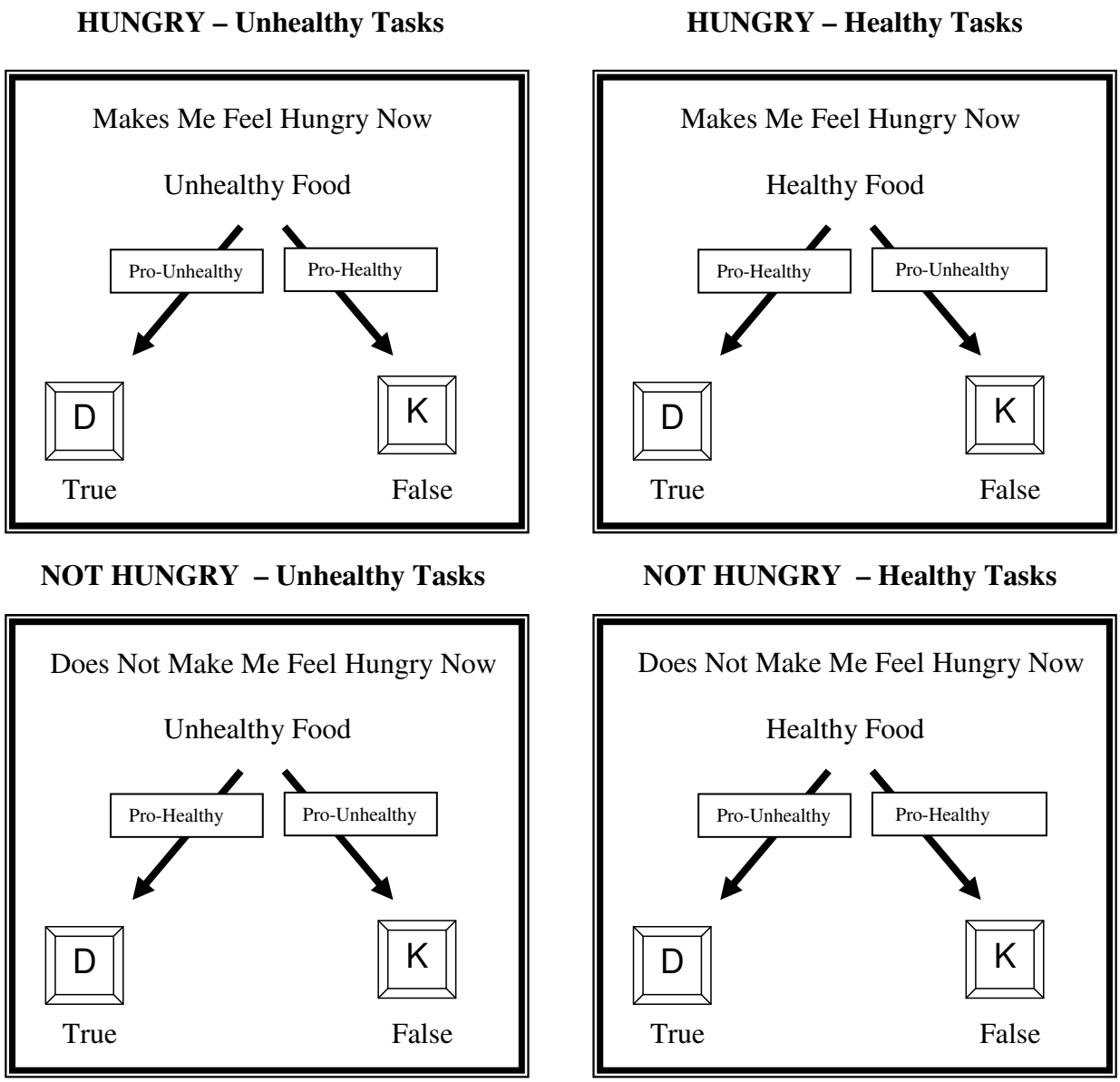

Figure 4.1. The four IRAP trial-types.

4.2 RESULTS

Pre-Analysis Checks

Similar to Study 1, initial screening checks were used to determine if there were significant differences on the explicit measures (Age, BMI, EDE-Q5, BIDR, PFS, and MAAS) between the deprivation states for each weight category. The twelve

independent *t*-tests that were used for this purpose all proved to be non-significant (all *ps* > .07).

4.2.1 Implicit Measures

Data Preparation

The data were transformed into *D*-IRAP scores using the same strategy adopted for Study 1. The data for fifty-seven participants were included in the final analyses (16 normal-weight 2-hr participants, 16 normal-weight No-Restriction participants, 11 obese 2-hr participants and 14 obese No-Restriction participants).

Due to the age difference between the normal-weight (M = 21 years, SE = .24) and obese groups (M = 41 years, SE = 1.98) it was once again necessary to investigate if there was an age by deprivation state and/or weight category interaction. If a non-significant interaction was found, then subsequent IRAP analyses could ignore age. Due to the stark difference in age distribution between normal and obese groups it was not possible to perform a single ANCOVA including both groups. For the normal-weight groups an ANCOVA was conducted on the *D*-IRAP score with deprivation state (2-hr versus No-Restriction) as the between group variable and age as the covariate. The age by deprivation state interaction was non-significant (p = .97). After adjusting for age the main effect for deprivation condition was non-significant, (p = .99). Using the same strategy an ANCOVA was carried out on the *D*-IRAP scores for the obese groups yielding a non-significant age by deprivation state interaction (p = .07). The main effect for deprivation condition was significant after adjusting for age F (1, 22) = 9.21, p = .01, η^2 = .30. Given the absence of any significant effects for age, this variable was removed from all subsequent IRAP analyses.

IRAP Analyses

Figure 4.2 presents the overall mean *D*-IRAP scores divided by weight category and deprivation state. For the normal weight participants the *D*-IRAP scores indicated a healthy bias in both the No-Restriction condition and the 2-hr deprivation state. The obese group demonstrated the same effect in the No-Restriction condition (healthy bias) but the opposite in the 2-hr deprivation state (unhealthy bias). A 2x2 analysis of variance (ANOVA) was performed on the *D*-IRAP data with weight category (normal-weight versus obese) and deprivation state (2-hr versus No-Restriction) as between groups variables. The ANOVA yielded a significant main effect for weight category; F (1, 53) = 4.13, p = .031, η^2 = .09, and a marginally significant effect for deprivation condition F (1, 53) = 3.99, p = .051, η^2 = .07. Critically, a significant interaction between weight category and deprivation state was also recorded; F (1, 53) = 4.13 p = .047, η^2 = .07. Planned comparisons were conducted using four one-way between-groups ANOVAs. A significant difference was found between the weight categories in the 2-hr condition, F (1, 25) = 14.72, p = .0008, η^2 = .37, but not for the No-Restriction condition, p = .90. A significant difference was found between the deprivation states (2-hr versus No-Restriction) for the obese individuals, F (1, 23) = 6.92, p = .015, η^2 = .23; but not for the normal-weight individuals, p = .98.

Four one-sample *t*-tests were used to determine if the *D*-IRAP effects for each of the deprivation states for both weight-categories differed significantly from zero. The effects for the 2-hr normal-weight, t (15) = -2,41, p = .03, and obese group, t (10) = 2.91, p = .015, were significant, but the effects for the No-Restriction groups were not (ps > .17). Overall, therefore, the normal-weight individuals showed a healthy food bias at two hours deprivation but a non-significant healthy food bias when

deprivation was not controlled. The obese individuals showed an unhealthy bias at two hour deprivation, and a weak and non-significant healthy bias when deprivation was uncontrolled.

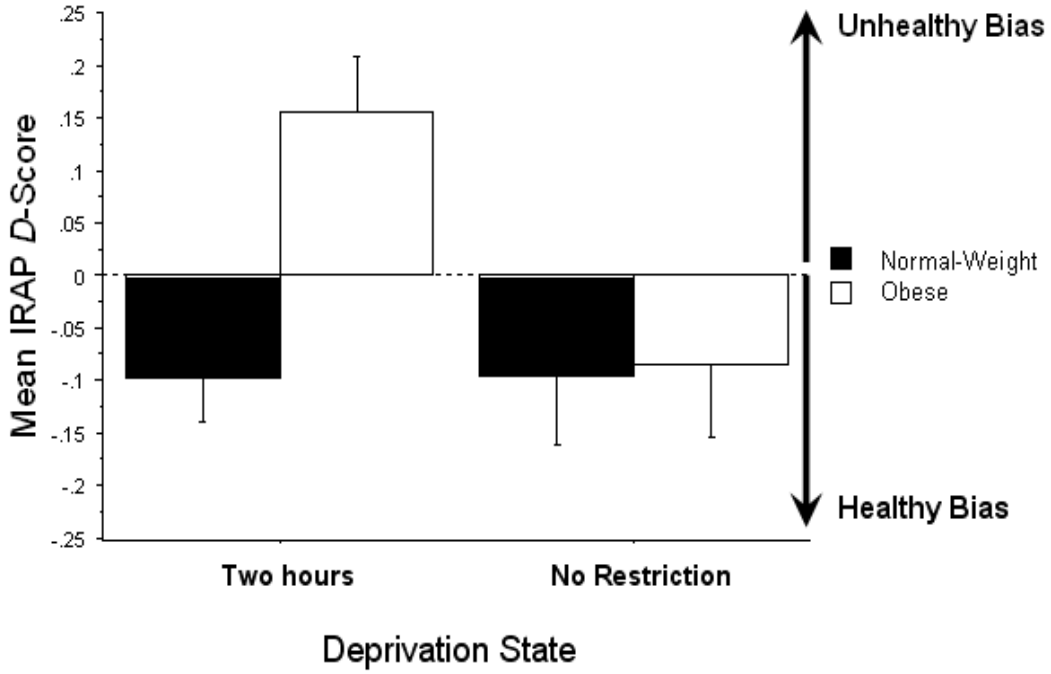

Figure 4.2. *Overall mean D-IRAP scores, with standard errors, for the normal-weight and obese groups in the 2-hr and No-Restriction food deprivation conditions.*

Split-half correlations. The split-half correlation, with a Spearman-Brown correction, was moderate and significant, $r = .6$, $n = 57$, $p = .001$. These data thus provide a reasonably strong indicator of internal consistency for the IRAP, particularly for a response-time measure (see Nosek et al., 2006).

4.2.2 Explicit Measures

4.2.3 Hunger-scales

Similar to the two mean wanting-food scores calculated in the previous study, two mean hunger-scores were first calculated from the 9-point Likert scales. Thus, a positive score indicated an unhealthy-food/anti-healthy-food bias and a negative score

indicated the opposite (healthy/anti-unhealthy bias)[3]. All four groups produced healthy food biases (normal-weight 2-hr group, M = -.54, SE = .36; normal-weight No-Restriction, M = -.75, SE = .36; obese 2-hr, M = -.41, SE = .62; obese No-Restriction, M = -1.03, SE = .53). A 2x2 ANOVA with weight category and deprivation state as between-participant variables yielded no significant effects or interactions (all ps > .37). Thus, unlike the IRAP the hunger scales failed to differentiate among the four different groups even though the same pictorial stimuli were used.

4.2.4 Eating Disorder Examination Questionnaire (EDE-Q5)

Similar to the previous study, Restraint, Shape, Concern, Eating Concern, Weight Concern and Global EDE-Q were calculated from the 7-point rating scales for each of the subscale items[4]. Furthermore, mean scores for the behavioural items for each of the four groups were calculated as per Study 1. The means and standard deviations for the Global EDE-Q score and the subscale scores are reported in Table 4.1.

Attitude items. In general, the pattern of differences between the normal-weight and obese groups on the EDE-Q was broadly similar to the norms reported in two previous studies (Fairburn & Beglin, 1994; & Mond, Hay, Rodgers, Owen, &

[3] Given the age difference between the normal-weight and obese groups, separate analyses for the two weight categories were again conducted. An ANCOVA for the normal-weight groups yielded a non-significant age by deprivations effect (p = .37). After adjusting for age, there was a non-significant main effect for deprivation condition (p = .73). The ANCOVA for the obese groups indicated that the age by deprivation state interaction was also non-significant (p = .75), as was the main effect for deprivation condition after adjusting for age (p = .38). Thus, age was removed from further hunger-scale analyses.

[4] The ANCOVA analyses conducted for the hunger--scales were also applied to the Global and EDE-Q subscales, behavioural items, Global and BIDR subscales, PFS, and to the MAAS data for the normal-weight and obese participants (presented subsequently). Only the Self-Deception subscale of the BIDR produced a significant age by deprivation state interaction F (1, 28) = 5.05, p = .03, η^2 = .15 (all other ps > .12). For the obese group only PFS, F (1, 21) = 6.48, p = .02, η^2 = .23, and Total Behaviours, F (1, 21) = 6.86, p = .02, η^2 = .25, obtained significant age by deprivation state interactions (all other ps > .07). Given that only three significant effects emerged from 24 statistical tests, all at p > .01, and none of these effects (for Self-Deception, PFS, Total Behaviours) were replicated in any of the other studies reported in the current thesis, it was decided to remove age from subsequent analyses.

Beumont, 2004) although the scores for both the normal-weight groups and the obese No-Restriction group tended to be lower. For the obese 2-hr condition the scores for Eating Concern, were slightly higher in the current study. The mean scores for each of the attitude subscales for each of the normal-weight groups were lower than for their corresponding obese groups. In comparing within each weight category, the scores for the normal-weight and obese participants were lower in the No-Restriction condition for each subscale, respectively. Five 2x2 ANOVAs were used to analyze the data for each subscale and for the Global EDE-Q, with weight category and deprivation state as between group variables. The results of the ANOVAs are presented in Table 4.2. In each case, significant main effects were obtained for weight category. All other effects and interactions were non-significant (all *ps* > .06). Thus, overall, the obese groups reported higher levels of pathological attitudes to food on each of the EDE-Q subscales and on the Global EDEQ relative to the normal-weight individuals.

Behavioural items. The scores for the normal-weight groups (2-hr, M = .69, SE = .22, No-Restriction M = 1.00, SE = .39) were considerably lower than for the obese groups (2-hr, M = 17.82, SE = 7.03, No-Restriction, M = 13.86, SE = 4.04). Within groups, the normal-weight No-Restriction group had a slightly higher score than the 2-hr group; for the obese groups the opposite effect was observed. A 2x2 ANOVA, with weight category and deprivation state as the between group variables, yielded a significant effect for weight category F (1, 53) = 19.64, p = .0001, η^2 = .27, with the remaining effects being non-significant (all *ps* > .53). Consistent with the attitudinal subscales both obese groups reported significantly higher levels of pathological eating behaviours than the normal-weight groups.

Table 4.1. The Means and Standard Deviations for the Eating Disorder Examination Questionnaire (EDE-Q5) subscales items (Restraint, Eating Concern, Shape Concern and Weight Concern), the Global EDE-Q score).

Subscale	Normal-Weight 2-hr Group Mean (SD)	Normal-Weight No-Restriction Group Mean (SD)	Obese 2-hr Group Mean (SD)	Obese No-Restriction Group Mean (SD)	Fairburn & Beglin (1994) Community Based Norms Mean (SD)	Elder, Grilo, Masheb, Rothschild, Burke-Martindale, & Brody (2006) Obese Scores Mean (SD)
Restraint	.46 (.71)	.41 (.88)	2.53 (.69)	2.21 (.98)	1.25 (1.32)	2.8 (1.30)
Eating Concern	.24 (.44)	.18 (.30)	1.77 (1.43)	1.37 (1.72)	.62 (0.86)	1.7 (1.30)
Shape Concern	.81 (.83)	.64 (.83)	3.81 (1.4)	3.73 (1.72)	2.15 (1.60)	4.1 (1.30)
Weight Concern	.89 (.88)	.46 (.71)	4.02 (1.25)	3.31 (1.46)	1.59 (.1.37)	3.3 (1.00)
Global EDE-Q	.60 (.59)	.42 (.58)	3.03 (.95)	2.66 (1.26)	1.55 (1.21)	3.0 (0.90)

Table 4.2. Results for the Five Two-Way ANOVAs for the Eating Disorder Examination Questionnaire (EDE-Q5) subscales (Restraint, Eating Concern, Shape Concern and Weight Concern) and for the Global EDE-Q, with weight category (normal-weight, and obese), deprivation state (2-hr, and No-Restriction) as between group variables.

Subscale	Effect	*df*	*F*	*p*	η^2
Restraint	Weight Category	1, 53	79.07	.00*	.60
Eating Concern	Weight Category	1, 53	21.56	.00*	.29
Shape Concern	Weight Category	1, 53	87.57	.00*	.62
Weight Concern	Weight Category	1, 53	106.00	.00*	.67
Global EDE-Q	Weight Category	1, 53	99.58	.00*	.65

*$P < .001$

4.2.4 Balanced Inventory of Desirable Responding

Similar to the previous study, mean Self-Deception (SDE), Impression Management (IM) and Global BIDR scores were calculated for each weight category

and deprivation state using the 7-point Likert scales for each subscale. The means and standard deviations for each weight category and deprivation state are presented in Table 4.3. A 2x2 ANOVA, with weight category and deprivation state were conducted and each produced non-significant main and interaction effects for Self-Deception, Impression Management, and Global BIDR (all *ps* >.05). Thus, the normal-weight and obese groups reported similar rates of Self-Deception, Impression Management and Global BIDR.

Table 4.3. The Means and Standard Deviations for the Balance Inventory of Desirable Responding (BIDR) subscales items (Self-Deception and Impression Management) and the Overall BIDR score.

Subscale	Normal-Weight 2-hr Group Mean (SD)	Normal-Weight No-Restriction Group Mean (SD)	Obese 2-hr Group Mean (SD)	Obese No-Restriction Group Mean (SD)
Self-Deception	5.25 (2.84)	4.56 (2.94)	4.55 (2.94)	5.64 (2.74)
Impression Management	5.25 (2.84)	4.50 (2.76)	5.00 (3.46)	7.86 (3.92)
Global BIDR	10.5 (4.52)	9.19 (4.82)	9.55 (5.68)	13.50 (6.02)

4.2.5 Power of Food Scale

Similar to the previous study, a Power of Food score was calculated for each weight category and deprivation state using the 7-point Likert scales. The scores for the normal-weight groups (2-hr, $M = 41.00$, $SE = .2.30$, No-Restriction $M = 39.88$, $SE = 2.64$) were noticeably lower than for the obese groups (2-hr, $M = 63.82$, $SE = 7.26$, No-Restriction, $M = 57.71$, $SE = 6.80$). The 2-hr deprivation states were slightly higher than the No-Restriction condition for both weight categories. A 2x2 ANOVA, with weight category and deprivation state as independent variables, produced a significant main effect for weight category $F(1, 53) = 17.76$, $p = .0001$, $\eta^2 = .25$; all other effects were non-significant (all *ps* > .46). Thus the obese groups reported significantly higher levels of Power of Food Scores compared to the normal-weight groups.

4.2.6 Mindful Attention Awareness Scale

A total Mindful Attention Awareness Scale score was found for each participant by calculating their mean score across the fifteen 6-point Likert items. The scores for the normal-weight groups (2-hr, M = 4.20, SE = .24, No-Restriction M = .4.20, SE = .17) were very similar to the obese groups (2-hr, M = 3.70, SE = .26, No-Restriction, M = 4.5, SE = .33). The scores for the two deprivation states were similar for the normal-weight participants but the obese No-Restriction group was slightly higher than the 2-hr group. A 2x2 ANOVA found all effects to be non-significant (all ps > .12). Thus the normal-weight and obese groups had approximately equal levels of mindful attention and awareness.

4.2.7 Correlations between Implicit and Explicit Measures

A correlation matrix of implicit and explicit measures is presented in Table 4.4, which explores the relationships between the 12 explicit measures with the *D*-IRAP measure. Non-significant correlations were obtained (all rs < .23, all ps >.09), except for two weak correlations between the *D*-IRAP score and Eating Concern (r = .29, p = .03), and the *D*-IRAP score and the MAAS (r = .27, p = .05). Thus, higher *D*-IRAP scores (i.e., unhealthy bias) predicted increased concerns over eating and increased levels of mindfulness.

Table 4.4. Correlations between the Overall Mean *D*-IRAP score and the Self-Report Hunger-Scale, the Eating Disorder Examination-Questionnaire (EDE-Q5) and its subscales, the Balanced Inventory of Desirable Responding (BIDR) and its subscales, the Power of Food Scale, and the Mindful Attention Awareness Scale, 57 observations in total.

	Overall *D*-IRAP Score
Food-Hunger	.22
Global EDE-Q	.22
EDE-Q – Restraint	.11
EDE-Q - Eating Concern	.29*
EDE-Q - Shape Concern	.09
EDE-Q - Weight Concern	.23
Total Behaviours	.17
BIDR	-.13
BIDR – SDE	-.05
BIDR – IM	-.16
PFS	.21
MAAS	.27*

*$P < .05$

4.2.8 Prediction of Group Status

Eleven separate hierarchical logistic regression analyses were conducted for the 2-hr deprivation condition. For each model the explicit measure was entered as the predictor of weight category in the first step and the overall *D*-IRAP measure was entered into the model in the second step (see Table 4.5). Weight category was significantly predicted by the following self-report measures; EDE-Q Restraint, EDE-Q Eating Concern, EDE-Q Shape Concern, and PFS. When the *D*-IRAP measure was added it significantly increased the predictive validity of the hunger-scale (R^2 change = .34), EDE-Q Eating Concern (R^2 change = .20), BIDR Self Deception (R^2 change = .35), BIDR Impression Management (R^2 change = .31), and Global BIDR (R^2 change = .22), PFS (R^2 change = .22), and MAAS (R^2 change = .29).

Similarly for the No-Restriction deprivation condition, eleven separate hierarchical logistic regression analyses were conducted. As before, for each model the explicit measure was entered as the predictor of weight category in the first step with the overall *D*-IRAP measure entered as the second step (see Table 4.5). Weight category was significantly predicted by; EDE-Q Restraint, Shape Concern and Weight

Concern, Global EDE-Q and PFS. The *D*-IRAP did not significantly improve the predictive validity of any of the explicit measures (all *ps* >.32).

Overall, therefore, the regression analyses indicated that the *D*-IRAP measure accounted for additional variance in the 2-hr deprivation condition when the explicit measures targeted issues concerned with reactions to food and also eating concern, but not weight concern. The *D*-IRAP measure also significantly improved upon the explicit measures of self-presentation bias and mindful awareness. In the Non-Restriction condition, however, the *D*-IRAP measure failed to account for any additional variance across all of the explicit measures.

4.2.9 Summary and Conclusions

The IRAP in the current study differentiated between the weight categories in the 2-hr food deprivation condition but not in the No-Restriction condition. Unlike the IRAP, the pattern of results for the explicit *hunger* measure did not differentiate among the groups (i.e., all four groups produced healthy food biases). Similarly, the BIDR and MAAS did not discriminate between the four groups. However, the EDE-Q and PFS measures both discriminated between the two weight categories, but no effects for deprivation state were observed. Correlations between the implicit and explicit measures yielded only two positive and significant correlations between the *D*-IRAP scores and EDE-Q Eating Concern and MAAS respectively. Given that the IRAP effects differentiated between the groups, logistic regression analyses were conducted to determine if the IRAP measures increased prediction of group status over the explicit measures. The *D*-IRAP measure significantly increased the predictive validity of the hunger-scale, EDE-Q Eating Concern, BIDR Self Deception, BIDR Impression Management, and Global BIDR, PFS, and MAAS explicit measures for the 2-hr food deprivation participants. The *D*-IRAP measure did not significantly

increase the predictive validity of any of the explicit measures for individuals in the No-Restriction groups. In short, unlike the *Eat it NOW* versus *Eat it LATER* IRAP employed in the previous study the *Makes Me Feel Hungry Now* versus *Does Not Make Me Feel Hungry Now* IRAP appeared to be affected by the weight and deprivation states of the participants.

Table 4.5. Summary of Hierarchical Logistical Regression analysis for the variables predicting weight-category ($N = 57$).

Step 1 2-hr Deprivation State				Step 2 2-hr Deprivation State			
Predictor Variables	*B*	R^2	*p*	Predictor Variables	*B*	R^2	*p*
Food-Hunger	.05	.01	.84	Food-Hunger + *D*-IRAP	10.65	.35	.02*
EDE-Q Restraint	3.04	.68	.02*	EDE-Q Restraint + *D*-IRAP	9.07	.79	.11
EDE-Q Eating Concern	2.47	.42	.01*	EDE-Q Eating Concern + *D*-IRAP	8.97	.62	.05*
EDE-Q Shape Concern	1.62	.62	.01*	EDE-Q Shape Concern + *D*-IRAP	4.72	.65	.29
EDE-Q Weight Concern	2.00	.69	.01	EDE-Q Weight Concern + *D*-IRAP	4.76	.72	.31
Global EDE-Q	2.95	.73	.02*	Global EDE-Q + *D*-IRAP	3.86	.75	.41
BIDR Self Deception	-.09	.01	.52	BIDR Self Deception + *D*-IRAP	10.01	.36	.01*
BIDR Impression Management	-.03	.01	.83	BIDR Impression Management + *D*-IRAP	8.93	.32	.01*
Global BIDR	-.04	.01	.62	Global BIDR + *D*-IRAP	8.97	.33	.01*
PFS	.07	.26	01*	PFS + *D*-IRAP	8.08	.48	.02*
MAAS	-.62	.05	.18	MAAS + *D*-IRAP	8.56	.34	.01*
Step 1 No-Restriction Control				Step 2 No-Restriction Control			
Predictor Variables	*B*	R^2	*p*	Predictor Variables	*B*	R^2	*p*
Food-Hunger	-.11	.01	.64	Food-Hunger + *D*-IRAP	.30	.01	.84
EDE-Q Restraint	1.77	.45	.01*	EDE-Q Restraint + *D*-IRAP	2.30	.47	.36
EDE-Q Eating Concern	1.59	.21	.07	EDE-Q Eating Concern + *D*-IRAP	.22	-.94	.58
EDE-Q Shape Concern	1.34	.53	.01*	EDE-Q Shape Concern + *D*-IRAP	3.19	.56	.32
EDE-Q Weight Concern	1.82	.61	.01*	EDE-Q Weight Concern + *D*-IRAP	3.24	.64	.33
Global EDE-Q	2.16	.57	.01*	Global EDE-Q + *D*-IRAP	3.05	.59	.32
BIDR Self Deception	.14	.03	.30	BIDR Self Deception + *D*-IRAP	.27	.03	.86
BIDR Impression Management	.30	.16	.02	BIDR Impression Management + *D*-IRAP	1.04	.17	.53
Global BIDR	.16	.11	.05	Global BIDR + *D*-IRAP	.66	.12	.67
PFS	.06	.15	.04*	PFS + *D*-IRAP	-.36	.15	.82
MAAS	.35	.02	.40	MAAS + *D*-IRAP	.52	.02	.73

4.3 DISCUSSION

When two labels referring to hunger were inserted into the IRAP it successfully differentiated between obese and normal-weight groups in the 2-hr food deprivation condition, with obese individuals showing a bias for unhealthy foods, whereas the normal-weight individuals showed a bias for healthy foods. In the No-Restriction condition, however, both groups produced weak healthy food biases. The results of the current study differ, therefore, from Study 1 of the current thesis and all previous implicit food attitude research conducted among obese and normal-weight individuals using the IAT, EAST and APP. That is, this is the first study to find a difference between obese and normal-weight individuals' implicit attitudes to healthy and unhealthy foods. Note, that an APP study reported by Czyzewska, and Graham (2008) did find a difference between the weight categories, but in attitudes to sweet versus savoury unhealthy foods, rather than healthy and unhealthy food types. Given that Study 1 also employed the IRAP, but not the two hunger labels, this suggests that it was the focus on hunger, rather than the IRAP per se, that served to discriminate between the two weight-categories. In short, targeting the participants' immediate emotional hunger reactions to food served to differentiate between the groups in a manner not observed in previous research using implicit measures.

Unlike the IRAP, the pattern of results for the explicit hunger-scale did not differentiate among the groups (i.e., all four groups produced weak healthy food biases). This is consistent with the findings reported for all four groups on the explicit wanting-scale in Study 1. This indicates that the IRAP tapped into responses that were not captured by the explicit measures. Similarly, the MAAS did not discriminate between the four groups. However, the EDE-Q and PFS measures both discriminated between the two weight categories, but no effects for deprivation state were observed,

which is consistent with Study 1. Correlations between the implicit and explicit measures yielded only two positive and significant correlations between the *D*-IRAP scores and EDE-Q Eating Concern and MAAS, respectively. Hence, the higher the participants' concerns over eating, and the higher their level of mindfulness, the larger their unhealthy foods bias on the IRAP. Interestingly, the BIDR did not correlate with the *D*-IRAP as in Study 1. The *D*-IRAP measure significantly increased the predictive validity of the hunger-scale, EDE-Q Eating Concern, BIDR Self Deception, BIDR Impression Management, and Global BIDR, PFS, and MAAS explicit measures for the 2-hr food deprivation participants; no such effects were observed for individuals in the No-Restriction groups. Overall, therefore, the findings of the current study indicate that implicit food hunger attitudes may be related to eating behaviours among obese and normal-weight individuals.

The label stimuli employed in the current study separated hunger into two dichotomised extremes "Hungry" versus "Not Hungry". One possible criticism of this approach is that pictures of foods will frequently elicit some level of hunger response, except, of course, in those situations in which a participant has eaten a large meal immediately before arriving at the laboratory. Assuming that few participants would have done so, because eating a large meal in Ireland during the working day is relatively uncommon, it seems safe to assume that most participants would have responded with at least some hunger response to many of the food pictures. If this was the case, then the "Not Hungry" label may have reduced the ability of the IRAP to assess subtle differences between obese and normal-weight individuals' implicit hunger attitudes. In order to address this possibility a partial replication of Study 2 was conducted, but using the labels, *Makes Me Feel VERY Hungry* versus *Makes Me Feel SLIGHTLY Hungry*. Would the subtle hunger relation of "very-versus-slightly"

increase the sensitivity of the IRAP to individual differences in body-weight and deprivation state, relative to the previous study?

Chapter 5: Food Deprivation and Hunger Attitudes to Food along the Dimension of "Very" versus "Slightly" among Obese and Normal-Weight Individuals

The third study described in the current thesis sought to increase the ability of the IRAP employed in Study 2 to differentiate obese from normal-weight individuals' implicit attitudes to food. Specifically, the label stimuli *Makes Me Feel VERY Hungry Now* and *Makes Me Feel SLIGHTLY Hungry Now* were utilized. In addition, in order to reduce the work load and time required of participants the current study dropped the MAAS and PFS explicit measures. Apart from these changes, the current study was similar to the previous study.

5.1 METHOD

5.1.1 Participants

Normal-weight Individuals

The same six screening criteria that were employed in Studies 1 and 2 for the normal-weight participants were employed in Study 3. Forty-two participants met these criteria and completed the study. The sample consisted of 20 females and 22 males (age M = 21 years, range, 17-34; weight, BMI, M = 21.4 kg/m²) recruited from undergraduate students attending the National University of Ireland, Maynooth. No financial enticements were offered to the participants and all were naïve to the IRAP. Participants were assigned randomly to one of two groups, counterbalancing for gender.

Obese Individuals

The same screening criteria utilized in Studies 1 and 2 for recruiting obese participants were applied in Study 3. Thirty-two obese participants completed the study. Sixteen females and sixteen males recruited from a sample of patients who were attending the Diabetes and Weight Management Clinic, St., Columcilles

Hospital, Loughlinstown, County Dublin (age M = 36 years; weight M = 51 kg/m²). Once again, participants had no previous experience with the IRAP and completed the study without financial incentives. The participants were allocated randomly to one of two groups, counterbalancing for gender.

5.1.2 Setting

The settings were identical to Studies 1 and 2.

5.1.3 Apparatus/Materials

The apparatus and materials were the same as those employed in Study 1 and 2 except that the two label stimuli on the IRAP were changed to "Makes Me Feel VERY Hungry now" or "Makes Me Feel SLIGHTLY Hungry now". Furthermore, the hunger-scale was amended to correspond to the IRAP label stimuli. Specifically, the measure comprised of a 12-item questionnaire presented on 9-point Likert scales (i.e., "On the scale below –4 to 4, rate how hungry the 12 food items make you feel now? "-4 (NOT Hungry)," "0 (SLIGHTLY Hungry)," and "4 (VERY Hungry)"? (See Appendix J).

Finally, an additional explicit measure was included, the liking-scale. Individuals were instructed to "Please mark in the appropriate spaces below your answer to the following questions on how palatable (like the taste of) or unpalatable (do NOT like the taste of) you find the 12 food items right now?" "-4 (NOT Palatable)," "0 (NEUTRAL)," and "4 (VERY PALATABLE)" (See Appendix K). The primary reason for including this scale was to determine if explicit liking food attitudes correlated with the implicit and/or explicit measures.

In order to reduce the work load on participants and the duration of the study the Power of Food Scale and Mindful Attention Awareness Scale included in Studies 1 and 2 were removed from the current study.

5.1.4 Procedure

The experimental sequence was identical to that used in Studies 1 and 2, except, as noted above, the participants completed an amended hunger-scale after completing the IRAP. The IRAP procedure was similar to that utilised in Studies 1 and 2, except that different label stimuli were used "Makes Me Feel VERY Hungry now" versus "Makes Me Feel SLIGHTLY Hungry now"; see Figure 5.1). The IRAP instructions paralleled those used previously but were amended to accommodate the different label stimuli. Consistent with the previous study, the IRAP involved alternating between two different blocks of trials. All participants commenced the IRAP with a pro-unhealthy/anti-healthy block of trials, which involved the following four trial-types: "Makes Me Feel VERY Hungry now – Unhealthy Food – True"; "Makes Me Feel SLIGHTLY Hungry now – Unhealthy Food – False"; "Makes Me Feel VERY Hungry now – Healthy Food – False"; "Makes Me Feel SLIGHTLY Hungry now – Healthy Food – True". The next block of trials was defined as pro-healthy/anti-unhealthy and involved the following four trial-types; "Makes Me Feel VERY Hungry now – Unhealthy Food – False"; "Makes Me Feel SLIGHTLY Hungry now – Unhealthy Food – True"; "Makes Me Feel VERY Hungry now – Healthy Food – True"; "Makes Me Feel SLIGHTLY Hungry now – Healthy Food – False". Thus all odd numbered blocks of IRAP trials were pro-unhealthy/anti-healthy whereas all even numbered blocks of trials were pro-healthy/anti-unhealthy[5].

[5] In the Normal-weight No-Restriction condition the order in which participants completed both the IRAP practice and test blocks was counterbalanced. That is, half of the participants completed the blocks in the order described above, with the remaining half completing them in a Pro-Healthy-food first sequence (i.e., Practice Block 1 = Pro-Healthy-Food; Practice Block 2 = Pro-Unhealthy-Food, and so on; Test Block 1 = Pro-Healthy-Food; Test Block 2 = Pro-Unhealthy-Food, and so on). Subsequent analyses indicated that IRAP sequence did not have any significant effect in the Normal-Weight No-Restriction condition. Given that IRAP sequence has not functioned as a significant main or interacting variable across a number of previous IRAP studies (Barnes-Holmes, Barnes-Holmes, Hayden, Milne, Power, & Stewart, I, 2006; Barnes-Holmes, Hayden, Barnes-Holmes, & Stewart, 2008; Cullen, Barnes-Holmes, Barnes-Holmes, & Stewart, 2009; Power, Barnes-Holmes, Barnes-Holmes, & Stewart, 2009;

After the IRAP, participants completed the self-report measures; hunger-scale, the EDE-Q5, and the BIDR alone in their booths. Having completed the questionnaires the participants were informed it was the end of the experiment, they were thanked, debriefed and any questions they had were answered by the experimenter.

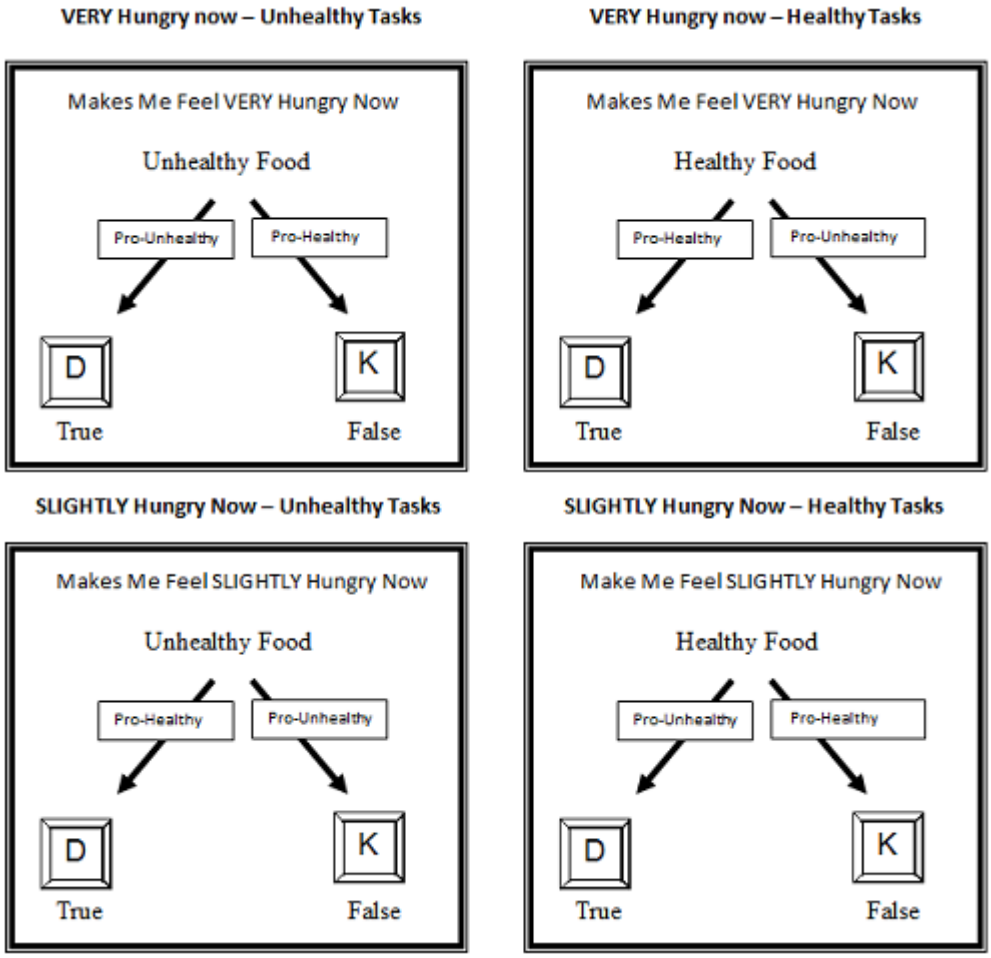

Figure 5.1. *The four IRAP trial-types.*

5.2 RESULTS

Pre-Analysis Checks

Similar to Studies 1 and 2, initial screening checks were used to determine if there were significant differences on the explicit measures (Age, BMI, EDE-Q5,

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Vahey, Barnes-Holmes, Barnes-Holmes, & Stewart, 2009), counterbalancing IRAP sequence was not employed with the remaining three conditions in the current study.

BIDR) between the deprivation states for each weight category. A series of independent *t*-tests performed on each explicit measure with deprivation state as the between group variable for each weight category all proved non-significant (all *ps* > .19).

5.2.1 Implicit Measures

Data Preparation

The data were transformed into *D*-IRAP scores using the same strategy adopted for Studies 1 and 2. The data for all 74 participants were included in the final analyses (22 in the normal-weight 2-hr group, 20 in the normal-weight No-Restriction group, 16 in the obese 2-hr group and 16 in the obese No-Restriction group).

Due to the age difference between the normal-weight (M = 21 years, SE = .37) and obese groups (M = 36 years, SE = 1.73) it was necessary to determine if age interacted with deprivation state and/or weight category. If no significant interaction was obtained, age could be ignored from subsequent IRAP analyses. The distribution in ages for the normal and obese groups was dramatically different, and thus it was not appropriate to conduct a single ANCOVA including both groups. Furthermore, age data for thirteen normal-weight No-Restriction group participants were lost due to a software recording problem, and thus it was not possible to conduct an ANCOVA with the normal-weight participants. However, a simple correlational analysis between age and the *D*-IRAP score for the normal-weight participants was weak and non significant (r = -.17, p = .37). For the obese groups, an ANCOVA was conducted on the *D*-IRAP score with deprivation state (2-hr versus No-Restriction) as the between group variable and age as the covariate. The age by deprivation state interaction was non-significant (p = .97), and after adjusting for age the main effect for deprivation condition proved to be significant, F (1, 29) = 5,70, p = .02, η^2 = .17.

Given the absence of any significant effects for age, this variable was removed from all subsequent IRAP analyses.

IRAP Analyses

The overall mean *D*-IRAP scores divided by weight category and deprivation state are presented in Figure 5.2. The *D*-IRAP effects for the normal weight individuals indicated a healthy bias for the 2-hr deprivation state, but an unhealthy bias in the No-Restriction condition. The opposite pattern was observed for the obese groups (2-hr = unhealthy; No-Restriction = healthy), although the effect for the No-Restriction group was relatively weak. The *D*-IRAP data were subjected to a 2x2 analysis of variance (ANOVA) with weight category (normal-weight versus obese), and deprivation state (2-hr versus No-Restriction) as between groups variables. The ANOVA yielded a significant interaction between weight category and deprivation state, F (1, 70) = 18.53, p = .0001, η^2 = .21, but all other effects were non-significant (all ps > .34). Four one-way between-participant ANOVAs were used to conduct planned comparisons between weight category and deprivation state. A significant difference was found between the normal-weight and obese groups for the 2-hr condition, F (1, 34) = 10.66, p = .003, η^2 = .24, and for the No-Restriction condition, F (1, 36) = 7.72, p = .009, η^2 = .18. Comparisons between the deprivation states (2-hr versus No-Restriction) for each weight category were also significant; normal-weight, F (1, 40) = 13.73, p = .0006, η^2 = .26; and obese, F (1, 30) = 6.33, p = .017, η^2 = .17.

Four one-sample *t*-tests were used to determine if the *D*-IRAP effects for each of the deprivation states for both weight-categories differed significantly from zero. The effects for the normal-weight groups were significant; 2-hr, t (19) = -2.20, p = .04, No-Restriction, t (21) = 3.12, p = .005. The effect for the obese 2-hr group was also significant, t (15) = 2.51, p = .02), but not for the No-Restriction group (p > .41).

Overall, therefore, the normal-weight individuals showed a healthy food bias at two hours deprivation but an unhealthy food bias when deprivation was not controlled. The obese individuals showed the opposite pattern, although the effect was weak and non-significant when deprivation was uncontrolled.

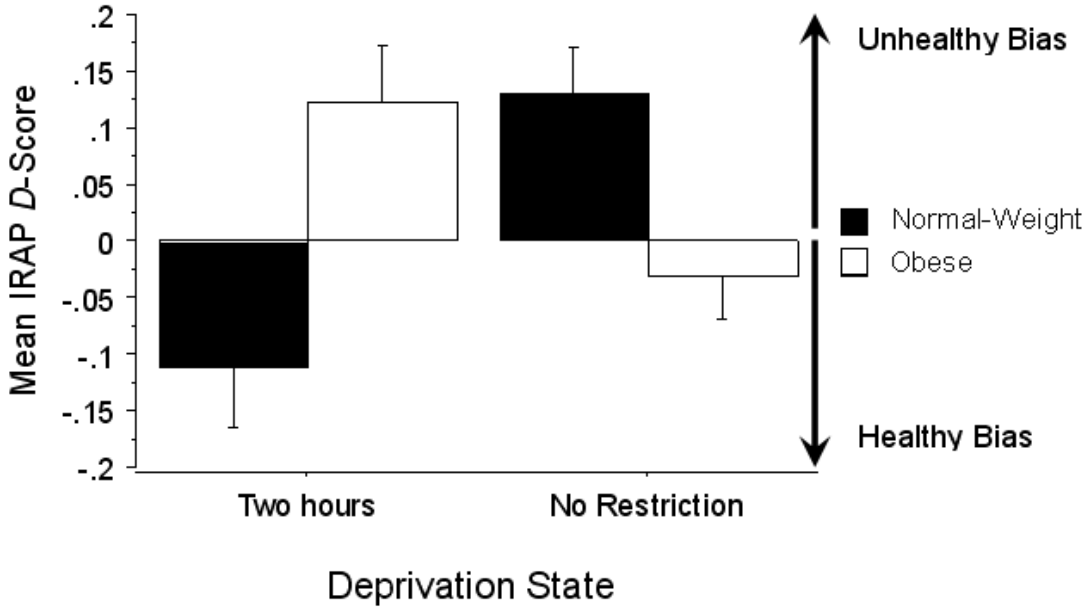

Figure 5.2. *Overall mean D-IRAP scores, with standard errors, for the normal-weight and obese groups in the 2-hr and No-Restriction food deprivation conditions.*

Split-half correlations. The split-half correlation, with a Spearman-Brown correction, was moderate and significant, r = -.2.2, n = 55, p = .48. These data thus provide a reasonably strong indicator of internal consistency for the IRAP.

5.2.2 Explicit Measures

5.2.3 Hunger-scales

Similar to Studies 1 and 2 two mean hunger-scores were first calculated from the 9-point Likert scales. Thus, a positive score indicated an unhealthy-food/anti-healthy-food bias and a negative score indicated the opposite (healthy/anti-unhealthy

bias)[6]. The normal-weight 2-hr group produced a small unhealthy food bias (*M* = .46, *SE* = .48) with the remaining three groups all demonstrating the opposite effect (normal-weight No-Restriction, *M* = -.14, *SE* = .43; obese 2-hr, *M* = -.20, *SE* = .50; obese No-Restriction, *M* = -.64, *SE* = .45). A 2x2 ANOVA with weight category and deprivation state as between-participant variables yielded no significant effects (all *ps* > .22). Thus, unlike the IRAP the hunger-scales failed to differentiate among the four different groups even though the same pictorial stimuli were used.

5.2.4 Liking-scales

Overall mean relative liking-scores were obtained from the 9-point liking-scales using the same analytic strategy as was employed with the hunger-scales[7]. The normal-weight 2-hr group produced a small unhealthy food bias (*M* = .48, *SE* = .50) and the normal-weight No-Restriction participants demonstrated a small healthy food bias (*M* = -.16, *SE* = .53). The obese individuals produced the opposite pattern; 2-hr (*M* = -.04, *SE* = .49) and No-Restriction (*M* = .12, *SE* = .53). A 2x2 ANOVA with weight category and deprivation state as independent variables yielded no significant effects (all *ps* > .39). Once again, unlike the IRAP the explicit measure did not discriminate between weight class or hunger state using the same pictorial stimuli.

5.2.5 Eating Disorder Examination Questionnaire (EDE-Q5)

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[6] Given the age difference between the normal-weight and obese groups, and the missing age data for the normal-weight No-Restriction participants, separate analyses for the two weight categories were again conducted. A correlational analysis between age and the hunger score for the normal-weight groups was significant ($r = -.39$, $p = .03$), but the ANCOVA for the obese groups indicated that the age by deprivation state interaction was non-significant ($p = .56$). After adjusting for age, there was a non-significant main effect for deprivation condition ($p = .41$). Given that only one other explicit measure correlated with age (Liking-scales) from across 20 statistical tests, and that these finding were not replicated in two previous studies, it was decided to remove age from the analysis of Hunger- and Liking-scales.

[7] Similar to the hunger scales, a correlational analysis between age and the liking score for the normal-weight groups was significant ($r = -.42$, $p = .02$), but for the obese groups, the ANCOVA indicated that the age by deprivation state interaction was non-significant ($p = .60$); after adjusting for age, there was a non-significant main effect for deprivation condition ($p = .94$). Consistent with the strategy adopted for the hunger scales (see footnote 1) age was removed from the analysis of the Liking-scales.

Similar to the previous study, Restraint, Shape Concern, Eating Concern, Weight Concern and Global EDE-Q were calculated from the 7-point rating scales for each of the subscale items. Furthermore, mean scores for the behavioural items for each of the four groups were calculated as per previous studies[8]. The means and standard deviations for the global EDE-Q score and the subscale scores are reported in Table 5.1.

Attitude items. In general, the pattern of differences between the normal-weight and obese groups on the EDE-Q was broadly similar to the norms reported in two previous studies (Fairburn & Beglin, 1994; Mond, Hay, Rodgers, Owen, & Beumont 2004), although the scores tended to be lower for both groups in the current study. The mean scores for each of the attitude subscales for each of the normal-weight groups were lower than for their corresponding obese groups. In comparing within each weight category, the scores for the normal-weight group were lower in the 2-hr condition for each subscale, except for Restraint. For the obese groups, the scores were lower in the 2-hr condition for only one subscale, Eating Concern. Five 2x2 ANOVAs were used to analyze the data for each subscale and for the Global EDE-Q, with weight category, and deprivation state as between group variables. In each case, only significant effects were obtained for weight category (see Table 5.2; all other *ps* > .17). Thus, overall, the obese groups reported higher levels of pathological attitudes to food on each of the EDE-Q5 subscales relative to the normal-weight individuals.

Behavioural items. The scores for the normal-weight groups (2-hr, $M = 2.85$, $SD = 4.30$, No-Restriction $M = 5.86$, $SD = 6.50$) were considerably lower than for the obese groups (2-hr, $M = 17.25$, $SD = 21.84$, No-Restriction, $M = 13.44$, $SD = 13.66$).

[8] The correlational and ANCOVA analyses conducted for the Hunger- and Liking-scales were also applied to the global and EDE-Q subscales, behavioural items, and to the BIDR data (presented subsequently), and in each case non-significant results were obtained for age.

Within groups, the normal-weight No-Restriction group had a slightly higher score than the 2-hr group; for the obese groups the opposite effect was observed. A 2x2 ANOVA, with weight category and deprivation state as the between group variables, yielded a significant effect for weight category F (1, 70) = 13.70, p = .0004, η^2 = .16, with all other effects non-significant (all *ps* > .25). Consistent with the attitudinal subscales obese groups reported significantly higher levels of pathological eating behaviours than the normal-weight groups.

Table 5.1. The Means and Standard Deviations for the Eating Disorder Examination Questionnaire (EDE-Q5) subscales items (Restraint, Eating Concern, Shape Concern and Weight Concern), the Global EDE-Q score).

Subscale	Normal-Weight 2-hr Group Mean (SD)	Normal-Weight No-Restriction Group Mean (SD)	Obese 2-hr Group Mean (SD)	Obese No-Restriction Group Mean (SD)	Fairburn and Beglin (1994) Community Based Norms Mean (SD)	Elder, Grilo, Masheb, Rothschild, Burke-Martindale, and Brody (2006) Obese Scores Mean (SD)
Restraint	.70 (.82)	.66 (.69)	2.90 (1.39)	2.46 (1.44)	1.25 (1.32)	2.8 (1.30)
Eating Concern	150 (.22)	.27 (.35)	1.13 (1.35)	1.59 (1.33)	.62 (.0.86)	1.70 (1.30)
Shape Concern	1.11 (.98)	1.13 (.80)	3.66 (1.25)	3.53 (1.12)	2.15 (1.60)	4.10 (1.30)
Weight Concern	.71 (.73)	.85 (.73)	3.20 (1.18)	2.96 (1.03)	1.59 (.1.37)	3.30 (1.00)
Global EDE-Q	.69 (.57)	.73 (.51)	2.72 (1.11)	2.64 (.77)	1.55 (1.21)	3.00 (0.90)

Table 5.2 Results for the Five Two-Way ANOVAs for the Eating Disorder Examination Questionnaire (EDE-Q5) subscales (Restraint, Eating Concern, Shape Concern and Weight Concern) and for the Global EDE-Q, with weight category (normal-weight, and obese), deprivation state (2-hr, and No-Restriction) as between group variables.

Subscale	Effect	*df*	*F*	*p*	η^2
Restraint	Weight Category	1, 70	61.64	.00*	.47
Eating Concern	Weight Category	1, 70	28.91	.00*	.29
Shape Concern	Weight Category	1, 70	105.29	.00*	.60
Weight Concern	Weight Category	1, 70	115.68	.00*	.62
Global EDE-Q	Weight Category	1, 70	128.30	.00*	.65

*$P < .001$

5.2.5 Balanced Inventory of Desirable Responding

Similar to the previous study, mean Self-Deception (SDE), Impression Management (IM) and Global BIDR scores were calculated for each weight category and deprivation state using the 7-point Likert scales for each subscale. The means and standard deviations for each weight category and deprivation state are presented in Table 5.3. Three separate 2x2 ANOVAs, with weight category and deprivation state as variables, were conducted and these each produced a significant main effect for weight category on Self-Deception, F (1, 70) = 6.05, p = .016, η^2 = .08, Impression Management F (1, 70) = 5.46, p = .022, η^2 = .07, and Global BIDR, F (1, 70) = 7.91, p = .006, η^2 = .10; all other effects and interactions were non-significant (all *ps* > .20). Thus the obese groups reported significantly higher levels of Self-Deception, Impression Management and Global BIDR relative to the normal-weight groups.

Table 5.3. The Means and Standard Deviations for the Balance Inventory of Desirable Responding (BIDR) subscales items (Self-Deception and Impression Management) and the Overall BIDR score.

Subscale	Normal-Weight 2-hr Group Mean (SD)	Normal-Weight No-Restriction Group Mean (SD)	Obese 2-hr Group Mean (SD)	Obese No-Restriction Group Mean (SD)
Self-Deception	3.05 (2.26)	4.09 (2.83)	4.94 (2.91)	5.75 (4.24)
Impression Management	5.35 (3.15)	5.18 (3.26)	7.13 (3.98)	7.56 (4.86)
Global BIDR	8.40 (4.56)	9.27(5.44)	12.06 (5.58)	13.31 (7.74)

5.2.6 Correlations between Implicit and Explicit Measures

A correlation matrix of implicit and explicit measures is presented in Table 5.4, which explores the relationships between the 11 explicit measures and the *D*-IRAP measure. Non-significant correlations were obtained in all cases (all *rs* < .13, all *ps* >.26).

Table 5.4. Correlations between the Overall Mean *D*-IRAP score and the Self-Report Food-Hunger and Liking-Scales, the Eating Disorder Examination-Questionnaire (EDE-Q5) and its subscales, the Balanced Inventory of Desirable Responding (BIDR) and its subscales; 74 observations in total.

	Overall *D*-IRAP Score
Food-Hunger	.02
Liking-Food	.03
Global EDE-Q	.08
EDE-Q - Restraint	.05
EDE-Q - Eating Concern	-.04
EDE-Q - Shape Concern	.11
EDE-Q - Weight Concern	.12
Total Behaviours	.10
Global BIDR	.10
BIDR - SDE	.02
BIDR - IM	.10

5.2.7 Prediction of Group Status

Ten separate hierarchical logistic regression analyses were conducted for the 2-hr deprivation condition. For each model the explicit measure was entered as the predictor of weight category in the first step and the overall *D*-IRAP measure was

entered into the model in the second step (see Table 5.5). For the 2-hr deprivation condition weight category was significantly predicted by the following self-report measures; EDE-Q Restraint, EDE-Q Eating Concern, Global EDE-Q, and Global BIDR. When the *D*-IRAP measure was added it significantly increased the predictive validity of hunger-scale (R_2 change = .20), liking-scale (R_2 change = .21), EDE-Q Restraint (R_2 change = .12), EDE-Q Eating Concern (R_2 change = .14), BIDR Self Deception (R_2 change = .18), BIDR Impression Management (R_2 change = .18), and Global BIDR (R_2 change = .17).

Similarly for the No-Restriction deprivation condition, ten separate hierarchical logistic regression analyses were conducted. As before, for each model the explicit measure was entered as the predictor of weight category in the first step with the overall *D*-IRAP measure entered as the second step (see Table 5.5). Weight category was significantly predicted by; EDE-Q Restraint, Eating Concern, Shape Concern, Weight Concern, and the Global EDE-Q measure. The *D*-IRAP significantly improved the predictive validity of hunger-scale (R_2 change = .14), liking-scale (R_2 change = .15), EDE-Q Restraint (R_2 change = .10), BIDR Self Deception (R_2 change = .12), BIDR Impression Management (R_2 change = .15) and Global BIDR (R_2 change = .12); the increase in predictive validity was marginally significant for EDE-Q Eating Concern (R_2 change = .08) and Shape concern (R_2 change = .10).

Overall, therefore, the regression analyses indicated that the *D*-IRAP measure accounted for additional variance when the explicit measures targeted issues concerned with reactions to food, with a trend that also included concern over body shape, but not over weight concern. The *D*-IRAP measure also significantly improved upon the explicit measures of self-presentation bias.

5.2.7 Summary and Conclusions

The IRAP in the current study differentiated between the weight categories in the 2-hr food deprivation condition and the No-Restriction condition. Unlike the IRAP, the pattern of results for the explicit *hunger* and *liking* scales did not differentiate among the groups. The EDE-Q and BIDR measures discriminated between weight categories but not within deprivation states. The obese groups produced significantly higher levels of pathological EDE-Q behaviours and attitudes to food as well as significantly higher levels of BIDR, Self Presentation and Impression Management characteristics than the normal-weight participants. Correlations between the implicit and explicit measures revealed no significant relationships between the *D*-IRAP scores and any of the explicit measures. The *D*-IRAP measure significantly increased predictive validity for seven of the explicit measures for the 2-hr food deprivation participants, and for six of the explicit measures for the No-Restriction groups. In short, employing the "very-versus-slightly" hunger labels in the IRAP appeared to increase its sensitivity, in that it differentiated between the two weight categories for each of the deprivation states (in the previous study the IRAP did not show this discriminate between the groups in the No-Restriction condition).

Table 5.5. Summary of Hierarchical Logistical Regression analysis for the variables predicting weight-category ($N = 74$).

Step 1 2-hr Deprivation State				Step 2 2-hr Deprivation State			
Predictor Variables	*B*	R^2	*p*	Predictor Variables	*B*	R^2	*p*
Food-Hunger	-.16	.02	.34	Food-Hunger + *D*-IRAP	5.69	.22	.01*
Liking-Hunger	-.12	.01	.45	Liking-Hunger + *D*-IRAP	6.17	.22	.01*
EDE-Q Restraint	1.65	.47	.00**	EDE-Q Restraint + *D*-IRAP	6.68	.59	.04*
EDE-Q Eating Concern	2.43	.25	.03*	EDE-Q Eating Concern + *D*-IRAP	5.91	.39	.02*
EDE-Q Shape Concern	2.28	.59	.01*	EDE-Q Shape Concern + *D*-IRAP	5.22	.65	.14
EDE-Q Weight Concern	8.67	.78	.12	EDE-Q Weight Concern + *D*-IRAP	3.07	.79	.45
Global EDE-Q	4.07	.69	.01*	Global EDE-Q + *D*-IRAP	6.08	.75	.13
BIDR Self Deception	.32	.10	.05	BIDR Self Deception + *D*-IRAP	6.42	.28	.02*
BIDR Impression Management	.15	.04	.15	BIDR Impression Management + *D*-IRAP	5.71	.22	.01*
Global BIDR	15	.09	.05*	Global BIDR + *D*-IRAP	6.14	.26	.02*
Step 1 No-Restriction Control				Step 2 No-Restriction Control			
Food-Hunger	-.143	.01	.43	Food-Hunger + *D*-IRAP	-5.60	.15	.02*
Liking-Hunger	-5.60	.00	.64	Liking-Hunger + *D*-IRAP	-5.57	.15	.02*
EDE-Q Restraint	1.82	.40	.00**	EDE-Q Restraint + *D*-IRAP	-5.80	.50	.04*
EDE-Q Eating Concern	3.05	.42	.00**	EDE-Q Eating Concern + *D*-IRAP	-5.17	.50	.06
EDE-Q Shape Concern	2.44	.62	.00**	EDE-Q Shape Concern + *D*-IRAP	-7.46	.72	.06
EDE-Q Weight Concern	2.82	.62	.00**	EDE-Q Weight Concern + *D*-IRAP	-5.31	.67	.12
Global EDE-Q	4.79	.78	.00**	Global EDE-Q + *D*-IRAP	-6.88	.82	.20
BIDR Self Deception	.145	.04	.17	BIDR Self Deception + *D*-IRAP	-5.29	.16	.03*
BIDR Impression Management	.152	.06	.09	BIDR Impression Management + *D*-IRAP	-5.80	.21	.02*
Global BIDR	.10	.07	.08	Global BIDR + *D*-IRAP	-5.37	.20	.03*

*$P < .05$
**$P < .001$

5.3 DISCUSSION

Employing the relatively subtle relation "very-versus-slightly" in the IRAP replicated the effects observed in the 2-hr food deprivation condition in Study 2 for

the obese individuals (i.e., a pro-unhealthy food bias) and for the normal-weight participants (i.e., a healthy food bias). However, these labels also discriminated obese from normal-weight participants in the No-Restriction condition, with the normal-weight individuals demonstrating a pro-unhealthy food bias and the obese a weak healthy food bias. This latter effect was not recorded in the previous study. In sum, it appears that increasing the subtly of the relational hunger response to food on the IRAP served to improve the measure's ability to differentiate between the weight categories and deprivation states. This level of discrimination has not been obtained in previously published research using other implicit measures.

In contrast to the IRAP, the neither the explicit hunger- nor liking-scales discriminated among the groups, replicating the findings from Study 1 and 2. Again, this demonstrates that the IRAP appears to be capturing responses not being assessed by the explicit measures. The results for the EDE-Q measure were similar to Studies 1 and 2 (i.e., the EDE-Q discriminated between the weight categories but not within deprivation states). Unlike the previous two studies, the Global BIDR and BIDR subscales, Self-Deception (SD) and Impression Managements (IM), also differentiated between the weight categories (no effects were observed within deprivation state). At the current time it remains unclear why these differences were observed only in the current study.

Unlike studies 1 and 2, none of the explicit measures correlated with the implicit measure. Furthermore, the *D*-IRAP measure increased the ability of seven of the explicit measures to predict weight category in the 2-hr food deprivation condition (i.e., the hunger-scale, liking-scale, EDE-Q Restraint, EDE-Q Eating Concern, BIDR Self Deception, BIDR Impression Management, and Global BIDR); and for six of the explicit measures in the No-Restriction condition (hunger-scale, liking-scale, EDE-Q

Restraint, BIDR Self Deception, BIDR Impression Management and Global BIDR and marginally significant for EDE-Q Eating Concern and Shape concern). Interestingly, with regard to the EDE-Q, the IRAP increased predictive validity for those subscales that targeted eating related attitudes (i.e., hunger, liking, restraint and eating concern), rather than body and weight related concerns. Given that the IRAP labels and target stimuli focused on hunger and food, these findings appear to support the precision of the measure. In other words, the current IRAP appeared sensitive to specific features of eating disordered psychopathology.

The most obvious difference in the pattern of IRAP effects between the previous and current study is that the normal-weight No-Restriction group produced a pro-unhealthy food bias (in the previous study a weak pro-healthy effect was observed). In contrast, the pattern of results for the obese participants remained relatively unchanged across the two studies. Given that the only substantive difference between the studies was the use of the more subtle labels (very-versus-slightly), it appears that they impacted largely on the normal-weight participants. This is an interesting result and it will be revisited in Chapter 9.

Overall, the findings obtained thus far in the research programme highlight the potential of the "very versus slightly" hunger-IRAP for future investigations of implicit food attitudes among obese and normal-weight individuals. The study reported in the next chapter aimed to validate the analytic precision of this particular IRAP even further by assessing normal-weight participants' performances while also measuring their neurological responses using electroencephalograms (EEGs).

Chapter 6: Food Deprivation Effects on the "Very" versus "Slightly" IRAP while Recording Electroencephalograms

Study 4 aimed to further validate the analytic precision of the IRAP used in the previous study by assessing normal-weight participants' performances while also measuring their neurological responses using electroencephalograms (EEGs). Specifically, recordings were taken from multiple EEG signals, while participants completed the IRAP, and these signals were then transformed into event-related potentials (ERPs; e.g., Kutas, 1993; Kutas & Hilliard, 1984). This method of recording neural activity is relatively noninvasive and inexpensive, and allows researchers to investigate the neurophysiological processes underlying functions such as perception, semantic relations, and reasoning (see Barnes-Holmes, Staunton, Whelan, Barnes-Holmes, Comins, Walsh et al. 2005; Barnes-Holmes, Regan, Barnes-Holmes, Commins, Walsh, & Stewart et al. 2005).

Generating ERP data involves time-locking the EEG signals to a particular series of events and then averaging the signals across trials. The process of averaging allows the researcher to distinguish the brain's normal background activity from the activity produced by the stimuli presented in the experiment. In effect, each EEG signal for a particular set of stimuli is collated and averaged to produce a single waveform for each site, and then these waveforms are averaged across participants to provide "grand average" waveforms that provide group-based measures of the effect of the targeted stimulus or stimuli.

There is a range of waveforms associated with ERP measures. Some ERPs, for example, are thought to be correlated with specific cognitive processes, such as differentiating different auditory stimuli from one another or understanding words. These ERPs commonly occur at around 300 or 400 ms after stimulus onset. The use

of ERP measures with the hunger-IRAP in the current study was entirely exploratory, and thus no specific predictions were made pertaining to the ERP waveforms that might emerge. One

ERP measure, however, that seemed particularly pertinent to the IRAP is the N400, a late negative waveform (see Holcomb & Anderson, 1993; Kounios & Holcomb, 1992). The N400 is usually produced when participants are required to respond to stimuli that are unexpected, unrelated, or wrongly paired in some sense (known as low *cloze probability)*. Presenting pairs of words that are semantically unrelated, for example, tends to produce an N400, whilst words from the same semantic categories do not.

Insofar as pro-unhealthy/anti-healthy food trials on the hunger-IRAP require "incorrect" responses for normal-weight individuals in a 2-hr food deprivation state, a more negative waveform may emerge for these trials relative to pro-healthy/anti-unhealthy food trials. Indeed, this is the general pattern of results obtained in the only study that has measured EEG signals while participants completed an IRAP (Barnes-Holmes, Hayden, Barnes-Holmes, & Stewart, 2008). On balance, the previous study was conducted using verbal relations that did not pertain to food or hunger (e.g., Pleasant – Holiday – Similar). Given that the current study will focus on hunger reactions (e.g., Very Hungry -- Unhealthy-food – True) it is quite possible that different EEG results will emerge.

In Study 4, separate EEG waveforms, recorded across a range of sites, were collected while the participants completed the IRAP. A comparison could thus be made between the waveforms associated with the two types of blocks presented on the hunger-IRAP (i.e., pro-unhealthy versus pro-healthy).

6.1 Method

6.1.1 Participants

The same six screening criteria that were employed in Studies 1, 2, and 3 were applied in the current study for the normal-weight participants. Fourteen participants met these criteria and completed the study. The sample consisted of 7 females and 7 males (age M = 25 years, range, 19-46; weight, BMI, M = 21.49 kg/m²) recruited from undergraduate students attending the National University of Ireland, Maynooth. No financial enticements were offered to the participants and all were naïve to the IRAP.

6.1.2 Apparatus/Materials.

The IRAP, apparatus, and questionnaire materials were identical to those employed in Study 3. Additionally, participants conducted the entire study in an electrically shielded room in the human neuroscience laboratory in the Department of Psychology at NUI, Maynooth. A Brain Amp MR (Class IIa, Type BF), with approved control software (Brain Vision Recorder 1.0), and electrode cap (BrainCap MR) were used to record the EEG signals during the IRAP task. Two Dell computers (Pentium 4), one controlling the Brain Amp and the other the IRAP, were utilised for the experiment. The ERPs data were analysed using approved analysis software (Brain Vision Analyser 1.0). Hardware and software were manufactured and supplied by Brain Products GmbH, Munich, Germany.

6.1.3 Procedure

The IRAP procedure and instructions were identical to those utilised in the 2-hr food-deprivation condition in Study 3. In contrast to the previous studies, however, approximately 45 mins were required to complete the electrode placements and establish appropriate impedance levels for all of the electrode sites. Evoked potentials were recorded and analysed from 128 sintered AG/AG-CI scalp electrodes positioned

according to international 10-20 system. The central vertex electrode was used as a reference and the Nz as ground. Amplifier resolution was 0.1μV (range +/- 3.2768mV) and the bandwidth was set at 50Hz. All electrode impedances were at or below 10 ohms. The EEG was collected continuously and edited off-line. Data were analyzed from the following sites: F3, F4, F5, F6, C1, C2, C3, C4, P3, P4, P5 and P6.

When participants had completed the IRAP, the electrode cap was removed and they completed the explicit measures. Finally, they were thanked and debriefed.

6.2 RESULTS

Implicit Measures

Data Preparation

The data were transformed into *D*-IRAP scores using the same strategy adopted in Studies 1, 2, and 3. The data for two participants were removed due to artifacts recorded in the EEG signals (see below), leaving data for twelve (normal-weight) participants.

6.2.1 IRAP Analyses

The overall mean *D*-IRAP score for the normal-weight participants in a 2-hr food deprivation condition was 1.3 (*SE* = .036), thereby indicating the healthy bias observed for this type of participant and condition in the previous study. A one-sample *t*-test revealed that the *D*-IRAP effect differed significantly from zero, t (13) = -3.56, p = .004. A post-hoc analysis using an independent *t*-test were conducted to determine if there was a difference between the *D*-IRAP scores from the current study with the *D*-IRAP scores from the normal-weight 2-hr group from Study 3. No significant difference was found (p > .83). Overall, therefore, the current study replicated the healthy food bias observed previously with normal-weight participants in a 2-hour deprivation condition.

Split-half correlations. The split-half correlation, with a Spearman-Brown correction, approached significance, $r = .47$, $n = 14$, $p = .09$.

6.2.2 Explicit Measures

6.2.3 Hunger-scales

Two mean hunger scores were calculated using the 9-point Likert scales as per Study 3. Thus, a positive score indicated an unhealthy-food/anti-healthy-food bias and a negative score indicated the opposite (healthy/anti-unhealthy bias). Participants produced a very weak unhealthy food bias ($M = .09$, $SE = .43$). Post-hoc analyses using an independent t-test on the food-hunger score from the current study versus the food-hunger score from the normal-weight participants in the 2-hr condition in Study 3 revealed a non-significant effect ($p > .59$).

6.2.4 Eating Disorder Examination Questionnaire (EDE-Q5)

Similar to Study 3, Restraint, Shape Concern, Eating Concern, Weight Concern and Global EDE-Q were calculated from the 7-point rating scales for each of the subscale items. The means and standard deviations for the global EDE-Q score and the subscale scores are reported in Table 6.1.

Attitude items. In general, the pattern of scores for the normal-weight participants on the EDE-Q was broadly similar to the norms reported by Fairburn and Beglin (1994), although the scores were all lower. Post-hoc analyses were conducted on the subscales and Global EDEQ score using five independent *t*-tests comparing the participants in the current study with those from Study 3 (normal-weight 2-hr deprivation condition). All effects were non-significant (all $ps > .29$).

Behavioural items. The participants' overall mean total score was 3.29 ($SD = 5.20$). Post-hoc analyses were conducted using an independent *t*-test to compare the

current behavioural data with that obtained from Study 3 for the normal-weight, 2-hr deprivation group. Once again, a non-significant effect was found ($p > .13$).

Table 6.1. The Means and Standard Deviations for the Eating Disorder Examination Questionnaire (EDE-Q5) Attitudinal subscales items (Restraint, Eating Concern, Shape Concern and Weight Concern), the Global EDE-Q score).

Subscale	Normal-Weight 2-hr Group Mean (SD)	Experiment 3 Normal Weight 2-hr Group Mean (SD)	Fairburn and Beglin (1994) Community Based Norms Mean (SD)
Restraint	.41 (.90)	.70 (.82)	1.25 (1.32)
Eating Concern	.37 (.89)	.15 (.22)	.62 (.0.86)
Shape Concern	1.08 (1.5)	1.11 (.98)	2.15 (1.60)
Weight Concern	.69 (1.05)	.71 (.73)	1.59 (.1.37)
Global EDE-Q	.64 (.88)	.69 (.57)	.1.55 (1.21)

6.2.5 Balanced Inventory of Desirable Responding

Similar to Study 3, participants mean Self-Deception (SDE), Impression Management (IM) and Global BIDR scores were assessed using the 7-point Likert scales for each subscale. The means and standard deviations for SDE, IM and Global BIDR are presented in Table 6.2. Post-hoc analyses were conducted on the subscales and Global score using three independent *t*-tests to compare the data from the current study with that of Study 3 (normal-weight 2-hr group). All effects were non-significant (all *ps* > .22).

Table 6.2. The Means and Standard Deviations for the Balance Inventory of Desirable Responding (BIDR) subscales items (Self-Deception and Impression Management) and the Overall BIDR score.

Subscale	Normal-Weight 2-hr Group Mean (SD)	Study 3 Normal-Weight 2-hr Group Mean (SD)
Self-Deception	4.29 (.3.45)	3.05 (2.26)
Impression Management	5.57. (4.40)	5.35 (3.15)
Global BIDR	9.86 (7.00)	8.40 (4.56)

6.2.6 Correlations between Implicit and Explicit Measures

A correlation matrix of implicit and explicit measures is presented in Table 6.3, which explores the relationships between the ten explicit measures and the *D*-IRAP score. Non-significant correlations were obtained in all cases (all $r = > -.41$, *ps* >.15), except for two marginally significant correlations, between the *D*-IRAP score and the hunger-scale ($r = .51$, $p = .06$), and the *D*-IRAP score and the EDE-Q Restraint ($r = -.46$, $p = .10$). Thus, higher *D*-IRAP scores (i.e., unhealthy bias) marginally predicted higher levels of explicit hunger preferences for unhealthy foods and decreased levels of excessively controlled eating.

Table 6.3. Correlations between the Overall Mean *D*-IRAP score and the Self-Report Food-Hunger, the Eating Disorder Examination-Questionnaire (EDE-Q5) and its subscales, the Balanced Inventory of Desirable Responding (BIDR) and its subscales, 12 observations in total.

	Overall *D*-IRAP Score
Food-Hunger	.51*
Global EDE-Q	-.18
EDE-Q - Restraint	-.46*
EDE-Q - Eating Concern	-.24
EDE-Q - Shape Concern	-.01
EDE-Q - Weight Concern	-.02
Total Behaviours	.08
Global BIDR	-.26
BIDR - SDE	-.41
BIDR - IM	-.01

*$P < .10$

6.2.7 EEG data

The continuous EEG signals for each of the 12 participants were filtered (0.53 Hz, time constant = 0.3s, 24dB/Octave roll-off) and then segmented for pro-unhealthy and pro-healthy trials. Segments were divided into 1,000ms epochs commencing 100ms before the onset of the stimuli on each trial (overlapping segments were removed). Vertical and horizontal ocular artifacts were corrected and any segments on

which EEG or electro-ocular activity exceeded +/- 75μV were rejected. The EEG data for two participants were rejected because the signals were consistently "noisy". The remaining segments were baseline corrected (using the 100ms pre-stimulus interval) and subsequently averaged for consistent versus inconsistent IRAP trials. Figure 6.1 presents the grand average waveforms for each of the 12 electrode sites (F3, F4, F5, F6, C1, C2, C3, C4, P3, P4, P5 and P6) for pro-unhealthy (light gray lines) versus pro-healthy (dark lines) trials. Visual inspection of the waveforms from the 12 electrode sites indicated little evidence of differential activity for the two types of IRAP trial until approximately 200ms following onset of the stimulus. The pro-healthy relative to the pro-unhealthy trials produced greater negativity for electrodes sites F4, F6, C2, and C4, whereas electrode sites P3 and P5 demonstrated the opposite pattern (i.e., the pro-healthy trials were more positive relative to the pro-unhealthy trials). There was little evidence of clear differential activity on the remaining six electrode sites.

The area dimension (μV x ms) for each ERP waveform (in the temporal region 400 to 700ms) for each participant was calculated, yielding either a positive or negative value with respect to the 0μV level. A 2x6x2 ANOVA was then conducted with laterality (left and right), position (F3-F4, F5-F6, C1-C2, C3-C4, P3-P4, P5-P6), and IRAP condition (pro-unhealthy and pro-healthy) as repeated measures variables. The ANOVA revealed a significant main effect for position, $F(5, 55) = 5.44$, $p = .0004$, $n_p^2 = .33$ and an interaction effect for position by IRAP condition, $F(5, 55) = 4.87$, $p = .0009$, $n_p^2 = .31$. All other main effects and interactions were non-significant (all ps > .06). A series of Sheffe post-hoc tests indicated that each of the positions F3-F4 versus P3-P4 and F5-F6 versus P3-P4 respectively differed significantly from each other (all ps < .014). All other comparisons were non-significant (all ps > .15).

Twelve separate paired t-tests were used to conduct comparisons between IRAP condition for each electrode site (F3, F4, F5, F6, C1, C2, C3, C4, P3, P4, P5 and P6). Positions F4, F6, P3 and P5 yielded significant effects for IRAP condition; $t(11) = -2.28$, $p = .043$); $t(11) = -3.33$, $p = .008$); $t(11) = 3.25$, $p = .008$); and $t(11) = 3.69$, $p = .003$), respectively. Positions C2 and C4 yielded marginally significant effects, $t(11) = -1.74$, $p = .11$); and $t(11) = -2.18$, $p = .05$), respectively. All other electrodes sites yielded non-significant effects (all $ps > .19$). In short, pro-healthy waveforms were significantly more negative than pro-unhealthy waveforms in the 400 to 700ms interval for the F4 and F6 sites, but the reverse pattern was demonstrated for P3 and P5.

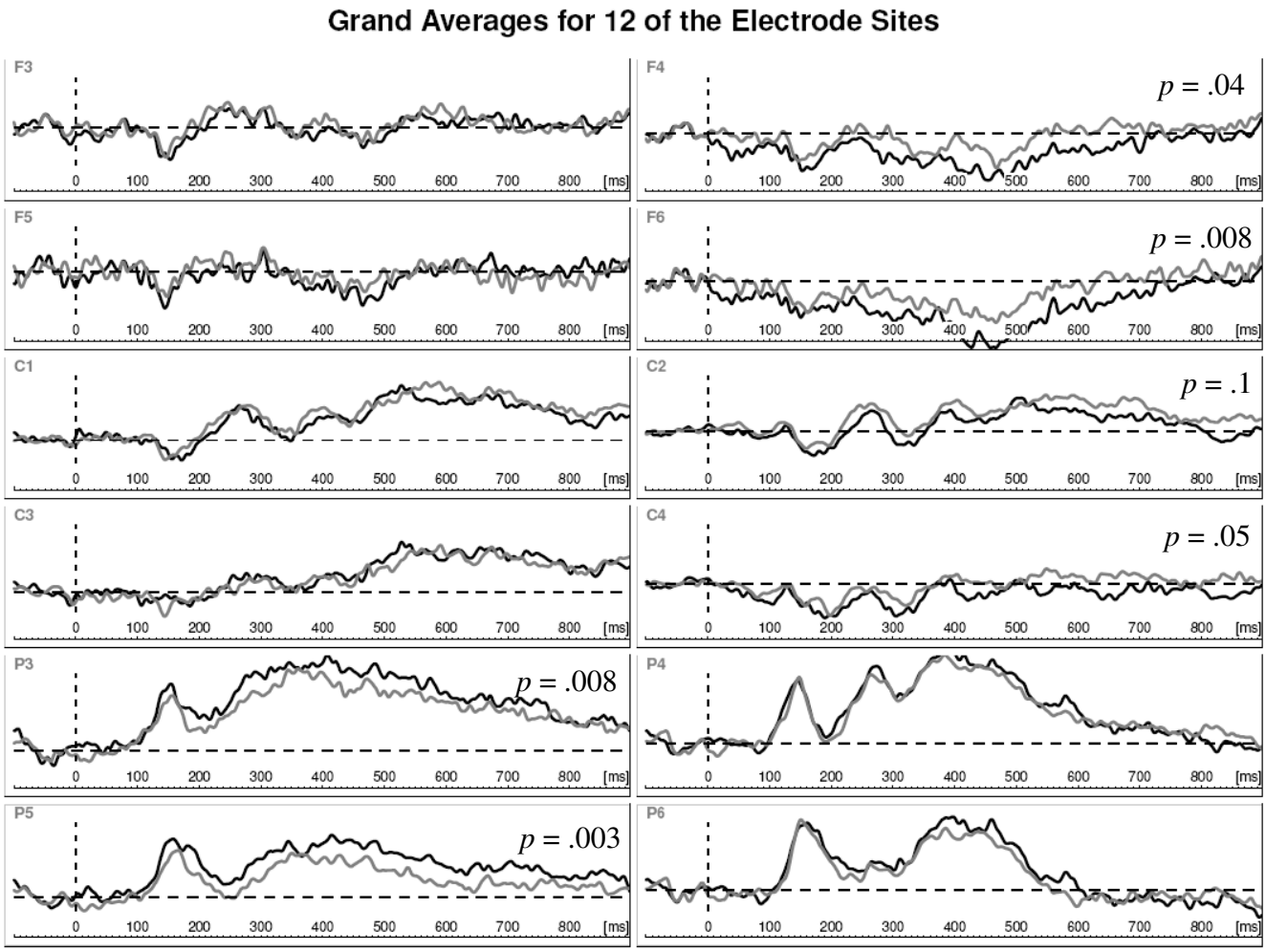


Figure 6.1 The Grand Average waveform for the Pro-Unhealthy (light grey lines) and Pro-Healthy (dark grey lines) trial-types for the twelve electrode sites F3, F4, F5, F6, C1, C2, C3, C4, P3, P4, P5, and P6.

6.3 DISCUSSION

Study 4 replicated the effects found in Study 3, demonstrating a pro-healthy food bias in the 2-hr food deprivation condition. The ERP grandaverage waveforms for the pro-healthy trials were more negative than pro-unhealthy waveforms for the F4 and F6 sites, but the reverse pattern was demonstrated for P3 and P5 (pro-unhealthy trials were more negative than pro-healthy waveforms). As noted in the introduction to the current study, pro-unhealthy responding for normal-weight participants in a 2-hr food deprivation state may be considered inconsistent with their dominant response bias (i.e., participants typically show a pro-healthy bias, as indicated in the previous

and current studies). Based on the results reported by Barnes-Holmes et al. (2008), more negative ERPs waveforms would thus be predicted for pro-unhealthy relative to pro-healthy IRAP trials. This prediction was upheld for sites P3 and P5, but interestingly the opposite pattern was observed for sites F4 and F6. At the current time, it is unclear why these differences emerged in the ERPs measures across the two studies. As noted earlier, however, the previous study employed stimuli that were unrelated to food and hunger. Clearly, therefore, further research will be required to determine the variables responsible for the different ERP patterns observed across the two studies. Nevertheless, the current findings do indicate that EEG signals may be used to discriminate between two different types of IRAP trials, even when hunger-related stimuli are employed. This finding thus provides further validation of the IRAP as a measure of food attitudes. The current findings are also important because there are no published studies that have attempted to record brain activity while participants complete an implicit measure targeting attitudes to food. As such, the current data may provide a useful foundation for future work in the area, and serves to highlight the potential of the IRAP in this regard.

Thus far, the research reported in the current thesis has involved developing an IRAP that may be used to measure implicit food biases. Both response latencies and EEG patterns have been shown to be sensitive dependent measures. However, a critical issue in the area of food attitudes concerns the development of methods that may be used to cope with food urges. The penultimate study reported in the current thesis focused on this issue.

Chapter 7: The Malleability of Implicit Attitudes: Exploring the Impact of Two Response Strategies to Food Urges

Socio-cognitive researchers have argued that explicit attitudes are susceptible to change via various factors at any given point in time due to an individual's cognitive resources, focus of attention, motivation and goals, and on contextual cues (e.g., Wilson, Lindsey, & Schooler, 2000). Empirical evidence indicates that explicit attitudes have been affected by influencing the following factors: (a) social context (Lowery, Hardin, Sinclair, 2001); (b) an individual's current mood (Forgas, 1992); (c) an individual's present thoughts and feelings (Chaiken & Yates, 1985); (d) the experience of cognitive dissonance (Senemeaud & Somat, 2009); and (e) the provision of normative and informational social influence (Werner, Sansone, & Brown, 2008).

In contrast to explicit attitudes, in the past researchers assumed that implicit attitudes were typically fixed and therefore were difficult to modify because they represented well learned patterns that were relatively insensitive to the immediate context. However, there is currently a growing body of evidence challenging the assumption of the inflexibility of this type of responding. For example, it has been shown that implicit attitudes are influenced by various cognitive, motivational and situational factors, that is, the same sorts of unwanted influences to which explicit measures are susceptible (Blair, 2002). Malleability is the name given to the characteristic of implicit responding whereby it is susceptible to modification through extraneous variables.

Evidence for the malleability of implicit attitudes has typically come from research using the IAT. The empirical evidence indicates that IAT-assessed attitudes are indeed malleable via the influence of several variables. These variables include (a)

contextual factors (Boysen, Vogel, & Maddon, 2006; Dasgupta & Asgari, 2004; Dasgupta & Greenwald, 2001; Lowery et al., 2001; McCaul & Dasgupta, 2009; Mitchell, Nosek, & Banaji, 2003); (b) social roles (e.g., Barden, Maddux, Petty, & Bewer, 2001); (c) mental strategies (Blair et al., 2001); (d) education (Rudman, Ashmore, & Gary, 2001); (e) experience (Karpinski & Hilton, 2001); and (f) mood (Gemar, Segal, Sagrati, & Kennedy, 2001). Much of this research has focused on the malleability of implicit prejudice as measured by the IAT in the domains of; homosexuality (e.g., Boysen et al., 2006), race (e.g., Barden et al., 2001; Dasgupta & Greenwald, 2001; Lowery et al., 2001), and gender stereotypes (e.g., Dasgupta & Asgari, 2004; McCaul & Dasgupta, 2009).

One method, known as exemplar training, has been used by some researchers to study the malleability of implicit attitudes. This involves presenting participants with a series of specific exemplars which are designed to manipulate their attitudes toward a specific target (e.g., Dasgupta & Greenwald, 2001; Lowery et al., 2001). In Experiment 1, reported by Dasgupta and Greenwald, participants were provided with exemplars (i.e., pictures of either admired Black and disliked White individuals, or vice versa, disliked Black and admired White individuals). Participants subsequently completed an IAT, and again after 24 hours (without re-exposure to the exemplars). Explicit attitude measures were also administered in each of the phases. The results found that exemplar exposure to admired Black and disliked White pictures significantly weakened implicit pro-White preferences for 24 hours, but explicit attitudes remained unaffected. This basic effect was replicated in a second experiment, but with implicit ageism as the focal attitude.

More recently, Experiment 2 from Dasgupta and Greenwald (2001) was partially replicated but using the IRAP instead of the IAT (Cullen et al., 2009).

Findings indicated that when participants were presented with positive exemplars of old people and negative exemplars of young people, implicit negative bias towards old people was significantly reduced. In line with Dasgupta and Greenwald's study, the explicit measures were mostly unaffected.

At the time of writing, no published study had demonstrated the malleability of implicit attitudes to food. Furthermore, no published study had attempted to investigate the impact of any therapeutic analogues on IRAP performance. The fifth study in the current thesis reports research that was designed to compare the effects of two types of response strategies to food urges/cravings for a favourite snack food; a protocol based on acceptance and commitment therapy (Forman, Hoffman, McGrath, Herbert, Brandsma, & Lowe, 2007; Wilson & DuFrene, 2008) and an Indulgence of Food Urges protocol.

Acceptance-based strategies are a feature of several novel cognitive-behavioral therapies (e.g., Acceptance and Commitment Therapy, Hayes, Strosahl & Wilson, 1999). In contrast to control-based interventions, acceptance-based strategies do not set out to specifically reduce the number of cravings or relieve discomfort caused by cravings; instead, the goal is to promote willingness to experience what cannot be controlled (i.e., cravings, thoughts, feelings/emotions) while at the same time fostering behavior that is consistent with desired goals and values. This is achieved through the combination of several types of strategies: (a) recognizing the futility of trying to control internal experiences such as thoughts and feelings; (b) mindfulness-based protocols aimed at increasing awareness of internal experiences, while accepting them as they are, and; (c) defusion techniques (i.e., stepping back/distance from), ones thoughts and other internal experiences.

Paradoxically, acceptance-based interventions have been found to increase tolerance of previously avoided or suppressed internal experiences while simultaneously relieving distress that they cause (Levitt, Brown, Orsillo, & Barlow, 2004; Twohig & Woods, 2004; Zettle, 2003). Acceptance-based therapies have suggested it is as effective, if not more so, than traditional cognitive-behavioural and control-based strategies for a myriad of psychological problems, for example, the treatment of social anxiety (Block, 2003), depression (Zettle & Hayes, 1986), emotional distress (Forman, Herbert, Moitra, Yeomans, & Geller, 2007; Lappalainen, Lehtonen, Skarp, Taubert, Ojanen, & Hayes, 2007) and chronic pain (Geiser, 1993). Interestingly, an acceptance based protocol for smoking cessation, instructing ways to cope with cravings without acting on them, has been found to be more effective than the nicotine patch in a randomized controlled trial that compared these two interventions (Gifford et al., 2004). Smoking cessation could be a close parallel to maintaining weight loss, given the focal feature of abstaining from (smoking) or limiting the intake of (for foods) a craved substance. Typically, smoking cessation attempts fail because of the difficulty of resisting cravings to smoke (Brown, Lejuez, Kahler, Strong, & Zvolensky, 2005); similarly weight reduction efforts generally fail due to the difficulties in resisting urges to eat high-fat/unhealthy foods (Alsene, Li, Chaverneff, & de Wit, 2003).

The effectiveness of an acceptance-based strategy versus a control-based strategy for coping with chocolate cravings was tested by Forman et al. (2007). Measures included the PFS (employed in Studies 1 and 2 of the current research programme), self-report ratings of chocolate cravings and chocolate consumption. The findings indicated that the effect of the intervention depended on baseline PFS levels; specifically, the acceptance-based strategy was associated with better outcomes

(lower cravings and chocolate consumption) among participants reporting the highest sensitivity to food cues in the environment (on the PFS), but greater cravings among those who scored lowest on the PFS. In contrast, the control-based strategy provided the highest outcomes for those who had the lowest PFS scores. In short, this finding highlights the potential utility of acceptance based strategies for dealing with food cravings for individual's who are most susceptible to food cues in the environment.

The fifth study reported in the current thesis sought to investigate the malleability effects of implicit attitudes to healthy and unhealthy foods in response to an Acceptance versus Indulgence of Food Urges strategy. Participants in the Acceptance of Food Urges condition were provided with a powerpoint presentation of an acceptance-based strategy for dealing with food urges, which involved an experiential exercise using their favourite snack food. Participants in the Indulgence of Food Urges condition were presented with a similar presentation and exercise, but one that focused on indulging in (i.e., acting on) a craving for their favourite snack food. Both groups then completed the "very-versus-slightly" hunger-IRAP and explicit measures. A control group also completed the study but did not receive a food-urge presentation and exercise; instead they completed the IRAP and explicit measures. Given that no previous published study had investigated the effects an Acceptance versus Indulgence of Food Urges strategy on implicit food attitudes, no specific predictions were made concerning the impact that these two different interventions might have.

7.1 Method

7.1.1 Participants

The same six screening criteria that were employed in all previous studies for the normal-weight participants were employed in the current study. Fifty-five

participants met these criteria, consisting of 30 females and 25 males (age *M* = 19.5 years, range, 17-33; weight, BMI, *M* = 21.34 kg/m²). All participants were undergraduate students attending the National University of Ireland, Maynooth. No financial enticements were offered to the participants and all were naïve to the IRAP. Participants were randomly assigned to one of three groups; Acceptance of Food Urges (ACC, n = 18), Indulgence of Food Urges (IND, n = 19), and Control (n =18).

7.1.2 Setting

The setting was identical to that for the normal-weight participants in all previous studies.

7.1.3 Apparatus/Materials

The hunger-IRAP and explicit questionnaire materials employed in Study 3 were used, as well as the PFS and MAAS scales used in Study 2.

Craving Questionnaire. The first item of the questionnaire was designed to determine the strength of participants' cravings for their favourite snack food. Participants were instructed to "Please rate how strong your cravings are to eat your favourite snack right now, circle the appropriate number below?" Responses were recorded on an 11-point Likert Scale "0 (No Cravings)," "5 (Slight Cravings)," "10 (Extremely Strong Cravings)". The second item measured participants' "ability to resist cravings for their favourite snack right now" on an 11-point Likert Scale "0 (No Ability)," "5 (Slight Ability)," "10 (Strong Ability)" (See Appendix L).

Acceptance/Indulgence of Food Urges Audio Protocol and Food Exercises. The computer-administered procedure was presented on Windows PowerPoint 2002 using standard Pentium 4 personal computers running Windows XP. The PowerPoint software controlled the presentation of all written and audio instructions (VLC Media file.wav).

Acceptance of Food Urges Exercise Questionnaire. This questionnaire was completed by participants in the ACC condition only. It is a five item questionnaire employed to assess participants understanding of the ACC Protocol they had been exposed to during the Audio clips. The first item asked participants "what does acceptance mean", the second, "what does willingness mean", the third "what does awareness mean", the fourth, "what does distancing mean?". The fifth item asked participants to "Please write down a summary of the strategy you have been instructed to use here today?" Item six asked participants to "list any thoughts you had during the exercise"; Item seven asked participants to "list any feelings you had during the exercise"; Item eight instructed participants to "Please rate how useful the strategy was" on an 11-point Likert Scale "0 (Not Useful)," "5 (Slightly Useful)," "10 (Very Useful)". Finally, item nine requested participants to "rate how difficult it was to use the strategy during the task?" on an 11-point Likert Scale "0 (Very Easy)," "5 (Slightly Difficult)," "10 (Very Difficult)" (see Appendix M).

Indulgence of Food Urges Exercise Questionnaire. This questionnaire assessed participants' thoughts and feeling during the food exercise. Item one asked participants to "list any thought you had during the exercise" while item two asked participants to "list any feelings you had during the exercise" (See Appendix N).

7.1.4 Procedure

The procedure consisted of seven phases (see Table 7.1). In Phase 1, participants in all three groups were asked to complete items one and two of the Craving questionnaire and the Hunger-State questionnaire. The Control group read the October 2009, NUI, Maynooth student magazine "The Print" for twenty-seven minutes and did not complete the subsequent phases 2, 3, 4, and 5. The IND group read the same magazine for twenty minutes and did not complete phases 2 and 3.

During Phase 2, participants in the ACC group were exposed to their Acceptance of Food Urges audio Protocol. During phase 3, the ACC group received items 1 to 5 of the Acceptance of Food Urges Exercise Questionnaire. During phase 4, the ACC and IND groups received their respective audio food exercises. During phase 5 all groups received the Craving questionnaire for the second time. The ACC group also received the final four items of the Acceptance of Food Urges Exercise Questionnaire. The IND group received the Craving questionnaire again followed by the Indulgence of Food Urges Exercise Questionnaire. All participants were exposed to the hunger-IRAP in phase 6. All participants received the remaining six self-report measures in Phase 7; the hunger-scale questionnaires; the EDE-Q5; the BIDR; the PFS and the MAAS respectively.

Table 7.1. The Experimental Sequence.

	Group		
Experimental Phases	**Control**	**Indulgence of Food Urges**	**Acceptance of Food Urges**
Phase 1	Craving Questionnaire and Hunger-State questionnaire	Craving Questionnaire and Hunger-State questionnaire	Craving Questionnaire and Hunger-State questionnaire
Phase 2	Read Magazine	Read Magazine	Acceptance Protocol
Phase 3	Read Magazine	Read Magazine	Acceptance of Urges Exercise Questionnaire (items 1 - 5)
Phase 4	Read Magazine	Indulgence Food Exercises	Acceptance Food Exercises
Phase 5	Craving Questionnaire	Craving Questionnaire and Indulgence of Urges Exercise Questionnaire	Craving Questionnaire and Acceptance of Urges Exercise Questionnaire (items 6 - 9)
Phase 6	Hunger IRAP	Hunger IRAP	Hunger IRAP
Phase 7	Hunger-scale questionnaire, EDE-Q5, BIDR, PFS and the MAAS	Hunger-scale questionnaire, EDE-Q5, BIDR, PFS and the MAAS	Hunger-scale questionnaire, EDE-Q5, BIDR, PFS and the MAAS

Participants were randomly assigned to either the Control, ACC or IND groups (counterbalancing for gender). All groups were told the study would involve answering questions about food. Only the ACC and IND groups were instructed to bring their favourite cold snack with them to the study (e.g. a bar of chocolate or a bag of crisps etc.); they were instructed to refrain from eating this snack during the day of the study, but otherwise eat as normal. The ACC and IND groups were reimbursed the cost of their favourite snacks upon arrival for the study. The Control group did not receive any such instructions.

At the start of each experimental session the researcher thanked the participants for coming and informed them of the brief nature of the study. Participants were told that participation was voluntary, that they were completely free to with-draw at any stage, and all information they provided during the study was fully confidential. All individuals completed a written consent form (see Appendix O).

Phase 1: Craving questionnaire and hunger-state questionnaires. All individuals completed the Craving questionnaire and Hunger-State questionnaire sitting alone at a table in the experimental cubicle. Subsequently, participants in the Control condition read a student magazine for twenty-seven minutes, while the IND group read it for twenty minutes.

Phase 2: Acceptance of Food Urges Protocol. Upon starting the Acceptance of Food Urges Protocol the researcher instructed the participants to follow the on-screen instructions carefully (i.e., only press the arrow keys to go to the next slide when the PowerPoint programme instructs you to do so). Participants in the ACC group were seated in front of the computer which presented a short description of the procedure, the instructions for completing the Acceptance of Food Urges Protocol

(See Appendix P for full Acceptance of Food Urges Protocol). Participants controlled the presentation of the protocol, delivered through headphones, via Powerpoint. The idea behind the protocol was to teach participants a strategy that psychologists have developed to resist food cravings. Participants were informed that they would have to utilize this strategy to help them deal with cravings for their favourite snack foods during a subsequent food exercises. Furthermore, participants were informed that there will be a quiz at the end of the instruction phase to track how well they remember the coping strategies.

The protocol covered five core areas (see Appendix P for full protocol). The first of these areas, *Control*, focused on illustrating for participants via a thought control exercise that they cannot control their thoughts, feeling, cravings or urges even when they have the most intense motivation to do so. In short, if you have a craving for food there's not much you can do about it!

The second core area *Acceptance*, informed participants that instead of trying to control their food cravings they can simply choose to accept their cravings, because we are going to have food cravings no matter what.

The third core area *Willingness*, informed participants that they have only two options if they cannot accept what it feels like to have cravings. Either they can give into the cravings and eat the food or they can figure out away to tolerance the cravings. Although, they don't have much control over what they think, feel or crave, they do have control over the willingness to think, feel or crave certain things. This ability is called *Willingness*.

The fourth core area *Awareness*, sought to teach participants the concept of awareness, (i.e., how to notice and observe their own internal experiences such as,

thoughts, feelings, physical sensations, and cravings). This concept was illustrated through a thought observation metaphor and exercise.

The fifth and final area of the protocol covered *Distancing*. Participants were informed that a very important way to increase willingness and decrease the distress of coping with their cravings is to distance themselves from their cravings. When they step back from themselves and their cravings they have psychological distance, and can experience their thoughts, feeling, and cravings as just feelings that their mind is having at that moment. When they have this distance they can choose not to do what their thoughts, feelings, cravings are telling them to do. Participants were instructed to use the awareness exercise used previously to simply notice their thoughts, feelings, physical sensations and food cravings. But this time try and step back, see your mind having the experience from a psychological distance. Describe it to yourself and thank your mind for whatever it throws up (i.e. "So say to yourself my mind is having a craving to eat my favourite snack right now. It's a really strong craving. But I'm going to let that feeling just be there, give it room and choose not to eat it"). The participants were also provided with a memory aid to help them remember the strategy:

> AWAD!
>
> A: Acceptance.
>
> Whatever thoughts or feelings or cravings your mind creates are okay.
>
> W: Willingness.
>
> Be willing to have what your mind gives you. No matter how strong a craving is, you can let it be. You don't have to make it go away.
>
> A: Awareness.
>
> Become aware of what it is you are thinking and feeling and craving in any given moment.
>
> D: Distancing.
>
> Step back from your thoughts and feelings and cravings. See them from a distance. "I see myself having a craving for chocolate cake right now.

The IND and the Control group read the magazine during this phase.

Phase 3, Acceptance of Urges Exercise Questionnaire items 1 to 5. Participants completed these items which examined their understanding of the various components of the Acceptance of Food Urges protocol i.e., acceptance, willingness, awareness and distancing, as well as a summary of the strategy participants were asked to use. Finally, the researcher also asked participants to verbally explain their answers to the questions to ensure they understood the Acceptance protocol fully before they could proceed to the next phase (See Appendix M). The IND group and the Control continued to read the magazine during this phase

Phase 4, Acceptance / Indulgence of Urges Food Exercises. The food exercise for the ACC group instructed each participant to hold a piece of his/her favourite snack in his/her hand and to bring it to his/her mouth and gently move in tiny increments towards eating the snack, but never actually putting it in his/her mouth and chewing it. Participants held the food at the cusp between eating and not eating (i.e., the snack was held close to an open mouth almost touching the lips for 60 seconds, and participants were asked to use the Acceptance of Food Urges Strategy they had just learned previously to help them cope with urges to eat their favourite snack. Participants completed this exercise two more times (see Appendix Q for the full Acceptance of Food Urges Exercise).

The Indulgence of Food Exercise was identical to the Acceptance of Food Urge Exercise except that participants were instructed to eat the piece of their favourite snack food when their cravings to eat it became too strong for them to resist anymore. They also completed this exercise three times in total (see Appendix R for the full Indulgence of Food Urges Exercise).

Phase 5: Craving questionnaire, Acceptance of Food Urges Exercise Questionnaire and Indulgence of Food Urges Exercise Questionnaire. Participants in all groups completed the Cravings questionnaire. The ACC group also completed the final four items of the Acceptance of Food Urges Exercise Questionnaire. The IND group completed the Indulgence of Food Urges Exercise Questionnaire.

Phase 6: The Hunger-IRAP. The hunger-IRAP procedure and instructions were identical to that utilised in the No-Restriction condition in Study 3. All participants in the present study completed the pro-unhealthy /anti-healthy block of trials first.

Phase 7: Self report measures. After the hunger-IRAP, participants completed the six self-report measures alone in their booths; the Hunger-Scale, the EDE-Q5, the BIDR, PFS, and the MAAS, respectively.

Having completed the questionnaires the participants were informed it was the end of the experiment, they were thanked, debriefed and any questions they had were answered by the experimenter (see Appendix R).

7.2 RESULTS AND DICUSSION

Pre-Analysis Checks

Initial screening checks were used to determine if there were significant differences on the explicit measures (Age, BMI, EDE-Q5, BIDR, PFS, MAAS, Craving-questionnaire-before-the-food exercise) between the groups (ACC, IND, and Control). If no differences were found, any subsequent differences on the implicit measure between the groups were unlikely due to individual differences. A series of one-way between groups ANOVA performed on each explicit measure with group as the independent variable, proved non-significant (all *ps* > .09), except for BMI. A follow-up analysis revealed a significant difference between the Control and the ACC

groups (F (1, 34) = .35, p = .05, η^2 = .11), even though both groups were within the normal-weight BMI range (18.5 to 24.9 BMI); no differences were found for BMI between the Control and IND (p = .79), or between ACC and IND groups (p = .07). Analyses reported subsequently thus determined if BMI interacted with each of the implicit and explicit measures.

Significant differences were found for the Craving-questionnaire between the Control and the ACC groups (F (1, 34) = 11.77, p = .0016, η^2 = .26) and between the Control and IND groups (F (1, 35) = 12.35, p = .0012, η^2 = .26). This was expected because both the ACC and IND groups were instructed prior to the study to take their favourite snacks with them to the study (and to refrain from eating them during the day). The Control group received no such instructions, and thus it was assumed that cravings would not be elevated above normal. Importantly, however, no differences on the Craving-questionnaire were found between the ACC and IND groups (p = .78).

7.2.1 Implicit Measures

Data Preparation

The data were transformed into *D*-IRAP scores using the same strategy adopted for all previous studies. The data for all 55 participants were included in the final analyses (18 Control participants, 18 Acceptance of Food Urges participants, 19 Indulgence of Food Urges participants).

IRAP Analyses

Figure 7.1 presents the overall mean *D*-IRAP scores divided by group. The *D*-IRAP scores indicated a strong unhealthy bias for the Control group, with a slightly stronger unhealthy bias in the ACC group. The IND had no bias towards either unhealthy or healthy foods. Due to the BMI difference between the Control (M = 20.93 years, SE = .41) and ACC groups (M = 22.04 years, SE = .38) it was necessary

to determine if there was a BMI by group interaction. If non-significant interaction effects were found, then subsequent IRAP analyses could ignore BMI. An ANCOVA was conducted on the *D*-IRAP scores with group (Control, ACC, and IND groups) as the between group variable and BMI as the covariate. The BMI by group interaction was non-significant ($p = .50$). After adjusting for BMI the main effect for group was significant F (1, 49) = .70, $p = .02$, $\eta^2 = .19$. Given the absence of any significant effects for BMI, this variable was removed from all subsequent IRAP analyses.

Three one-way between-participant ANOVAs were used to conduct planned comparisons between groups. A significant difference was found between the Control and IND groups; F (1, 35) = 5.87, $p = .02$, $\eta^2 = .14$, and between the ACC and IND groups, F (1, 35) = 6.56, $p = .02$, $\eta^2 = .16$. No significant difference was found between the Control and the ACC groups ($p > .73$)

Three one-sample *t*-tests were used to determine if the *D*-IRAP effects for each of the groups differed significantly from zero. The effects for the Control, ($p = .01$) and ACC ($p < .01$) groups were significant but not for the IND group ($p > .94$). Overall, therefore, the Control and ACC groups showed similarly strong significant unhealthy biases but the IND group did not show any bias.

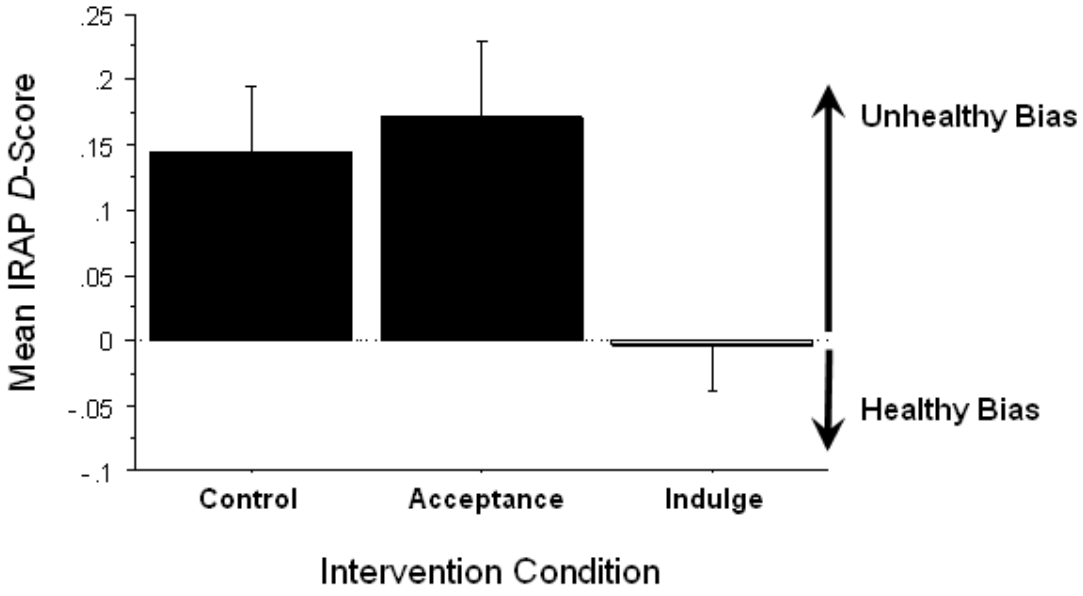


Figure 7.1. *Overall mean D-IRAP scores, with standard errors, for the Control, IND, and ACC groups.*

Split-half correlations. The split-half correlation, with a Spearman-Brown correction, was strong and significant, $r = .90$, $n = 55$, $p < .05$. These data thus provide a strong indicator of internal consistency for the IRAP.

7.3.2 Explicit Measures

7.2.3 Hunger-scale

Similar to Studies 3 and 4, two mean hunger-scores were calculated from the 9-point Likert scales. Thus, a positive score indicated an unhealthy-food/anti-healthy-food bias and a negative score indicated the opposite (healthy/anti-unhealthy bias)[9]. All three groups produced unhealthy food biases (Control group, $M = .29$, $SE = .46$; ACC, $M = .95$, $SE = .50$; IND, $M = 2.07$, $SE = .39$, see Figure 7.2). A one-way analysis of variance (ANOVA) with group (ACC, IND, and Control) as the between

[9] The ANCOVA analyses conducted for the *D*-IRAP scale were also applied to the Hunger-scale, Craving-questionnaire, Global EDE-Q and EDE-Q subscales, behavioural items, Global BIDR and BIDR subscales PFS and MAAS data. All BMI by group state interactions were non-significant (all *ps* > .11). As a result, BMI was removed from all subsequent analyses of the explicit measures.

group variable found a significant main effect for group F (1, 51) = .15.015, p = .03, η^2 = .14. Three follow-up ANOVAs yielded a significant difference between the Control and IND; F (1, 35) = 8.62, p = .01, η^2 = .20; the other effects were non-significant (p > .08). Thus, the only significant difference for the hunger scale was between the Control and Indulge conditions.

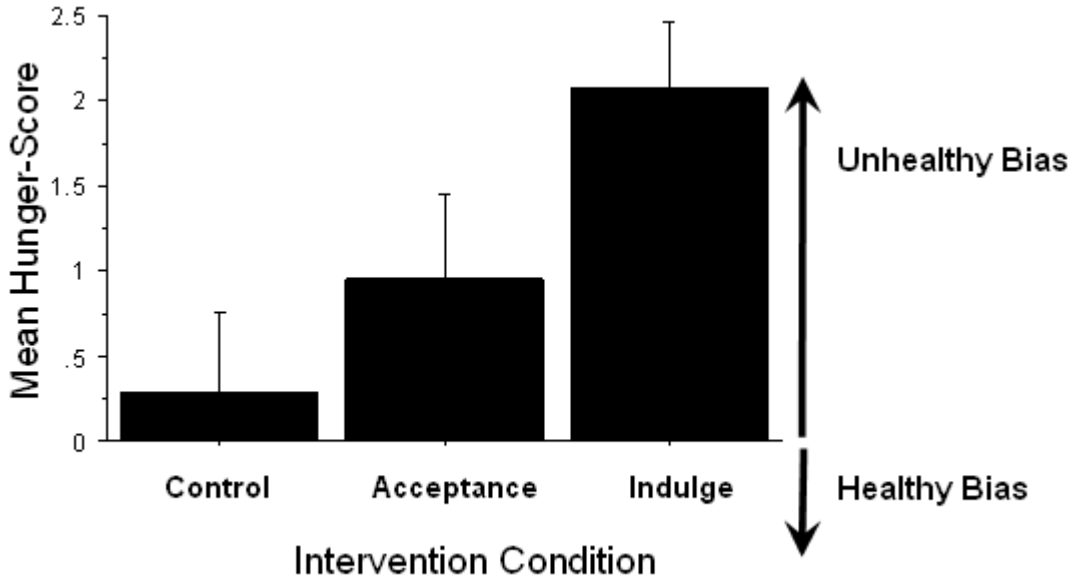
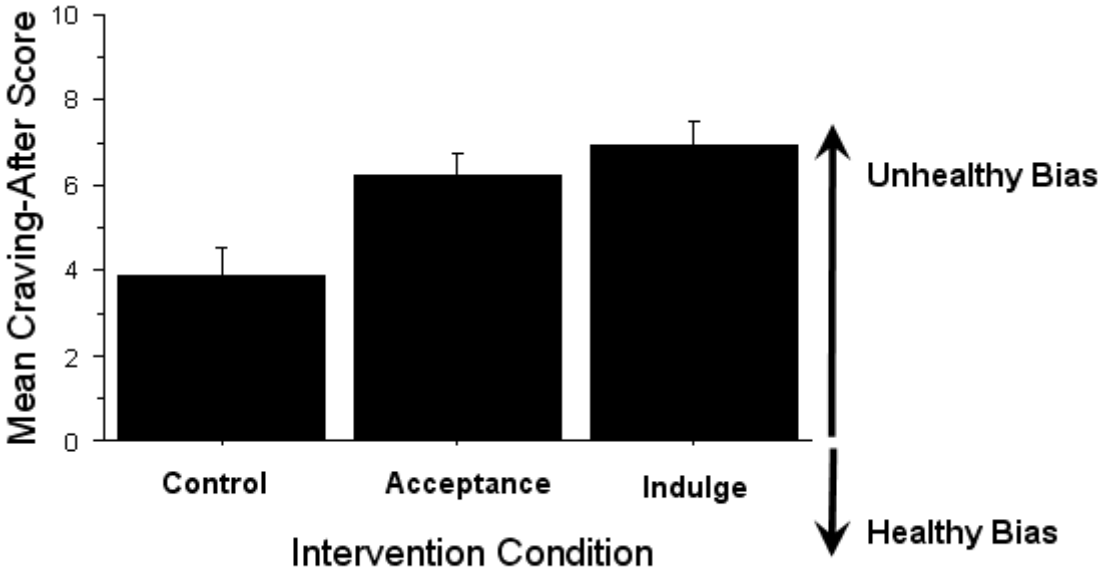


Figure 7.2. *Overall mean Hunger-scores, with standard errors, for the Control, IND, and ACC groups*

7.2.4 Craving Questionnaire

The first item of the questionnaire was designed to determine the strength of participants' "cravings" for their favourite snack. Participants rated how strong their cravings were to eat their favourite snack right now, on an 11-point Likert Scale. The second item assessed participants' "ability to resist cravings" for their favourite snack right now on an 11-point Likert Scale. Overall mean craving scores were calculated for each group by summing the respective individual cravings scores and dividing by the number of individuals in each group. Overall resist scores were calculated for each of the groups in a similar manner.

Cravings. Figure 7.3 presents the overall mean craving scores divided by group. All three groups had cravings for their favourite snack. The IND group had the largest cravings score, followed closely by the ACC group. The Control group had the lowest (i.e., this group did not undertake any food exercise). A one-way ANOVA with groups as the between group variable found a significant difference between the groups F (1, 49) = .6.44, p = .01, η^2 = .22. Three follow-up ANOVAs revealed significant effects between the Control and IND groups; F (1, 35) = 12.78, p = .01, η^2 = .27, and between the Control and ACC groups, F (1, 35) = 8.03, p = .01, η^2 = .19, but not between the ACC and IND groups (p = .34). Thus, the Control participants reported significantly lower cravings compared to the other two.



7.3. *Overall mean Cravings scores, on the Craving-Questionnaire, for the Control, IND, and ACC groups.*

Resist. Figure 7.4 presents the overall mean resist scores divided by group. All three groups had moderate to strong resist scores for their favourite snack foods. The ACC group had the largest resist score, followed by the Control group (i.e., this group did not undertake any food exercise) and the IND group had the lowest resist

score. A one-way ANOVA demonstrated a significant difference among the groups F (1, 51) = .4.53, p = .02, η^2 = .151. Three one-way between-participant ANOVAs revealed a significant difference between the ACC and IND groups; F (1, 35) = .93, p = .01, η^2 = .17, a marginally significant effect between the Control and IND groups; F (1, 35) = 3.88, p = .06, η^2 = .10, and a non-significant difference between the Control and ACC groups (p = .47). Thus, the IND group reported substantively lower resistance than the other two groups, with Control and ACC showing very little difference.

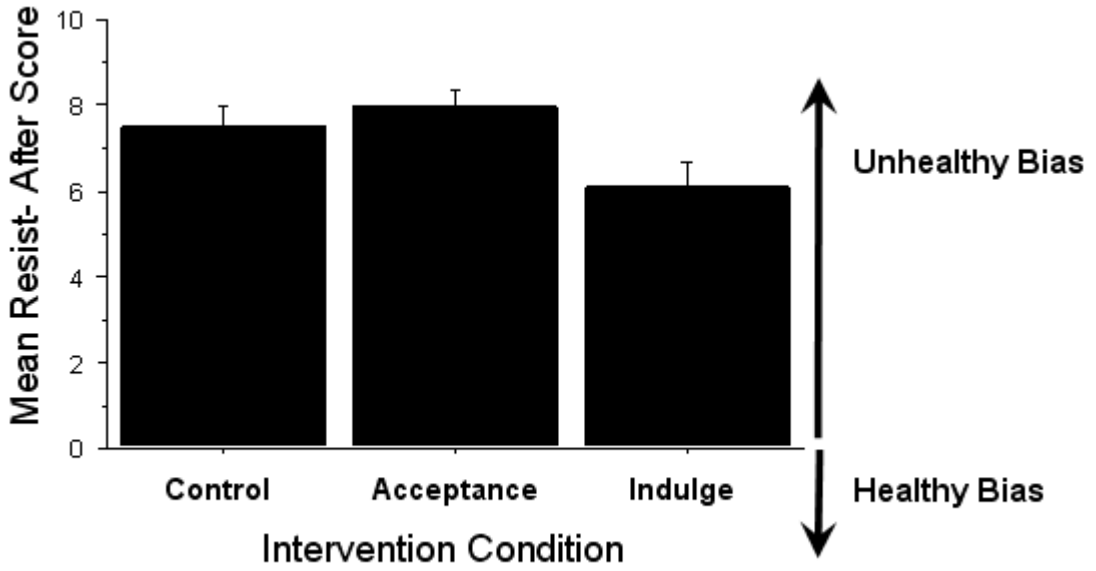


Figure 7.4. *Overall mean Resist scores on the Craving-Questionnaire, for the Control, IND, and ACC groups.*

7.2.5 Correlations between Implicit and Explicit Measures

A correlation matrix of implicit and explicit measures is presented in Table 7.2, which explores the relationships between the 14 explicit measures and the *D*-IRAP measure. Non-significant correlations were obtained in all cases except between the *D*-IRAP score and MAAS (r = .34, p = .01). Thus the higher the *D*-IRAP score

(i.e., the stronger the unhealthy bias) the more participants engaged mindful awareness.

Table 7.2. Correlations between the Overall Mean *D*-IRAP score and the Self-Report Hunger-scale, the Eating Disorder Examination-Questionnaire (EDE-Q5) and its subscales, the Balanced Inventory of Desirable Responding (BIDR) and its subscales, the Power of Food, and the Mindful, Attention, Awareness Scale, 55 observations in total.

	Overall *D*-IRAP Score
Hunger-Scale	.02
Cravings item of the Cravings-questionnaire	-.03
Resist item of the Cravings-questionnaire	.15
Global EDE-Q	.19
EDE-Q - Restraint	-.04
EDE-Q - Eating Concern	.19
EDE-Q - Shape Concern	.12
EDE-Q - Weight Concern	.15
Total Behaviours	.11
Global BIDR	.14
BIDR – SDE	.12
BIDR – IM	-.02
PFS	.01
MAAS	.34*

*$P < .05$

7.2.6 Prediction of Group Status

Three separate hierarchical logistic regression analyses were conducted for the three groups. For each model the explicit measure was entered as the predictor of group status (Control, ACC, and IND) in the first step and the overall *D*-IRAP measure was entered into the model in the second step (see Table 7.3). Group status was significantly predicted by the following self-report measures; the hunger-scale for the IND group, the cravings item of the Cravings-questionnaire for the IND and the ACC groups. Group was marginally significantly predicted by the resist item of the Cravings-questionnaire for the IND group. When the *D*-IRAP measure was added it significantly increased the predictive validity for the IND group with respect to the

hunger-scale (R_2 change = .06), and the cravings item of the Cravings-questionnaire (R_2 change = .07). The increase in predictive validity was marginally significant for the resist item of the Cravings-questionnaire for the IND group (R_2 change = .04).

Table 7.3. Summary of Hierarchical Logistical Regression analysis for the variables predicting group status (N = 55).

Step 1 Control versus Indulgence/Acceptance of Food Urges				Step 2 Control versus Indulgence/Acceptance of Food Urges			
Predictor Variables	R^2	*B*	*p*	Predictor Variables	R^2	*B*	*p*
Hunger-scale	.07			Hunger-scale + *D*-IRAP	.13		
Acceptance		.18	.31	Acceptance		.28	.87
Indulgence		.52	.01*	Indulgence		-.42	.03*
Cravings-After	.11			Cravings-After + *D*-IRAP	.18		
Acceptance		.35	.01*	Acceptance		.55	.75
Indulgence		.48	.002*	Indulgence		-4.2	.04*
Resist-After	.07			Resist-After + *D*-IRAP	.11		
Acceptance		.14	.46	Acceptance		.15	.46
Indulgence		-.31	.06	Indulgence		-3.29	.06

7.2.7 Summary and Conclusions

The Control and the ACC group produced similar and significant unhealthy food biases on the IRAP, whereas the IND group did not discriminate between unhealthy and healthy foods. The explicit *hunger-scale* indicated the opposite pattern with the IND group providing the strongest unhealthy food preference; the Control and ACC groups' hunger score did not differ significantly from each other. The ACC and IND groups produced similarly high levels of craving for their favourite snack, with cravings for both groups significantly higher than the Control group. The ACC and Control groups reported similarly high levels of resistance towards their favourite snack foods, with both groups having higher resistance compared to the IND group. Correlations between the implicit and explicit measures yielded only one positive and significant correlation between the *D*-IRAP score and the MAAS. When logistic regression analyses were conducted to determine if the IRAP measure increased prediction of group status over the explicit measures, the *D*-IRAP increased predictive

validity for the IND group for the hunger-scale and the cravings and resist items of the Cravings-questionnaire. Of the three groups, the IND group showed the highest hunger and craving effects combined with lower resistance. However, on the IRAP participants showed almost no discrimination between healthy and unhealthy foods (the ACC and Control groups showed strong unhealthy food biases).

7.4 DISCUSSION

The experimental manipulation had a significant effect on the IND group's implicit bias compared to the ACC and Control groups. That is, the Control and the ACC group produced similar and significant unhealthy food biases on the IRAP, whereas the IND group did not discriminate between unhealthy and healthy foods. Thus, it would seem that the Indulgence of Food Urges exercise served to increase participants' implicit bias for both unhealthy and healthy foods (i.e., a lack of discrimination between the food categories). The Acceptance of-Food-Urges protocol on the other hand did not impact on the ACC group's implicit food bias. In fact, the bias was very similar that of the Control group's, which is interesting given that the ACC group had conducted the food exercise, but the Control group had not. The results are in line with the findings of IAT malleability effects (Lowery et al. 2001; Dasgupta & Greenwald, 2001; Boysen et al., 2006), and the IRAP malleability results reported by Cullen et al. (2009). It is also worth noting that the IRAP effect for the Control group in the current study was in line with the No-Restriction condition of Study 3 of the present thesis (i.e., an unhealthy food bias). The findings for the explicit hunger-scale indicated the opposite pattern from that of the IRAP. The IND group demonstrated the most pronounced unhealthy food preference; significantly higher that the Control group. The Control and ACC groups' hunger scores did not differ significantly from each other. Thus, it seems that the Indulgence of Food Urges

exercise increased the IND groups' explicit preference for unhealthy food. However, the ACC group's implicit and explicit biases did not differ from the Control group's biases. This suggests that the Acceptance of Food-Urges protocol allowed this group to respond to their urges/cravings for their favourite snack foods as if they had not been exposed to the food exercise at all (as per the Control group).

Interestingly, the ACC and IND groups reported similarly high levels of craving for their favourite snack, both significantly higher than the Control group. However, the ACC and Control groups reported similarly high levels of resistance towards their favourite snack foods, with both groups having higher resistance relative to the IND group. This suggests that the Acceptance of Food-Urges protocol resulted in the ACC group having similar resistance for their favouite snack foods to the Control group who did not conduct any food exercise. This finding again supports the potential utility of an acceptance-based intervention for dealing with urges/cravings for food.

Only one positive and significant correlation was reported between the *D*-IRAP score and the explicit measures (i.e., MAAS), indicating that when normal-weight participants are in an unrestricted food deprivation state they have higher levels of mindfulness. This correlation was also recorded in Study 2 of the current thesis, but in that earlier study the relationship was only observed for the obese participants.

The *D*-IRAP measure increased the ability of the explicit measures to predict group status for participants in the IND group only (i.e., the hunger-scale, the cravings and resist items of the Cravings-questionnaire). The finding that the IRAP increased the predictive validity of the explicit hunger measure is consistent with Studies 3 and 4.

Overall, the findings from the current study support the utility of an acceptance-based protocol for dealing with urges/cravings for favourite snack foods. Importantly, the study indicated that implicit and explicit food attitudes are similarly susceptible to malleability variables (but can show contrasting effects) based on the type of intervention employed. Finally, a particular feature of the current findings raised a specific question, which was addressed in the next and final study of the thesis. Specifically, it might have been expected that the IND group would produce the largest unhealthy food bias on the IRAP, given that they reported the highest level of explicit hunger for unhealthy foods. However, this group actually produced a very weak healthy food bias, indicating a lack of discrimination between food types. Although this outcome might seem counter-intuitive, on balance perhaps relatively high levels of hunger on the IRAP are indicated by lack of discrimination between different types of foods. Or more informally, if one is hungry then, at an implicit level, any food will do. The final study of the current thesis subjected this argument to empirical test.

Chapter 8 Food Deprivation and Satiation Effects on "Very" versus "Slightly" Implicit Hunger Attitudes

As noted above, it is possible that a relatively neutral IRAP effect may be observed when participants are hungry. It also follows that a similar effect would be recorded if participants were experiencing little or no hunger, because all foods are relatively unappealing. The final study in the current thesis used the IRAP to examine normal-weight participants' implicit and explicit hunger attitudes to healthy and unhealthy food when very hungry (i.e., in a 4-hr food deprivation condition) and when sated (immediately after a large meal). Apart from the changes in food deprivation, the current study was similar to Study 3.

8.1 Method

8.1.1 Participants

The same six screening criteria that were employed in all previous studies were used here for the normal-weight participants. Thirty seven participants met these criteria and completed the study. The sample consisted of 16 females and 21 males (age M = 22 years, range, 17-29; weight, BMI, M = 21.6 kg/m²) recruited from undergraduate students attending the National University of Ireland, Maynooth. Once again, no financial enticements were offered to the participants and all were naïve to the IRAP. Participants were assigned randomly to one of two groups (19 in the 4-hr-Plus and 18 in the Sated condition), counterbalancing for gender

8.1.2 Setting

The setting was identical to Studies 1, 2, and 3.

8.1.3 Apparatus/Materials

The apparatus and materials were the same as those employed in Study 3.

8.1.4 Procedure

The procedure was similar to the procedure from Study 3, except that participants were randomly assigned to either a 4-hr-Plus versus Sated group (rather than 2-hr and No-Restriction groups). Again, gender was balanced within groups. Participants in the 4-hr-Plus group were instructed upon recruitment, and reminded via SMS message 24 hours before the study, to eat a large meal until full, finishing it no less than 4 hours before commencing the experiment. Participants in the Sated group received the same instructions except that they were asked to eat a large meal immediately before arriving for the study. All participants were exposed to an IRAP block sequence that commenced with pro-unhealthy/anti-healthy trials.

8.2 RESULTS

Pre-Analysis Checks

As per Studies 1, 2, 3 and 5 initial screening checks were used to determine if there were significant differences on the explicit measures (Age, BMI, EDE-Q5, BIDR) between the deprivation states. Independent *t*-tests conducted on each explicit measure were all non-significant (all *ps* > .20), and thus any differences on the implicit measure recorded in subsequent analyses were likely due to the deprivation manipulation.

8.2.1 Implicit Measures

IRAP Analyses

The latency data obtained from the IRAP were prepared in the same way as in previous studies. Figure 8.1 presents the overall mean *D*-IRAP scores for both deprivation states. For the 4-hr-Plus participants the *D*-IRAP score indicated a weak unhealthy bias whereas the sated participants demonstrated a weak healthy bias. An

independent *t*-test performed on the *D*-IRAP data with deprivation state (4-hr-Plus versus Sated) as between group variable was non-significant ($p > .59$).

Two one-sample *t*-tests were used to determine if the *D*-IRAP effects for the two deprivation states differed significantly from zero, and these were found to be non-significant (*ps* > .61). Overall, therefore, the 4-hr-Plus and Sated individuals showed weak and non-significant unhealthy and healthy food biases, respectively, with no effect for deprivation condition.

Split-half correlations. The split-half correlation calculated across all participants, with a Spearman-Brown correction, was weak and non-significant, $r = .03$, $n = 37$, $p = .92$.

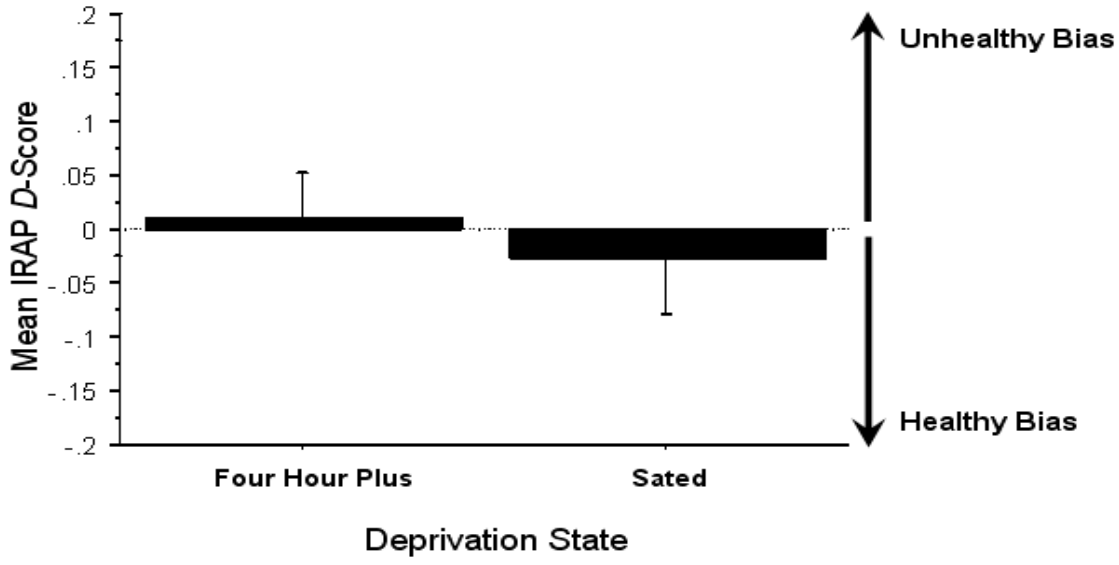


Figure 8.1. *Overall mean D-IRAP scores, with standard errors, for the normal-weight groups in the 4-hr and Sated food deprivation conditions.*

8.2.2 Explicit Measures

8.2.3 Hunger-scales

Two mean hunger-scores were first calculated from the 9-point Likert scales. Thus, a positive score indicated an unhealthy-food/anti-healthy-food bias and a negative score indicated the opposite (healthy/anti-unhealthy bias). Both groups

produced neutral biases (4-hr-Plus, M = -.001, SE = .49; Sated, M = -.03, SE = .41). An independent t-test with deprivation state as the between-participant variable yielded non-significant effects (p >.97). Thus, like the IRAP the hunger scales failed to differentiate among the two groups even using the same pictorial stimuli.

Overall mean relative liking-scores were obtained from the 9-point liking-scales using the same analytic strategy as employed with the hunger-scales. Both groups produced weak healthy biases (4-hr-Plus, M = -.69, SE = .48; Sated, M = -.65, SE = .43). An independent t-test with deprivation state as a between-participant variable found a non-significant effect (p >.95). Once again, like the IRAP the explicit measure did not discriminate between hunger states using the same pictorial stimuli.

8.2.4 Correlations between Implicit and Explicit Measures

A correlation matrix of implicit and explicit measures is presented in Table 8.1, which explores the relationships between the 10 explicit measures with the *D*-IRAP measure. Non-significant correlations were obtained in all cases (all rs < -.22, all ps >.19) except between the *D*-IRAP score and EDE-Q Total Behaviours (r = -.33, p = .048). Thus the lower the *D*-IRAP score (i.e., the stronger the healthy bias) the more participants reported they engaged in abnormal eating behaviours.

Table 8.1. Correlations between the Overall Mean *D*-IRAP score and the Self-Report Food-Hunger, the Eating Disorder Examination-Questionnaire (EDE-Q5) and its subscales, the Balanced Inventory of Desirable Responding (BIDR) and its subscales, and the Power of Food, 37 observations in total.

	Overall *D*-IRAP Score
Hunger-scale	-.22
Global EDE-Q	-.06
EDE-Q - Restraint	-.04
EDE-Q - Eating Concern	-.15
EDE-Q - Shape Concern	.02
EDE-Q - Weight Concern	-.06
Total Behaviours	-.33
Global BIDR	.21
BIDR - SDE	.18
BIDR - IM	.17

*P < .05

8.2.5 Summary and Conclusions

Overall, the deprivation state manipulation had no effect on either of the groups' implicit biases. The 4-hr-Plus and Sated groups demonstrated weak and non-significant unhealthy and healthy food biases, respectively on the IRAP. In other words neither of the two groups discriminated between healthy or unhealthy food implicitly. Similar to the IRAP, the explicit hunger- and liking-scales did not discriminate between the deprivation states using the same pictorial stimuli. Only the EDE-Q Total Behaviour explicit measure produced a significant negative correlation with the *D*-IRAP scores; all other correlations were non-significant. In short, these results confirm that when individuals are hungry or sated they demonstrate a lack of discrimination between healthy and unhealthy foods (i.e., both healthy and unhealthy foods make them feel "Very" hungry).

8.3 DISCUSSION

As predicted, both of the two deprivation state manipulations appeared to reduce the participants' implicit and explicit discriminations between healthy and unhealthy foods to near zero. This finding thus supports the explanation offered at the end of the previous chapter for the lack of discrimination recorded for the IND group. In effect, the Indulgence of Urges exercise served to increase hunger, and this was reflected in the lack of discrimination between food types on the IRAP. Finally, the current study yielded a negative correlation between the EDE-Q Total Behaviour measure and the IRAP. Thus, the healthier participants' implicit bias the less abnormal eating behaviours they reported engaging in. This result differed form all other previous studies, in which this relationship was always non-significant, and given the relatively large *p* value (.48) it seems wise to interpret this result with caution.

Chapter 9: General Discussion

The aim of the current program of research was to develop a food-IRAP that was sensitive enough to discriminate obese and normal-weight individual's implicit attitudes to food as a function of food deprivation state manipulations. Having achieved this aim, a subsequent objective of the research programme was to determine if it was possible to detect reliable differences in neurophysiological activity while participants completed the food-IRAP. Finally, the research aimed to examine the malleability of the food-IRAP effect. This final chapter will now review the major findings of the six empirical investigations presented in the thesis and will consider a number of conceptual and theoretical issues arising from the work.

9.1 Overview of the Current Research Programme

As outlined in the introductory chapter, the IRAP is a novel methodology developed from an RFT empirical foundation. Other implicit attitude measures, such as the IAT, EAST, and APP, on the other hand, have arisen from within the mainstream associative socio-cognitive arena. To date, implicit food attitudes among obese and normal-weight individuals have typically been measured using these mainstream measures. Despite the fact that the IAT is seen as the gold standard implicit measure and is also the most widely employed in the domain of implicit food attitudes, several salient weaknesses have been highlighted (see Chapter 1). Moreover, research using the IAT, and the other mainstream measures, have failed to provide any evidence to support the claim that implicit attitudes to healthy and unhealthy foods are related in any meaningful way to eating behaviour, at least in terms of differentiating between normal-weight and obese individuals. As noted previously, an APP study did find a difference between these weight categories, but in their attitudes

to sweet versus savoury unhealthy foods, rather than healthy and unhealthy food types (Czyzewska, & Graham, 2008).

As noted previously, one criticism of mainstream associative measures is that they may be sensitive to social or cultural associations, and it is these that are reflected in the measures (Wittenbrink, & Schwarz, 2007). As a result, an IAT performance pertaining to healthy and unhealthy foods may reflect, in part, social conditioning rather than the individual's actual food preferences. The current research programme therefore employed the IRAP because it was designed to assess relations rather than "raw" or simple associations. In this way, it was possible to target food-wanting and food-hunger relations directly with the implicit measure. A review of the findings from each of the studies will now be given.

Study 1 (Chapter 3) investigated implicit and explicit food-wanting attitudes among obese and normal-weight individuals in a 2-hr food deprivation state and in an unrestricted food deprivation condition. The wanting-IRAP failed to differentiate obese from normal-weight individuals, with all four groups producing relatively weak healthy food biases. Similarly, the explicit wanting-scale did not discriminate between the four groups with each demonstrating a weak healthy food bias. Only the EDE-Q and PFS measures discriminated between the two weight categories, but not between the deprivation states. The obese groups reported higher levels of abnormal EDE-Q eating attitudes and behaviors and susceptibility to food cues in the environment relative to the normal-weight participants. Correlations between the implicit and explicit measures yielded only one significant negative correlation, with the BIDR. That is, lower *D*-IRAP scores (i.e., a stronger healthy bias) predicted higher levels of Self-Deception and Impression Management.

Given that the wanting-IRAP did not differentiate obese from normal-weight participants, the second study (Chapter 4) aimed to partially replicate Study 1 but target hunger rather than wanting to eat. The labels *Makes Me Feel Hungry Now* and *Does Not Make Me Feel Hungry Now* were used instead of the labels *I want to eat it NOW* versus *LATER*. The hunger-IRAP differentiated between the weight-categories in the 2-hr food deprivation condition. The obese participants demonstrated a pro-unhealthy food bias and the normal-weight group a pro-healthy bias. No group differences were found in the No-Restriction condition. The explicit hunger-scale did not differentiate among the groups (i.e., all four groups produced weak healthy food biases). Only the EDE-Q and PFS explicit measures discriminated between the weight categories, but no effects for deprivation state were observed. The obese groups reported higher levels of abnormal EDE-Q eating attitudes and behaviors and susceptibility to food cues in the environment relative to the normal-weight participants.

Correlations between the implicit and explicit measures yielded only two positive and significant correlations between the *D*-IRAP scores and EDE-Q Eating Concern and a mindfulness measure (MAAS), respectively. Thus, higher levels of unhealthy food bias on the IRAP predicted more abnormal concerns about eating and higher levels of mindfulness. The IRAP measure increased the predictive ability of the hunger-scale, EDE-Q Eating Concern, BIDR Self Deception, BIDR Impression Management, and Global BIDR, PFS, and MAAS explicit measures for the 2-hr food deprived participants. In contrast, the *D*-IRAP measure did not significantly increase the predictive validity of any of the explicit measures for individuals in the No-Restriction groups. In sum, an IRAP that targeted eating (now versus later) did not discriminate between normal-weight and obese participants, but when the IRAP

targeted hunger reactions to food a clear discrimination was observed, but only in the two-hour food-deprivation condition.

Study 3 (Chapter 5) aimed to increase the ability of the hunger-IRAP to discriminate obese from normal-weight participants' implicit food attitudes (utilizing "very" versus slightly" rather than the dichotomous hungry versus not hungry relation). Similar to Study 2, the obese participants produced a pro-unhealthy food bias and the normal-weight participants a pro-healthy bias in the 2-hr food-deprivation condition. In contrast with Study 2, the normal-weight participants also showed a pro-unhealthy bias in the No-Restriction condition, whereas the obese produced a weak pro-healthy bias. Once again, the explicit measures (i.e., the hunger-scale and the liking-scales) did not differentiate among the groups. The EDE-Q and BIDR measures discriminated between weight categories but not within deprivation states. The obese groups produced significantly higher levels of pathological EDE-Q behaviours and attitudes to food as well as significantly higher levels of BIDR, Self Presentation and Impression Management relative to the normal-weight participants (significant differences between the groups for the BIDR were not observed in the previous studies). Unlike the previous studies, no correlations between the implicit and explicit measures were found.

The IRAP measure increased predictive validity for seven of the explicit measures for the 2-hr food deprived participants (i.e., the hunger-scale, liking-scale, EDE-Q Restraint, EDE-Q Eating Concern, BIDR Self Deception, BIDR Impression Management, and Global BIDR), and for six of the explicit measures for the No-Restriction participants (i.e., the hunger-scale, liking-scale, EDE-Q Restraint, BIDR Self Deception, BIDR Impression Management and Global BIDR; marginal significance was obtained for EDE-Q Eating and Shape concern). In sum, the very-

versus-slightly hungry IRAP employed in Study 3 was affected by participants' weight and deprivation state, with the normal-weight group showing an unhealthy bias not observed in Study 2. It appears, therefore, that introducing the very-versus-slightly dimension to the IRAP increased the sensitivity of the measure, relative to the dichotomous IRAP used in the previous study.

Study 4 (Chapter 6) sought to further test the validity of the very-versus-slightly IRAP by examining an additional response measure. Specifically, the study recorded participants' EEG signals while they completed the IRAP in a 2-hr deprivation state. The findings replicated the effects found in the 2-hr food deprivation condition in Study 3, (i.e., a pro-healthy bias). The ERP grandaverage waveforms for the pro-healthy trials were more negative than pro-unhealthy waveforms in the 400 to 700ms interval for the frontal sites, F4 and F6, but the reverse pattern was demonstrated for the parietal areas, P3 and P5 (pro-unhealthy trials were more negative than pro-healthy waveforms). No differences were found between any of the explicit measures in the current study and in the 2-hr food deprivation condition in Study 3 (i.e., hunger-scale, EDE-Q, and BIDR). Similar to Study 3, no significant correlations were reported among the explicit measures and *D*-IRAP scores. These data this served to replicate (partially) the previous study to provide additional evidence for the validity of the measure.

Having developed a food-IRAP that appeared sensitive to both body mass and food deprivation state, Study 5 (Chapter 7) provided an initial examination of the malleability of implicit hunger attitudes on the IRAP. Specifically, participants completed the IRAP following an Acceptance versus Indulgence of Food Urges manipulation. The results showed that the manipulation affected the IRAP effects. Specifically, the Control and the ACC group produced similar pro-unhealthy food

biases, whereas the IND group did not discriminate between unhealthy and healthy foods. The inverse pattern was indicated on the explicit hunger-scale; the IND group provided the strongest unhealthy food preference, but the Control and ACC groups' hunger scores were lower and not significantly different from each other. The ACC and IND groups produced similarly high levels of craving for their favourite snack, both significantly higher than the Control group. The IND group reported significantly lower resistance for their favourite snack foods relative to the ACC group (the Control group's resistance level did not differ from the ACC group). Only one positive and significant correlation was found between the *D*-IRAP scores and the explicit measures (i.e., MAAS). Thus, higher unhealthy food biases predicted increased levels of mindfulness. The *D*-IRAP score increased predictive validity for the hunger-scale, the cravings and the resist items of the Cravings-questionnaire for the IND group.

Overall, Study 5 indicated that implicit and explicit food attitudes are susceptible to malleability effects based on the type of response strategy used to deal with food urges/cravings. Implicitly, the IND group showed almost no discrimination between healthy and unhealthy foods (the ACC and Control groups showed strong unhealthy food biases), but explicitly the IND group showed the highest hunger and craving effects combined with lower resistance. Although the lack of bias on the IRAP might be seen as inconsistent with the explicit measures, it was argued that it could also be indicative of relatively high levels of hunger (because any food will do when one is hungry).

The final study (Chapter 8) sought to test this interpretation of the lack of bias on the IRAP. Specifically, normal-weight participants were exposed to the IRAP in either a hungry (4-hr-Plus deprivation) or sated condition. In both conditions, a lack of

discrimination between healthy and unhealthy foods was recorded for the implicit and explicit measures. This finding supports the conclusion that the lack of discrimination recorded on the IRAP for the IND group in the previous study was indicative of increased hunger. Note, however, that the participants in the former study reported a pro-unhealthy bias on the explicit measures, but no such bias was recorded in the current study. No differences were found between the groups on the EDE-Q or BIDR explicit measures. Only the EDE-Q Total Behaviour explicit measure produced a significant negative correlation with the *D*-IRAP scores (i.e., healthier implicit bias predicted increased reports of abnormal eating behaviours). All other correlations were non-significant.

Having summarized the findings arising from the current research programme, the remaining sections of this final chapter will consider some of the conceptual and theoretical issues that are raised by this research.

9.2 Explicit Measures of Attitudes to Healthy and Unhealthy Foods

Neither the explicit wanting-, hunger-, nor liking-scales differentiated obese from normal-weight participants' attitudes towards healthy and unhealthy foods in any of the studies that compared these groups (i.e., Studies 1, 2, or 3). These findings are consistent with previous studies that employed explicit measures along with the IAT, APP or EAST (Reofs & Jansen, 2002; Craeynest et. al., 2007; Craeynest et. al., 2006; Craeynest et. al., 2005; Czyzewska, & Graham, 2008). This lack of discrimination for the explicit measures could be as a result of participants' responding in a socially desirable manner based on the current Western idealization of the slim body type (Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999). In other words, the stigmatization associated with being obese might make it difficult for obese individuals to admit to wanting food, feeling hungry or liking unhealthy foods.

Note, however, that in Study 5 the explicit hunger-scale did differentiate normal-weight individuals in the IND group from those in the control group, which seems inconsistent with the previous findings. On balance, the food exercise employed in this study focused on the participants' self-identified favourite snack and not unhealthy and healthy foods *per se*. Thus, the contextual influence of social desirability may have been undermined here, given that participants were required to identify to the researcher the food they wanted to eat. To conclude, the current thesis found that explicit wanting, hunger and liking measures are not particularly sensitive for discriminating obese from normal-weight individuals' attitudes toward healthy and unhealthy foods. It remains to be seen if such measures would discriminate between these groups in a context in which they must first identify their favourite snack food to the researcher.

The EDE-Q is an established clinical measure of attitudes and behaviours with regard to food, and has been widely used in both research and treatment of obesity and other eating disorders. Consequently, significant differences between the two weight categories would be expected on this measure. In Studies, 1, 2 and 3 differences were recorded on the Global EDE-Q, and on the EDE-Q subscales (Restraint, Eating Concern, Shape Concern and Weight Concern) as well as for EDE-Q Total Behaviours. These findings are in line with other EDE-Q research with normal-weight and obese samples (e.g., Elder, Grilo, Masheb, Rothschild, Burke-Martindale, & Brody 2006; Fairburn & Beglin, 1994).

The recently developed PFS scale measured participants' susceptibility to food cues in the environment. Differences between obese and normal-weight individuals were predicted for this measure. The findings from Study 1 and 2 were in line with these predictions and other PFS research (e.g., Lowe and Butryn, 2007).

The Balanced Inventory of Desirable Responding is a well established measure of self-presentation biases. The BIDR differentiated between obese and normal-weight participants in Study 3 but not in Studies 1 and 2. The lack of BIDR differences reported in the latter two studies is in line with Andreson, Rieger and Caterson (2006). At the current time it remains unclear why a difference was found in only one study.

The Cravings-Questionnaire measure used in Study 5 was designed to assess normal-weight participants' cravings for their favourite snack food. The carvings measure discriminated normal-weight controls from both the Acceptance and Indulgence groups. Thus, these finding highlight the ability of the explicit cravings measure to detect malleability effects as a result of food-urge response strategy manipulations on normal-weight individuals. The resistance item of Cravings-Questionnaire also discriminated between normal-weight groups; the indulgence group differed from the Acceptance group and marginally from the Control group. These results highlight the utility of the explicit resistance measure to detect the malleability effects observed in the study.

Overall, therefore, as expected the explicit clinical assessment measures (i.e., the EDE-Q and PFS), but not wanting-, hunger-, or liking-scales, discriminated between obese and normal-weight individuals. These results thus support the conclusion that the obese and normal-weight populations employed in the current research were broadly similar to those employed in previous studies. The findings for the BIDR were also similar to previous research, except for one study. Finally, the cravings and resistance items of the Cravings-Questionnaire, which was developed for the current research, successfully differentiated between the normal-weight groups

responses to their favourite snack foods. The findings thus support the possible future use of this measure in subsequent research on food urges.

9.3 The IRAP as a Measure of Implicit Attitudes to Healthy and Unhealthy Foods

The IRAP did not differentiate obese from normal-weight individuals' implicit attitudes to food when it targeted wanting to eat now versus later. However, the IRAP did differentiate between these groups when it targeted hunger. Specifically, a consistent trend emerged on the IRAP with normal-weight individuals demonstrating a pro-healthy food bias in a 2-hr food deprivation state in Studies 2, 3 and 4, and obese individuals demonstrating a pro-unhealthy bias in Studies 2 and 3. This finding is both theoretically and practically interesting.

It is theoretically interesting because these are the first studies to discriminate between obese and normal weight individuals in terms of their implicit attitudes to healthy and unhealthy foods (as noted previously, an APP study did find a difference between these weight categories, but only in their attitudes to unhealthy foods, sweet versus savoury, rather than between healthy and unhealthy foods; Czyzewska, & Graham, 2008). Furthermore, these are the first studies to target implicit hunger responses specifically, rather than associative valence. Thus, the current research indicates that implicit hunger responses to food (i.e., an immediate emotive response) is a more useful discriminator of obese and normal-weight individuals' food attitudes than both implicit wanting (i.e., a more cognitive property of food attitudes) and implicit food valance (a less direct food attitude as used within the socio-cognitive literature). These findings serve to highlight the advantage of the IRAP over the IAT, EAST and APP.

The current findings are practically interesting insofar as they could be used to inform interventions in the treatment and management of obesity. For example, it

remains to be determined if the obese individuals in the current study were aware of their unhealthy food biases (in the 2-hr food deprivation conditions), but failed to report them on the explicit measures. If they were aware, then perhaps therapeutic interventions could focus on achieving greater openness and honesty with regard to food preferences. Alternatively, if the obese participants were unaware of their implicit food biases, then it may be useful to focus on increasing their awareness of difficulties to discriminate food preferences. For example, even informing obese individuals that they are more likely to experience an unconscious bias towards unhealthy foods around 2 hours after eating a meal could help them to be more mindfully aware of the ebb and flow of their food preferences (Baer, Fisher, Huss, 2005; Baer, Fisher, Huss, 2006; Forman et al., 2007; Kristeller, 2003; Kristeller & Hallet, 1999; Telch, 1997: Telch, Agras, & Linehan, 2000; Safer, Telch, & Agras, 2001).

Another pattern of findings from the IRAP should also be noted. The normal-weight individuals in the No-Restriction condition in Study 3 produced a pro-unhealthy food bias, whereas in the previous study a neutral bias was recorded. Thus, the switch from dichotomous (hungry versus not hungry) to relative hunger labels (very verses slightly) across these two studies appeared to impact on the normal-weight participants. Interestingly, the obese groups failed to show similar sensitivity, producing neutral biases in both studies. This finding suggests that normal-weight but not obese individuals are capable of relatively fine self-discriminations of their private hunger states, at least at an implicit level. This finding seems to accord with previous research that has shown that the sight and/or smell of food elicits appetitive responses from obese individuals regardless of their self-reported hunger state (e.g., Faith, Berkowitz, Stallings, Kerns, Storey, & Stunkard, 2006; Fisher & Birch, 2002; Lowe,

2007; Mela, 2006); normal-weight individuals only show such responses when they are hungry. Thus, when the obese participants were shown pictures of food on the IRAP in the No-Restriction condition the stimuli elicited a relatively strong hunger response, which was not shared by the normal-weight groups. Insofar as this was the case, only the normal-weight participants would be able to show an effect for the relatively subtle "very versus slightly hungry" labels.

Given these are the first studies to employ a hunger-IRAP, future research needs to explore whether the effects demonstrated by Irish obese and normal-weight individuals would also emerge with participants from other countries. There is no reason to suspect that only Irish obese and normal-weight individuals would reveal a pro-unhealthy and pro-healthy food bias, respectively, in a 2-hr food deprivation state, and that only normal-weight individuals would show a pro-unhealthy bias in a No-Restriction food deprivation condition. Nevertheless, a replication of these findings in populations of similar weight in a different country would further bolster confidence in the general pattern of results arising from the first implicit measure to clearly discriminate between obese and normal-weight groups in their reactions to healthy and unhealthy foods.

Another finding arising from the current work that provided additional evidence for the validity of the IRAP as a measure of implicit hunger responses was obtained in Study 4. That is, participants once again produced a pro-healthy bias in a 2-hr food deprivation condition, and EEG recordings also clearly discriminated between responding on pro-healthy versus pro-unhealthy trials. Specifically, the ERP grandaverage waveforms for the parietal area were more negative for the pro-unhealthy trials than for the pro-healthy trials, but the reverse pattern was found for two frontal sites (i.e., pro-unhealthy waveforms more positive than pro-healthy). The

results for the two parietal sites are consistent with the findings from the only other IRAP/EEG study (Barnes-Holmes et al. 2008). That is, waveforms associated with relational responding that was deemed inconsistent with the participants' response biases were more negative than those waveforms associated with responding in accordance with those biases. In contrast, the pattern from the frontal sites was completely opposite. Currently, it is unclear why these differences emerged in the EEG measures across the two studies. Future research will need to explore this matter further. Nevertheless, these findings replicate (partially) the previous study and provide additional support for the validity of the IRAP.

Additional evidence for the validity of the hunger-IRAP was provided in Study 5, in that a malleability effect was observed using an Acceptance versus Indulgence of Food Urges manipulation. Specifically, the Indulgence group demonstrated a lack of implicit discrimination between healthy and unhealthy food categories, whereas the Acceptance and Control groups showed unhealthy food biases. The lack of discrimination on the IRAP was interpreted as evidence for an increased hunger response produced by the indulgence exercise, and supportive results for this view were obtained in the final study of the thesis (i.e., in the 4-hr-Plus deprivation condition). The findings thus showed that an acceptance strategy to food urges produced implicit responses that were broadly similar to a control group who had been presented with any food. Thus, at least at an implicit level, the acceptance strategy appeared to undermine the psychological functions of the food exercise. This finding is of course consistent with a growing body of evidence that supports the effectiveness of acceptance-based interventions in dealing with psychological discomfort (Block, 2003; Forman, Herbert, Moitra, Yeomans, & Geller, 2007; Forman, Hoffman, McGrath, Herbert, Brandsma, & Lowe, 2007; Geiser, 1993;

Lappalainen, Lehtonen, Skarp, Taubert, Ojanen, & Hayes, 2007; Levitt, Brown, Orsillo, & Barlow, 2004; Twohig & Woods, 2004; Zettle, 2003; Zettle & Hayes, 1986).

9.4 Predictive Validity

9.4.1 Prediction of Weight Category by Explicit and Implicit Hunger Attitudes

No correlations were reported among the explicit food attitude measures (i.e., the wanting-, hunger-, and liking-scales) and the *D*-IRAP scores for obese and normal-weight individuals in Studies, 1, 2 and 3. Overall, therefore, it would seem that the explicit measures were not tapping into the same food attitude responses as those captured by the IRAP. This general finding is consistent with a now large body of evidence indicating that implicit and explicit measures reflect different types of behaviours (e.g., Greenwald, McGhee, & Schwartz, 1998; Greenwald, Smith, Sriram, Bar-Anan, & Nosek, 2009; Nock, & Banaji, 2007).

A small number of correlations were recorded between the IRAP and the explicit measures across the studies; that is with MAAS in Studies 2 and 5, with BIDR in Study 1, with EDE-Q Eating Concern in Study 2, with EDE-Q Total Behaviors in Study 6, and marginally with EDE-Q Restraint and the Hunger-scale in Study 4. Given the relatively large number of correlational analyses conducted within and across studies, and the resultant possibility of Type-2 error, it would be unwise to read too much into these findings. Nonetheless, a relationship between the IRAP and the MAAS was recorded in two separate studies, and thus it warrants comment here. Specifically, increased unhealthy food bias on the IRAP predicted increased mindfulness. Although this result might appear counterintuitive, in that mindfulness has been linked with positive psychological health (Brown & Ryan, 2003), the MAAS questionnaire focuses on participants' attention and awareness to present experience.

Thus it could be that individuals with an unhealthy food bias have an acute sensitivity to current internal and external experiences. It is also worth noting that the MAAS is a relatively old mindfulness scale. In addition, according to Acceptance and Commitment Therapy research, mindfulness not only specifies contact with the present moment but also includes; acceptance of current experience, defusion from the literally of thoughts; as well as a transcendent sense of self (Fletcher & Hayes, 2007). Thus, the MAAS scores in Study 2 and 5 do not reflect these other important mindfulness properties. Perhaps, utilizing a more recent mindfulness scale that also includes the other mindfulness properties may have yielded different effects from those reported in both Studies 2 and 5 (i.e., the Five Facet Mindfulness Questionnaire; FFMQ, Baer, Smith, Lykins, Button, Krietemeyer, Sauer et al., 2008)

The general lack of correlations between the implicit and explicit measures noted above does not of course speak to the predictive validity of the measures. To address this issue, logistic regression analyses were conducted in Studies 2 and 3 to determine if the IRAP increased the validity of the explicit measures in predicting the weight category of the participants. The hunger-scale did not significantly predict weight category for either deprivation condition in Study 2, but when the IRAP was added it significantly increased predictive validity in the 2-hr deprivation condition. In Study 3, neither the explicit hunger nor liking measures predicted participants' weight category, but once again when the IRAP measure was added to the models, it significantly increased prediction of weight category for both the 2-hr and No-Restriction deprivation conditions. Critically, these findings are in stark contrast to previous studies that have employed implicit measures in the study of food attitudes. Specifically, the IAT, APP and the EAST have all failed to predict weight category. The current findings thus point to the utility of employing the hunger-IRAP in future

studies investigating obese and normal-weight individuals' attitudes to healthy and unhealthy foods.

9.4.2 The Eating Disorder Examination-Questionnaire and the IRAP. As an established clinical measure, the EDE-Q would be expected to predict weight-category, and indeed this was found to be the case. Specifically, when the Global score or a subscale (Restraint, Eating Concern, Shape Concern and Weight Concern) were entered into the first step of a hierarchical logistic regression model they predicted weight category in Study 2 (except for Weight Concern in the 2-hr deprivation condition and Eating Concern in the No-Restriction condition) and Study 3 (except for Shape Concern and Weight Concern in the 2-hr condition). Critically, however, when the IRAP measure was entered into the model in the second step it significantly increased predictive validity for one of the subscale measures in Study 2 (i.e., Eating Concern), but only for the 2-hr deprivation condition. In Study 3, however, the IRAP measure increased predictive validity for two of the subscales (i.e., Restraint and Eating Concern) for the 2-hr condition and for one of the subscales (Restraint) in the No-Restriction condition. It is worth noting, that in Study 3 the IRAP increased the predictive validity of those subscales that targeted eating-related issues rather than concerns over body-shape and weight, which might be expected given that the implicit measure was targeting hunger rather than concerns over body image. In any case, the fact that the IRAP increased the predictive validity of a well-established clinical measure in a relatively precise manner provides compelling evidence in support of the potential utility of the IRAP in the study of food attitudes and eating behaviour. Indeed, this finding is particularly noteworthy given that at the time of writing no published study had reported similar predictive validity with any other implicit measure.

9.4.3 Power of Food Scale and the IRAP. The ability of the PFS to predict weight category was in line with expectations for the clinical measure. That is, when the PFS was entered into the regression model in the first step it significantly predicted weight category for participants in both the 2-hr and No-Restriction deprivation conditions in Study 2. The inclusion of the IRAP in the model increased predictive validity in the 2-hr condition. Once again, these findings provide additional support for the validity of the IRAP.

9.4.4 Balanced Inventory of Desirable Responding and the IRAP. The Global BIDR measure only predicted weight category for participants in the 2-hr condition in Study 3. Adding the IRAP to the model increased the predictive validity of the Global BIDR and its subscales (i.e., IM and SDE) in the 2-hr condition of Study 2 and both the 2-hr and No-Restriction conditions of Study 3. In each case, therefore, the IRAP either improved significant predictive validity or provided a significant effect that was absent with the BIDR alone. Again, this finding supports the utility of the IRAP.

The IRAP also increased the predictive validly of other explicit measure that were not central to the current thesis. That is, the IRAP demonstrated significant prediction effects that were not found using the MAAS on its own in Studies 2 and 5. Additionally, the IRAP significantly increased the predictive validity for the cravings item and marginally for the resist item on the Craving-Questionnaire in Study 5.

Overall, therefore, the IRAP repeatedly increased the predictive validity of explicit measures that targeted food and clinically relevant eating attitudes (i.e., hunger, cravings, resistance, restraint, eating concern and the PFS, but not measures targeting body image). In addition, the IRAP also increased the predictive validity of measures of Mindfulness, and of Social Desirability Responding. In sum these

findings further support the inclusion of the IRAP in future research on pro-healthy and pro-unhealthy food attitudes in obese and normal-weight populations.

9.5 Why did the IRAP Increase Predictive Validity?

At this point, it seems important to ask the IRAP was a better predictor of weight category than some of the explicit measures? In the second chapter of the current thesis the REC model was outlined as a possible behavioural account of implicit cognition (Barnes-Holmes et al., 2010), and an explanation based on this model might be as follows. According to the REC model, when an individual is required to express an attitude on a standard self-report measure, it is likely that the person will produce a relational response that coheres with one or more other relational responses in their behavioural repertoire. If these relational responses also cohere with their initial relational response then implicit attitudes (measured by the IRAP) and explicit attitudes (reported on self-reports measures) will converge; however, if there is a lack of coherence in this respect then there will be a divergence between them. This latter trend is particularly common with respect to psychologically sensitive attitudes, in which an individual might be judged negatively for expressing a particular attitude.

Imagine, for example, when an obese participant is asked to rate a pictures of unhealthy and healthy foods as "making them feel very" or "slightly hungry", and the two pictures are rated equally on these rating scales. A participant's initial ratings of these pictures might indicate that the unhealthy food is higher on the "very hungry" dimension and the healthy food is higher on the "slightly hungry" dimension. However, other relevant features of an extended relational network may be involved, such as, "I might seem weak for wanting to eat the unhealthy food." Thus, this statement would not cohere with the initial response to the pictures, and in the context

of an explicit measure the person's initial response might be rejected in favour of the more elaborated relational responding. On the IRAP, however, the influence of a participant's elaborated relational responding would be absent or significantly reduced, because there is insufficient time on each trial to engage in the elaborate relational activity that can serve to generate a relationally coherent response. As a result, there would be a divergence between responding as measured by the IRAP and the elaborated responding provided on the questionnaire.

The lack of discrimination on the explicit hunger measures seen in Studies 2 and 3 could well have been the result of pressure to respond in a socially desirable manner (due to the western idealization of "slim as beautiful"). As a result, the explicit measures were limited in their ability to predict participants' weight category. From an RFT perspective, human cognition is relational in nature (Hayes, Barnes, & Roche, 2001), and hence any instrument that approaches human responding in that fashion may provide a better predictor of behaviour in certain contexts.

9.6 Conclusion

The aim of the current program of research was to develop an IRAP that was sensitive enough to discriminate obese and normal-weight individual's implicit attitudes to food as a function of food deprivation state manipulations. Having achieved this aim, a subsequent objective of the research programme was to determine if it was possible to detect reliable differences in neurophysiological activity while participants completed the IRAP. Finally, the research aimed to examine the malleability of the IRAP effect.

The advantages of the IRAP were several fold: (a) unlike any other implicit measure, it differentiated between the implicit responses of obese and normal-weight individuals to healthy and unhealthy foods, accounting for variance beyond that

provided by a range of explicit measures; (b) the IRAP effects were relatively robust across studies; (c) a measure of neurological processing (EEGs) was successfully obtained while participants completed the IRAP, and the data yielded some effects that appear consistent with previous research; and (d) it revealed the malleability of implicit responses using an acceptance-based intervention, an effect that has not yet been reported in the literature on psychological acceptance or implicit attitudes.

Overall, these findings support the utility of the IRAP in future investigations of food biases in obese and normal-weight individuals. Finally, the current research programme adds to previously published IRAP studies showing the efficacy of the IRAP as a measure of implicit bias across a range of domains.

References

Alsene, K. M., Li, Y., Chaverneff, F., & de Wit, H. (2003). Role of abstinence and visual cues on food and smoking craving. *Behavioural Pharmacology*, *14*, 145–151.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.), Washington, DC: Author.

Arkes, H. R., & Tetlock, P. E. (2004). Attributions of implicit prejudice, or "Would Jesse Jackson 'fail' the Implicit Association Test? *Psychological Inquiry, 13,* 257-278.

Baer, R. A., Fischer, S., & Huss, D. B. (2005). Mindfulness-based cognitive therapy applied to binge eating: A case study. *Cognitive and Behavioral Practice*, *12*, 351–358.

Baer, R. A., Fischer, S., & Huss, D. B. (2006). Mindfulness and Acceptance in the Treatment of Disordered Eating. *Journal of Rational-Emotive & Cognitive-Behavioural Therapy*, *23*(4), 281-300.

Baer, R. A., Smith, G. T., Lykins, E., Button, D., Krietemeyer, J., Sauer, S., et al. (2008). Construct validity of the five facet mindfulness questionnaire in meditating and nonmeditating samples. *Assessment, 15*, 329-342.

Barden, J., Maddux, W. W., Petty, R. E., & Brewer, M. B. (2004). Contextual moderation of racial bias: The impact of social roles on controlled and automatically activated attitudes. *Journal of Personality & Social Psychology, 87*, 5-22.

Bargh, J. A., Chaiken, S., Raymond, P., & Hymes, C. (1996). The automatic evaluation effect: Unconditional automatic attitude activation with a

pronunciation task. *Journal of Experimental and Social Psychology*, *32*, 104–128.

Barnes, D. (1994). Stimulus equivalence and relational frame theory. *The Psychological Record*, *44*, 91-124.

Barnes, D., & Hampson, P. (1993). Stimulus equivalence and connectionism: Implications for behavior analysis and cognitive science. *The Psychological Record, 43*, 617-638.

Barnes, D., & Holmes, Y. (1991). Radical behaviorism, stimulus equivalence, and human cognition. *The Psychological Record, 41*, 19-31.

Barnes, D., Lawlor, H., Smeets, P. M., & Roche, B. (1996). Stimulus equivalence and academic self-concept among mildly mentally handicapped and nonhandicapped children. *The Psychological Record, 46*, 87-107.

Barnes, D., McCullagh, P., & Keenan, M. (1990). Equivalence class formation in non-hearing impaired children and hearing impaired children. *Analysis of Verbal Behavior, 8*, 1-11.

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., Hayden, E., Milne, R., Power, P., & Stewart, I. (2006). Do you really know what you believe? Developing the Implicit Relational Assessment Procedure 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., Hayden, E., Barnes-Holmes, Y., & Stewart, I. (2008). The Implicit Relational Assessment Procedure (IRAP) as a response-time and event-related- potentials methodology for testing natural verbal relations: A preliminary study. *The Psychological Record, 58,* 497-516.

Barnes-Holmes, D., Hayden, E., Barnes-Holmes, Y., & Stewart, I. (2008). The Implicit Relational Assessment Procedure (IRAP) as a response-time and event-related- potentials methodology for testing natural verbal relations: A preliminary study. *The Psychological Record, 58,* 497-516.

Barnes-Holmes, D., Healy, O., & Hayes, S. C. (2000). Relational frame theory and the relational evaluation procedure: Approaching human language as derived relational responding. In J. C. Leslie and D. E. Blackman (Eds.), *Experimental and applied analyses of human behavior* (pp.149-180). Reno, NV: Context Press.

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,* 57-66.

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.

Barnes-Holmes, D., Staunton, C., Barnes-Holmes, Y., Whelan, R., Stewart, I., Commins, S., et al. (2004). Interfacing relational frame theory with cognitive neuroscience: Semantic priming, the implicit association test, and event related potentials. *International Journal of Psychology and Psychological Therapy, 4,* 215–240.

Barnes-Holmes, D., Regan, D., Barnes-Holmes, Y., Commins, S., Walsh, D., Stewart, I., et al . (2005). Relating derived relations as a model of analogical reasoning: Reaction times and event related potentials. *Journal of the Experimental Analysis of Behavior. 84,* 435–452.

Barnes-Holmes, D., Staunton, C., Whelan, R., Barnes-Holmes, Y., Commins, S., Walsh, D., et al . (2005). Derived stimulus relations, semantic priming, and event-related potentials: Testing a behavioral theory of semantic networks. *Journal of the Experimental Analysis of Behavior*. *84,* 417–434.

Barnes-Holmes, D., Waldron, D., Barnes-Holmes, Y., & Stewart, I. (2009). Testing the Validity of the Implicit Relational Assessment Procedure (IRAP) and the Implicit Association Test (IAT): Measuring attitudes towards Dublin and country life in Ireland. *The Psychological Record, 59,* 389-406.

Baum, W. M. (1994). *Understanding behaviorism: Science, behavior, and culture.* New York: Harper-Collins.

Bellezza, F. S., Greenwald, A. G., & Banaji, M. R. (1986). Words high and low in pleasantness as rated by male and female college students. *Behavior Research Methods, Instruments, and Computers*, *18*, 299–303.

Berridge, K. C. (1996). Food reward: Brain substrates of wanting and liking. *Neuroscience and Biobehavioral Reviews*, *20*, 1–25.

Berndsen, M., & Van der Pligt, J. (2004). Ambivalence towards meat. *Appetite*, *42*, 71-78.

Blackman, D. E. (1995). B.F. Skinner. In R. Fuller (Ed.). *Seven pioneers of psychology.* London: Routldege.

Blair, I. V., Ma, J., & Lenton, A. P. (2001). Imagining stereotypes away: The moderation of implicit stereotypes through mental imagery. *Journal of Personality & Social Psychology, 81*, 828-841.

Blanton, H., & Jaccard, J. (2006). Arbitrary metrics in psychology. *American Psychologist, 61,* 27-41.

Blanton, H., and Jaccard, J., Gonzales, P. M., & Christie, C. (2006). Decoding the Implicit Association Test: Implications for criterion prediction. *Journal of Experimental Social Psychology, 42,* 192-212.

Boysen, G. A., Vogel, D. L., & Madon, S. (2006). A public versus private administration of the Implicit Association Test. *European Journal of Social Psychology 36*, 845-856.

Bradley, M. M., & Lang, P. J. (1994). Measuring emotion: The Self-Assessment Manequin and the semantic differential. *Journal of Behavior Therapy and Experimental Psychiatry*, *25*, 49–59.

Bradley, M. M., & Lang, P. J. (1999). Affective norms for English words (ANEW): Stimuli, instruction manual and affective ratings. *Technical report C-1*, Gainesville, FL. University of Florida: The Center for Research in Psychophysiology.

Braet, C., Tanghe, A., De Bode, P., Franckx, H., & Van Winckel, M. (2003). Inpatient treatment of obese children: A multicomponent programme without stringent calorie restriction. *European Journal of Pediatrics*, *162*, 391–396.

Brown, R. A., Lejuez, C. W., Kahler, C. W., Strong, D. R., & Zvolensky, M. J. (2005). Distress tolerance and early smoking lapse. *Clinical Psychology Review*, *25*, 713–733.

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology, 84*(4), 822-848.

Blackman, D. E. (1995). B.F. Skinner. In R. Fuller (Ed.), *Seven pioneers of psychology.* London: Routldege.

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

Blair, I. V., Ma, J., & Lenton, A. P. (2001). Imagining stereotypes away: The moderation of implicit stereotypes through mental imagery. *Journal of Personality & Social Psychology, 81*, 828-841.

Baum, W. M. (1994). *Understanding behaviorism: Science, behavior, and culture.* New York: Harper-Collins.

Brug, J., Lechner, L., & De Vries, H. (1995). Psychosocial Determinants of Fruit and Vegetable Consumption. *Appetite*, *25*(3), 285-296.

Capaldi, E. D. (1996). Conditioned food preferences. In E. D. Capaldi (Ed.), *Why we eat what we eat: The psychology of eating* (pp. 53–80). Washington, DC: American Psychological Association.

Cepeda-Benito, A., Gleaves, D. H., Williams, T. L., & Erath, S. A. (2000). The development and validation of the state and trait food-cravings questionnaires. *Behavior Therapy*, *31*, 151–173.

Chaiken, S. (1987). The heuristic model of persuasion. In M. P. Zanna, J. M. Olson, & C. P. Herman (Eds.), *Social influence: The Ontario Symposium* (Vol. 5, pp. 3-39). Hillsdale, NJ: Erlbaum.

Chaiken, S., & Yates, S. M. (1985). Affective-cognitive consistency and thought-induced attitudes polarization. *Journal of Personality & Social Psychology, 49,* 1470-1481.

Chan, G., Barnes-Holmes, D., Barnes-Holmes, Y., & Stewart, I. (2009). Implicit attitudes to work and leisure among North American and Irish individuals: A preliminary study. *International Journal of Psychology & Psychological Therapy*. *9, 317-334.*

Cowley, J., Green, G., & Braunling-McMorrow, D. (1992). Using stimulus equivalence procedures to teach name-face matching to adults with brain injuries. *Journal of Applied Behaviour Analysis, 25,* 461-475.

Creaynest, M., Crombez, G., Deforche, D., Tanghe, A., & De Bourdeaudhuil, I. (2008). The role of implicit attitudes towards food and physical activity in the treatment of youth obesity. *Eating Disorders*, *9*, 41-51.

Craeynest, M., Crombez, G., De Houwer, J. D., Deforche, B., & De Bourdeaudhuij, I.D. (2006). Do children with obesity implicitly identify with sedentariness and fat content? *Journal of behaviour Therapy and Experimental Psychiatry*, *37*, 347-357.

Craeynest, M., Crombez, G., De Houwer, J., Deforche, B., Tanghe, A., & De Bourdeaudhuij, I. (2005). Explicit and implicit attitudes toward food and physical activity in childhood obesity. *Behaviour Research and Therapy*, *43*, 1111–1120.

Craeynest, M., Crombez, G., Haerens, L., & De Bourdeaudhuij, I. D. (2007). Do overweight youngster like food more than lean peers? Assessing there implicit attitudes with a personalized Implicit Association Task. *Journal of behaviour Therapy and Experimental Psychiatry*, *39*, 354-368.

Craeynest, M., Crombez, G., Koster, E. H. W., Haerens, L., & De Bourdeaudhuij, I.D. (2007). Cognitive-motivational determinants of fat food consumption in overweight and obese youngster: The implicit association between fat food and arousal. *Food Quality and Preference*, *18*, 1077-1084.

Crites, S. L., Fabrigar, L. R., & Petty, R. E. (1994). Measuring the affective and cognitive properties of attitudes: Conceptual and methodological issues. *Personality and Social Psychology Bulletin*, *20*, 619–634.

Crowne, D., & Marlow, D. (1964). *The approval motive.* New York: Wiley.

Cullen, C., & Barnes-Holmes, D. (2008). Implicit pride and prejudice: A heterosexual phenomenon? In T. G. Morrison & M. A. Morrison (Eds.), *Modern Prejudice* (pp. 195-223). New York: Nova Science.

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., Preacher, K. J., and Banaji, M. R. (2001). Implicit attitude measures: Consistency, stability, and convergent validity. *Psychological Science, 12,* 163-170.

Czyzewska, M., & Graham, R. (2008). Implicit and explicit attitudes to high- and low-calorie food in females with different BMI status, *Eating Behaviours*, *9*, 303-312.

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

Dasgupta, N. G., & Asgari, S. (2004). Seeing is believing: exposure to counter-stereotypic women leaders and its effects on the malleability of automatic gender stereotyping. *Journal of Experimental Social Psychology, 40,* 642-658.

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

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

Dawson, D. L., Barnes-Holmes, D., Greswell, D. M., Hart, A. J. P., & Gore, N. J. (2009). Assessing the implicit beliefs of sexual offenders using the Implicit Relational Assessment Procedure: A first study. *Sexual Abuse: A Journal of Research and Treatment, 21,* 57-75.

Dickins, D. W., Singh, K. D., Roberts, N., Burns, P., Downes, J. J., Jimmieson, P., et al. (2001). An fMRI study of stimulus equivalence. *Neuroreport, 12,* 405-411.

De Bourdeaudhuij, I., Lefevere, J., Deforche, B.,Wijndaele, K., Matton, L., & Philippaerts, R. (2005). Physical activity and psychosocial correlates in normal-weight and overweight 11 to 19 year olds. *Obesity Research*, *13*, 1097–1105.

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. (2002). The Implicit Association Test as a tool for studying dysfunctional associations in psychopathology: Strengths and limitations. *Journal of Behavior Therapy & Experimental Psychiatry, 33,* 115-133.

De Houwer, J. (2006). What are implicit attitudes and why are we using them? In R. W. Wiers & A. W. Stacy (Eds.), *The handbook of implicit cognition and addiction* (pp. 11–28). Thousand Oaks, CA: Sage.

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

De Houwer, J., Crombez, G., Koster, E. H. W., & De Beul, N. (2004). Implicit alcohol-related cognitions in a clinical sample of heavy drinkers. *Journal of Behavior Therapy and Experimental Psychiatry*, *35*(4), 275-286.

De Houwer, J., & De Bruycker, E. (2007). The identification-EAST as a valid measure of implicit attitudes toward alcohol-related stimuli. *Journal of Behavior Therapy and Experimental Psychiatry*, *38*(2), 133-143.

Dennison, C. M., & Shepherd, R. (1995). Adolescent food choice: An application of the Theory of Planned Behaviour. *Journal of Human Nutrition and Dietetics*, *8*, 9–23.

Deforche, B., De Bourdeaudhuij, I., Tanghe, A., Hills, A. P., De Bode, P. (2004). Changes in physical activity and psychosocial determinants of psychical activity in children and adolescents treated for obesity. *Patient Education and Councelling*, 55(3), 407-415.

Devany, J. M., Hayes, S. C., & Nelson, R. O. (1986). Equivalence class formation in language-able and language-disabled children. *Journal of the Experimental Analysis of Behaviour, 46,* 243-257.

Dickins, D. W., Singh, K. D., Roberts, N., Burns, P., Downes, J. J., Jimmieson, P., et al. (2001). An fMRI study of stimulus equivalence. *Neuroreport, 12,* 405-411.

Drewnowski, A. (1991). Obesity and eating disorders: Cognitive aspects of food preference and food aversion. *Bulletin of the Psychonomic Society, 29,* 261–264.

Drewnowski, A. (1996). The behavioral phenotype in human obesity. In E. D. Capaldi (Ed.), *Why we eat what we eat: The psychology of eating* (pp. 291–308). Washington, DC: American Psychological Association.

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

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

Drewnowski, A., Kurth, C., Holden-Wiltse, J., & Saari, J. (1992). Food preferences in human obesity: Carbohydrates versus fats. *Appetite, 18,* 207–221.

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. (2002). The Implicit Association Test as a tool for studying dysfunctional associations in psychopathology: Strengths and limitations. *Journal of Behaviour Therapy and Experimental Psychiatry, 33*, 115-133.

De Houwer, J. (2003a). 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.), *The handbook of implicit cognition and addiction* (pp. 11-28). CA: Sage Publishers.

De Houwer, J., Crombez, G., Baeyens, F., & Hermans, D. (2001). On the generality of the affective Simon effect. *Cognition and Emotion*, *15*, 189–206.

De Houwer, J., & De Bruycher, E. (2007). *Implicit attitudes towards meat and vegetables in vegetarians and nonvegetarians*. *42*(3), 158-165.

De Houwer, J., Hermans, D., Rothermund, K., & Wentura, D. (2002). Affective priming of semantic categorisation responses. *Cognition & Emotion*, *16*(5), 643–666.

Dixon, M. R., Dymond, S., Rehfeldt, R. A., Roche, B., & Zlomke, K. R. (2003). Terrorism and relational frame theory. *Behavior and Social Issues, 12*, 129-147.

Dougher, M. J., Augustson, E., Markham, M. R., Greenway, D. E., & Wulfert, E. (1994). The Transfer of Respondent Eliciting and Extinction Functions Through Stimulus Equivalence Classes. *Journal of the Experimental Analysis of Behaviour*, *62*, 331-351.

Dugdale, N., & Lowe, F. C. (2000). Testing for symmetry in the conditional discriminations of languagetrained chimpanzees. *Journal of the Experimental Analysis of Behavior, 73,* 5-22.

Elder, K. A., Grilo, C. M., Masheb, R. M., Rothschild, B. S., Burke-Martindale C. H., & Brody M. L. (2006). Comparison of two self-report instruments for assessing binge eating in bariatric surgery candidates. *Behaviour Research and Therapy*, *44*(4), 545-560.

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*(4), 281-299.

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

Fairburn, C. G., & Cooper, Z. (1993). The eating disorder examination. In C. G. Fairburn, & G. T. Wilson (Eds.), *Binge eating: Nature, assessment, and treatment* (12th ed.) (pp. 317–332). New York: Guilford Press.

Fazio, R. H. (1990). Multiple processes by which attitudes guide behaviour: The MODE model as an integrative framework. *Advances in Experimental Social Psychology*, *23*, 75–109.

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

Fiedler, K., Messner, C., & Bluemke, M. (2006). Unresolved problems with the "I," the "A," and the "T": A logical and psychometric critique of the Implicit Association Test (IAT). *European Review of Social Psychology, 17,* 74-147.

Finlayson, G., King, N., & Blundell, J.E. (2008). The role of implicit wanting in relations to explicit liking and wanting for food: Implications for appetite control. *Appetite*, *50*, 120-127.

Finlayson, G., Neil, K., & Blundell, J. E. (2007). Is it possible to dissociate 'liking' 'wanting' for foods in humans? A novel experimental procedure. *Physiology and Behavior*, *90*(1), 36-42.

Fisher, J. O., & Birch, L. L (2002). Eating in the absence of hunger and overweight in girls from 5 to 7 y of age. *American Journal of Clinical Nutrition*. *76*, 226 – 31.

Fletcher, L., & Hayes, S. C. (2006). Relational Frame Theory, Acceptance and Commitment Therapy, and a Functional Analytic Definition of Mindfulness. *Journal of Rational-Emotive & Cognitive-Behavioral Therapy*, *23*(4), 315-336.

Forgas, J. P. (1972). On mood and peculiar people: Affect and person typicality in impression formation. *Journal of Personality & Social Psychology, 62,* 863-875.

Forman, E. M., Herbert, J. D., Moitra, E., Yeomans, P. D., & Geller, P. A. (2007). A randomized controlled effectiveness trial of Acceptance and Commitment Therapy and Cognitive Therapy for anxiety and depression. *Behavior Modification, 31*(6), 772-799.

Forman, M. E., Hoffman, K. L., McGrath, K. B., Herbert, J. D., Brandsma, L. L., & Lowe, M, R. (2007). A comparison of acceptance- and control-based strategies for coping with food cravings: An analog study. *Behaviour Research and Therapy*, *(45)*, 2372-2386.

French, S. A., Jeffery, R. W., Forster, J. L., McGovern, P. G., Kelder, S. H., & Baxter, J. E. (1994). Predictors of weight change over two years among a population of working adults: The healthy worker project. *International Journal of Obesity*, *18*, 145-154.

Friedlander, S. L., Larkin, E. K., Rosen, C. L., Palermo, T. M., & Redline, S. (2003). Decreased quality of life associated with obesity in school-aged children. *Archives of Pediatrics and Adolescent Medicine*, *157*, 1206–1211.

Gawronski, B., & Bodenhausen, G. V. (2006). Associative and propositional processes in evaluation: An integrative review of implicit and explicit attitude change. *Psychological Bulletin, 132,* 692-731.

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., LeBel, E. P., & Peters, K. R. (2007). What do implicit measures tell us? Scrutinizing the validity of three common assumptions. *Perspectives on Psychological Science, 2,* 181-193.

Geiser, D. S. (1993). A comparison of acceptance-focused and control-focused psychological treatments in a chronic pain treatment center. *Dissertation Abstracts International*, *54*(2-B), 1096.

Gemar, M. C., Segal, Z. V., Sagrati, S., & Kennedy, S. J. (2001). Mood-induced changes on the Implicit Association Test in recovered depressed patients. *Journal of Abnormal Psychology, 110*, 282- 289.

Gifford, E. V., Kohlenberg, B. S., Hayes, S. C., Antonuccio, D. O., Piasecki, M. M., Rasmussen-Hall, M. L., et al. (2004). Acceptance-based treatment for smoking cessation. *Behavior Therapy*, *35*, 689–705.

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

Green, A. R., Carney., D. R., Pallin, D. R., Ngo, L. H., Raymond, K. L., Iezzoni, L. I., & Banaji A. R. (2007). Implicit Bias among Physicians and its Prediction of Thrombolysis Decisions for Black and White Patients. *Journal of General Internal Medicine*, *22*(9), 1231-1238.

Greenwald, A. G., Banaji, M. R., Rudman, L. A., Farnham, S. D., Nosek, B. A., & Mellot, D. S. (2002). A unified theory of implicit attitudes, stereotypes, self-esteem, and self-concept. *Psychological Review*, *109*, 3–25.

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The Implicit Association Test. *Journal of Personality and Social Psychology, 74,* 1464-1480.

Greenwald, A. G., Smith, C. T., Sriram, N., Bar-Anan, Y., & Nosek, B. A. (2009). Race attitude measures predicted vote in the 2008 U. S. Presidential Election. *Analyses of Social Issues and Public Policy*, *9*, 241-253.

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*(6), 1155-1167.

Hayes, S. C. (1989). Nonhumans have not yet shown stimulus equivalence. *Journal of the Experimental Analysis of Behavior, 51,* 385-392.

Hayes, S. C., Barnes-Holmes, D., & Roche, B. (2001). *Relational frame theory: A post-Skinnerian account of human language and cognition.* New York: Plenum.

Hayes, S. C., & Hayes, L. J. (1989). The verbal action of the listener as a basis for rule-governance. In S. C. Hayes (Ed.), *Rule-governed behavior: Cognition, contingencies, and instructional control* (pp. 153-190). New York: Plenum.

Hayes, S. C., Strosahl, K., & Wilson, K. G. (1999). *Acceptance and commitment therapy: An experiential approach to behavior change*. New York: Guilford Press.

Hayes, S. C., & Wilson, K. G. (1993). Some applied implications of a contemporary behavior-analytic account of verbal events. *The Behavior Analyst, 16,* 283-301.

Hermans, D. (1997). The Need to Evaluate Scale (NES). Unpublished authorised Dutch translation.

Hermans, D., Baeyens, F., Lamote, S., Spruyt, A., & Elen. P. (2005). Affectiving Priming as an indirect Measure of Food Preferences Acquired Through Odor Conditioning. *Experimental Psychology*, *52*(3), 180-186.

Hermans, D., & De Houwer, J. (1994). Affective and subjective familiarity ratings of 740 Dutch words. *Psychologica Belgica, 34,* 115–139.

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.

Herman, C. P., & Polivy, J. (1980). Restrained eating. In A. J. Stunkard (Ed.), *Obesity* (pp. 208–225). Philadephia: Saunders.

Hesketh, K., Wake, M., & Waters, E. (2004). Body mass index and parent-reported self-esteem in elementary school children: Evidence for a causal relationship. *International Journal of Obesity*, *28*, 1233–1237.

Hoefling, A., & Strack, F. (2008). The tempting effects of forbidden foods. High calorie content evokes conflicting implicit and explicit evaluations in restrained eaters. *Appetite*, *51*, 681-689.

Hofmann, W., & Friese, M. (2008). Impulses Got the Better of Me: Alcohol Moderates the Influence of Implicit Attitudes towards Food Cues on Eating Behaviour. *Journal of Abnormal Psychology*, *117*(2), 420-427.

Hofman. W., Gschwender, T., Friese, M., Wiers, R. W., & Schmitt, M. (2008). Working Memory Capacity and Self-Regulatory Behaviour: Towards an Individual Difference Perspective on Behaviour Determined by Automatic Versus Controlled Processes. *Journal of Personality and Social Psychology*, *95*(4), 962-977.

Holcomb, P. J., & Anderson, J. E. (1993). Cross-modal semantic priming: A time-course analysis using event-related potentials. *Language and Cognitive Processes, 8,* 327-411.

Huijding, J., de Jong, P. J., Wiers, R. W., & Verkooijen, K. (2005). Implicit and explicit attitudes toward smoking in a smoking and a nonsmoking setting. *Addictive Behaviors*, *30*(5), 949–961.

Jansen, A. (1996). How restrained eaters perceive the amount they eat. *British Journal of Clinical Psychology*, *35*, 381–392.

Jarvis, W. B. G., & Petty, R. E. (1996). The need to evaluate. *Journal of Personality and Social Psychology*, *70*, 172–194.

Karpinski, A. and Hilton, J. L. (2001) Attitudes and the Implicit Association Test. *Journal of Personality Social Psychology*, *81*, 774–788.

Karpinski, A., & Steinman, R. B. (2006). The single category implicit association test as a measure of implicit social cognition. *Journal of Personality and Social Psychology, 91,* 16–32.

Kendall, S. B. (1983). Tests for mediated transfer in pigeons. *The Psychological Record, 33,* 245-256.

Klauer, K. C., Rossnagel, C., & Musch, J. (1997). List-context effects in evaluative priming. *Journal of Experimental Psychology: Learning Memory & Cognition*, *23*(1), 246–255.

Kounios, S. A., & Holcomb , P. J. (1992). Structure and process in semantic memory: Evidence from event-related potentials and reaction times. *Journal of Experimental Psychology: General, 121,* 460-480.

Kristeller, J. L. (2003). Mindfulness, Wisdom, and Eating: Applying a Multi-Domian Model of Meditation Effects. *Journal of Constructivism in the Human Sciences*, *8*(2), 107-118.

Kristeller, J. L., & Hallett, C. B. (1999). An exploratory study of a meditationbased intervention for binge eating disorder. *Journal of Health Psychology*, *4*, 357–363.

Krohne, H. W., Egloff, B., Kohlmann, C. W., & Tausch, A. (1996). Unter"Positive and Negative Affect Schedule" (PANAS)]. *Diagnostica, 42,* suchungen mit einer deutschen Version der, Positive and Negative Affect Schedule" (PANAS) "Positive and Negative Affect Schedule" (PANAS)]. *Diagnostica, 42,* 139–156.

Kutas, M. (1993). In the company of other words: Electrophysiological evidence for simple-word and sentence-context effects. *Language and Cognitive Processes, 8,* 533–578.

Kutas, M., & Hiliard, S. A. (1984). Brain potentials during reading reflect word expectancy and semantic association. *Nature, 307,* 1161–1163.

Lamote, S., Hermans, D., Baeyens, F., & Eelen, P. (2004). An exploration of affective priming as an indirect measure of food attitudes. *Appetite*, *42*, 279–286.

Lang, P. J. (1995). The emotion probe. Studies of motivation and attention. *American Psychologist*, *50*, 372–385.

Lang, P. J., Bradley, M. M., & Cuthbert, M. M. (1997). Motivated attention: Affect, activation and action. In P. J. Lang, R. F. Simons, & M. T. Balaban (Eds.),

Attention and orienting: Sensory and motivational processes (pp. 97–134). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (2005). *International affective picture system (IAPS): Affective ratings of pictures and instruction manual* [Technical Report A-6]. Gainesville: University of Florida.

Lappalainen, R., Lehtonen, T., Skarp, E., Taubert, E., Ojanen, M., & Hayes, S. C. (2007). The impact of CBT and ACT models using psychology trainee therapists: *A preliminary controlled effectiveness trial. Behavior Modification*, *31*, 488-511.

Leslie, J. C., & O'Reilly, M. F. (1999). *Behavior Analysis: Foundations and applications to psychology.* New York: Psychology Press.

Leslie, J. C., Tierney, K. J., Robinson, C. P., Keenan, M., Watt, A., & Barnes, D. (1993). Differences between clinically anxious and non-anxious subjects in a stimulus equivalence training task involving threat words. *The Psychological Record, 43,* 153-161.

Levitt, J. T., Brown, T. A., Orsillo, S. M., & Barlow, D. H. (2004). The effects of acceptance versus suppression of emotion on subjective and psychophysiological response to carbon dioxide challenge in patients with panic disorder. *Behavior Therapy*, *35*, 747–766.

Lissner, L., & Heitmann, B. (1995). Review: Dietary fat and obesity: Evidence from epidemiology. *European Journal of Clinical Nutrition*, *49*, 79–90.

Lowe. M. R., & Butryn. M. L. (2007) Hedonic hunger: A new dimension of appetite. *91*, 432-439.

Lowe, M. R., Butryn, M. L., Didie, E. R., Annunziato, R. A., Thomas, J. G., Crerand, C. E., Ochner, M. C., Coletta, M. C., Bellace, D., Wallaert, M., & Halford, J.

(2009). The Power of Food Scale. A new measure of the psychological influence of the food environment. *Appetite*, *53*(1), 114-118.

Lowery, B. S., Hardin, C. D., & Sinclair, S. (2001). Social influence effects on automatic racial prejudice. *Journal of Personality & Social Psychology, 81,* 842-855.

Maison, D., Greenwald, A. G., & Bruin, R. (2004). The Implicit Association Test as a measure of implicit consumer attitudes. *Polish Psychological Bulletin, 32*, 61–69.

Maison, D., Greenwald, A. G., & Bruin, R. (2001). Predictive Validity of the Implicit Association Test in the Studies of Brands, Consumer Attitudes and Behaviour. *Journal of Consumer Psychology*, *14*(4), 405-415.

McCaul, C., & Dasgupta, N. (2009). The malleability of men's gender self-concept. *Self & Identity, 6,* 173-188.

McGlinchey, A., Keenan, M., & Dillenburger, K. (2000). Outline for the development of a screening procedure for children who have been sexually abused. *Research on Social Work Practice*, *10*, 722-747.

McKenna, I., 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.

Mela, D. J. (2006). Eating for pleasure or just wanting to eat? Reconsidering sensory hedonic responses as a driver of obesity. *Appetite*, *47*, 10–17.

Mitchell, J. P., Nosek, B. A., & Banaji, M. R. (2003). Contextual variations in implicit evaluation. *Journal of Experimental Psychology: General*, *132*, 455–469.

Myles S. Faith, Robert I. Berkowitz, Virginia A. Stallings, Julia Kerns, Megan Storey, & Albert J. Stunkard. (2006). Eating in the Absence of Hunger: A Genetic Marker for Childhood Obesity in Prepubertal Boys. *Obesity*, *14*(1), 131-138.

Neely, J. H. (1991). Semantic priming effects in visual word recognition: a selective review of current findings and theories. In D. Besner, & G. W. Humphreys (Eds.), *Basic processes in reading: Visual word recognition* (pp. 264–337). Hillsdale, NJ: Erlbaum.

Nock, M. K., & Banaji M. R. (2007). Prediction of suicide ideation and attempts among adolescents using a brief performance-based test. *Journal Consulting and Clinical Psychology*. *75*(5):707-15

Nosek, B. A., & Banaji, M. R. (2001). The go/no-go association task. *Social Cognition*, *19*, 625–666.

Nosek, B. A., Banaji, M., and Greenwald, A. G. (2002). Harvesting implicit group attitudes and beliefs from a demonstration web site. *Group Dynamics, 6,* 101-115.

Nosek, B. A., Greenwald, A. G., and 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., Greenwald, A. G., & Banaji, M. R. (2007). The Implicit Association Test at age 7: A methodological and conceptual review. In J. A. Bargh (Ed.), *Automatic processes in social thinking and behaviour.* Psychology Press.

Nosek, B. A., and Sriram, N. (2007). Faulty assumptions: A comment on Blanton, Jaccard, Gonzales, and Christie (2006). *Journal of Experimental Social Psychology, 43,* 393-398.

Nye, R. D. (1975). *Three view of man: Perspectives from Sigmund Freud, B.F. Skinner, and Carl Rogers.* CA: Brooks-Cole.

Oberauer, K., Su¨ß, H. M., Schulze, R., Wilhelm, O., & Wittmann, W. W. (2000). Working memory capacity: Facets of a cognitive ability construct. *Personality and Individual Differences, 29,* 1017–1045.

Olson, M. A., & Fazio, R. H. (2004). Reducing the influence of extrapersonal associations on the implicit association test: Personalizing the IAT. *Journal of Personality and Social Psychology*, *86*, 653–667.

O'Toole, C., Barnes-Holmes, D., & Smyth, S. (2007). A derived transfer of functions and the Implicit Association Test. *Journal of the Experimental Analysis of Behavior, 88*, 263-283.

Papies, E. K., Stroebe, W., & Aarts, H. (2008a). The allure of forbidden food: On the role of attention in self-regulation. *Journal of Experimental Social Psychology*, *44*, 1283–1292.

Papies, E. K., Stroebe, W., & Aarts, H. (2008b). Healthy cognition. Processes of self-regulatory success in restrained eating. *Personality and Social Psychology Bulletin*, *34*, 1290–1300.

Papies, E. K., Wolfgang, S., & Aart, H. (2009). Who likes it more? Restrained eaters' implicit attitudes towards food. *Appetite*, *53*, 279-287.

Perl, M. A., Mandic, M. L., Primorac, L., Klapec, T., & Perl, A. (1998). Adolescent acceptance of different foods by obesity status and by sex. *Physiology and Behaviour*, *65*, 241–245.

Perugini, M., & Prestwich, A. (2007). The IAT as a predictor of food choice: The case of fruits and snacks. International *Journal of Psychology*, *42*(3), 166-177.

Petty, R. E., & Cacioppo, J. T. (1986). *Communication and persuasion: Central and peripheral routes to attitude change.* New York: Springer-Verlag.

Power, P. M., 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.

Pudel, V., & Westenhoefer, J. (1989). *Fragebogen zum Essverhalten. Three-Factor Eating Questionnaire-German Version*. Göttingen: Hogrefe.

Puhl, R. & Brownell, K. D. (2003) Ways of coping with obesity stigma: Review and conceptual analysis. *Eating Behaviors, 4*, 53–78.

Reed, D. R., Bachmanov, A. A., Beauchamp, G. K., Tordoff, M. G., & Price, A. R. (1997). Heritable variation in food preferences and their contribution to obesity. *Behavior Genetics, 27,* 373–387.

Reese, H. W. (1968). *The perception of stimulus relations: Discriminating learning and transposition.* New York: Academic Press.

Rehfeldt, R. A. & Barnes-Holmes Y. (2009). *Derived relational responding: Applications for children with autism and other developmental disorders*. CA: New Harbinger.

Robinson, T. E., & Berridge, K. C. (1993). Addiction. *Annual Review of Psychology*, *54*, 25–53.

Roche, B., & Barnes, D. (1996). Arbitrarily applicable relational responding and sexual categorization: A critical test of the derived difference relation. *The Psychological Record, 46,* 451-475.

Roddy, S., Stewart, I., & Barnes-Holmes, D. (2010). 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.

Roef, A., & Jansen, A. (2002). Implicit and Explicit Attitudes Towards High-Fat Food in Obesity. *Journal of Abnormal Psychology*, *111*(3), 517-521.

Roefs, A., & Jansen, A. (2004). The effect of information about fat content on food consumption in overweight/obese and lean people. *Appetite*, *43*(3), 319–322.

Roefs, A., Stapert. D., Isabella. I. S. A., 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 Behaviours*, *6*, 151-163.

Roefs, A., Quaedackers, L., Werrij, M. Q., Wolters, G., Havermans, R., Nederkoorn, C., van Breukelen, G., & Jansen, A. (2006). The environment influences whether high-fat foods are associated with palatable or with unhealthy. *Behaviour Research and Therapy*, *44*, 715-736.

Roefs, A., Werrij, M. Q., Smulders, F. T. Y., & Jansen, A. (2006). The Value of Indirect Measures for Assessing Food Preferences in Abnormal Eating. *Journal of Consumer Protection and Food Safety*, *1*, 180-186.

Rudman, L. A., Ashmore, R. D., & Gary, M. L. (2001). “Unlearning" automatic biases: The malleability of implicit prejudice and stereotypes. *Journal of Personality & Social Psychology*, *81*, 856-868.

Safer, D. L., Telch, C. E., & Agras, W. S. (2001). Dialectical behavior therapy for bulimia nervosa. *American Journal of Psychiatry, 158,* 632-634.

Saunders, J. B., Aasland, O. G., Babor, T. F., De la Fuente, J. R., & Grant, M. (1993). Development of the Alcohol Use Disorders Identification Test (AUDIT):

WHO collaborative project on early detection of persons with harmful alcohol consumption. *Addiction, 88,* 791–804.

Schotte, D. E., McNally, R. J., & Turner, M. L. (1990). A dichotic-listening analysis of body-weight concern in bulimia nervosa. *International Journal of Eating Disorders*, *9*(1), 109–113.

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.

Senemeaud, C., & Somat, A. (2009). Dissonance arousal and persistence in attitude change. *Swiss Journal of Psychology, 68,* 25-31.

Sidman, M. (1971). Reading and auditory-visual equivalences. *Journal of Speech & Hearing Research, 14,* 5-13.

Sidman, M., & Tailby, W. (1982). Conditional discrimination vs. matching to sample: An expansion of the testing paradigm. *Journal of the Experimental Analysis of Behaviour, 37,* 5-22.

Skinner, B. F. (1938). *The behavior of organism*. New York: Appleton-Century-Croft.

Spruyt, A., Hermans, D., De Houwer, J., & Eelen, P. (2002). On the nature of the affective priming effect: Affective priming of naming responses. *Social Cognition*, *20*, 227–256.

Spruyt, A., Hermans, D., De Houwer, J., & Eelen, P. (2004). Non-associative semantic priming: Episodic affective priming of naming responses. *Acta Psychologica*, *116*, 39–54.

Spruyt, A., Hermans, D., Pandelaere, M., De Houwer, J., & Eelen, P. (2004). On the replicability of the affective priming effect in the pronunciation task. *Experimental Psychology*, *51*, 109–115.

Stafford, L. D., & Scheffler, G. (2008). Hunger inhibits negative associations to food but not auditory biases in attention. *Appetite*, *51*, 731-734.

Stroebe, W., Mensink, W., Aarts, H., Schut, H., & Kruglanski, A. W. (2008a). Why dieters fail. Testing the goal conflict model of eating. *Journal of Experimental Social Psychology*, *44*, 26–36.

Stice, E. (2002). Risk and maintenance factors for eating pathology: A meta-analytic review. *Psychological Bulletin*, *128*, 825–848.

Stewart, I., Barnes-Holmes, D., & Roche, B. (2004). A functional-analytic model of analogy using the grelational evaluation procedure. *The Psychological Record, 54*, 531-552.

Swanson, J. E., Rudman, L. A., & Greenwald, A. G. (2001). Using the Implicit Association Test to investigate attitude-behaviour consistency for stigmatised behaviour. *Cognition and Emotion*, *15*, 207–230.

Teachman, B. A., & Brownell, K. D. (2001). Implicit anti-fat bias among health professionals: Is anyone immune? *International Journal of Obesity*, *25*, 1525–1531.

Teachman, B. A., Gregg, A. P., Woody, S. R. (2001) Implicit associations for fear-relevant stimuli among individuals with snake and spider fears. *Journal of Abnormal Psychology*, *110*(2), 226-235.

Teachman, B. A., Gapinski, K. D., Brownell, K. D., Rawlins, M., & Jeyaram, S. (2003). Demonstrations of implicit anti-fat bias: The impact of providing causal information and evoking empathy. *Health Psychology*, *22*, 68–78.

Telch, C. E (1997). Skills training treatment for adaptive affect regulation in a woman with binge-eating disorder. *International Journal of Eating Disorders, 22,* 77-81.

Telch, C. E., Agras, W. S., & Linehan, M. (2000). Group dialectic behavior therapy for binge-eating disorder: A preliminary, uncontrolled trial. *Behavior Therapy, 31,* 569-582.

Thompson, J. K., Heinberg, L. J., Altabe, M. N., & Tantleff-Dunn, S. (1999). *Exacting beauty: Theory, assessment and treatment of body image disturbance.* Washington: APA.

Vahey, N. A., Barnes-Holmes, D., Barnes-Holmes, Y., & Stewart, I. (2009). A first test of the Implicit Relational Assessment Procedure (IRAP) as a measure of self-esteem: Irish prisoner groups and university students. *The Psychological Record, 59,* 371-388.

van Strien, T., Frijters, J. E. R., Bergers, G. P. A., & Defares, P. B. (1986). The Dutch Eating Behavior Questionnaire (DEBQ) for assessment of restraint, emotional, and external eating behavior. *International Journal of Eating Disorders*, *5*, 295-315.

Valverde, M. A., Patin, R. V., Oliveira, F. L. C., Lopez, F. A., & Vitolo, M. R. (1998). Outcomes of obese children and adolescents enrolled in a multidisciplinary health program. *International Journal of Obesity*, *22*, 513–519.

Verldhuizen, M.G., Ooosterhoff, A.F., & Kroeze, J. H. A. (2009). Flavours prime processing of affectively congruent food words and non-food words. *Appetite*, *871*, 1-6.

Verhulst, F., Hermans, D., Baeyens, F., Spruyt, A., Eelen, P. (2006). Determinants and predictive validity of direct and indirect measures of recently acquired food attitudes. *Appetite*, *46*, 137-143.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54,* 1063–1070.

Watt, A., Keenan, M., Barnes, D., & Cairns, E. (1991). Social categorization and stimulus equivalence. *The Psychological Record, 41,* 33-50.

Weisbrod, M., Keifer, M., Winkler, S., Maier, S., Hill, R., Roesch-Ely, D., et al. (1999). Electrophysiological correlates of direct versus indirect semantic priming in normal volunteers. *Cognitive Brain Research, 8,* 289–298.

Werner, C. M., Sansone, C., & Brown, B. B. (2008). Guided group discussion and attitude change: The role of normative and informational influence. *Journal of Environmental Psychology, 28,* 27-41.

Weriji, M. Q., Roefs, A., Janssen, I., Stapert, D., Wolters, G., Mulkens, S., Hospers, H. J., & Jansen, A. (2009). Early Associations with palatable foods in overweight and obesity are not disinihibition related but restraint related. *Journal of Behavior Therapy and Experimental Psychiatry*, *40*, 136-146.

Wiers, R. W., van Woerden, N., Smulders, F. T. Y., & de Jong, P. J. (2002). Implicit and explicit alcohol-related cognitions in heavy and light drinkers. *Journal of Abnormal Psychology*, *111*, 648–658.

Wilson, K. G., & Dufrene, T. (2008). *Mindfulness for two: An Acceptance and Commitment Therapy Approach to Mindfulness in Psychotherapy*. California: New Harbinger.

Wilson, T. D., Lindsey, S., & Schooler, T. Y. (2000). A model of dual attitudes. *Psychological Review, 107,* 101-126.

Wilson, G. T., & Smith, D. (1989). Assessment of bulimia nervosa: An evaluation of the Eating Disorder Examination. *International Journal of Eating Disorders, 8,* 173–179.

Wittenbrink, B., & Schwarz, N. (2007). *Implicit measures of attitudes.* New York: The Guildford Press.

Woodward, D. R., Boon, J. A., Cumming, F. J., Ball, P. J., Williams, H. M., & Hornsby, H. 1996). Adolescent's reported usage of foods in relation to their perceptions and social norms for those foods. *Appetite*, *27*, 109-117.

World Healthy Organisation. (2006). Fact Sheet N° 311. Retrieved on 26 of August, from http://www.who.int/mediacentre/factsheets/fs311/en/

Wulfert, E., & Hayes, S. C. (1988). The transfer of conditional sequencing through conditional equivalence classes. *Journal of Experimental Analysis of Behavior, 50,* 125-144.

Zettle, R. D. (2003). Acceptance and commitment therapy (ACT) vs. systematic desensitization in treatment of mathematics anxiety. *Psychological Record*, *53*, 197–215.

Zettle, R. D., & Hayes, S. C. (1986). Dysfunctional control by client verbal behavior: The context of reason giving. *The Analysis of Verbal Behavior*, *4*, 30–38.

Appendix A: Summary of Implicit Food Studies

Study	Author	Adults	Children	Normal-Weight	Obese	Restrained	Unrestrained	Words Stimuli	Picture Stimuli	Unhealthy Bias	Healthy Bias	Other	Implicit Explicit Correlation	Implicit Predicts Behaviour
IAT Fruit Juice vs. Sodas	Maison, Greenwald, and Bruin (2001) Experiments 1 & 2	Yes		Not reported as otherwise				Yes			Yes		Yes	Not reported
IAT High vs. Low Calorie Foods among Females	Maison, Greenwald, and Bruin (2001) Experiments 2	Yes		Not reported as otherwise				Yes			Yes		Yes	Not reported
IAT Apple vs. Candy bar	Karpinski and Hilton (2001)	Yes		Not reported as otherwise				Yes			Yes		No	No
IAT Apple vs. Candy bar	Olzon and Fazio (2004) Study 1	Yes		Not reported as otherwise				Yes			Yes		No	No
Personalized IAT Apple vs. Candy bar	Olzon and Fazio (2004)	Yes		Not reported as otherwise				Yes				Neutral Bias	Yes	Not reported
IAT Images of two Yoghurt Brands	Maison, Greenwald, and Bruin (2004) Experiments 1	Yes		Not reported as otherwise					Yes			Bias toward preferred brand.	Yes	Marginal
IAT McDonald's vs. Milk Bar Restaurants	Maison, Greenwald, and Bruin (2004) Experiments 2	Yes		Not reported as otherwise				Yes				Bias toward preferred restaurant and observed behaviour.	Yes	No
IAT Coca-Cola vs. Pepsi	Maison, Greenwald, and Bruin (2004) Experiments 3		Secondary School Children	Not reported as otherwise					Yes			Bias toward preferred brand, only for those who used the product most	Not Reported	Yes

												frequently and also those who could discriminate Coca-Cola from Pepsi based on blind tasting.		
IAT Four studies With Fruits vs. snacks	Perugini and Pretwich (2007)	Yes		Not reported as otherwise				Yes			Yes	Bias for fruit over snacks in all studies.	Only in one study, conducted in summer	Yes
IAT Foods vs. Furniture	Stafford and Scheffler (2008)	Yes		Marginally over-weight				Yes				Bias for food over furniture.	Not Reported	Not reported
SC-IAT M&MS-pleasant vs. M&MS-unpleasant	Hofmann, Gschwender, Friese, Wiers, and Schmitt (2008)	Yes		Not reported as otherwise				Yes	Yes			Differentiated between individuals with high and low bias towards M&Ms.	Yes	Moderated by Working Memory Capacity
SC-IAT M&MS-pleasant vs. M&MS-unpleasant	Hofmann and Friese (2008)	Yes		Normal and slightly overweight				Yes	Yes			Differentiated between individuals with high and low bias for M&Ms.	No	Moderated by alcohol.
IAT High fat vs. low fat food	Reofs and Jansen (2002)	Yes		Yes	Yes			Yes				More negative bias towards high-fat food for the obese.	No	Not reported
Self-Concept IAT, self vs. others, for non-fat vs. fat foods .	Craeynest, Crombez, De Houwer, Deforche, and De Bourdeaudhuij (2006)		Yes	Yes	Yes			Yes	Yes		Yes	Normal-weight individuals associated themselves more strongly with non-fat foods. Obese individuals associated themselves with fat and non-fat food equally.	Not Reported	Not reported
Personalized IAT, Study 1; palatable	Craeynest, Crombez, Haerens, and		Yes	Yes	Yes			Yes			Yes	In study 1, both groups liked food and	Yes	Not reported

foods vs. hobbies and Study 2; palatable healthy foods vs. palatable unhealthy foods.	De Bourdeaudhuij (2007)											hobbies to the equally. In Study 2, both groups produced a significant positive implicit attitude towards palatable healthy over palatable unhealthy foods.		
Arousal IATs, fat vs. lean-food and positive v.s negative arousal among normal-weight vs. overweight individuals in study 1 and among normal-weight vs. obese individuals in Study 2.	Craeynest, Crombez, Koster, Haerens and De Boudeaudhuij (2008)		Yes	Yes	Yes			Yes	Yes	Yes		All groups produced pro-fat-food-high-positive-arousal and pro-fat-food-high-negative-arousal effects respectively on the food-positive and food-negative arousal IATs with no difference for weight category in Study or Study 2.	Only for the obese group.	Not reported
APP, Strong versus Moderately like foods	Lamote, Hermans, Baeyens, and Eelen (2004)	Yes		Not reported as otherwise				Yes	Yes			Bias towards liked over disliked foods	Not Reported	Not reported
APP, recently acquired food odours	Hermans, Baeyens, Lamote, Spruyt, and Eelen (2005)	Yes		Not reported as otherwise				Yes	Yes			Bias towards pleasant over unpleasant yoghurt.	Not Reported	Not reported
Food Priming Picture Naming APP, Sensory and expected consequence	Verhurlst, Hermans, Baeyens, Spruyt, and Eelen (2006)	Yes		Not reported as otherwise					Yes			Bias towards positive over negative conditioned cookies.	Not Reported	For the sensory-liking group but not the expected consequence

														group.
APP Oral Flavour Priming	Veldhuizen, Oosterhoof, and Kroeze (2009)	Yes		Not reported as otherwise				Words and Oral Flavour Primes				Bias towards positive over negative conditioned flavour.	Only Non-parametric Correlation between strawberry lemonade and explicit pleasantness rating	Not reported
APP, Lean unrestainted vs. anorexic vs. obese individuals	Roefs, Stapert, Isabella, Wolters, Wojciechowski, and Jansen (2005)	Yes		Yes	Yes	Yes	Yes	Yes				Study 1; Marginal bias for palatable over unpalatable food for lean controls vs. anorexics. Study 2; both obese and unrestrained had a marginally significant bias for low-fat palatable over unpalatable foods, no group differences.	Not reported	Not reported
APP, high-fat vs. low-fat and palatable vs. unpalatable foods, restaurant and hospital context manipulation and after food craving induction.	Roefs, Quaedackers, Werrij, Wolters, Havermans, Nederkoorn, van Breukelen and Jansen (2006)	Yes		Yes	Yes		Yes	Yes				Study 1; error data showed. palatable over unpalatable food bias for both groups in the restaurant condition and opposite effect in the health condition. Study 2; both groups had a significant bias for low-fat foods after cravings induction. No significant	Only in Study 2, for the obese group with high initial food cravings.	Not reported

												differences due among the weight categories in Study 1 or Study 2.		
New picture-symbol variant of the APP	Papies, Wolfgang and Aarts (2009)	Yes		Yes		Yes	Yes		Yes			Two Studies found unrestrained eaters had a significantly more positive bias towards palatable foods over unpalatable and neutral foods but restrained eaters did not.	Not reported.	Restraints Scale and palatable food negative ambivalence score predict APP score.
APP, high calorie savory vs, high calorie sweet foods between obese, overweight and normal-weight individuals.	Czyzewska, and Graham, (2008)	Yes			Yes and over-weight			Yes	Yes			Obese group only had significant bias for high-calorie non-savoury foods and negative bias for high-calorie sweet. Normal-weigh (NW) and overweight (OW) had significant reverse pattern. NW and OW had significant negative bias toward low calorie foods compared to high-calorie sweet foods, obese did not.	Not reported	Not reported
APP and EAST,	Roefs, Herman, MacLeod,	Yes		Yes			Yes	Yes				Restrained and unrestrained	Not reported	Not reported

palatable vs. unpalatable foods.	Smulders, and Jansen (2005)											eaters have a significant bias towards palatable compared to unpalatable foods.		
EAST with healthy vs. unhealthy foods	Craeynest, Crombez, De Houwer, Deforche, Tanghe, and De Bourdeaudhuij (2005)		Yes	Yes	Yes		Yes					Biases for healthy and unhealthy foods for obese, normal-weight youngsters were neutral towards both.	Not reported	Not reported
IAT and EAST, meat vs. vegetables for vegetarians and nonvegetarians	De Houwer and De Bruycker (2007)	Yes		Not reported as otherwise					Yes			Vegetarians had a pro-vegetable over meat bias on both measures	Both IAT and EAST correlated with explicit rating measures.	Explicit but not implicit measures were significant predictors of group status.
IAT, EAST and Behavioural AST for food attitudes among normal and eating disorder individuals (anorexics and bulimics)	Seibt, Häfner and Deutsch, (2007)	Yes		Not reported as otherwise		Yes		Yes	Yes			Study 1; normal-weight had bias for food over sport on the IAT. Study 2: bias for food over flowers and non-words on the EAST. All groups all had stronger approach tendencies toward food when food deprived than sated.	Correlation between IAT and EAST and food deprivation time.	Not reported
EAST and explicit food and exercise attitudes	Creaynest, Crombez, Deforche, Tanghe, & De		Yes		Yes			Yes		Yes	Yes	Bias towards both healthy and unhealthy foods. Similar to	Not reported	Implicit healthy food bias predicted

assess during an obesity treatment program and at follow up.	Bourdeaudhuil, (2008)											Craeynest et al. (2005)		weight loss at end of treatment but not a follow-up. Explicit measures did not.
EAST High calorie food related word vs. low calories food related words	Hoefling and Strack (2008)	Yes		Yes		Yes	Yes	Yes				Both restrained and unrestrained has had positive high- and lo w calorie food bias when deprived. But the restrained group also had a marginally stronger positive bias for high-calorie food related words compared to the unrestrained eaters when food deprived and sated.	No	Not reported
GNAT assessing attitudes to Genetically Modified (GM) food in three contexts, context free, compared to ordinary food context and organic food context.	Spence and Townsend (2006)	Yes		Not reported				Yes				Pro GM food bias in context free condition, neutral bias in other two conditions.	No	Not reported
SPP assessing the associations between high-fat palatable	Weriji, Roefs, Janssen, Stapert, Wolters, Mulkens,	Yes		Yes	Yes			Yes				High-fat palatable foods primed restraint related words faster than	Not reported	Not reported

foods and disinhibition and restraint related words	Hospers, and Jansen (2009)											neutral words. No difference based on weight category. There was no association for disinhibition related words		
Forced choose behavioural measure assessed implicit wanting food attitudes when hungry and satiated.	Finlayson, King, and Blundell (2008)	Yes		Yes	Yes				Yes			Significant implicit bias towards sweet over savoury foods when sated compared to hungry.	None	Significant correlations between implicit measure and behavioural food preferences for high-fat sweet, low-fat- sweet and savoury.

Appendix B: Hunger-State-Questionnaire

Subject Number:_____

Please answer all of the following questions as honestly as possible.

1. How long is it since you ate your last meal, please specify the amount of time?_____

2. Was your last meal Small □ Medium □ Large □

3. Please indicate below how you feel right now?

Very Hungry	Slightly Hungry	Neither	Slightly Full	Very Full
☐	☐	☐	☐	☐

4. Have you suffered from any gastrointestinal problems in the last 48 hours that have impacted on your eating habits (e.g., nausea, diarrhoea, vomiting, over-eating, binge-eating or hung-over). If yes, please describe problem; otherwise, state no.

_____

_____

5. How well do you feel now? Unwell □ Well □ Very well□

6. Please specify your age? _____

Appendix C: Wanting-Scale

Subject Number:_____

Please mark in the appropriate spaces below your answers to the following questions on how much you want to eat the particular foods below "NOW" or "LATER"?

LATER NEUTRAL NOW
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

1. Hamburger and Chips _____

2. Chocolate _____

3. Ice-Cream _____

3. Steak _____

3. Crisps _____

3. Donuts _____

3. Chicken Salad _____

3. Nuts _____

3. Fruit _____

3. Soup _____

3. Salad _____

3. Fish _____

1.

2.

3.

4.

5.


Cheese & Onion
TAYTO
THE ORIGINAL IRISH CRISP
Salt & Vinegar
TAYTO
THE ORIGINAL IRISH CRISP

6.

7.

8.

9.

10.

11.

12.

Appendix D: Eating Disorder Examination Questionnaire (EDE-Q5)

EATING QUESTIONNAIRE

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

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

.

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

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

Over the past four weeks (28 days) ……

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

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

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

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

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

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

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

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

If so, how many? ……
Have you been taking the "pill"? ……

THANK YOU

Appendix E: Balanced Inventory of Desirable Responding

Using the scale below as a guide, write a number beside each statement to indicate how much you agree with it.

NOT TRUE			SOMEWHAT TRUE			VERY TRUE
1	2	3	4	5	6	7

____ 1 My first impression of people usually turn out to be right.
____ 2 It would be hard for me to break any of my bad habits.
____ 3 I don't care to know what other people really think of me.
____ 4 I have not always been honest with myself.
____ 5 I always know why I like things.
____ 6 When my emotions are aroused, it biases my thinking.
____ 7 Once I've made up my mind other people can seldom change my opinion.
____ 8 I am not a safe driver when I exceed the speed limit.
____ 9 I am full in control of my own fate.
____ 10 It's hard for me to shut off a disturbing thought.
____ 11 I never regret my decisions.
____ 12 I sometimes lose out on things because I can't make up my mind soon enough.
____ 13 The reason I vote is because my vote can make a difference.
____ 14 My parents were not always fair when they punished me.
____ 15 I am a completely rational person.
____ 16 I rarely appreciate criticism.
____ 17 I am very confident of my own judgements.
____ 18 I have sometimes doubted my ability as a lover.
____ 19 It's alright with me if some people dislike me.
____ 20 I don't always know the reasons why I do the things I do.
____ 21 I sometimes tell lies if I have to.
____ 22 I never cover up my mistakes.
____ 23 There have been occasions when I have taken advantage of someone.
____ 24 I never swear.
____ 25 I sometimes try to get even rather than forgive and forget.
____ 26 I always obey laws, even if I'm unlikely to get caught.
____ 27 I have said something bad about a friend behind his or her back.
____ 28 When I hear people talking privately, I avoid listening.
____ 29 I have received too much change from a sales person without telling him or her.
____ 30 I always declare everything at customs.
____ 31 When I was young I sometimes stole things.
____ 32 I have never dropped litter on the street.
____ 33 I sometimes drive faster that the speed limit.
____ 34 I never read sexy books or magazines.
____ 35 I have done things that I don't tell other people about.
____ 36 I never take things that don't belong to me.
____ 37 I have taken sick leave from work even though I wasn't really sick.
____ 38 I have never damaged a library book or store merchandise without reporting it.
____ 39 I have some pretty awful habits.
____ 40 I don't gossip about other people's business.

Appendix F: Power of Food Scale

Please indicate the extent to which you agree that the following items describe you. Use the following scale from 1 to 5 for your responses.	I don't agree at all (1)	I agree a little (2)	I agree somewhat (3)	I agree (4)	I strongly agree (5)
1. I find myself thinking about food even when I'm not physically hungry.	☐	☐	☐	☐	☐
2. When I'm in a situation where delicious foods are present but I have to wait to eat them, it is very difficult for me to wait.	☐	☐	☐	☐	☐
3. I get more pleasure from eating than I do from almost anything else.	☐	☐	☐	☐	☐
4. I feel that food is to me like liquor is to an alcoholic.	☐	☐	☐	☐	☐
5. If I see or smell a food I like, I get a powerful urge to have some.	☐	☐	☐	☐	☐
6. When I'm around a fattening food I love, it's hard to stop myself from at least tasting it.	☐	☐	☐	☐	☐
7. I often think about what foods I might eat later in the day.	☐	☐	☐	☐	☐
8. It's scary to think of the power that food has over me.	☐	☐	☐	☐	☐
9. When I taste a favorite food, I feel intense pleasure.	☐	☐	☐	☐	☐
10. When I know a delicious food is available, I can't help myself from thinking about having some.	☐	☐	☐	☐	☐
11. I love the taste of certain foods so much that I can't avoid eating	☐	☐	☐	☐	☐

Please indicate the extent to which you agree that the following items describe you. Use the following scale from 1 to 5 for your responses.	I don't agree at all (1)	I agree a little (2)	I agree somewhat (3)	I agree (4)	I strongly agree (5)
them even if they're bad for me.					
12. When I see delicious foods in advertisements or commercials, it makes me want to eat.	☐	☐	☐	☐	☐
13. I feel like food controls me rather than the other way around.	☐	☐	☐	☐	☐
14. Just before I taste a favorite food, I feel intense anticipation.	☐	☐	☐	☐	☐
15. When I eat delicious food I focus a lot on how good it tastes.	☐	☐	☐	☐	☐
16. Sometimes, when I'm doing everyday activities, I get an urge to eat "out of the blue" (for no apparent reason).	☐	☐	☐	☐	☐
17. I think I enjoy eating a lot more than most other people.	☐	☐	☐	☐	☐
18. Hearing someone describe a great meal makes me really want to have something to eat.	☐	☐	☐	☐	☐
19. It seems like I have food on my mind a lot.	☐	☐	☐	☐	☐
20. It's very important to me that the foods I eat are as delicious as possible.	☐	☐	☐	☐	☐
21. Before I eat a favorite food my mouth tends to flood with saliva.	☐	☐	☐	☐	☐

Appendix G: CONSENT FORM

PARTICIPANT:

I …… consent to participate in an experimental psychology study being run by Ian M McKenna and supervised by Professor Dermot Barnes-Holmes in the Department of Psychology, National University of Ireland, Maynooth (Tel: +353 1 708 4765).

I understand and consent to the following:

- The experiment will not last longer than 3 hours on any given day.
- All data from the study will be treated confidentially.
- The data will be stored in a locked cabinet in the Department of Psychology
- The data will be retained for a minimum of five years.
- An alphanumeric code will be entered into the IRAP program to protect your identity. This alphanumeric code will also be used on all explicit measures to protect your identity.
- Your data is available to you at your discretion
- The data collected as part of this study will be collated and form part of Ian M McKenna's doctoral thesis and the results may be included in other publications.
- I am free to terminate my participation in the study at any time and may withdraw the data obtained from my participation, if I so wish, up to the time of publication.
- I understand that this experiment **cannot** be considered a form of treatment for any disorder.
- I have also been informed that my attitudes may change or remain the same following the experiment.
- Results from this research work will not be used deceptively or without your consent.
- If during my participation in the study I feel the information and guidelines I have been given are neglected or disregarded in anyway, or if I am unhappy about the process I may contact the Secretary of the National University of Ireland Maynooth Ethics Committee at pgdean@nuim.ie or 01 708 6018.
- I have been assured that my concerns will be dealt with in a sensitive manner.
- I have received this information in an understandable way.

- I was given at least 24 hours before agreeing to volunteer for this study.
- All my questions at this stage have been answered.

Please print and sign your name below if you are willing to abide fully by the conditions stated above.

Name:

_____

(Please print in block capitals)

Signature:

_____

Date: _____

EXPERIMENTER:

I, Ian M McKenna, as primary experimenter, accept full responsibility for the care of all experimental participants and I confirm that all the necessary safety precautions have been taken.

Signature of experimenter: _____ Date: _____

Ian M McKenna
c/o Department of Psychology
NUI Maynooth

Appendix H: Hunger-Scale

Please mark in the appropriate spaces below your answers to the following questions on how hungry or not hungry the following foods makes you feel now?

NOT HUNGRY NEUTRAL HUNGRY
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

1. Hamburger and Chips _____

2. Chocolate _____

3. Ice-Cream _____

4. Steak _____

5. Crisps _____

6. Donuts _____

7. Chicken Salad _____

8. Nuts _____

9. Fruit _____

10. Soup _____

11. Salad _____

12. Fish _____

Appendix I: Mindful Attention Awareness Scale

Day-to-Day Experiences

Instructions: Below is a collection of statements about your everyday experience. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what *really reflects* your experience rather than what you think your experience should be. Please treat each item separately from every other item.

1	2	3	4	5	6
Almost Always	Very Frequently	Somewhat Frequently	Somewhat Infrequently	Very Infrequently	Almost Never

I could be experiencing some emotion and not be conscious of it until some time later.	1	2	3	4	5	6
I break or spill things because of carelessness, not paying attention, or thinking of something else.	1	2	3	4	5	6
I find it difficult to stay focused on what's happening in the present.	1	2	3	4	5	6
I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.	1	2	3	4	5	6
I tend not to notice feelings of physical tension or discomfort until they really grab my attention.	1	2	3	4	5	6
I forget a person's name almost as soon as I've been told it for the first time.	1	2	3	4	5	6
It seems I am "running on automatic," without much awareness of what I'm doing.	1	2	3	4	5	6
I rush through activities without being really attentive to them.	1	2	3	4	5	6
I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there.	1	2	3	4	5	6
I do jobs or tasks automatically, without being aware of what I'm doing.	1	2	3	4	5	6
I find myself listening to someone with one ear, doing something else at the same time.	1	2	3	4	5	6

1	2	3	4	5	6
Almost Always	Very Frequently	Somewhat Frequently	Somewhat Infrequently	Very Infrequently	Almost Never

I drive places on 'automatic pilot' and then wonder why I went there.	1	2	3	4	5	6
I find myself preoccupied with the future or the past.	1	2	3	4	5	6
I find myself doing things without paying attention.	1	2	3	4	5	6
I snack without being aware that I'm eating.	1	2	3	4	5	6

Appendix J: VERY/SLIGHTLY Hunger-Scale

Please answer all of the following questions as honestly as possible.

1. On the scale below –4 to 4, rate how hungry or not hungry "Hamburger and Chips" makes you?

NOT HUNGRY SLIGHTLY HUNGRY VERY HUNGRY
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

2. On the scale below –4 to 4, rate how hungry or not hungry "Chocolate" makes you?

NOT HUNGRY SLIGHTLY HUNGRY VERY HUNGRY
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

3. On the scale below –4 to 4, rate how hungry or not hungry "Ice-Cream" makes you?

NOT HUNGRY SLIGHTLY HUNGRY VERY HUNGRY
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

4. On the scale below –4 to 4, rate how hungry or not hungry "Steak" makes you?

NOT HUNGRY SLIGHTLY HUNGRY VERY HUNGRY
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

5. On the scale below –4 to 4, rate how hungry or not hungry "Crisps" makes you?

NOT HUNGRY SLIGHTLY HUNGRY VERY HUNGRY-
4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

6. On the scale below –4 to 4, rate how hungry or not hungry "Donuts" makes you?

NOT HUNGRY SLIGHTLY HUNGRY VERY HUNGRY
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

7. On the scale below –4 to 4, rate how hungry or not hungry "Chicken Salad" makes you?

NOT HUNGRY SLIGHTLY HUNGRY VERY HUNGRY
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

8. On the scale below –4 to 4, rate how hungry or not hungry "Nuts" makes you?

NOT HUNGRY SLIGHTLY HUNGRY VERY HUNGRY
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

9. On the scale below –4 to 4, rate how hungry or not hungry "Fruit" makes you?

NOT HUNGRY SLIGHTLY HUNGRY VERY HUNGRY
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

10. On the scale below –4 to 4, rate how hungry or not hungry "Soup" makes you?

NOT HUNGRY SLIGHTLY HUNGRY VERY HUNGRY
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

11. On the scale below –4 to 4, rate how hungry or not hungry "Salad" makes you?

NOT HUNGRY SLIGHTLY HUNGRY VERY HUNGRY
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

12. On the scale below –4 to 4, rate how hungry or not hungry "Fish" makes you?

NOT HUNGRY SLIGHTLY HUNGRY VERY HUNGRY
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

Appendix K: Liking-Scale

Please answer all of the following questions as honestly as possible.

1. On the scale below –4 to 4, rate how palatable (like the taste of) or unpalatable (do NOT like the taste of) you find "Hamburger and Chips"now?

VERY UNPALATABLE NEUTRAL VERY PALATABLE
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

2. On the scale below –4 to 4, rate how palatable (like the taste of) or unpalatable (do NOT like the taste of) you find "Chocolate" now?

VERY UNPALATABLE NEUTRAL VERY PALATABLE
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

3. On the scale below –4 to 4, rate how palatable (like the taste of) or unpalatable (do NOT like the taste of) you find "Ice-Cream"now?

VERY UNPALATABLE NEUTRAL VERY PALATABLE
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

4. On the scale below –4 to 4, rate how palatable (like the taste of) or unpalatable (do NOT like the taste of) you find "Steak" now?

VERY UNPALATABLE NEUTRAL VERY PALATABLE
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

5. On the scale below –4 to 4, rate how palatable (like the taste of) or unpalatable (do NOT like the taste of) you find "Crisps" now?

VERY UNPALATABLE NEUTRAL VERY PALATABLE
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

6. On the scale below –4 to 4, rate how palatable (like the taste of) or unpalatable (do NOT like the taste of) you find "Donuts" now?

VERY UNPALATABLE NEUTRAL VERY PALATABLE
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

7. On the scale below –4 to 4, rate how palatable (like the taste of) or unpalatable (do NOT like the taste of) you find "Chicken Salad" now?

VERY UNPALATABLE NEUTRAL VERY PALATABLE
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

8. On the scale below –4 to 4, rate how palatable (like the taste of) or unpalatable (do NOT like the taste of) you find "Nuts" now?

VERY UNPALATABLE NEUTRAL VERY PALATABLE
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

9. On the scale below –4 to 4, rate how palatable (like the taste of) or unpalatable (do NOT like the taste of) you find "Fruit" now?

VERY UNPALATABLE NEUTRAL VERY PALATABLE
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

10. On the scale below –4 to 4, rate how palatable (like the taste of) or unpalatable (do NOT like the taste of) you find "Soup" now?

VERY UNPALATABLE NEUTRAL VERY PALATABLE
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

11. On the scale below –4 to 4, rate how palatable (like the taste of) or unpalatable (do NOT like the taste of) you find "Salad" now?

VERY UNPALATABLE NEUTRAL VERY PALATABLE
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

12. On the scale below –4 to 4, rate how palatable (like the taste of) or unpalatable (do NOT like the taste of) you find "Fish" now?

VERY UNPALATABLE NEUTRAL VERY PALATABLE
-4_____-3_____-2_____-1_____0_____ 1_____ 2_____ 3_____4

Appendix L: Cravings Questionnaire

1. **Please rate how strong your cravings are to eat your favourite snack right now (circle the appropriate number below)?**

No Cravings					**Slight Cravings**					**Extremely Strong Cravings**
0	1	2	3	4	5	6	7	8	9	10

2. **Please rate your ability is to resist your cravings for your favourite snack right now (circle the appropriate number below)?**

No Ability					**Slight Ability**					**Strong Ability**
0	1	2	3	4	5	6	7	8	9	10

Appendix M: Acceptance of Food Urges Exercise Questionnaire

1. What does acceptance mean?

_____

_____

_____

_____

_____

2 What does willingness mean?

_____

_____

_____

_____

_____

3. What does awareness mean?

_____

_____

_____

_____

_____

4. What does distancing mean?

_____

_____

_____

_____

_____

5. Please write down a summary of the strategy you have been instructed to use here today?

_____

_____

_____

_____

_____

6. List any thoughts you had during the exercise?

_____

_____

_____

_____

_____

_____

_____

7. List any feeling you had during the exercise?

_____

_____

_____

_____

_____

_____

_____

8. Please rate how useful the strategy was (circle the appropriate number below)?

Not Useful						**Slightly Useful**				**Very Useful**
0	1	2	3	4	5	6	7	8	9	10

9. Please rate how difficult it was to use the strategy during the task (circle the appropriate number below)?

Very Easy						**Slightly Difficult**				**Very Difficult**
0	1	2	3	4	5	6	7	8	9	10

Appendix N: Indulgence of Food Urges Exercise Questionnaire

1. List any thoughts you had during the exercise?

_____
_____
_____
_____
_____
_____
_____

2. List any feeling you had during the exercise?

_____
_____
_____
_____
_____
_____
_____

Appendix O: Consent Form for Participants in Chapter 7

PARTICIPANT:

I …… consent to participate in an experimental psychology study being run by Mr. Ian M McKenna and supervised by Professor Dermot Barnes-Holmes, in the Department of Psychology, National University of Ireland, Maynooth (Tel: +353 1 708 4765).
I understand and consent to the following:

- There are no known risks associated with participation in this workshop and any issues that may arise will be addressed by Professor Barnes-Holmes.
- The workshop will not last longer than 3 hours.
- Any issues discussed during the workshop will be treated confidentially.
- To protect your identity an alphanumeric code will be used in all public dissemination of the research findings.
- The data collected as part of this study will be collated and form part of Ian McKenna's doctoral thesis and the results may be included in other publications.
- I am free to terminate my participation in the study at any time and may withdraw the data obtained from my participation, if I so wish, up to the time of publication.
- I understand that this study **cannot** be considered a form of treatment for any disorder.
- I have also been informed that my attitudes and behaviour with respect to food and eating may change or remain the same following the study.
- Results from this research work will not be used deceptively or without my consent.
- If during my participation in the study I feel the information and guidelines I have been given are neglected or disregarded in anyway, or if I am unhappy about the process I may contact the Secretary of the National University of Ireland Maynooth Ethics Committee at pgdean@nuim.ie or 01 708 6018.
- I have been assured that my concerns will be dealt with in a sensitive manner.
- I have received this information in an understandable way.
- I was given at least 24 hours before agreeing to volunteer for this study.

- All my questions at this stage have been answered.

Please print and sign your name below if you are willing to abide fully by the conditions stated above.

Name:

_____

___

(Please print in block capitals)

Signature:

_____

___

Date: _____

Researchers:

I, Mr. Ian M McKenna, as primary researchers, accept full responsibility for the care of all research participants and we confirm that all the necessary safety precautions have been taken.

Signature of researchers: _____ Date: _____

Mr. Ian M McKenna
c/o Department of Psychology
NUI Maynooth

Appendix P: Acceptance of Food Urges Protocol

- Control is the Problem
    - We are taught from a young age that we can control our mind, including our cravings. However, psychologists have begun to realize that attempts to control our craving are most likely not going to be successful and may even make the cravings worse.
    - Can you think of an example where an attempt to control a thought, feeling or craving made it even worse? (10 seconds)

    - Maybe I can give you an example right here. Try this: for the next 60 seconds do not let your mind think about or imagine yourself eating a warm chocolate cake covered in ice-cream. Don't think about what it looks like, tastes, smells, or feels like to eat. Suppose I offered a 1 million euro reward if you can do it, but you will be wired you up to a mind-reading machine to verify if you did it or not.

    - Ok so try it now for the next 60 seconds, do not let your mind think about or imagine yourself eating a warm chocolate cake covered in ice-cream. I will keep time!

    - Hello again, what happen during the task?
      One of two things happened;

        1. either you found it particularly difficult or even impossible not to think about eating warm chocolate cake or,
        2. you're attempts to not think about eating warm chocolate cake "*by thinking about something else*" actually required you to think about eating chocolate cake (otherwise how would your mind know that you had not thought about it).

      So this example shows that we cannot control our thoughts even when we have the most intense motivation to do so. It works the same for cravings: In the same way that we can't control what we think about, we can't control how we feel or our cravings. In short, *If you have cravings to eat chocolate, then you have them and there's not much you can do about having them.*

- Acceptance
    - "If we don't try to control or suppress our cravings what can we do? Perhaps it could help us to accept that we are going to have food cravings no matter what and we can't do anything to stop our mind from wanting something that tastes good. After all it's natural!"

- Willingness

    - "If we can't accept what it feels like to have a craving, where does that leave us? What must we do if we don't have a control to turn down a craving, but we can't stand what it feels like to have craving? … That's right. We have to give in to the craving and eat the food! But, is there another option? … Yes, we could figure out a way to tolerate the

craving feeling. The ability to tolerate a feeling or thought is called *Willingness.* Although we don't have much control over what we feel or think, is it possible that we *do* have control of our "willingness" to feel and think certain things? *Can you imagine saying to yourself: No matter how strong this craving to eat chocolate gets, I'm just going to let it be in my head, give it room. I don't need to make it go away?*

- Awareness

    - Psychologists have discovered that it is incredibly useful to be able to notice and observe your own internal experiences. What do I mean by internal experiences? Things like your thoughts: such as, "I must check my email." "I'm looking forward to going to the cinema this evening." Another type of internal experience are feelings, such as emotions like sadness, anxiety and excitement. Cravings and urges to do things (like eat) are also internal experiences. So are physical feelings like an itch and sensations like smells and sounds.

    - Closes your eyes and just sit back, try to notice whatever internal experiences you are having right this second. What do you see, hear, smell, feel? What are you thinking? (10 seconds)

    - Was that possible?

    - Sometimes it is easier to get this awareness concept using a metaphor.

    - Close your eyes and imagine that you are standing on a railway bridge gazing down at long freight train, rumbling along, it has many, many train cars that stretch far into the distance. The train-cars are open-topped, so you can see the freight inside each one. The freight is labeled and is, in fact, the content of your mind: some of the cars have your thoughts, some have your emotions, some have cravings, and some have the noises, sights and sounds that you are sensing. So one car might have "smell of perfume" another might have the thought "I forgot to call my friend back", another, the feeling of being very hot, and one might have a craving to eat chocolate.

- Distancing

    - "A very important way to increase willingness and decrease the distress you have about cravings is to distance yourself from the cravings. When we distance from a craving, we 'step back from' ourselves and our cravings and see ourselves having the cravings from a psychological distance. When we are distanced we can experience cravings (or any thought or feeling) as just a feeling our mind is having at that moment. Maybe we can even realize this craving feeling is nothing more than chemical and electrical activity in our brain. When we have this kind of distance from our thoughts and feelings we can choose "not to do" what those thoughts and feelings are 'telling' us to do. In other words, we can say: '*I can see myself having a craving to*

eat chocolate right now. It's a really strong craving. But I'm going to let that feeling just be there, give it room and choose not to eat chocolate.'

- Again, conjure up the image of looking down at the train from the railway bridge above. In your mind's eye can you get perspective so that you can see each thought, feeling or craving you have, *from a distance?* Now can you imagine being *inside* a particular train-car where the only thing you can see is a huge sign that says "Craving to eat chocolate!" That difference between being inside the train-car *engaging* with your thoughts and seeing your thoughts in a train-car *from a distance* (like standing above on a railway bridge just watching your thoughts go by without engaging with them) is what I mean by distancing.

- You are now going to do a distancing exercise for the next minute, I will keep time: Once again, close your eyes and imagine that you are standing on a railway bridge gazing down at long freight train carrying you thoughts in the train-cars below, Notice each thought, feeling and craving that you are experiencing right now. But this time, try to step back, *see* your mind having the experience. Describe it to yourself and thank your mind for whatever it throws up in the train-cars below. So say things to yourself like "*I see my mind is having the thought that this is unusual experience" or "I see my mind is having the thought that I need to go to the shop to get milk later" or "I see my mind is having a craving for some chewing-gum.".*

- Ok keep noticing and practicing distancing for then next minute until I ask you to stop!

60 second pause.

- Hello again, what was that like? Were you able to achieve distance?

Strategy Memory Aid:

- **A: Acceptance. Whatever thoughts or feelings or cravings your mind creates are okay.**
- **W: Willingness. Be willing to have what your mind gives you. No matter how strong a craving is, you can let it be. You don't have to make it go away.**
- **A: Awareness. Become aware of what it is you are thinking and feeling and craving in any given moment.**
- **D: Distancing. Step back from your thoughts and feelings and cravings. See them from a distance. "I see myself having a craving for chocolate cake right now.**

Thank you for listening, please contact the experimenter.

Appendix Q: Acceptance of Urges Food Exercises

You are now going to do an exercise with your favourite snack.

- Take a piece of your favourite snack and pick it up with your hand. Then just stop. (5 seconds)
- Smell the food until I ask you to stop (10 seconds)
- Now, raise it towards your mouth and gently move in tiny increments towards eating, but do not eat, stop at the cusp right between eating and not eating. Linger right there at the cusp. Find that place right at the tipping point between eating and not eating, but do not eat. Your mind will not like this but practice the craving coping strategy you learned earlier.
- Accept whatever your mind to throws up,
- Be willing to experience it,
- Be aware of what you are thinking, and feeling, your internal experiences.
- Distance yourself from your internal experiences by watching you're thoughts, feeling and physical experiences go by you as if they were freight on a train, while you simply observe the freight go by from the railway bridge above. Do this until I ask you to stop (60 secs)

- Thank you, please put the snack down. (10 seconds)

- **We will repeat this process another times**

- Once again, take a piece of your favourite snack and pick it up with your hand. Then just stop. (5 seconds)
- Smell the food until I ask you to stop (10 seconds)
- Now, raise it towards your mouth and gently move in tiny increments towards eating, but do not eat, stop at the cusp right between eating and not eating. Linger right there at the cusp. Find that place right at the tipping point between eating and not eating, but do not eat. Your mind will not like this but practice the craving coping strategy you learned earlier.
- Accept whatever your mind to throws up,
- Be willing to experience it,
- Be aware of what you are thinking, and feeling, your internal experiences.
- Distance yourself from your internal experiences by watching you're thoughts, feeling and physical experiences go by you as if they were freight on a train, while you simply observe the freight go by from the railway bridge above. Do this until I ask you to stop (60 secs)

- Thank you, please put the snack down. (10 seconds)

- **We will repeat this process once more.**

- Once again, take a piece of your favourite snack and pick it up with your hand. Then just stop. (5 seconds)
- Smell the food until I ask you to stop (10 seconds)
- Now, raise it towards your mouth and gently move in tiny increments towards eating, but do not eat, stop at the cusp right between eating and not eating. Linger right there at the cusp. Find that place right at the tipping point between eating and not eating, but do not eat. Your mind will not like this but practice the craving coping strategy you learned earlier.

- Accept whatever your mind to throws up,
- Be willing to experience it,
- Be aware of what you are thinking, and feeling, your internal experiences.
- Distance yourself from your internal experiences by watching you're thoughts, feeling and physical experiences go by you as if they were freight on a train, while you simply observe the freight go by from the railway bridge above. Do this until I ask you to stop (60 secs)

- Put the snack down. (10 seconds)

Thank you for listening, please contact the experimenter.

Appendix R: Indulgence of Urges Food Exercises

Open your favourite snack but not to touch it afterwards

You are now going to do an exercise with your favourite snack.

- For the next 60 seconds let your mind think about or imagine yourself eating your favourite snack. Think about what it looks like, tastes, smells, or feels like to eat.

- (60 seconds)

  - Hello again,
  - Take a piece of your favourite snack and pick it up with you hand. Then just stop again. (5 seconds).
  - Smell the food until I ask you to stop (10 seconds)
  - Now, raise it towards your mouth and gently move in tiny increments towards eating, but do not eat, stop at the cusp right between eating and not eating. Linger right there at the cusp. Find that place right at the tipping point between eating and not eating. Think about what it would feel like to eat this food right now. Your mind will not like this but, try and notice whatever thoughts feeling, urges and sensations your mind throws up. When the cravings get so strong that you can't resist them anymore take a bite of your snack and then, put the snack down.
    (30 seconds)

  - **We will repeat this process another two times**

  - Hello once again, take a piece of your favourite snack and pick it up with you hand. Then just stop. (5 seconds).
  - Smell the food until I ask you to stop (10 seconds)
  - Now, raise it towards your mouth and gently move in tiny increments towards eating, but do not eat, stop at the cusp right between eating and not eating. Linger right there at the cusp. Find that place right at the tipping point between eating and not eating. Think about what it would feel like to eat this food right now. Your mind will not like this but, try and notice whatever thoughts feeling, urges and sensations your mind throws up. When the cravings get so strong that you can't resist them anymore take a bite of your snack and then, put the snack down.
    (30 seconds)

  - **We will repeat this process one more time**

  - Hello once again, take a piece of your favourite snack and pick it up with you hand. Then just stop. (5 seconds).
  - Smell the food until I ask you to stop (10 seconds)
  - Now, raise it towards your mouth and gently move in tiny increments towards eating, but do not eat, stop at the cusp right between eating and not eating. Linger right there at the cusp. Find that place right at the tipping point between eating and not eating. Think about what it would feel like to eat this food right now. Your mind will not like this but, try and notice whatever thoughts

feeling, urges and sensations your mind throws up. When the cravings get so strong that you can't resist them anymore take a bite of your snack and then, put the snack down.
(10 seconds)

Thank you please contact the experimenter

Appendix S: Debriefing Form for Participants in Chapter 7

Thank you for taking part in this experiment. I really appreciate you giving your time.

I am happy to answer any questions you might have about this study. The frequently asked questions debriefing form *(over)* should address any concerns you may have. If you still have further concerns you can contact Professor Dermot Barnes-Holmes on Tel: +353 1 708 4765, who will arrange an appointment to discuss the research project and its implications in detail.

Any information given to Professor Barnes-Holmes would be entirely confidential and will not be made available to any one else.

Any information given to Dr Barnes-Holmes would be entirely confidential and will not be made available to any one else. It will be completely separate from my research.

If during your participation in the study you felt the information and guidelines that were given to you were neglected or disregarded in anyway, or if you are unhappy about the process you may contact the Secretary of the National University of Ireland Maynooth Ethics Committee at pgdean@nuim.ie or 01 708 6018.

There would be no charge for this service.

Frequently Asked Questions

1. Could the result be a function of the order in which I did the two parts? I had to group one category (i.e. 'Healthy Foods *or* 'Unhealthy Foods) together with the term "VERY Hungry" first. Later, when I had to group the other category with the term "SLIGHTLY Hungry", I found it difficult.

   Answer: The order in which tests are administered ***does*** make a small difference in some tests to the overall result. This effect has been referred to as an *order effect*. In order to circumvent this problem, the orders used to present words/terms in the IRAP are random. For any stimuli we present, we are careful to be sure that half the test-takers got the **A then B** order and the other half got the **B then A** order.

2. **How does the IRAP measure implicit attitudes?**

   Answer: The IRAP asks you to respond more rapidly to relational tasks that reflect your current beliefs *(e.g., pro-healthy trials)* than to tasks that do not *(e.g., pro-unhealthy trials).* So, if you found it easier to respond faster on IRAP trials that involved categorising healthy foods with "VERY Hungry" and unhealthy foods with "SLIGHTLY Hungry" relative to trials that involved the opposite categorisations, this suggests a healthy bias towards food.

3. **What does it mean if I get a test result that I don't believe describes me or, if I take the *same* test twice, I get different results each time.**

   Answer: The IRAP is not 100% accurate. As is often the case, if you repeat the test you may find that your outcome will change *slightly*. If you repeat the test and the outcome does not change, the result is definitely more trustworthy than is the first result alone. It would be unusual to observe a large difference in outcome from one sitting to the next. In this case we suggest that you regard the results as 'inconclusive'.

   Interestingly, several recent studies have suggested that implicit attitudes may be malleable (see Blair, 2001). This study specifically sought to investigate the effects of two different food urge response strategies on implicit food-related attitudes using the IRAP. You were presented with either an acceptance or indulgence of food urges response strategy designed to impact upon your implicit food attitudes (*depending upon which group you were assigned to*). Therefore, the strategy to which you were exposed to may have made it more difficult for you to respond in a manner consistent with your own beliefs.

4. **The red Xs forced me to give responses I did not consider proper. Does that mean the test is no good for me?**

   Answer: No – it is likely that you would find one way of responding to the tasks more difficult than the other. This is completely normal and what the test was designed to do.

5. **Where can I find technical discussion of implicit social cognition and the**

IRAP?

Answer: Papers on the IRAP are available at http://psychology.nuim.ie/IRAP/IRAP_1.shtml and at http://www.contextualpsychology.org. An overview of the IRAP is also available in an article by Barnes-Holmes et al. (2006) in the Irish Psychologist. For an overview of the topic of 'implicit social cognition' refer to articles by Greenwald and Banaji in the Psychological Review, (1995; 2002).

6. **If I consistently score 75% or less, does this mean I have no implicit preference?**

Answer: The test requires a certain number of correct responses in order to generate an interpretable result. If you consistently scored 80% or less, then there were too many errors to determine a result. This means that the data produced in your test were ones that cannot be interpreted confidently with regard to implicit preferences. This is *not* the same as a result that shows little or no implicit preferences.

7. **When will implicit attitudes agree with explicit attitudes?**

Answer: Two explanations have been offered to account for why direct (explicit) and indirect (implicit) attitudes may not be the same. The simplest explanation is that an individual may be *unwilling* to report their attitude for reasons of embarrassment or social desirability. A second explanation which has been offered to account for the difference between implicit and explicit attitudes is that an individual may be *unable* to accurately report their attitudes. For example, research has shown that individuals who claim *not* to hold prejudiced attitudes towards old people have nevertheless demonstrated such prejudice in their IRAP performances. Often such individuals are unaware of their implicit prejudice and are therefore unable to report it explicitly.

8. **What can I do about an implicit preference that I would rather not have?**

Answer: Remember that the IRAP test is not 100% accurate. You may wish to repeat the test to see whether your outcome changes before drawing a conclusion. If you repeat the test and the outcome does not change, the result is more trustworthy than is the first result alone. However, it is possible to possess an undesirable implicit preference. One solution is to seek experiences that will alter the patterns of experience that may have created the unwanted preference. Such experiences could include reading material that opposes the implicit preference, or interacting with people that provide experiences to counter your preference. A more practical alternative may be to notice the existence of the undesired preference, and remain alert to the possibility that it may intrude in unwanted fashion into your judgments and actions. This may lead you to act in ways that you may not normally act – for example, fully expecting and embracing very strong urges to eat without giving in to those urges. Additionally, you may decide to consciously undertake planned behaviours to compensate for known unconscious preferences. Identifying effective interventions for managing and changing unwanted implicit preferences is an active research question in psychological science. The good news is that implicit preferences, implicit as they are, appear to be malleable. This study was designed to determine if an acceptance or psych-education intervention for unhealthy eating can impact upon implicit preferences.

9. **What is an 'implicit' attitude?**

Answer: An *attitude* is a positive or negative evaluation of some object. *Implicit attitudes* as defined by Greenwald and Banaji (1995) are *"introspectively unidentified or inaccurately identified traces of past experience that mediate favourable or unfavourable feeling, thought, or action toward social objects"* (p.8). The core argument is that implicit attitudes are often unconscious and thus their influence on subsequent behaviours may go unnoticed. Insofar as implicit attitudes are unconscious, traditional explicit measures, such as questionnaires and open-ended interviews, will likely fail to capture these psychological states.

10. **What are 'explicit' attitudes or beliefs?**

Answer: Explicit attitudes and beliefs are ones that are directly expressed or publicly stated. For example, the question asking for your liking for particular groups before you take the IRAP is an example of your explicit or consciously accessible attitude. The standard procedure for obtaining such direct expressions is known as 'self-report', which involves asking people to report or describe their attitudes. For example, the responses typically given in opinion surveys are considered explicit attitudes or beliefs.

11. **What is the difference between 'implicit' and 'automatic'?**

Answer: The terms "unconscious" "automatic" and "implicit" are closely related. They all refer to thought processes that are so well-established as to operate without awareness, intention, or control.

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