The Emotional Decision Maker:

Exploring the role of affect in sweet food choice

by

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For my parents, Ian and Deborah…

…and my son, Keto Ellis.

Abstract

Obesity is now described as a pandemic (Hu, 2013) and a strong association has been identified between sugar consumption and excessive weight gain (e.g. Te Morenga, Mallard & Mann, 2013). Yet difficulty in establishing the factors driving this relationship leaves a dearth of research investigating causal mechanisms behind this global crisis (Lean, Astrup & Roberts, 2018). Food choice has been linked with cognitive processes involved in decision making (Peters, 2009), which in turn, has been linked with affect, i.e. mood and emotion (Lerner, Li, Valdesolo & Kassam, 2015). The aim of this thesis was therefore to explore the way in which both state and trait affect influence impulsive, sweet food decision making across three studies. As hypothesised and supported by affective regulation theory (Gross, 1998), results showed that as laboratory-induced mood (i.e. state affect) moved from positive to negative, the likelihood of choosing a chocolate reward over a non-food/neutral reward increased. This finding was conclusively evident when controlling for other factors such as chocolate craving in Study 2, ultimately highlighting the complex influence of affect on sweet food choice. Following this initial choice in Studies 1 and 2, subsequent hypotheses concerning impulse and self-control were not wholly supported as participants in both mood conditions were more likely to make impulsive decisions than exercise self-control. While affective regulation theory also explained those in negative moods making impulsive choices, an integrative framework was put forward to explain those in positive moods displaying the same behaviour (Andrade, 2005). In Studies 2 and 3 a willingness-to-pay (WTP) task was included to explore the relationship between state and trait affect and economic decisions concerning chocolate and high-sugar foods. While laboratory-induced mood did not predict WTP prices in Study 2, decreasing positive affectivity (i.e. trait affect) was found to significantly predict higher WTP prices for chocolate and high-sugar items, as hypothesised in Study 3. Reduced positive affectivity has been linked with symptoms of depression (Watson, Clark & Carey, 1988) which, in turn, is associated with an increase in desire for chocolate and sweet foods (Lester & Bernard, 1991). These results therefore provided robust evidence that higher spending for sweet items is connected to the absence of positive affectivity rather than presence of negative affectivity. Finally, increasing chocolate craving was found to significantly predict choices and increasing WTP prices for chocolate items in Studies 2 and 3. The potential parallel between chocolate and substances more commonly associated with addiction is discussed, together with the broad, practical implications of all findings in the context of sweet food choice and obesity.

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Glossary of Abbreviations

A: Alanine

ANOVA: Analysis of Variance

BIS-11: Barratt Impulsiveness Scale, Version 11

BIS-Brief: Barratt Impulsivity Scale-Brief

BMI: Body Mass Index

DoG: Delay of Gratification

DSM-5: Diagnostic and Statistical Manual of Mental Disorders, 5th Edition

DVD: Digital Versatile Disc

GDPR: General Data Protection Regulations

GNAT: Go/No-go Association Task

IAT: Implicit Association Test

ID(s): Individual Difference(s)

I-PANAS-SF: International Positive And Negative Affect Schedule Short Form

IS: Impulsive System

JDM: Judgment and Decision Making

LSBU: London South Bank University

MIT: Mood Induction Task

NA: Negative Affect

OCEAN: Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism

OCQ: Orientation to Chocolate Questionnaire

P: Proline

PA: Positive Affect

PANAS: Positive And Negative Affect Schedule

PROP: Propylthiouracil

PTC: Phenylthiocarbamide

QR code: Quick Response code

RIM: Reflective-Impulsive Model

RPS: Research Participation Scheme

RS: Reflective System

SAD: Seasonal Affective Disorder

SC-IAT: Single Category Implicit Association Test

SCS-Brief: Brief Self-Control Scale

SD(s): Standard Deviation(s)

SRC task: Stimulus Response Compatibility task

SSB(s): Sugar-Sweetened Beverage(s)

UMACL: UWIST Mood Adjective Checklist

VAS: Visual Analogue Scale

WTP: Willingness-To-Pay

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1. Sweet preference: A review

Why do we choose sugar?

1.1 Introduction

As obesity levels increase in both children and adults (Dattilo et al., 2012; Ng et al., 2014; Wang & Lobstein, 2006), health-related problems directly resulting from excessive weight gain are becoming more prevalent (Malik, Willet & Hu, 2013; Must & Strauss, 1999; Must et al., 1999). The rise in negative social and economic consequences that also stem from this global problem has led to the call for effective treatments and preventive strategies to directly address obesity (Malik et al., 2013; Roberts, Christiansen & Halford, 2019). Environmental factors such as a marked increase in energy intake coupled with a corresponding decrease in energy expenditure have been emphasised as societal changes in developed countries which are contributing to these growing problems (Koplan & Dietz, 1999; Malik et al., 2013). As well as environmental determinants, behavioural factors such as over-consumption have also been highlighted as being problematic in this context (Reaves et al, 2019). Notably, recent focus and strong arguments have concluded that the increase of energy intake through excessive sugar consumption plays a key role in the development and continuation of obesity (e.g. Bray & Popkin, 2014; Ludwig, Peterson & Gortmaker, 2001; Malik et al., 2013; Te Morenga et al., 2013). This broadening of understanding has been utilised within interventions designed to reduce energy intake in specific areas such as sugar consumption, albeit with only moderate success (e.g. James, Thomas, Cavan & Kerr, 2004). It is therefore proposed that the understanding of *why* such food choices are made, on the individual as well as the societal level, is what will ultimately pave the way in successful treatment design. Given the recent growth in concern surrounding the link between high sugar consumption and both child and adult obesity (e.g. Bray & Popkin, 2014; Ludwig et al., 2001; Malik et al., 2013; Te Morenga et al., 2013), deeper understanding of what drives consumption of this particular food is more prudent than ever.

Various disciplines including psychology, biology, and sensory and consumer food sciences have attempted to explain the mechanisms behind human food choice, both in general, and in terms of sweet food choice specifically (Köster, 2009). Despite fundamentally different approaches, the common theme of ‘preference’ has arisen from the literature as being central across such diverse disciplines in understanding food choice. For example, the observation from a sensory perspective that children show a heightened sweet preference compared to adults (Drewnowski, 1989); from a biological perspective that genetic differences in certain taste receptor genes affect preferences for sweet tastes (Mennella, Pepino & Reed, 2005); and from a psychological perspective that food choices and eating behaviours are intrinsically linked with cognitive processes concerned with judgment and decision making (JDM; Peters, 2009). These cognitive processes, in turn, are intrinsically linked with the construction of preference (Peters, 2009 Slovic, 1995). It has been observed, however, that research within specific disciplines remains limited as a result of missed opportunities to incorporate and expand upon insight gathered through alternative disciplinary approaches (Köster, 2009). This observation highlights an opportunity to draw together the common thread of preference which runs through the aforementioned disciplines, ultimately broadening the understanding of sweet food choice.

‘Preference’ describes the selection or choice of one item over another (Birch, 1999). While a hedonic or ‘liking’ element is synonymous with this term (Birch, 1999), and also influences food selection (Drewnowski, 1997), for the purpose of this review the term ‘preference’ refers to this choice. For example, one might state a liking for both broccoli and chocolate. However, when presented with such a choice, it is preference which ultimately dictates whether to choose the broccoli or the chocolate (Peters, 2009). The outwardly straightforward behaviours of eating (and drinking) are governed by many complex, interacting factors (Köster, 2009). These interactions often create conflict when making food choices, and thus understanding the many different strands which lead to preference is a prudent place to start in understanding this aspect of human behaviour (Peters, 2009). Further to this is understanding the way in which preference leads to sweet food choice as a maladaptive behaviour, and in turn, the influence this construct has in the development and continuation of obesity. The aim of the current review chapter is therefore to delineate sweet preference and measures thereof from the perspectives of two broad fields under which several subtopics naturally fall: physiology (encompassing evolution, biology, sensory research, and genetics); and psychology (encompassing cognition, judgment and decision making, affect[1], and emotion). The identification of ‘missing links’ and potential oversights from each area will ultimately lead to an increased understanding

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[1] Throughout this thesis, the term ‘affect’ (and derivatives thereof) broadly refer to constructs concerning feelings, emotions and mood, as defined by Lerner et al. (2015).

of eating behaviours, and specifically sweet food preference, by answering the question: ‘Why do we choose sugar?’

While every effort has been made to keep each field as distinct as possible, there are instances where overlaps occur. These overlaps have been discussed in accordance to relevance within each field. It should also be noted that in much of the reviewed literature, other preferences are discussed simultaneously with sweet preference and how these interrelate (e.g. Birch, 1999; Drewnowski, 1997). For the purpose of this review, however, the main findings relate purely to sweet preference, within both child and adult populations.

The next two sections of this literature review cover, respectively, physiology and psychology. They are followed by a third section which concentrates on the psychology subtopics of judgment and decision making (JDM) and affect, and their influence on preference, which are particularly relevant to the studies that are described in subsequent chapters of this thesis.

1.2 Physiology and sweet preference

It is well established that the preference for sweet tastes is innate, or unlearned (Drewnowski, 1997), due to the early formation of specialised taste cells during the 7th and 8th weeks of gestation (Ventura & Mennella, 2011). This has been demonstrated in studies involving infants born prematurely who display changes in autonomic activity such as the sucking reflex when presented with sweet tastes (Desor, Maller & Turner, 1973). It has also been shown that full term new-born infants can differentiate between water and sugar solutions and clearly show a preference by consuming a greater volume of sugar solutions compared to water (Desor et al., 1973). In addition to ingestion measures, the emotions or affect associated with sweet tastes have also been studied in new-born infants. For example, through positive facial reactions, e.g. smiling, as an indicative measure of preference (Steiner, Glaser, Hawilo & Berridge, 2001); and the analgesic and calming properties of a sweet taste to mediate pain e.g. during infant circumcision (Blass & Hoffmeyer, 1991) or immunization injections (Ramenghi et al., 2002). This innate or unlearned predisposition for sweet preference has also shown to be heightened in young children compared to adults, indicating that sensory systems develop and mature throughout childhood (Mennella et al., 2005). For example, De Graaf and Zandstra (1999) used sucrose concentrations in water and orangeade to assess discriminatory ability and sugar pleasantness in children (9-10 years), adolescents (14-16 years) and adults (20-25 years). The results confirmed the declination of sweet preference over the increasing age groups with children preferring higher sucrose concentrations than adolescents, and adolescents preferring higher sucrose concentrations than adults (De Graaf & Zandstra, 1999).

An explanation of this developmental difference in age groups has been explained from an evolutionary perspective: a heightened sweet preference during infancy guides children towards energy-dense foods to ensure optimal growth and survival (Drewnowski, 1989; Mennella et al., 2005). However, there are other factors interrelating with the development of sensory systems which also shape children's developing food preferences during the early years (Birch, 1999). For example, environmental factors affect children's predispositions for sweet preference through experience (Birch, 1999). This was demonstrated by Beauchamp and Moran (1982) in a study involving new-borns, all of whom were reported as preferring sweet solutions compared to plain water. Based on maternal dietary reports spanning the first six months of life, those infants who had been consistently fed with sweetened water showed a greater preference upon re-testing than those who had not (Beauchamp & Moran, 1982). This demonstrates a shift dependent on familial, environmental experience from the unlearned to the learned, and also supports such findings which conclude that children's taste preferences are guided by familiarity as well as sweetness (e.g. Beauchamp & Moran, 1982). A further study repeatedly exposed older children (aged four to five years) to the novel foods of sweetened, salted or plain tofu (Sullivan & Birch, 1990). Children were assigned to one of the three food types for repeated exposure. However, preference was measured for all foods before, during and after the nine-week experimental period. Each child tasted a sample of the foods from individual cups, and indicated their preference by placing the cup in front of one of three faces - a smiling face to indicate 'like'; a neutral face to indicate 'just okay'; or the final face (expression not specified) to indicate 'dislike'. The results showed that preference for the assigned, repeated exposure food groups increased over the experimental period, confirming that the familiarity of the initially novel food had, through exposure (or experience), become more preferred (Sullivan & Birch, 1990). Experiential learning during childhood perhaps compensates for the declination of biological sweet preference over the life span, driving adults to still seek out energy dense foods. The fact that such adaptive mechanisms are no longer necessary in today's society where energy dense foods are readily available can go some way to explaining excessive sugar consumption from this perspective (Birch, 1999).

Further to environmental factors which affect children's food preferences and extend into adulthood are the influence of genetic variations in taste receptor genes

(Birch, 1999; Drewnowski, Henderson & Barratt-Fornell, 2001; Mennella et al., 2005). While a heightened sweet preference in childhood can be explained from an evolutionary perspective (e.g. Drewnowski, 1989; Mennella et al., 2005), the identification of genetic variations can account for individual differences which also influence food preference (Birch, 1999; Mennella et al., 2005). The TAS2R38 taste gene has been identified as a bitter taste receptor, allowing humans to taste bitter compounds such as phenylthiocarbamide (PTC) and propylthiouracil (PROP; Kim et al., 2003). The presence of allelic differences within this gene determines the specific genotype of an individual, and such differences have been shown to alter the strength of the ability to identify bitter tastes, as well as affecting preferences for sweet-tasting foods (Mennella et al., 2005). For example, within TAS2R38, although there are three allelic variant sites which indicate bitter sensitivity, the first of these (A49P) reliably predicts a change in the amino acid alanine (A) to proline (P) at position 49. The presence of either two of the same alleles (homozygous, i.e. AA or PP) or two different alleles (heterozygous, i.e. AP) then indicates the strength of ability in bitter taste perception. Thus, individuals can be grouped according to this allelic difference as either AA (homozygous for bitter insensitive, i.e. not bitter sensitive/non-taster); AP (heterozygous for bitter insensitive, i.e. bitter sensitive/medium-taster); or PP (homozygous for bitter sensitive, i.e. bitter sensitive/super-taster; Mennella et al., 2005).

Phenotypic behaviours are the physical expressions or observable characteristics of an individual which result from the interaction of a given genotype with the environment (Birch, 1999). Phenotypic differences between adult and child sensitivity to PROP have been identified in that more children are sensitive to the lowest concentration of PROP presented in a forced-choice procedure compared to their mothers (Mennella et al., 2005). This can again be explained from an evolutionary perspective given that bitter tastes are often associated with toxins, and this heightened sensitivity therefore serves to protect children from ingesting poisons before they have learnt to identify such foods (Mennella et al., 2005). In terms of sensitivity to bitter tastes affecting sweet food preferences, Mennella et al. (2005) found that AP and PP children preferred significantly higher concentrations of sucrose solutions in a forced-choice procedure, compared to AA children; and also that they were more likely to include fizzy drinks and cereals higher in sugar when asked which beverage/cereal they most preferred. Thus, phenotypic differences as observable characteristics are influenced by the children's genotype (Mennella et al., 2005).

Given that children of today face the probability of widespread obesity and other related diseases, the implications of such interactions have the potential to assist in overcoming related health problems by informing future health interventions (Mennella et al., 2005). However, conflicting results in similar studies involving both adults and children have highlighted the need for further investigation in this area. For example, Looy and Weingarten (1992) found that compared to PROP non-tasters, both adult and child PROP tasters were more likely to be sweet non-likers; and a study based on children's daily food intake reports identified no relationship between PROP status and sweet food intake (O'Brien, Feeney, Scannell, Markey & Gibney, 2013). Given these discrepancies, Keller et al. (2014) incorporated observable behaviour in a controlled laboratory test meal for young children aged 4 to 6 years in order to resolve such inconsistencies. Food offered to the children included sweet snacks (e.g. gummy candies), sweet-fat snacks (e.g. chocolate chip cookies) and savoury-fat snacks (e.g. chicken nuggets). As hypothesised, those children who were phenotypically PROP tasters consumed significantly more sweet snacks than those children who were phenotypically PROP non-tasters. However, the TAS2R38 genotype did not significantly impact the consumption of any of the snack food groups (Keller et al., 2014). While the reason for this was not postulated, the apparent inconsistencies between genotypic and phenotypic markers perhaps highlights important subtleties involved in the role of such sensory measures. For example, rather than relying solely on genetic variability, the way in which environmental and experiential factors react with genetic predispositions have been proposed as being equally important when accounting for food preferences (Birch, 1999). Further to this is the observation that sensory research remains restricted due to limited methodological progress and repetition within the field (Köster, 2009). The application of psychological insight has been suggested in order to expand understanding of the complexities associated with food choice in general (Köster, 2009). In terms of the link between excessive sugar consumption and obesity (e.g. Bray & Popkin, 2014; Ludwig et al., 2001; Malik et al., 2013), it is posited that this application would also assist in understanding psychological factors influencing the specific area of maladaptive sweet food choice.

1.3 Psychology and sweet preference

The central focus of psychology as a discipline is the study of human behaviour (Köster, 2009). Given that eating and drinking remain fundamental to human existence and are therefore one of the most necessary as well as frequent behaviours (Sobal & Bisogni, 2009), relatively little research has been collected in this area from a psychological point of view (Köster, 2009). Much more research has been carried out in the context of sensory analysis, i.e. responses to the sensory properties of food and drinks (e.g. Mennella et al., 2005), which has mainly incorporated psychological ideas from areas such as psychophysics - the relationship between physical stimuli and the sensations they produce. Such psychophysical ideas are predominantly based on the theory that human behaviour is under conscious, rational control (Köster, 2009). When compared to the much larger volume of sensory research, the 'gap' or lack of investigation concerning eating behaviours from a psychological perspective can perhaps be accounted for by the proliferation of novel ideas stemming from social psychology at this time (Köster, 2009). This relatively new psychological research centred on the idea that human behaviour is *not* wholly under conscious, rational control, but also governed by non-conscious, implicit mental processes, of which people are not aware (Dehaene, 2008). Of particular relevance is the application of this psychological insight concerning the mostly automatic or unconscious nature under which the majority of our *decisions* are also made (Köster, 2009). While noted as being particularly important in understanding eating behaviours, to date this has seemingly been overlooked in the context of food choice (Köster, 2009). Although sensory research has therefore contributed to understanding the psychophysical attributes of food, and psychological research has contributed to much deeper understanding of human behaviour in general, the two approaches have been observed relatively recently as remaining conceptually distinct (Köster, 2009). In the context of food choice, the opportunity to apply psychological insight concerning the way in which choices and decisions are generally made will therefore perhaps help in deepening our understanding of how food-related decisions concerning specific foods (such as sugar) are constructed.

An influx of interest concerning automatic processes suddenly began influencing aspects of social psychology such as judgment and decision making (JDM) from the latter half of the 20th century. Although this interest can arguably be traced back as far as Freud and his work around the unconscious mind (e.g. Bargh & Morsella, 2008), the way in which these central ideas have shaped social psychology can nevertheless be viewed as relatively recent (Payne & Gawronski, 2010). This can be demonstrated within health psychology (as a relevant example in terms of this review), which, as a general discipline, also finds its roots in aspects of social psychology predating the inclusion of automatic processes to explain health behaviours (Wiers et al., 2010). Models of health such as the theory of reasoned action and planned behaviour (Ajzen, 1985; Fishbein & Ajzen, 1975) are examples of these more traditional models, the main constructs of which have subsequently been expanded upon and applied in understanding health behaviours (e.g. Rogers, 1975; Rosenstock, 1974). These early examples all assumed that health behaviours were a direct result of cognitive appraisals or subjective interpretations concerning the expectancy and value of potential health threats, coupled with prospective coping strategies in response to these threats (e.g. Rosenstock, 1974). In the broad context of the current review chapter, i.e. obesity, cognitive appraisals concerning weight gain could be viewed as potentially leading to the formation of behavioural intentions (e.g. to reduce food consumption) in order to avoid that health threat (e.g. obesity), through adopting a health protecting behaviour (e.g. dieting). From this early perspective, both the cognitive appraisals and ensuing behavioural decisions were generally interpreted as being conscious, intentional acts, and therefore such health behaviour models (or reasoned action models) relate to conscious, reflective processes through which health behaviours are regulated (Wiers et al., 2010). Subsequent criticisms concerning the low predictive validity of these more traditional models of health have highlighted the limited application of these purely singular processes as well as noting the omission of other potential influences on health behaviours, e.g. less reasoned and conscious pathways, such as habit, impulse and emotion (e.g. Conner & Sparks, 2002; Köster, 2009). For example, habits (as automatic responses to environmental cues which have become habitual over time; Triandis, 1977) can account for the gap between forming conscious intentions to behave in a certain way (goal setting), and subsequent failure to do so (Sheeran, 2002). Essentially, behaviours performed many times in stable contexts become increasingly automatic and recurrent, i.e. habitual, whereas behaviours performed fewer times in unstable contexts remain more conscious and reasoned (Ouellette & Wood, 1998). Thus, the best intentions to adopt a new health behaviour are overridden by the automaticity of more familiar and therefore persistent habits.

Several models of health account for psychological processes which are necessary in order to bridge this gap from intention to behaviour (e.g. Schwarzer, 1992; Weinstein, 1988). For example, self-efficacy i.e. a person’s belief in their ability to carry out a given behaviour in order to achieve a specific goal (Bandura, 1986). Again, however, self-efficacy relies on conscious, reasoned thought processes (Bandura, 1993), and therefore does not take automatic, implicit processes into consideration. As habits are difficult to control, they consequently ‘override’ intention due to the mental representation of the habitual behaviour being directly elicited within a given context (Bargh, 1990). Failure to consider the role of habitual behaviour within reasoned action models has therefore led to further criticism of such models by offering the convincing argument that past behaviour, i.e. as an indicator of habit, rather than intentional goal setting, is a better predictor of future behaviour (Köster, 2009; Ouellette & Wood, 1998). This has been previously demonstrated in terms of problematic behaviours such as binge eating and smoking (e.g. Stacy, Bentler & Flay, 1994).

Such observations concerning the role of automatic influences (such as habit), as well as conscious and reflective processes in health behaviours, then led to the expansion of reasoned action models of health from the perspective of social psychology (Wiers et al., 2010). These expansions take account of these less reasoned and more impulsive influences which also affect behaviour, by drawing on the recognition that the human mind operates from two distinct processes or systems. Such dual-system approaches have been applied to a broad spectrum of psychological research; for example, within the areas of social judgment, decision making, and reasoning. Here, Process or System 1 is generally characterised as being fast, automatic and nonconscious, i.e. implicit; and Process or System 2 is generally characterised as being slow, controlled and conscious, i.e. explicit (Frankish & Evans, 2009). In terms of decision making specifically, it is noted that more traditional theories have been primarily based on the controlled and conscious processing component (Lerner et al., 2015; Lichtenstein & Slovic, 2006) with the role of more automatic influences such as feelings and emotions only considered relatively recently (Lerner et al., 2015; Peters, 2009). However, researchers primarily interested in emotion (e.g. Epstein, 1993; Zajonc, 1980) have long since positioned affect as the dominant driver of the fast, automatic processes associated with System 1, conceptualising this system as being primarily affective (and working in parallel with the more rational processes associated with System 2). Extending this affective theoretical stance, Berkowitz (1993) postulated that affect in itself can be conceptualised as being both lower-order, i.e. resulting from more automatic/implicit processes, and higher-order, i.e. resulting from more conscious/explicit processes usually associated with rational thought and reasoning. Only later did decision researchers from a more reasoned and rational standpoint acknowledge that the cognitive operations involved in System 1 are often emotionally charged, and as they are also ruled by habit, difficult to override or control (e.g. Kahneman, 2003).

Affect, referring broadly to mental states that involve evaluative feelings relating to personal experience (Gray & Watson, 2007), is widely established as being dominated by the relatively independent constructs of positive and negative affect (e.g. Watson, 1988; Watson & Tellegen, 1985). While the terms 'positive affect' and 'negative affect' might intuitively suggest that these factors are opposing constructs (i.e. negatively correlated), each term is in fact independent and therefore fundamentally not correlated with the other (Watson, Clark & Tellegen, 1988; Watson & Tellegen, 1985). That is to say, a person experiencing high positive affect will not usually experience concurrent low negative affect, or vice versa (Watson & Clark, 1984). Instead, as each separate dimension runs from high to low (i.e. high to low positive affect and high to low negative affect), an experience at the high end of a given affective dimension will tend to simultaneously correlate highly negatively with the low end of that same affective dimension (Watson & Tellegen, 1985). For example, positive affect (PA) concerns the extent of being pleasurably engaged with the environment (Watson & Tellegen, 1985). High PA therefore relates to higher levels of positive engagement and can be described using terms such as joy and excitement; whereas low PA conversely relates to lower levels or an absence of positive engagement and is better described in terms of lethargy or depression (Watson, 1988; Watson, 2002). Conversely, negative affect (NA) concerns general subjective distress (Watson, 1988; Watson & Pennebaker, 1989; Watson & Tellegen, 1985). High NA points to higher levels of negative engagement such as strong feelings of anger or disgust; whereas low NA relates to an absence of distress and is therefore associated with feelings of being calm and relaxed (Watson & Tellegen, 1985). These internal feeling states can be experienced with or without conscious awareness, ultimately allowing an individual to specifically identify a stimulus or situation along a valence scale of either 'goodness' or 'badness' (Slovic, Finnucane, Peters & MacGregor, 2002; Västfjäll et al., 2016).

Affect is now also accepted as being the broad term encompassing feelings, emotions and mood, given agreement concerning the shared similarities between these constructs (Lerner et al., 2015). That is to say, emotions and moods share similarities in that both refer to feeling states that can be generally categorised as being either positive or negative and represent how pleasant or unpleasant an individual perceives such internal feeling states (Gray & Watson, 2007). While mood and emotion are similar in that they are both subjective experiences, there are, however, differences between these two constructs. Moods tend to be much broader than emotions, lasting longer (e.g. hours or even days) and with less fluctuation; whereas genuine emotional reactions happen much less often, generating an intense but much shorter experience (e.g. seconds or minutes; Gray & Watson, 2007).

Whereas a specific event or experience will trigger an emotional reaction, a mood is not so much caused by a reaction to a specific event but rather provides a continual background summary of a person's internal feeling state, descriptively termed 'the stream of affect' by Watson (2000). The example of anxiety would therefore describe a mood, whereas fear illustrates a more intense emotional response (Gray & Watson, 2007). Despite these differences between emotion and mood, their shared similarities, which are widely agreed upon as also being under the control of similar processes, have often led to research investigating both constructs together under the more general 'umbrella' term of affect (Lerner et al., 2015). However, the continued plethora of definitions specifically concerning emotion highlight ongoing differences surrounding a formal set of criteria for what constitutes and what does not constitute an emotion (Russell, 2003). For example, Lazarus (1991) states that emotions are simply organised psychophysiological reactions to environmental stimuli; whereas Ekman (1992) acknowledges their adaptive and evolutionary nature. According to Russell (2003) the lay concept of emotion simply allows the categorization of feelings combining pleasure/displeasure and level of arousal using words which are now widely understood in everyday terms, e.g. 'fear' or 'anger'; whereas Lerner et al. (2015), state that emotions are "multifaceted, biologically mediated, concomitant reactions (experiential, cognitive, behavioural, expressive) regarding survival-relevant events" (p.800). Further debate abounds over which emotions are primary or basic, i.e. innate (or inborn) and genetically coded in our nervous systems, and which emotions are secondary, i.e. a product of other emotions (Keltner & Lerner, 2010). Certainly, the argument that emotions per se are not the sole expression of emotional or affective experience (Keltner & Lerner, 2010) seems to capture what has previously been described as the “puzzling” nature concerning the definition of emotion (Russell, 2003, p.145).

Despite such differences in definitions surrounding emotion, it is now widely accepted that affective experiences, both positive and negative (Russell, 2003), can be studied or analysed at four distinct levels (e.g. Kahneman, 1999), only one of which - *emotions* - might be described as the universally understood or accepted concept of emotion. *Emotional traits,* as the broadest level of affective experience, encompass general types of emotional reactions that maintain relative stability over time and context (Larsen & Ketelaar, 1989; Shiota, Keltner & John, 2006). For example, people who report consistent trait-like responses to specific emotions have a subjective, demonstrative and biological profile that reflects these emotions in the same manner (Gross, Sutton & Ketelaar, 1998). *Moods* fall under the second level of analysis and, compared to *emotions* (at the third level), are broader and less specific, last longer and are not constrained by the situational context (Watson & Tellegen, 1985). To use the example previously mentioned, ‘anxiety’ as a mood state would not necessarily be in response to or defined by a specific cause; whereas the emotion ‘fear’ is more likely to be as a direct result of a specific context or event and will be a shorter experience (Gray & Watson, 2007). The final (and most specific) level of analysis concerns *sensory experiences* such as pleasure or pain (Kahneman, 1999). The temporal dynamics that these sensory experiences are likely to consist of can then turn into emotional experiences (Fredrickson & Kahneman, 1993). For example, Rozin (1996) uses the illustration of how the emotion “disgust” followed the sensory experience of “distaste”: initially a way of protecting the body from harm, but ultimately evolving “to a system to protect the soul from harm” (Rozin, 1996, p.21) -

i.e. the feelings that are experienced in response to behaviours considered emotionally distasteful (Keltner & Lerner, 2010). Further to these four levels, the component of subjective experience, i.e. on an individual level, is also noted as being paramount in defining the experience of emotion, albeit one that is acknowledged as needing deeper development (Barrett, Mesquita, Ochsner & Gross, 2007; Keltner & Lerner, 2010).

In terms of emotions influencing health behaviours, Kiviniemei, Voss-Humke and Seifert (2007) incorporated affective associations (defined as feelings associated with a given behaviour) with cognitive constructs from more traditional models of health such as the health belief model (e.g. Rosenstock, 1974) and the theory of planned behaviour (e.g. Ajzen, 1985).The behavioural affective associations model (Kiviniemi et al., 2007) demonstrates that the effects of cognitive beliefs concerning a health behaviour (in this case physical exercise) are mediated through positive affective associations (i.e. positive feelings) concerning that behaviour. That is, when deciding whether or not to engage in a health behaviour, positive affective associations as well as cognitively based beliefs play a central role in that process (Kiviniemi et al., 2007). Previous theories relating affect or feelings to decision making have put forward the idea that affective associations can act as ‘cognitive shorthand,’ which allow decisions to be made both more quickly and more efficiently (e.g. Damasio, 1994; Schwarz & Clore, 1983). In this sense, Kiviniemi et al. (2007) incorporate affect as a less reasoned pathway and a more ‘cost effective’ method of making health behaviour decisions concerning exercise. With the results finding that as positive affective associations increased (i.e. positive feelings concerning exercise), reports of performing that behaviour also increased, this is one example of a less reasoned process influencing health behaviours in a beneficial way (Kiviniemi et al., 2007). However, it is noted that affective associations might not always have such positive outcomes in that they might not necessarily lead to healthy behavioural decisions. For example (and with explicit reference to the subject of this review), the positive affect associated with eating high sugar foods could potentially influence more reasoned and conscious processes, thus causing more negative and maladaptive health behaviours such as the overconsumption of such foods (Kiviniemi et al., 2007). Further to this is that while Kiviniemi et al. (2007) conceptualise affective associations as less reasoned influences on health behaviours, the failure to expressly define affect as an implicit process but simply as a ‘feeling’ perhaps weakens the overall validity of this model from a dual process perspective.

Following Berkowitz (who theorised that affect can be both lower- and higher-order; 1993), Shiv and Fedorikhin (1999) incorporated the influence of affect in a choice task expressly designed to demonstrate how affect as both automatic, i.e. lower-order, and conscious, i.e. higher-order, can influence decision-making depending on whether processing resources are either high or low, via manipulation of cognitive load. In this study, affect was induced by the task itself rather than an affective state such as a positive or negative mood (Shiv & Fedorikhin, 1999). Participants either memorised a two-digit number (low cognitive load leaving high processing resources available) or a seven-digit number (high cognitive load leaving low processing resources available). They then chose between one alternative associated with higher positive affect but cognitions associated with less favourable consequences (chocolate cake), and a second alternative associated with lower positive affect but cognitions associated with more favourable consequences than the first choice (fruit salad). As hypothesised, the results showed that choices are more likely to be based on implicit task-induced affect when processing resources are low, i.e. restricted, and more likely to be based on cognitions when processing resources are high, i.e. available (Shiv & Fedorikhin, 1999). That is, when processing resources are low, the implicit, positive affective associations with choosing the chocolate cake influenced more conscious and reasoned affective associations which might otherwise have resulted in choosing the fruit salad. While this therefore demonstrates positive, task-induced affect influencing eating behaviours in a potentially maladaptive way, implications concerning impulse and self-control are also noted (Shiv & Fedorikhin, 1999). With reference to dual-system models of behaviour, impulse has been defined as an automatic, implicit process whereas self-control has been defined as a conscious, explicit process (Hofmann, Friese & Strack, 2009). As explicit processes (such as self-control) are restricted with increased cognitive load, implicit processes therefore become more available, leading to decision-making driven by impulse as well as task-induced affect (Shiv & Fedorikhin, 1999). This implies that anything restricting cognitive processing resources is likely to increase affective, impulsive choices, such as choosing chocolate cake over fruit salad (Shiv & Fedorikhin, 1999). Stress, for example, affects the ability to reason (Arnsten, 2015), and an increase in consumption of high-fat, sweet foods has been identified as a way of managing periods of acute, emotional stress (e.g. Oliver, Wardle & Gibson, 2000). The propensity to eat palatable food in order to cope with worries, problems and negative moods has also been linked to higher body mass index (BMI; e.g. Burgess, Turan, Lokken, Morse & Boggiano, 2014), as well as an increased likelihood to engage in unhealthy snacking (Reaves et al., 2019) and binge-eating (e.g. Boggiano et al., 2014). Given the prevalence of psychological stress in modern society, (Kudielka & Wüst, 2010), this perhaps illustrates a long-term implication of impulse control breakdown in terms of sweet food choice and obesity.

Directly acknowledging the influence of affect in the context of impulse and self-control, Metcalfe and Mischel (1999) expanded upon the dual-process explanation of behaviour (e.g. Frankish & Evans, 2009) by proposing a Hot/Cool system framework to account for important functional differences between affective and cognitive processes. The 'hot' system encompassing affective or emotional processes can be likened to Process 1, i.e. automatic, fast and implicit; whereas the 'cool' system encompassing cognitive processes can be likened to Process 2, i.e. deliberative, slow and explicit (Metcalfe & Mischel, 1999). Whereas the cool system is governed by knowledge resulting in a continual, coherent narrative; the hot system incorporates the affective or 'feelings' aspect and is largely under stimulus control (i.e. the exposure to a stimulus increasing the probability of a behaviour occurring). Again referring to the current review, given that the 'problem' of stimulus control is central to self-regulatory behaviours, the way in which the hot, emotional system as a driver of impulses interacts with the cool, cognitive system as a driver of self-regulation is crucial in understanding such behaviours (Metcalfe & Mischel, 1999).

The reflective-impulsive model (RIM; Strack & Deutsch, 2004) is another example of a dual-system model of behaviour which incorporates less reasoned processes previously mentioned, e.g. habit, affect and impulse. The impulsive system (IS), elicits behaviour through associative links, i.e. automatic processes similar to Process 1; whereas the reflective system (RS) generates behavioural decisions based on knowledge, i.e. conscious thought similar to Process 2. However, rather than relying on distinct, domain-specific regularities such as affect, as suggested by previous dual-process models (e.g. Kiviniemi et al., 2007) the RS and the IS work *interactively* to determine behaviour (Deutsch & Strack, 2006). Both systems are influenced by the other in several ways, depending on different representations and computations in which each serve different purposes and require different conditions for optimal functioning (Deutsch & Strack, 2006).

Within the IS, the spread of activation from perceptual stimulation to behavioural schemata (habit-like, procedural memories) is based on previous learning. Like the observations concerning habit (Ouellette & Wood, 1998), these associative links therefore change slowly and gradually, eventually forming clusters which vary in their ease of access according to the frequency of their activation. These clusters can be activated simultaneously, the cluster with the strongest activation consequently translating into behaviour. There is also an affective element of the IS, and activation of such affective representations (which are a product of learning) will induce either positive or negative feelings, as well as arousal. These feelings induce either approach behaviours (from positive affect) or avoidance behaviours (from negative affect). In terms of fundamental needs such as nutrition (e.g. food) or hydration (e.g. water), deprivation of a need will activate the habit or behavioural schemata which previously resolved the deprivation state. Therefore, when deprived, e.g. hungry, the relevant stimulus, e.g. food, is more easily detected, and affective representations in the IS will induce approach behaviours. The IS cannot, however, produce conscious propositional judgments and decisions that are required in higher order cognitive capabilities (Hummel & Holyoak, 2003). It is also incapable of incorporating abstract concepts such as time; and it cannot produce plans of action which have not been executed previously. Responses to a situation lack metacognition or conscious thought and are therefore quick and immediate (Deutsch & Strack, 2006).

Compared to the IS, the processing capacity of the RS is limited and dependent on intentions which it can generate alongside new action plans, judgments and decisions to result in behaviour. The RS can also overcome habitual responses (such as those generated in the IS), through higher order cognitive capabilities which activate the appropriate behavioural schemata in the IS. Such RS processes are based on symbolic representations, or metarepresentations, of the concepts stored in the IS, which, if continually rehearsed during operation, activate the corresponding IS concepts. However, in contrast to the IS, where the activation of a behavioural schemata merely depends on previous associations and their strength, within the RS the same stimulus can generate very different processes. These are dependent on intentions, processing capabilities and constraints, which, in turn, are dependent on the specific situation. While allowing greater flexibility, the RS also operates more slowly and can be easily distracted or interrupted by other processes. Drawing on reasoned action models such as the theory of reasoned action (Fishbein & Ajzen, 1975), the RS influences behaviour through decision making processes relating to the desirability and feasibility of a given action. If a behavioural decision is made, activation by the RS of the corresponding behavioural schemata in the IS results in plainly apparent behaviour, with intention bridging the gap between the decision to be made and subsequent appropriate actions (Deutsch & Strack, 2006). According to the RIM, therefore, it is the interaction of the IS and RS which ultimately dictates behaviour (Strack & Deutsch, 2004). The conflict which can arise as a result of each system's influence upon the other when presented with relevant stimuli has recently become the focus specifically within the study of health behaviours (Hofmann et al., 2009; Wiers et al., 2010). As noted in criticisms of reasoned-action models of health (e.g. Conner & Sparks, 2002), it is the omission of this impulsive element which explains the discrepancy between forming a behavioural intention to adopt a health behaviour and subsequently failing to implement this decision (Wiers et al., 2010).

Wiers et al. (2010) offer a direct example of the integration and application of a dual-system model of social behaviour in an attempt to bridge the gap between these limitations of more traditional models of health, thereby explaining individual differences (IDs) specific to health behaviours. Within this dual-system model, as well as the interaction of reflective and impulsive (or associative) processes, two other variables are offered as being fundamental in predicting health behaviours: personality differences, and the relevance of the given health-behaviour situation (Wiers et al., 2010). Whereas situational factors potentially bias a person's information processing more towards either reflective or impulsive processes, general differences in personality which influence certain health behaviours can be thought of as relatively stable IDs within both reflective and impulsive processes. Impulsive processes often (but not always) orientate a person towards 'approach' reactions, and reflective processes often (but not always) orient a person towards 'avoidance' reactions. Therefore, being of a naturally impulsive disposition will influence the interaction of reflective or impulsive processes in a different manner to someone who is naturally more cautious (Wiers et al., 2010). Further to this, and similar to the RIM (Strack & Deutsch, 2004), Wiers et al. (2010) propose that, in many health behaviours, a conflict occurs between the associative (impulsive) processes (leading to approach behaviours) and the reflective processes (leading to avoidance behaviours). This conflict is demonstrated when reflective processes become necessary to ‘approach’ a health behaviour (e.g. the conscious decision to diet and lose weight), but are overridden by associative processes which can trigger ‘avoidance’ behaviours (e.g. the impulse to eat to prevent hunger; Wiers et al., 2010).

With particular reference to the subject of this review comes the further observation that humans are capable of planned behaviour but also act impulsively (Hofmann et al., 2009). This is particularly apparent in tempting situations (Hofmann et al., 2009), to which the presence of sweet foods can be reasonably included. Again, therefore, conflict arises between the incompatible influences of conscious self-control and impulse. This has led to the observation that previously, within the framework of temptation, much research has focused on the self-control aspect of these two influences; and from this, the proposition that impulse should therefore be considered in a more equal manner in order to understand human decision making specifically in terms of temptation (Hofmann et al., 2009). Expanding upon the RIM (Strack & Deutsch, 2004), Hofmann et al. (2009) offer a dual-process framework specific to self-control and impulse, with the express purpose of predicting self-control outcomes more accurately. Like Wiers et al. (2010), situational and dispositional (i.e. personality) boundary conditions are included as a single element which must be considered together with impulsive and reflective precursors of behaviour (Hofmann et al., 2009). The RIM assumes that the RS and IS interact during the activation of behavioural schema (or schemata) with the behavioural outcome dependent on the strength of the competing schema (Strack & Deutsch, 2004). In terms of impulse vs.

self-control, however, the different operating characteristics of the two systems are heavily influenced by situational/dispositional boundary conditions, the strength of which will again influence one system more strongly than the other to determine behavioural decisions (Hofmann et al., 2009).

To summarise this section, understanding the way in which the human mind operates has been revolutionised through psychological insight concerning non-conscious as well as conscious thought processes (e.g. Hofmann et al., 2009; Strack & Deutsch, 2004; Wiers et al., 2010). Such insight has been applied in terms of automatic influences on health behaviours such as exercise (e.g. affective associations; Kiviniemi et al., 2007) and specifically in terms of sweet food choices (e.g. Shiv & Fedorikhin, 1999). It is posited, however, that while expanding our understanding of *how* the human mind operates, with reference to food preference as a choice of one item over another (Birch, 1999), the question of *why* such decisions are made remains largely unanswered from this perspective. Once again, the inclusion of insight from other areas has the potential to increase our understanding of human behaviour, specifically in terms of why sweet food choices are made.

1.4 Judgment and decision making, affect and preference

It has been noted that food choices and eating behaviours are intrinsically linked with cognitive processes concerned with judgment and decision making (JDM; Peters, 2009), which, in turn, are intrinsically linked with the construction of preference (Peters, 2009; Slovic, 1995). Essentially, preference construction can be considered at the heart of decision making; and current theories of decision making can therefore be considered theories of preference construction (Lichtenstein & Slovic, 2006). Following the generation of early, prolific work centred on choices and decisions concerning risky prospects in the guise of simple bets (Lichtenstein & Slovic, 1971; 1973), this view linking preference and JDM has subsequently received much attention (see Lichtenstein & Slovic, 2006). A central concept within preference construction is the idea that preferences are not truly ‘known’ but are actually constructed through a process of elicitation (or are drawn forth) based on external and internal cues dependent on the given context (Peters, 2009; Slovic, 1995). This relatively recent stance within the study of JDM has altered the thinking concerned with preference measurement from that of an archaeological perspective, i.e. revealing existing preferences, to that of an architectural perspective, i.e. building or constructing preferences (Slovic, 1995). Within the psychology of food choice (and particularly in terms of maladaptive food choice), therefore, the major theme of preference construction must be considered (Peters, 2009).

Many preferences are, of course, constructed throughout life and experience, becoming well-established and easily available in memory when choices arise (Lichtenstein & Slovic, 2006). Such preferences can be more abstract and conceptual, e.g. ‘I aspire to be healthy’, and others can be more concrete and definite, e.g. ‘I hate spinach’ (Peters, 2009). The need for preference construction occurs when those well-established preferences restrict our ability to solve a given decision, perhaps through unfamiliarity or conflict. An example involving food choice can be illustrated by the conflict that arises between a learnt preference for wanting to eat healthily as opposed to unhealthily; and the learnt preference for chocolate as opposed to broccoli (Peters, 2009). When such conflicts arise, preferences are constructed in the moment based on available internal and external cues (Peters, 2009; Slovic, 1995). The processing of such cues in a situation of conflict can influence subsequent judgments and decisions, even in typically familiar circumstances. For example, Wansink[2], Painter and North (2005) provide evidence of momentary preference construction in a study designed to demonstrate the influence of visual food cues on actual consumption quantities. Participants who unknowingly ate soup from a purposefully designed ‘bottomless bowl’ consumed a greater quantity than those participants who ate soup from a conventional bowl. Further to this was the finding that those who had eaten from the ‘bottomless bowls’ did not indicate that they were aware of consuming significantly more soup, nor did they rate themselves as being significantly more sated than those who ate from the conventional bowls (Wansink et al., 2005). This unfamiliar situation in a familiar domain demonstrates the conflict leading to ‘on the spot’ preference construction. That is, when no longer being able to rely on the amount of soup remaining in the bowl as a visual aid to stop eating, the decision to continue eating is nevertheless influenced by this learnt reference point, which in this example led to overconsumption (Wansink et al., 2005).

A cognitive element is apparent when constructing preferences, and it is upon this deliberative and analytical component that more traditional theories of decision making have been based (Lerner et al., 2015; Lichtenstein & Slovic, 2006). However, more recent observations have concluded that decision making is not solely reliant on rational thinking or cognitive reasoning, with the influence of feelings and emotions

[2] It is acknowledged that several papers published by Brian Wansink were later retracted. However, to the best of this authors’ knowledge, all papers that appear in this thesis by the aforementioned were not among those to be retracted.

proposed as an equally important element involved in the process of constructing or building preferences (Lerner et al., 2015; Peters, 2009). This shift from a purely cognitive focus in such areas of psychology perhaps pre-empts the subsequent attention concerning affect (i.e. emotions and mood), which has quietly been gathering pace specifically within the psychology of judgment and decision making (Lerner et al., 2015). Acknowledging this shift, Finucane, Peters and Slovic (2003) use the phrase ‘the dance of affect and reason’ to highlight the way in which these two ostensibly paradoxical constructs interrelate; elsewhere the terms ‘affective rationality’ (Slovic, Finucane, Peters & MacGregor 2002a) and ‘affective algebra’ (Finucane et al., 2003) are used as descriptive idioms. Further to such recognition is the observation that the inclusion of affect within theoretical decision models now has the potential to create a paradigm shift within such theories (Lerner et al., 2015). Prior to this observation, although emotion and reason had both been identified as motivations of human behaviour, reason took precedence in terms of decision making research, in character with the rationalistic origins of the subject itself (Lichtenstein & Slovic, 2006; Slovic et al., 2002). In terms of resolving the conflicts which restrict our ability to make decisions, formal models or reason-based analyses were employed to explain subsequent choices (Shafir, Simonson & Tversky, 1993). The wealth of pioneering empirical evidence and subsequent theoretical models based on human rationality (e.g. Kahneman & Tversky, 1979) demonstrates the importance of this cognitive element. However, such evidence either fails to include an affective element, or its addition remains post-cognitive, i.e. stemming from prior cognitions or knowledge of a given stimulus (see Zajonc, 1980). Indeed, not only is it relatively recently that affect has been integrated within the study of judgments and decisions, but also that its influence may well preclude cognitions (Shafir et al., 1993; Slovic et al., 2002). For example, Shafir et al. (1993) recognised the role of affect when it was admitted that “People’s choices may *occasionally* stem from affective judgments that preclude a thorough evaluation of the options” (p.32, emphasis added). Such concessions are not completely novel: Zajonc (1980) had previously put forward the argument that affective reactions rather than cognitions are often the first to arise as a consequence of stimuli, going on to postulate that whereas affect always accompanies cognitions, the opposite is not invariably true of cognitions. And, from a neurobiological standpoint, Duncan and Barrett (2007) go so far as to say that cognition and affect are two sides of the same coin; and that “there is no such thing as a ‘non-affective thought’” (p. 1185).

Extending early examples acknowledging affect as a guiding influence of decision making (e.g. Shafir et al., 1993; Zajonc, 1980), the ‘affect heuristic’ demonstrates the application of affect specifically within the psychology of judgment and decision making (Slovic et al., 2002). The central tenet of this theoretical framework states that judgments and decisions are guided by positive and negative affective feelings (with or without consciousness), and thus affect is the cue upon which choices are made. Images or representations of objects and events become classified or identified with a measure of affect, or feelings concerning those objects or events. When making a subsequent judgment or decision, these affective ‘tags’ are referred to (whether consciously or unconsciously) and become cues for either approach or avoidance actions in order to reproduce the feelings associated with the original image. In this way, affect can serve as a mental shortcut for judgments and decisions, particularly when faced with complex choices, or low mental resources;

hence the use of the word ‘heuristic’ (Slovic et al., 2002). An example in the context of food choice might be demonstrated using the previously mentioned conflict between preferences e.g. aspiring to be healthy, but preferring chocolate over broccoli (Peters, 2009). The positive affect associated with eating chocolate could lead to approach behaviours which thus override the preference for eating healthily; or the negative affect associated with the memory of being coerced into eating vegetables at a young age could lead to avoidance behaviours, again overriding the preference for eating healthily. Further examples illustrating the influence of depleted mental resources come from the studies previously presented in which cognitive load was shown to lead to affect-driven rather than reasoned-based decision making in the context of chocolate cake and fruit salad (Shiv & Fedorikhin, 1999); and coping with worries, problems and negative moods (Reaves et al., 2019), as well as stress specifically (Oliver et al., 2000), were all associated with an increased consumption of palatable, unhealthy foods.

Two types of affect influence judgment and decision making: incidental affect, i.e. unrelated to a stimulus or decision (e.g. current or general mood), and integral affect, i.e. integral to a situation or as a direct result of a decision under consideration (e.g. stimulus evoked; Peters, 2006; Västfjäll et al., 2016). Both incidental and integral affect can be generally measured on a scale of ‘goodness’ and ‘badness’ (i.e. valence; Peters, 2009). This measurement as a subsequent emotional feeling or experience from both incidental and integral affect can impact information processing and thus, influence judgments and decisions in four distinct ways (Peters, 2006). Firstly, as well as influencing information processing, affect itself can also act as information (e.g. Schwarz & Clore, 1983). Feelings are considered at the time of decision making and the resulting feedback guides the subsequent judgment or choice to be made (Schwarz & Clore, 1983). Secondly, affect can take the role of a common currency, enabling us to weigh up the utility or worth involved in two very different decision choices (e.g. comparing apples with oranges, Cabanac, 1992). In this role (as an extension of acting simply as information, Peters, Västfjäll, Garling & Slovic, 2006), affect seems to convert the future outcomes linked with each choice element into a more easily interpretable internal "currency." Thus, rather than having to weigh up many logical yet contrasting values, the decision-making process is simplified through the integration of affective worth (Montague & Berns, 2002; Peters et al., 2006), making it a more effective process than without such considerations (Peters, 2006). Thirdly, affect can act as a 'spotlight' (Peters, 2006) in a two-part process: initially, the strength (weak/strong) as well as valence (good/bad) of an affective feeling focuses attention on new information. Rather than the original affective feeling then driving behaviour, the *new* information is instead used to make subsequent decisions (Peters, 2006; Västfjäll et al., 2016). And finally, affect can function as a motivator of behaviour (Peters, 2006). Environmental stimuli are automatically filed as being either positive or negative; positive stimuli then motivate approach tendencies, whereas negative stimuli then motivate avoidance tendencies (Chen & Bargh, 1999).

Existing research has reliably demonstrated the influence of incidental affect within many areas pertinent to JDM (Garg & Lerner, 2013). For example, attending to incidental affect/current mood (whether this is conceived as good or bad on a valence scale) has been shown to increase preferences for choices which are more likely to promote or protect a good mood (Caruso & Shafir, 2006). Without attending to mood, these choices may be susceptible to maintaining the internal affective state associated with the current (unattended to) mood. Caruso and Shafir (2006) demonstrate this in a series of studies in which participants who merely thought about being in a neutral/good/bad mood were more likely to choose a light-hearted comedic movie over a heavy drama, despite that choice being presented as the inferior option. Those who had not attended to mood were more likely to choose the heavy drama, which was interpreted as being due to the lack of mood salience. These findings led to the conclusion that attending to mood can influence decision making in a potentially sub-optimal way as the salience of the hedonic outcome of a given choice is increased (Caruso & Shafir, 2006). However, studies have demonstrated that actually inducing a positive or negative mood (rather than merely instructing subjects to attend to their current mood) can influence subsequent judgments by increasing the availability of mood-congruent thoughts (e.g. Kavanagh & Bower, 1985). Participants had positive and negative moods induced via the recall of successful or unsuccessful romantic encounters whilst in a hypnotic state. When asked to rate their perceived self-efficacy for a variety of activities such as social skills and athletic pursuits, the mood evoked affected all judgments in a congruent manner. Those in a positive mood rated their abilities as being significantly higher than those in a negative mood, demonstrating the generalisation of affective mood states in unrelated areas (Kavanagh & Bower, 1985).

It is posited that examples noted here, e.g. the affect heuristic (Slovic et al., 2002), attending to mood (Caruso & Shafir, 2006) and mood induction (Kavanagh & Bower, 1985), demonstrate ways in which judgments and decisions are directly influenced by positive and negative affect within the current literature. Despite this reliable evidence, the role of affect within JDM is still considered an emerging and very much ongoing area of research with the potential to create a paradigm shift within theoretical decision models (Lerner et al., 2015). As previously observed, food choices and eating behaviours are intrinsically linked with cognitive processes concerned with both judgment and decision making (Peters, 2009) and preference construction (Peters, 2006; Slovic, 1995). The opportunity to therefore further clarify the way in which affect influences judgment and decision making in the context of food-related choices has the potential to strengthen research in this relatively new area (Peters, 2009). Drawing as well on conclusions from a sensory perspective that suggest emphasis should be placed on research involving observations of actual food-choice rather than relying solely on question and answer methodology (Köster, 2009), the following three chapters presented in this thesis (Chapters 2, 3 and 4) describe a series of studies that incorporated the following elements: the presentation of choices concerning sweet food (i.e. preference construction in the context of sugar), and the induction of positive and negative incidental affect via a mood induction task (MIT; Robinson, Grillon & Sahakian, 2012; i.e. the influence of affect unrelated to a stimulus or decision). Dual process frameworks incorporating impulse and self-control provided the underlying foundation upon which these studies were based (e.g. Hofmann et al., 2009; Metcalfe & Mischel, 1999; Strack & Deutsch, 2004). It is posited that the opportunity to explore the role of affect in the context of impulsive, sweet food decision making will allow clarification and further understanding of factors potentially driving sugar consumption from the psychological perspective of judgment and decision making, ultimately going some way towards answering the question: ‘Why do we choose sugar?’.

2. Study 1: Laboratory-induced positive and negative incidental moods and delay of gratification (DoG) on impulsive, sweet food choice

2.1 Overview

Excessive sugar consumption has been notably identified as a major factor involved in the development and continuation of obesity (Lancet, 2015; Malik et al., 2013; Te Morenga et al., 2013). While studies have identified a strong, positive association between sugar intake and weight gain (e.g. Schulze et al, 2004; Te Morenga et al., 2013), there is a paucity of research specifically investigating causal mechanisms between these two constructs (Stanhope, 2016). This is perhaps explained by the noted difficulty of establishing both psychological and physiological determining factors behind this relationship (Lean et al., 2018). Following a review of relevant literature (see Chapter 1), this chapter therefore sought to develop a suitable methodology to investigate psychological mechanisms potentially driving sugar consumption. Specifically, this incorporated the under-researched area of emotion/mood within the psychology of judgment and decision making (JDM; Lerner et al., 2015). A mood induction task (MIT; Robinson et al., 2012) was used to assess the influence of positive and negative incidental mood (i.e. mood incidental to a stimulus) on decisions concerning chocolate (as a commonly craved sweet food) vs. non-food/neutral items. The delay of gratification paradigm (DoG; Mischel, 1974) was also included in order to assess the influence of manipulated positive and negative incidental mood on impulsive decisions concerning chocolate vs. non-food/neutral items.

2.2 Introduction

The way in which food related choices and decisions are made has been linked with the cognitive processes concerned with the psychology of judgment and decision making (JDM; Peters, 2009). These processes have also been linked with preference (as the choice of one item over another; Birch, 1999; Slovic, 1995) in that the preferences a person holds will reflect their subsequent choices or decisions (Peters, 2009). Preferences have also therefore been correspondingly linked with eating behaviours (Peters, 2009). Whereas historically JDM research has focused primarily on deliberative, rational and cognitive processes (Peters et al., 2006), more recent views regarding both JDM and the way in which preferences are built or constructed also include emotional processing of information as an influence (Peters, 2006; Peters, 2009; Peters et al., 2006). This dual approach stems from research within social and cognitive psychology in which two modes of thinking govern human thought and behaviour: the first being analytic and reason oriented; and the second being experiential and feeling-based (Slovic et al., 2002). As well as the link with JDM/preference, the experiences of emotions and mood have also been identified as specifically influencing overeating; and consequently obesity (Evers, Adriaanse, de Ridder & de Witt Huberts, 2013; Singh, 2014). In terms of the relationship that has been identified between sugar consumption and the obesity pandemic (Lancet, 2015; Malik et al., 2013; Te Morenga et al., 2013), understanding the way in which JDM, preference and emotion interrelate in this context is timely and important.

While the food that we eat can influence our moods (Christensen & Brooks, 2006), this relationship is not unidirectional but bidirectional, meaning that our mood can also influence our food choices (Christensen & Brooks, 2006; Lyman, 1989). In terms of negative moods, for example, meta-analyses have confirmed a link between obesity and a higher risk of developing depression, which in turn, has been linked to increased weight gain (e.g. Luppino et al., 2010). Christensen (2001) postulates that the relationship between mood and food is cyclical, perhaps reinforcing the link between emotions influencing overeating, and consequently obesity (e.g. Evers at al., 2013; Singh, 2014). For example, symptoms of emotional distress can lead to the craving and consumption of sweet and fat carbohydrate-rich snack foods such as confectionary, ice cream and cake (Christensen & Brooks, 2006). Such foods can be collectively termed as being 'hedonic' in that they tend to be perceived as being low in terms of health but high in terms of mood-altering properties (Garg, Wansink & Inman, 2007). For example, on a hedonic scale that included the statements "lifts me up when I am down" and "are pleasurable", buttered popcorn and M&M's were rated more highly than a cereal bar and raisins (Garg et al., 2007). From a psychophysiological perspective, the way in which an increase of carbohydrate appears to influence mood seems primarily due to the palatable qualities of such foods leading to a release of endorphins which are in fact responsible for the subsequent elevation in mood (Benton & Donohoe, 1999). Accounts from those suffering with seasonal affective disorder (SAD; Rosenthal et al., 1984) and some depressed individuals seem to support this view, as such groups report cravings for foods rich in sugar and fat because of the subsequent improvement in mood following consumption (Christensen, 2001). The reciprocal relationship between food and mood is further corroborated by the observation that the ameliorating effects of such palatable snacks are only temporary, meaning that the negative mood state returns and the cycle of craving followed by seeking out carbohydrate-rich foods continues (Christensen, 2001).

The influence of food cravings and consumption on moods has also been noted in non-clinical populations. Hill and Heaton-Brown (1994) investigated prospective food cravings in healthy, non-clinical females and found that foods containing chocolate were the most commonly craved (i.e. confectionary, cakes and puddings containing chocolate; 49 per cent); followed by ‘something sweet’ (16 per cent); and savoury foods (i.e. crisps and pizzas; 12 per cent). A version of the UWIST Mood Adjective Checklist (UMACL; Matthews, Jones & Chamberlain, 1990) was included, which records pre- and post-craving moods including hedonic tone (contentment/happiness) and tense arousal (anxiety/tension). Consistent with the probability of cravings leading to consumption, hunger motivation (the drive to consume food) significantly decreased across all food types; post-tense arousal (anxiety/tension) significantly decreased for chocolate and other sweet foods; and post-hedonic tone (contentment/happiness ratings) significantly increased for foods containing chocolate and other sweet foods. In other words, following the consumption of chocolate or other sweet foods, negative mood ratings reduced significantly, while positive mood ratings increased significantly (Hill & Heaton-Brown, 1994).

In terms of the theoretical link between mood or affect leading to behaviour in general, it is widely understood that emotions can sometimes induce and at other times inhibit action (Bagozzi, Gopinath & Nyer, 1999; Plutchik, 1980). For example, Frijda (1986, 1993) upholds the view that different emotions are linked with specific action tendencies and that these tendencies can encompass moving towards *or* away and paying attention to *or* showing disinterest. For example, fear is generally linked with avoidant behaviours; whereas joy is generally linked with approach behaviours (Frijda, 1988). However, regarding behaviour concerning food, and sweet, hedonic food in particular, conflicting examples of how mood and emotion influence behaviour (i.e. consumption) have been observed. For example, Macht, Roth and Ellgring (2002) found that after watching film clips designed to experimentally induce emotions, chocolate consumption was significantly higher following positive compared to negative mood manipulations; whereas Garg et al. (2007) report the opposite effect in that after watching film clips designed to experimentally induce emotions, chocolate consumption (compared to the less hedonic choice of raisins) was significantly higher following negative compared to positive mood manipulations. It is acknowledged that participants in the Macht et al. (2002) study were all male whereas those in the Garg et al. (2007) study were both male and female. However, Garg et al. (2007) specifically investigated the influence of gender to address potential differences in consumption. Across a wider set of studies, they did not identify any significant effects of gender, concluding that it is not a distinguishing factor in general populations and that men and women are equally likely to manage their affective states through consumption (Garg et al., 2007).

In support of Macht et al. (2002), static affective evaluation theories postulate that a person's current mood state (i.e. general mood) will influence information processing, subsequent judgments, and ultimately behaviour (Andrade, 2005). While it has been theorised that this affective influence can occur both directly (e.g. affect-as-information; Schwarz & Clore, 1983), or indirectly (e.g. mood congruency; Bower, 1981), crucially, this occurs in a congruent manner. Thus, positive emotions lead to positive appraisals of a situation or stimulus which tend to result in proactive behaviour, generally promoting action e.g. increasing consumption. Conversely, negative emotions lead to negative appraisals of a situation or stimulus and while still resulting in congruent behaviour, this is consequently more negative and therefore tends to hinder or impede action e.g. decreasing consumption (Andrade, 2005).

In support of Garg et al. (2007), the more dynamic affective regulation theories can account for scenarios unexplained by static affective evaluation theories. For example, instances when the influence of positive emotions inhibit action (e.g. the mood-maintenance hypothesis; Clark & Isen, 1982) and negative emotions induce action (e.g. mood management theories; Zillmann, 1988). These theories state that the way in which a person perceives their current feelings in relation to how they will feel as a result of a future behaviour forms the affective guide in making that subsequent behaviour choice (see Gross, 1998). According to this theoretical approach, people in a positive mood will seek to protect or maintain this, which potentially results in a more passive response i.e. inhibiting behaviour; whereas people in a negative mood will seek to alter or repair this, resulting in a more proactive response i.e. stimulating action or inducing behaviour (Andrade, 2005). Given that hedonic foods are, by definition, mood altering (Garg et al., 2007), the finding that those in the positive mood condition consumed less of the chocolate compared to the raisins was interpreted as being a more passive response, as stated by affective regulation theory (Garg et al., 2007). The conflict between mood congruent and mood management theories is clear in that neither theory can account for all possible combinations of the affect (positive/negative)-behaviour (induce/inhibit) relationship (Andrade, 2005). In other words, the same emotion, e.g. happiness, has been found to produce differing behavioural effects- at times inducing (e.g. Macht et al., 2002) and at other times inhibiting behaviour (e.g. Garg et al., 2007).

To explain circumstances in which one theory will take precedence compared to the other, Andrade (2005) proposes an integrative approach. Here, the crucial aspect depends on whether the behaviour under consideration involves mood-changing properties. If such properties are present, it is more likely that people will adopt affective regulation or mood management choices, whereas when such properties are not present, it is more likely that people will adopt affective evaluation or mood congruent choices (Andrade, 2005). Thus, in the presence of a mood-changing cue or opportunity, those experiencing negative affect will attempt to alter this state by taking action, whereas those experiencing positive affect will attempt to protect this state by resisting action (Andrade, 2005). Garg et al. (2007) acknowledge affective regulation/mood management theories to explain their findings that chocolate consumption was significantly higher following negative compared to positive mood manipulations. Their deeper conclusion, however, incorporated this integrative approach (e.g. Andrade, 2005). That is, of the choices under consideration i.e. chocolate vs. raisin consumption, chocolate consumption (as the more hedonic choice) was viewed by participants as a mood-changing behaviour, thus explaining the use of affective regulation/mood management strategies. That is, those in the negative state consumed significantly more chocolate, supporting the hypothesis that the mood-altering properties generated from eating a hedonic food would alter the negative emotion generated by watching the sad movie. Conversely, those in the positive state consumed less chocolate, interpreted as being in order to avoid regretting the consumption of a hedonic, unhealthy snack food and therefore protecting or maintaining the positive emotion that the uplifting movie produced (Garg et al., 2007).

Earlier studies demonstrate further support for situations in which negative moods are responded to by consuming more food (i.e. affective regulation/mood management strategies) as a way of positively self-regulating emotions. Tice, Bratslavsky and Baumeister (2001) raise the compelling question of why impulse control seemingly breaks down during periods of emotional distress. Impulse control as a specific type of human self-regulation is essentially the forgoing of immediate, short-term rewards (i.e. impulses) in order to achieve larger but delayed long-term benefits (i.e. rewards as a result of self-control; Hofmann et al., 2009; Tice et al., 2001). While not invariably dysfunctional (Dalley, Everitt & Robbins, 2011), definitions of impulsivity as a dynamic personality construct usually include: a tendency towards maladaptive behaviours, problems concerning the inhibition of responses, and the tendency to avoid delay when making ‘risky’ decisions (Robbins, Curran & de Witt, 2012). Indeed, many impulsive behaviours that provide immediate pleasure are associated with hedonic but negative outcomes (e.g. alcohol, drug and tobacco consumption; eating unhealthy foods, risky sexual behaviour or gambling; Christiansen, Cole, Goudie & Field, 2012; Hofmann et al., 2009; Tice et al., 2001). In terms of the inability to resist the immediate pleasures of eating in favour of long-term weight loss, an increase in food consumption has been demonstrated in those who are overweight as well as anxious or depressed (Logue, 1993), dieters experiencing stress (Greeno & Wing, 1994), and obese people who have had anxiety induced (Slochower & Kaplan, 1980). As previously mentioned in the literature review chapter, (see Chapter 1), an increased consumption of unhealthy foods has also been observed within non-clinical populations as a way of coping with worries, problems and negative moods (Reaves et al., 2019), as well as acute stress (Oliver et al., 2000). Thus, specific emotional anguish such as anxiety, depression or stress contributes to a breakdown in self-control resulting in impulsive patterns of behaviour (Slessareva & Muraven, 2004; Tice et al., 2001).

The cyclical relationship between mood and food (Christensen, 2001) is again also noted whereby emotional distress causes eating, which in turn triggers a spiralling effect as the ensuing distress as a result of impulse control failure subsequently leads to even more eating (Heatherton & Polivy, 1992). The breakdown of self-control during negative periods seemingly occurs because the focus on long-term but delayed rewards (e.g. weight loss) is seemingly outweighed by a shift towards short-term but immediate rewards (e.g. eating in order to feel better). That is, maintaining a positive mood (i.e. affect regulation) takes precedence over other regulatory goals (e.g. impulse control; Tice et al., 2001); or, in simple terms, feeling better in the immediate present is more important than pursuing long term rewards. In the same way that Garg et al. (2007) evidenced the integrative approach (see Andrade, 2005; detailed previously), Tice et al. (2001) demonstrate the breakdown of impulse control as an affective regulation strategy in the presence of food as a mood-altering cue. That is, participants who had their moods manipulated negatively consumed significantly more unhealthy but tasty snacks (i.e. least healthy but most hedonically rewarding e.g. chocolate chip cookies) compared to those who had their moods manipulated positively. Interestingly however, and providing further support for the integrative approach which combines affective evaluation and regulation theories

(Andrade, 2005), Tice et al. (2001) also found that in the negative condition this response was eliminated or even reversed altogether when people were told that eating would not improve their mood and they therefore believed that their bad mood was ‘frozen’ or unchangeable. Thus, instead of maintaining the common belief that eating unhealthy snacks will effectively repair a bad mood, when food as a mood-changing cue was removed by being explicitly told that ‘eating does not make you feel better,’ those participants resorted to affective evaluation or mood congruent strategies. Such theories state that negative emotions lead to more negative evaluations which in turn generally lead to less action (Andrade, 2005). That is, rather than the emotional distress causing participants to find ways of repairing their negative mood by eating (i.e. affective regulation strategies; see Gross, 1998), when participants believed that eating would not alter their emotional distress, they were able to exercise their self-control (i.e. affective evaluation strategies; e.g. Bower, 1981). This ostensibly leads to the conclusion that rather than merely reducing a person’s ability to exercise self-control (in which case the mood freezing procedure should not have affected subsequent impulse regulation), emotional distress causes impulse control failure simply because people seek ways to make themselves feel better (Tice et al., 2001).

One of the most well-known examples that demonstrates the conflict that arises between impulse- and self-control is the delay of gratification paradigm (DoG; e.g. Mischel, 1974). DoG specifically refers to a person’s ability to voluntarily delay the acceptance of a small, immediate reward for a later but larger reward. The length of time that a person is able to wait is widely interpreted as self-control, therefore, choosing the immediate reward conversely demonstrates higher impulsivity (Mischel, 1974). Originally developed for children using the simple choice of ‘one marshmallow now or two marshmallows later’ (e.g. Mischel, 1974), this paradigm has also been extended within adult populations (e.g. Forstmeier, Drobetz & Maercker, 2011). The influence of emotional distress has also been noted as affecting people’s ability to delay gratification with negative emotions causing both adults and children to choose the small immediate reward over the later but larger option (e.g. Fry, 1975; Mischel, Ebbesen & Zeiss, 1973). Tice et al. (2001) incorporated emotional distress within the DoG paradigm using a ‘social trap’ dilemma developed by Knapp and Clark (1991). This procedure involves a fishing simulation in which the number of fish in a lake will increase over time and participants can ‘harvest’ the fish for increasing amounts of money depending on when they decide to harvest. Early harvesting of the fish will decrease the amount of money earned (i.e. small but immediate gratification), whereas delaying the harvesting of the fish will maximise the monetary pay out (i.e. larger but delayed gratification). In the original study, Knapp and Clark (1991) found that participants in a sad mood had a tendency to harvest their fish earlier than those participants in a happy mood, interpreted as being due to the desire to alter the sad mood. Tice et al. (2001) extended this study with an inclusion of a mood-freezing condition to demonstrate affect regulation, i.e. that people in a negative mood would seek to alter or repair this mood state resulting in a more proactive response, i.e. taking action (Andrade, 2005). The results showed that those participants who had their mood manipulated negatively were less able to delay gratification than those participants who were led to believe that their negative mood was ‘frozen’ or unchangeable. That is to say, those participants in the negative mood-freeze condition were able to delay the gratification and harvest their fish later because the mood-freeze prevented them from using the immediate gratification of early harvesting to repair their negative mood (Tice et al., 2001).

Examples reviewed here have included both positive and negative emotions (e.g. Garg et al., 2007) as well as impulse/self-control (e.g. Tice et al., 2001) within the area of hedonic eating, i.e. concerning foods that are perceived as being low in terms of health but high in terms of mood-altering properties (Garg et al., 2007). However, it has been noted elsewhere (e.g. Evers et al., 2013) that, specifically in terms of overeating and obesity, the focus has primarily been concerned with investigating negative emotions. For example, Garg and Lerner (2013) examined the effect of manipulated sadness vs. manipulated neutral states (but not manipulated happiness) on the consumption of M&M's finding that those in the sadness condition consumed significantly more than those in the neutral condition.

The first study in this thesis was therefore designed to assess the influence of positive, negative *and* neutral incidental mood (i.e. mood incidental to a stimulus) on decisions concerning chocolate vs. non-food/neutral items. The delay of gratification paradigm (DoG; Mischel, 1974) was also included in order to assess the influence of manipulated positive, negative and neutral incidental mood on impulsive decisions concerning chocolate vs. non-food/neutral items.

Specifically, this first study incorporated positive, negative and neutral incidental affect using a mood induction task (MIT; Robinson et al., 2012). The MIT involves the presentation of general (i.e. incidental) mood-relevant sentences (i.e. positive, negative or neutral) accompanied by appropriate pieces of classical music and has been reliably shown to successfully alter current mood states (e.g. Robinson, Cools, Crockett & Sahakian, 2010). To assess the initial influence of incidental mood on sweet food choice, participants were given the option to choose between a small sweet reward (a small bar of chocolate) or non-food/neutral reward (one from a selection of magazines) to thank them for participation in the study. Chocolate was selected as being an appropriate sweet reward choice because it is a commonly and intensely craved food item (Hill, Weaver & Blundell, 1991; Rozin, Levine & Stoess, 1991) with hedonic, mood-changing properties (Garg et al., 2007). A magazine was selected as being an appropriate non-food/neutral reward choice expressly because it is *not* a hedonic food but was rated at a similar desirability level to the chocolate in a preliminary pilot study. This preliminary pilot study was designed to ascertain the desirability of items that might be given to an adult to say 'Thank You' for something. That is to say, in terms of desirability, both a small bar of chocolate and a magazine fulfilled the stipulation of being suitably similar reward choices, but in terms of mood-altering properties they were considered to be suitably different. (This preliminary pilot study is fully reported in the materials sub-section of the method, see Section 2.3.2, below. The decision to use a non-food item as the comparative reward in the initial, sweet food choice task is also fully explained in the materials sub-section of the method, see Section 2.3.2, below.) To assess the influence of incidental mood on impulse/self-control, participants were then given the opportunity to delay the gratification of the small reward choice in exchange for a later but larger sweet reward (large box of chocolates) or non-food/neutral reward (a DVD). This element of the study was based on the original DoG paradigm (e.g. Mischel, 1974).

Based on previous research (e.g. Garg et al., 2007) it was hypothesised that following the incidental MIT (Robinson et al., 2012), participants would rely on affective regulation/mood management strategies (see Gross, 1998; Zillmann, 1988) when given the initial choice of a sweet or non-food/neutral reward. Specifically, it was hypothesised that those in the positive mood condition would seek to protect their good mood and would therefore be more likely to choose a non-food/neutral reward than a sweet reward compared to those in the negative mood condition. Those in the negative mood condition would seek to repair their bad mood and would therefore be more likely to choose a sweet reward than a non-food/neutral reward compared to those in the positive mood condition. Those in the neutral mood condition were expected to be more likely to choose a non-food/neutral reward than those in the negative mood condition but less likely to choose a non-food/neutral reward than those in the positive mood condition; and less likely to choose a sweet reward than those in the negative mood condition but more likely to choose a sweet reward than those in the positive mood condition. Again, based on past research (e.g. Tice et al., 2001), it was hypothesised that when given the opportunity to delay the gratification of the initial reward, those in the positive mood condition would be more likely to demonstrate self-control by choosing the later but larger reward, whereas those in the negative mood condition would be more likely to demonstrate impulsive behaviour by choosing the smaller, immediate reward. Those in the neutral mood condition were expected to demonstrate more self-control than those in the negative mood condition but less self-control than those in the positive mood condition.

2.3 Method

All paperwork relevant to this study can be found in the Appendix (see Chapter 7) which comprises:

- Ethics statement, ref: SAS1704.
- The mood-congruent sentences (Velten, 1967) and visual scales used to record participants' happiness and sadness ratings immediately before and after the positive, negative and neutral mood induction tasks (MIT; Robinson et al., 2012).
- Questionnaires included:
    - The Attitudes to Chocolate Questionnaire (Benton, Greenfield & Morgan, 1998).
    - The Barratt Impulsiveness Scale, Version 11 (BIS-11; Patton, Stanford & Barratt, 1995).

2.3.1 Participants

A total of 63 participants (15 males and 48 females) ranging in age from 18 to 70 years (mean = 29.33, SD = 11.64) were recruited for participation using a combination of methods. Following a low response to advertisements for the study leading to insufficient numbers of participants, the neutral condition of the experiment (totalling 15 of the original participants) was removed after data collection had commenced. Of the 48 participants included in the final analyses, 15 were male and 33 were female with ages ranging from 18 to 70 years (mean = 30.88, SD = 12.54). Posters advertising the study were displayed within the psychology department at London South Bank University (LSBU), and the study was also advertised on the LSBU Psychology Research Participation Scheme (RPS) website. Undergraduate psychology students who responded to the posters and RPS advertisements were offered course credits and a £5 Amazon™ voucher in exchange for participation. Opportunity sampling was also employed both within and outside the LSBU campus. Printed briefing sheets containing information about the study were presented to those recruited in this way. Those recruited via opportunity sampling were informed that they would receive a £5 Amazon™ voucher in exchange for participating via this method of recruitment. All participants met the necessary inclusion criteria of being aged 18 years or over.

Each participant's body mass index percentile (BMI) was calculated using the online 'NHS BMI healthy weight calculator' (2018). This was deemed appropriate for a study investigating psychological factors influencing sweet food decision making from the perspective of obesity, for example, in order to be able to control for differences in BMI when carrying out analyses of the data. Weight was recorded in kilograms using electronic scales, height was recorded in metres using a free-standing stadiometer, and gender and age were recorded by hand. BMI for the final 48 participants ranged from 16.80 to 37.00 kg/m^2, with a mean of 23.58 kg/m^2 (SD = 3.84). 8.30 per cent of participants were underweight (<18.5 kg/m^2), 70.80 per cent were of a healthy weight (18.5-25 kg/m^2), 12.50 percent were overweight (25-30 kg/m^2) and 8.30 percent were obese (>30 kg/m^2).

2.3.2 Materials

Hunger ratings

Participants completed a visual analogue scale (VAS) to record their current level of hunger by making a single vertical mark along a 10.70cm line ranging from 'not at all' to 'extremely' in response to the question 'How hungry are you?' (It is acknowledged that a 10cm line would have been a more intuitive scale, however, this command was not correctly implemented in Microsoft Word.)

Mood Induction Task (MIT; Robinson et al., 2012)

Immediately before the MIT, participants completed a mood rating VAS (Robinson et al., 2012). Each participant was directed to indicate their current mood state by making a single vertical mark along a 9.30cm line ranging from 'not at all' to 'extremely' in response to four questions relating to their current mood. An example question is: 'How happy are you?' (It is acknowledged again that a 10cm line would have been a more intuitive scale, however, this command was not correctly implemented in Microsoft Word.)

The MIT was presented on a laptop using Microsoft Visual Basic™ software and comprised three mood conditions: positive, negative and neutral. Participants were assigned to either the positive, negative or neutral mood condition using block randomisation. Each mood condition was manipulated through the presentation of mood-congruent sentences while listening to appropriate pieces of classical music for the duration of the MIT.

- Music: professional studio recordings of:

A) *Piano Concerto No. 4, Op. 58 in G Major: III. Rondo: Vivace* by Ludwig van Beethoven. (Positive condition.)

B) *Serenade No. 13 KV 525 G-Major: I. Serenade. Allegro* by Wolfgang Amadeus Mozart. (Positive condition.)

C) *Adagio for Strings, Op. 11* by Samuel Barber. (Negative condition.)

D) *Adagio in G Minor* by Tomaso Albinoni. (Negative condition.)

E) *The Planets, Op. 32: VII. Neptune, the Mystic* by Gustav Holst. (Neutral condition.)

- Mood-congruent sentences: the 60 positive, 60 negative and 60 neutral ‘Velten’ sentences (Velten, 1967).

For the positive and negative MIT, participants selected one of the two pieces of music (A or B for positive; C or D for negative). Participants were given the choice of wearing over-ear headphones provided by the researcher or wearing their own headphones for the duration of the procedure. Participants listened to excerpts of both music choices relevant to their mood condition and were asked to select the piece of music that they considered to be ‘happiest’ (positive condition) or ‘saddest’ (negative condition). They were also given the opportunity to adjust the volume of the music to the level that they found comfortable. To avoid ambiguity for the neutral MIT procedure, participants were not given a choice of music and always heard E.

For all three mood conditions, participants were initially presented with instructions displayed on the computer screen and were then directed to press the space bar or click a pop-up button saying ‘Next’ in order to start the MIT. The first mood-congruent sentence relevant to each mood condition then appeared on the screen. The 60 mood-congruent sentences were each displayed for 12 seconds. After the 12 seconds had passed, participants were able to press the space bar or click a pop-up button saying ‘Next’ in order to progress to the next sentence. Therefore, each participant saw every mood-congruent sentence for a minimum of 12 seconds; and the total length for each condition of the MIT was approximately 12 minutes. Positive sentences were presented in light blue text on a light-yellow background; negative sentences were presented in light grey text on a dark-blue background; and neutral sentences were presented in black text on a white background. An example of a positive sentence is: ‘This is great- I really do feel good. I am elated about things!’; an example of a negative sentence is: ‘All of my unhappiness of my past life is taking possession of me’; and an example of a neutral sentence is: ‘Agricultural products comprised seventy per cent of the income’ (Velten, 1967).

Immediately after the MIT, participants completed their current mood rating on a 9.30cm VAS for the second time (Robinson et al., 2012).

Initial choice and delay of gratification tasks (DoG; adapted from Mischel, 1974)

The initial choice and DoG tasks (adapted from Mischel, 1974) were both presented verbally with responses recorded by hand. Firstly, in order to assess the influence of mood on sweet and non-food/neutral decisions, participants were given the initial choice of receiving a small bar of Cadbury’s™ milk chocolate or one from a selection of magazines as ‘a reward to say “Thank you” for taking part in the study’. Each participant was given the choice verbally, i.e. did not actually see the rewards, and were told that they would receive their choice at the very end of the study. The DoG element was then presented as a second choice of either keeping the reward initially chosen (i.e. the small bar of Cadbury’s™ milk chocolate or one from a selection of magazines) which participants would receive as soon as the study ended; or instead exchanging that initial reward for a later but larger box of chocolates (instead of the small bar of Cadbury’s™ milk chocolate) or a DVD (instead of one from a selection of magazines). Again, participants were given the choice verbally, i.e. did not actually see the rewards, and were told that these second choices needed to be ordered and would therefore be available to collect ‘within the next day or two’. The researcher also recorded this second choice (‘Keep first reward’ or ‘Delay gratification’) by hand.

Chocolate was selected as being an appropriate sweet reward choice because it is a commonly and intensely craved food item (Hill et al., 1991; Rozin et al., 1991) with hedonic, mood-changing properties (Garg et al., 2007). The rationale for selecting a magazine as the comparative choice was based on the framing of the DoG task which was presented as ‘a reward to say, “Thank you” for taking part in the study’. That is to say, the subject of interest throughout this thesis is the investigation of psychological factors influencing sugar consumption. The rewards presented could therefore have been chosen to allow a comparison in responses concerning the extremities of the ‘sweet food spectrum’. For example, a high-sugar choice compared to a low-sugar choice. Equally, a sweet choice compared to a savoury choice could also have been used. However, as the initial choice and DoG tasks were presented to participants as a reward for taking part in the study, the items included needed to reflect this. An initial pilot study (reported below) was therefore carried out in order to check that the items used as the sweet and non-food/neutral rewards were firstly of a similar desirability, and secondly fulfilled the stipulation of being suitable reward choices to say “Thank you” for taking part in the study.

Online Qualtrics™ desirability pilot study

Ninety-eight adult participants (15 males and 83 females) ranging in age from 18 years-65+ years (54.55 per cent falling between 35-44 years) rated 47 sweet items e.g. ‘a bag of sweets’ and non-food/neutral items e.g. ‘a bunch of flowers’ on a 10-

point Likert scale ranging from 1 (least desirable) to 10 (most desirable) as "items that might be given to an adult to say 'Thank you' for something." A related *t*-test showed that there was a non-significant difference between mean desirability scores for a small bar of Cadbury's^{TM} milk chocolate (mean = 3.98, SD = 2.38) and mean desirability scores for a magazine (mean = 3.57, SD = 2.41; $t(97) = 1.44$, $p = .154$). A related *t*-test showed that there was a non-significant difference between mean desirability scores for a large box of chocolates (mean = 4.90, SD = 2.53) and mean desirability scores for a DVD (mean = 5.17, SD = 2.56; $t(97) = -.781$, $p = .437$). Related *t*-tests also showed that mean desirability scores were significantly different for a small bar of Cadbury's^{TM} milk chocolate (mean = 3.98, SD = 2.38) and a large box of chocolates (mean = 4.88, SD = 2.55; $t(97) = -2.91$, $p = .004$); and were significantly different for a magazine (mean = 3.57, SD = 2.55) and a DVD (mean = 5.17, SD = 2.56; $t(97) = -5.46$, $p <.001$).

The results of this pilot study confirmed that the sweet and non-food/neutral items selected as immediate rewards (a small bar of Cadbury's^{TM} milk chocolate/a magazine) and later rewards (a large box of chocolates/a DVD) in the DoG task were of a similar desirability; and that the later rewards (a large box of chocolates/a DVD) were rated as being significantly more desirable than the immediate rewards (a small bar of Cadbury's^{TM} milk chocolate/a magazine). As these items were presented in the pilot study as "items that might be given to an adult to say 'Thank you' for something," they also fulfilled the stipulation of being suitable reward choices for the DoG task.

Questionnaires

Following the DoG task, participants completed printed versions of the Attitudes to Chocolate Questionnaire (Benton et al., 1998) and the Barratt Impulsiveness Scale, Version 11 (BIS-11; Patton et al., 1995).

The Attitudes to Chocolate Questionnaire (Benton et al., 1998) contains 24 items and measures responses to statements concerning chocolate in terms of craving, guilt and functionality. An example statement for craving is ‘Chocolate often preys on my mind’; an example statement for guilt is ‘I often feel sick after eating chocolate’; and an example statement for functionality is ‘I eat chocolate only when I am hungry.’ Participants indicated their response to each statement for all three elements along a 10.00cm visual analogue line ranging from ‘not at all like me’ to ‘very much like me.’ However, because the craving element (but not guilt) is associated with chocolate consumption (Benton et al., 1998); and functionality was not deemed necessary in this study as this element reflects chocolate consumption to serve a useful purpose e.g. to keep energy levels up when exercising (Benton et al., 1998), craving was the only element used in the final analysis. Responses to the 10 craving responses were first added and then divided by 10 to produce a final score; therefore, the lowest possible score for this dimension was 0; and the highest possible score for this dimension was 10.00 with higher scores indicating a higher level of chocolate craving (Benton et al., 1998). Reliability analyses indicated that responses for the craving sub-scale of the attitudes to chocolate questionnaire in the current study had an appropriate level of internal consistency ($\alpha = .90$).

The BIS-11 (Patton et al., 1995) contains 30 statements which describe common impulsive or non-impulsive preferences and behaviours. An example of an impulsive statement is: ‘I act on the spur of the moment’; and an example of a non-impulsive statement is: ‘I plan tasks carefully’. The 19 impulsive statements are scored on a 4-point scale from 1 to 4 where 1 = rarely/never; 2 = occasionally; 3 = often; and 4 = almost always/always. The 11 non-impulsive statements are reversed scored on a 4-point scale from 4 to 1 where 4 = rarely/never; 3 = occasionally; 2 = often; and 1 = almost always/always. The lowest possible score is therefore 30 and the highest possible score is 120, with a total score of 72 or above being widely recognised as a high impulsive response (see Stanford et al., 2009). Reliability analyses indicated that responses for the BIS-11 in the current study had an appropriate level of internal consistency ($\alpha = .84$).

Following the questionnaires, participants completed the mood rating VAS for the third and final time (Robinson et al., 2012) and were asked the question: ‘Do you like chocolate?’ their response to which was recorded by hand. 97.90 per cent of participants responded ‘Yes’ and 2.10 per cent of participants responded ‘No’.

Finally, participants completed a funnelled debrief (based on Chartrand & Bargh, 1996). This was added to the study mid-way through data collection to confirm suspicions that the presentation of the DoG task needed strengthening and therefore only 13 participants completed this. An example question from the funnelled debrief is “Did anything about the study seem strange or suspicious to you?”

2.3.3 Design and Procedure

This study used an experimental, between-subjects design with manipulated positive and negative mood as the experimental variable. Participants either completed the study in a quiet research room within the psychology department at LSBU; or in a quiet room at the researcher’s home during a single 40-minute session. Information sheets were presented to those participants who had not already received them, and all participants signed a consent form. Following the recording of demographic information (gender, age, weight and height), participants completed a 10.70cm visual analogue scale (VAS) to record their current level of hunger. Each participant then took part in the standardised mood induction task (MIT; Robinson et al., 2012) which was presented on a laptop using Microsoft Visual Basic™ software. Immediately before, immediately after the MIT and at the very end of the study, participants completed a 9.30cm mood rating VAS to record their current mood (Robinson et al., 2012). Following the MIT, participants were verbally presented with the initial choice and delay of gratification tasks (DoG; adapted from Mischel, 1974), the responses to which were recorded by hand. Participants then completed printed versions of the Attitudes to Chocolate Questionnaire (Benton et al., 1998) and the Barratt Impulsiveness Scale, Version 11 (BIS-11; Patton et al., 1995). Verbal responses of either ‘Yes’ or ‘No’ to the question ‘Do you like chocolate?’ were recorded by hand and finally, participants (n = 13) completed the funnelled debrief (based on Chartrand & Bargh, 1996).

All participants were thanked after completing the study and received a printed debriefing statement.

Deception

The choices offered to participants in the DoG task were of a hypothetical nature and participants did not actually keep their choice of reward. However, genuine responses to the hypothetical DoG task were integral to the study and this is the reason that participants were led to believe that they would be keeping the reward of their choice by being told that it was a small present to say ‘Thank you’ for their participation. At the very end of the study it was revealed that this element of the study had been of a deceptive nature and each participant was given an additional £5 Amazon™ voucher as a genuine reward for taking part in the study. (Each participant therefore received a total of £10 in Amazon™ vouchers: £5 originally offered as an incentive to participate and £5 to replace the rewards promised during the study.)

2.4 Results: Preliminary analyses

Mood Induction Task (MIT; Robinson et al., 2012)

The mood induction task (MIT; Robinson et al., 2012) comprised positive and negative mood conditions (as the neutral condition of the experiment was removed after data collection had commenced). Preliminary analyses of the data used two related *t*-tests to ascertain whether positive and negative mood ratings were significantly different following the mood induction task.

Happiness ratings were higher after the positive mood manipulation (mean = 7.05, SD = 1.39) compared to before the positive mood manipulation (mean = 6.19, SD = 1.46; $t(23) = 5.14$, $p < .001$).

Sadness ratings were higher after the negative mood manipulation (mean = 3.82, SD = 2.18) compared to before the negative mood manipulation (mean = 1.26, SD = 1.28; $t(23) = 5.44$, $p < .001$).

These analyses confirmed that the positive and negative incidental mood induction tasks were successful in that participants' general happiness ratings (positive condition) and sadness ratings (negative condition) significantly increased following the corresponding induction procedure.

Hunger ratings

An unrelated *t*-test was used to check that hunger ratings did not differ significantly between those in the positive (mean = 4.08, SD = 2.82) and those in the negative mood condition (mean = 4.30, SD = 2.05; $t(46) = .316$, $p = .754$).

These results confirmed that hunger (which was included as a control variable for the main analyses) did not differ significantly between the two experimental groups.

2.5 Results and Discussion: Initial choice and delay of gratification tasks

The initial choice and delay of gratification (DoG) tasks comprised three elements which were all used for subsequent data analysis: All participants took part in the first 'initial choice' element of choosing between a sweet or non-food/neutral reward (a small bar of chocolate vs. one from a selection of magazines). Those participants who initially chose the chocolate comprised the sample for the second 'chocolate DoG' element of this task (delaying gratification of the sweet reward and instead receiving a large box of chocolates later); while those participants who initially chose the magazine comprised the sample for the third ‘magazine DoG’ element of this task (delaying gratification of the non-food/neutral reward and instead receiving a DVD later). Each of the three elements was examined with a chi-square analysis (main analyses).

These elements are presented in the following format:

- ‘Initial choice’ task:
    - Chi-Square analysis: Results and Discussion.
    - ‘Initial choice’ task: Summary.
- ‘Chocolate DoG’ task:
    - Chi square analysis: Results and Discussion.
    - ‘Chocolate DoG’ task: Summary.
- ‘Magazine DoG’ task:
    - Chi square analysis: Results and Discussion.
    - ‘Magazine DoG’ task: Summary.

2.5.1 ‘Initial choice’ task

Results, ‘Initial choice’ task: Chi-Square analysis

The association between manipulated positive and negative incidental affect and initial choice (small bar of chocolate/one from a selection of magazines).

A chi-square analysis was used to investigate the association between mood (positive and negative) and initial choice presented (small bar of chocolate vs. one from a selection of magazines).

Participants in both the positive and negative mood conditions were more likely to choose chocolate over a magazine when given the choice. A chi-square analysis therefore found a non-significant association between mood and initial reward choice, $\chi 2$ (1, N = 48) = .784, *p* = .376. The data are presented in figure 2-1.

Discussion, 'Initial choice' task: Chi-Square analysis

It was hypothesised that participants in the negative mood condition would be more likely to choose a sweet reward (small bar of chocolate) and less likely to choose a non-food/neutral reward (magazine) and that the reverse would be true of participants in the positive mood condition. However, the data showed that participants in both mood conditions were more likely to choose the chocolate over a magazine. It is

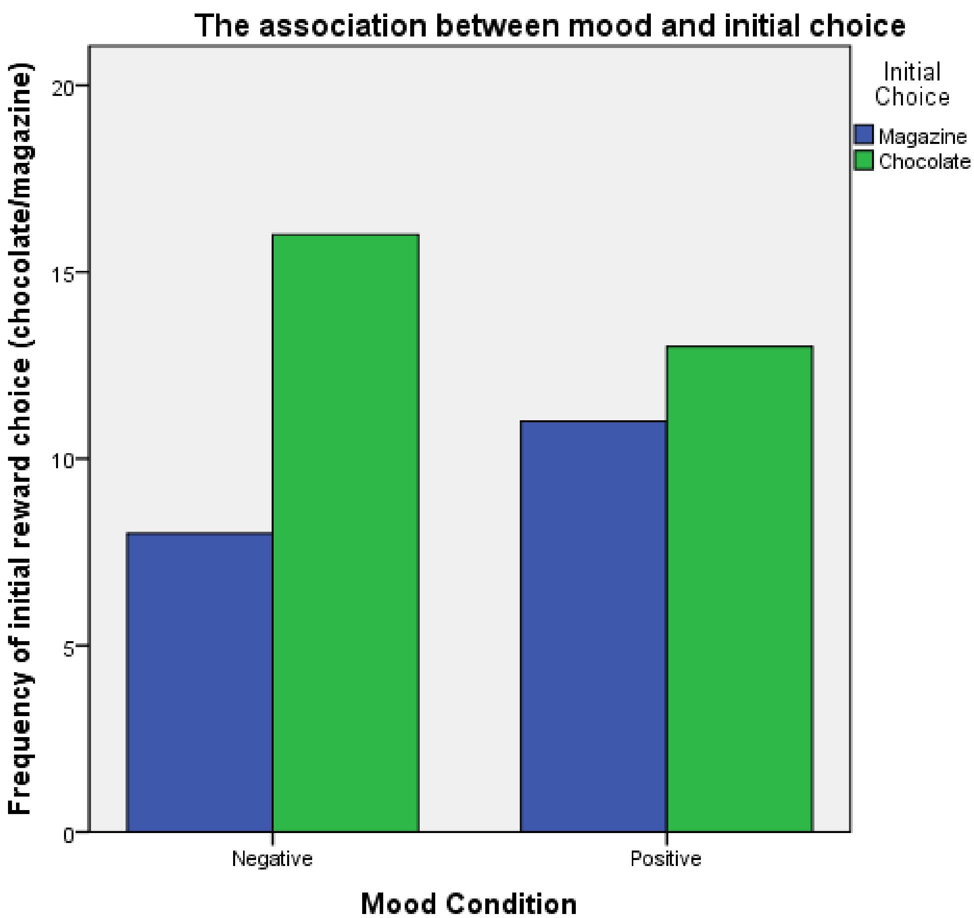

Figure 2-1: Study 1, 'Initial choice' task chi-square data

emphasized that this association between mood condition and reward choice was non-significant, and therefore the following discussion points are made with caution. However, observed frequencies of co-occurrence of those in the negative condition could be seen to align with affective regulation/mood management theories (see Gross, 1998; Zillmann, 1988), as hypothesised. These state that the way in which a person perceives their current feelings in relation to how they will feel as a result of a future behaviour forms the affective guide in making that subsequent behaviour choice (Andrade, 2005). That is to say, people in a negative mood will seek to alter or repair this feeling in order to feel better, leading to behavioural choices considered capable of achieving this change (Andrade, 2005). Therefore, those in the negative mood condition choosing a future sweet reward with hedonic, mood-altering properties was tentatively interpreted as a way of repairing the negative feelings induced by the negative mood manipulation. While the current study did not investigate subsequent consumption of the rewards, parallels can nevertheless be drawn with past research that also draws on these theoretical approaches. For example, previous findings that significantly higher sweet snack food consumption followed negative mood manipulations was also interpreted as the mood-altering properties of the hedonic food being chosen in order to repair the negative emotions (Garg et al., 2007; Tice et al., 2001).

Based again on affective regulation/mood management theories (see Gross, 1998), it was hypothesised that those in the positive mood condition would seek to maintain their positive good mood and would therefore be less likely to make behavioural decisions considered to be mood changing. Because chocolate, as a hedonic food is, by definition, mood altering (Garg et al., 2007), choosing the magazine as a non-food (and ostensibly the less hedonic and more passive choice) was expected to be more likely in this condition. Rather than being supported by this theoretical angle, however, the results instead appear to tentatively follow affective evaluation/mood congruency theories (see Bower, 1981; Schwarz & Clore, 1983). These state that current mood will influence behaviour in a congruent manner, which, in terms of positive emotions is generally more likely to lead to action (Andrade, 2005). This stance is supported by Macht et al. (2002) who found chocolate consumption to be significantly higher following positive compared to negative mood manipulations. In this previous study, affective congruence was interpreted as heightened positive emotions leading to a corresponding increase in the pleasures associated with eating chocolate, thus explaining the higher consumption (Macht et al., 2002). In terms of the current study, while it is reiterated that the results were non-significant, heightened or more salient pleasures associated with chocolate could potentially explain this choice made by those in the positive mood condition.

Despite not reaching significance, the direction of the current results concerning the choice of chocolate appear to follow conflict previously noted in the literature. That is to say, that neither affective evaluation/mood congruent theories, nor affective regulation/mood management theories can account for all possible combinations of the affect (positive/negative)-behaviour (induce/inhibit) relationship (Andrade, 2005). Instead, affective regulation/mood management theories (Gross, 1998; Zillmann, 1988) can explain those in the negative mood condition choosing chocolate (but not those in the positive mood condition choosing chocolate); and affective evaluation/mood congruent theories (Bower, 1981; Schwarz & Clore, 1983) can explain those in the positive mood condition choosing chocolate (but not those in the negative mood condition choosing chocolate). Past results also demonstrate conflict in that the same emotion (e.g. happiness) has been found to produce two opposing behavioural outcomes, i.e. at times inhibiting (e.g. Garg et al., 2007) and at other times inducing behaviour (e.g. Macht et al., 2002). The current results differ slightly in that two different emotions, (manipulated happiness and sadness) have both generated the same response, i.e. a more frequent likelihood of choosing the sweet reward; however, conflict is nevertheless apparent. Andrade's integrative approach (2005) states that in terms of explaining which theory takes precedence, the crucial aspect depends on whether the behaviour under consideration involves mood-changing properties. If such properties are present, it is more likely that people will adopt mood management choices, i.e. maintaining a positive mood through inaction (Clark & Isen, 1982), and changing a negative mood through action (Zillmann, 1988). If such properties are not present, it is more likely that people will adopt mood congruent choices, i.e. positive mood promoting action and negative mood promoting inaction (Bower, 1981; Schwarz & Clore, 1983). Whilst reiterating the speculative nature of this discussion point, perhaps, for those in the negative mood condition the selection of chocolate was deemed mood changing as hypothesised, which would explain the use of mood management strategies (Zillmann, 1988). That is to say, chocolate (which has been shown to have hedonic, mood-altering properties; Garg et al., 2007) was chosen as a way of altering or repairing their negative mood. Conversely, for those in the positive mood condition, the heightened positive emotions following the mood manipulation perhaps led to a corresponding increase in the pleasures associated with receiving a sweet reward. This would explain the choice of chocolate as a way of maintaining their positive mood, as supported by mood congruency theory (Bower, 1981).

It is also noted that while the majority of participants in both mood conditions chose chocolate as a reward, there were also instances when participants from both mood conditions chose the non-food/neutral reward. As previously emphasized, these associations were non-significant and therefore discussion is tentative However, for those in the positive condition, this behaviour seems to align with affective regulation/mood management theories, as hypothesised (Gross, 1998; Zillmann, 1988). These state that those experiencing positive moods will seek to maintain this feeling which generally leads to behaviour not deemed mood-changing (Andrade, 2005). This could therefore explain the choice of a magazine as a less-hedonic option by those in the positive mood condition. In terms of the negative mood condition however, selecting the magazine could be seen to align with affective evaluation/mood congruency theories (Schwarz & Clore, 1983; Bower, 1981). These state that current mood will influence behaviour in a congruent manner, which, in terms of negative mood, generally leads to more passive responses (Andrade, 2005). In terms of food specifically, negative affective congruency should reduce the pleasures associated with food and eating and instead make the unpleasant elements more salient e.g. the negative consequences of eating unhealthy food (Macht et al., 2002). The negative consequences of eating chocolate such as weight gain, are therefore perhaps what drove those in the negative mood condition to choose the magazine.

Summary, 'Initial choice' task

With the inclusion of a choice concerning chocolate as well as the consideration of mood, the results from this 'initial choice' chi-square analysis made up a central point of interest in this first study chapter. Despite broadly inconclusive results, an integrative framework incorporating mood management and mood evaluation theory (Andrade, 2005) was tentatively put forward to explain why participants in both positive and negative moods were more likely to choose chocolate over an equally desirable non-food reward. However, without a significant finding, this explanation cannot be generalised back to the wider population. Therefore, it was ultimately acknowledged that the following chapter in this thesis should strengthen the methodology used in order to obtain more conclusive insight concerning the influence of mood on sweet food decision making.

2.5.2 'Chocolate DoG' task

Results, 'Chocolate DoG' task: Chi-Square analysis

The association between manipulated positive and negative incidental affect and the ability to delay gratification for a sweet reward (one bar of chocolate now/a large box of chocolates later).

A second chi square analysis was used to investigate the association between mood (positive and negative) and ability to delay gratification for a sweet reward (small bar of chocolate now vs. large box of chocolates later).

Participants in both the positive and negative mood conditions were more likely to keep their first reward over delaying gratification when given the choice. Because of the small sample size (n = 29), Fisher's exact test was reported which found a non-significant association between mood and ability to delay gratification, Fisher, p = .697. The data are presented in figure 2-2.

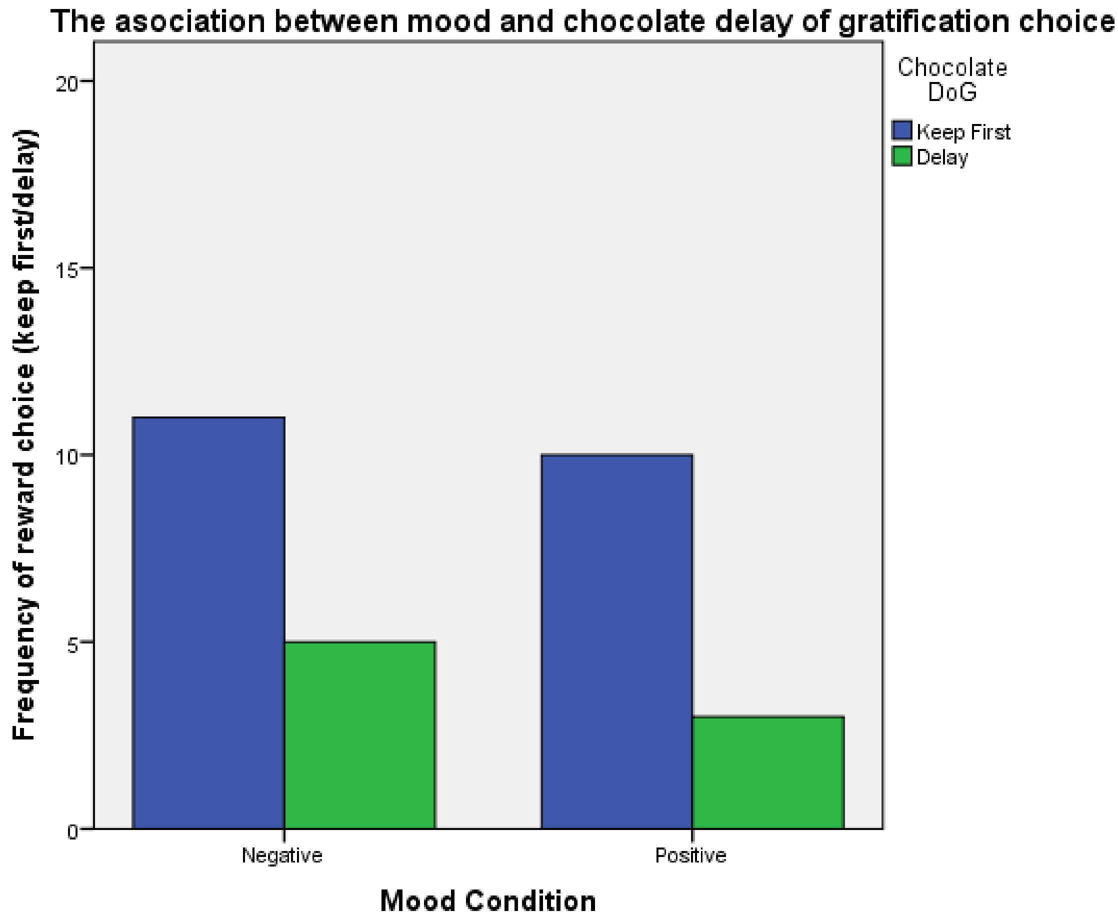

Figure 2-2: Study 1, 'Chocolate DoG' task chi-square data

<u>Discussion, 'Chocolate DoG' task: Chi-Square analysis</u>

It was hypothesised that participants in the positive mood condition would be more likely to delay the gratification of an immediate sweet reward (small bar of chocolate) in exchange for a later but larger sweet reward (large box of chocolates), and that the reverse would be true of those in the negative mood condition. However, the data showed that participants in both the positive and negative mood conditions were more likely to choose the immediate, chocolate reward and less likely to delay gratification, meaning the association between mood condition and delay of gratification choice was non-significant. Whilst noted as being highly speculative, observed frequencies of co-occurrence in the negative mood condition seem to support the hypothesis, i.e. that those in the negative mood condition were more likely to display impulsive behaviour (choosing the immediate chocolate reward) than exercise self-control (delay gratification). However, observed frequencies of co-occurrence in the positive mood condition did not appear to support the hypothesis with results showing that participants were also more likely to display impulsive behaviour than exercise self-control.

While it is emphasized that conclusions made are tentative, Andrade's integrative approach (2005) can again be drawn upon to explain these similarities. This states that if mood changing properties are present, people are more likely to adopt affective regulation/mood management theories (e.g. Gross, 1998; Zillmann, 1988), whereas if such properties are not present, people are more likely to rely on affective evaluation/mood congruency theories (e.g. Bower, 1981; Schwarz & Clore, 1983). Affective regulation/mood management theories state that those in negative moods will generally seek to repair or change this uncomfortable feeling. Perhaps, for those in the negative mood condition, accepting the initial reward *was* deemed mood-changing, which would explain this impulsive choice. This is supported by past research (Tice et al., 2001) which states that in times of emotional distress, impulse control breaks down simply because feeling better in the immediate present (i.e. accepting the small bar of chocolate now) is more important than pursuing long term rewards (i.e. having to wait to receive the reward of a larger box of chocolates later).

On the other hand, affective evaluation/mood congruency theories (see Bower, 1981; Schwarz & Clore, 1983) state that those in a positive mood will generally seek to protect or maintain this pleasant feeling. This would therefore explain the majority of those in the positive mood condition accepting the immediate, impulsive choice. In other words, choosing the smaller chocolate reward was *not* deemed mood-changing and instead served the purpose of maintaining their current good mood.

An obvious limitation concerning this element of the study is the small sample size. Following the initial choice presented to all participants (n = 48), only those who chose the chocolate were then included in this element of the DoG task (n = 29). This limitation will therefore be discussed further in the summary section at the end of this chapter and addressed in the second study (Chapter 3).

<u>Summary, ‘Chocolate DoG’ task</u>

The ‘chocolate DoG’ task extended the ‘initial choice’ element of this study with the inclusion of an impulsive decision, as well as the consideration of both chocolate and mood. Therefore, the results from this ‘chocolate DoG’ chi-square analysis made up the principal point of interest in this first study chapter. Despite broadly inconclusive findings, an integrative framework incorporating mood management and mood evaluation theory (Andrade, 2005) was again tentatively put forward to explain why participants in both positive and negative moods were more likely to choose an impulsive reward over an equally desirable non-food reward. However, without a significant finding, this explanation cannot be generalised back to the wider population. Therefore, it was ultimately acknowledged that the following chapter in this thesis should strengthen the methodology used in order to obtain more conclusive insight concerning the influence of mood on sweet food decision making.

2.5.3 ‘Magazine DoG’ task

Results, ‘Magazine DoG’ task: Chi-square analysis

The association between manipulated positive and negative incidental affect and the ability to delay gratification for a non-food/neutral reward (one magazine now/a DVD later).

Analyses of the data concerning those participants who initially chose a magazine were carried out although it is acknowledged that as this did not involve sweet items/chocolate this was not the primary focus of this thesis. However, this task nevertheless captured the influence of positive and negative manipulated mood on impulsive choice concerning non-food/neutral items. This third chi-square analysis therefore investigated the association between mood (positive and negative) and the ability to delay gratification for the non-food/neutral reward (one magazine now vs. a DVD later).

Participants in both the positive and negative mood conditions were more likely to keep their first reward over delaying gratification when given the choice. Because of the small sample size (n = 19), Fisher’s exact test was reported which found a non-significant association between mood and ability to delay gratification, Fisher, p = .603. The data are presented in figure 2-3.

Discussion, ‘Magazine DoG’ task: Chi-square analysis

The data showed that participants in both the positive and negative mood conditions were more likely to choose the immediate reward of receiving one magazine now and less likely to delay gratification for a later but larger reward (a DVD) although this association was non-significant. It is acknowledged again that this analysis did not involve sweet food/chocolate and was therefore not the primary focus of interest in this thesis. However, the small sample size for this analysis (*n* = 19) is again noted as an obvious limitation. A clear solution (which will be addressed in the following chapter) is to increase the sample size for this element of the study.

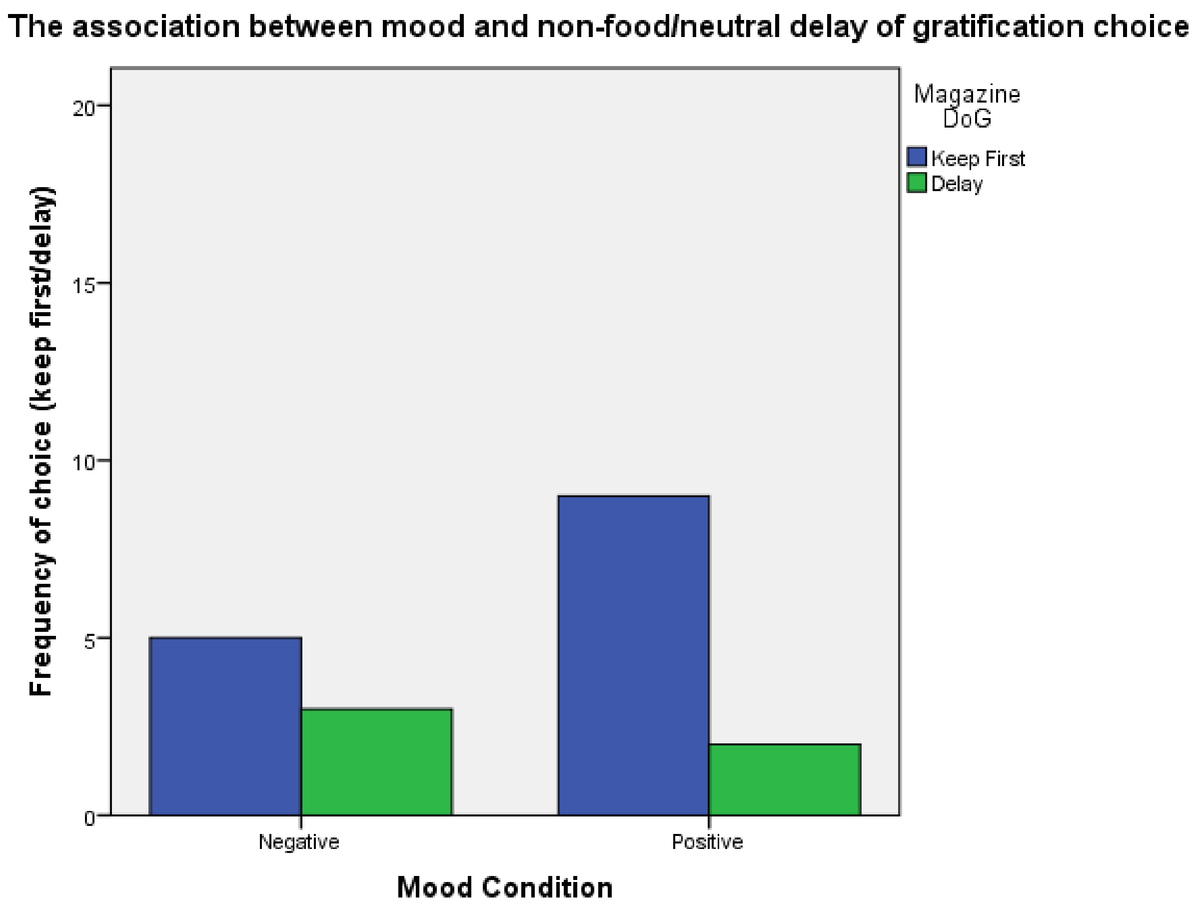

Figure 2-3: Study 1, 'Magazine DoG' task chi-square data

Summary, 'Magazine DoG' task

The 'magazine DoG' task concerned those participants who chose the non-food reward element presented in the 'initial choice' task. It is therefore acknowledged again that the subsequent chi-square analysis did not involve sweet food/chocolate and was therefore not the primary focus of interest in this thesis. However, the non-food element was integral to the study in that it allowed for a choice of categorically different (i.e. sweet vs. non-food), but equally desirable rewards to be presented to participants. While the results were broadly inconclusive, it is nevertheless important that this element of the study is strengthened in conjunction with the sweet element of the DoG task for next chapter in this thesis.

2.6 Chapter Summary

This study was firstly investigating the association between manipulated positive and negative incidental affect (i.e. mood incidental to a stimulus) and sweet food choice (sweet vs. non-food/neutral); and secondly investigating the association between manipulated positive and negative incidental affect on the ability to delay the gratification of an immediate sweet vs. non-food/neutral reward in exchange for a later but larger sweet vs. non-food/neutral reward (based on Mischel, 1974). Results initially showed that the incidental mood induction task (MIT; Robinson et al., 2012) was successful in that participants' general happiness ratings (positive condition) and sadness ratings (negative condition) significantly increased following each induction procedure.

However, as discussed previously, the results concerning the influence of positive and negative manipulated mood across all elements of the current study were broadly inconclusive and did not reach statistical significance. It is posited that problems recruiting a sufficient sample size can partially account for this. The entire cohort (n = 48) was only considered as a whole for the initial element of this study which investigated the association between manipulated positive and negative incidental affect (i.e. mood incidental to a stimulus) on sweet food choice (sweet vs. non-food/neutral). The two subsequent elements which investigated the association between positive and negative affect firstly on the ability to delay the gratification of an immediate sweet reward in exchange for a later but larger sweet reward; and secondly on the ability to delay the gratification of an immediate non-food/neutral reward in exchange for a later but larger non-food/neutral reward (based on Mischel, 1974), ostensibly divided the original sample to n = 29 and n =19 respectively. A clear solution would be to utilise the data collected in the current study to carry out a power analysis that will indicate the sample size needed in order to be confident of finding a significant effect in the following study.

A further observation concerning the design of the current study relates to the way in which the delay of gratification task was presented i.e. as a verbal choice. In other adult studies involving this paradigm, it is noted that the presentation of this task has involved the presentation of actual rewards (e.g. snacks, real money, hypothetical money and magazines; Forstmeier et al., 2011). The funnelled debrief (based on Chartrand & Bargh, 1996) that was included part-way through data collection indicated that the presentation of the DoG task could be improved. The second study (see Chapter 3) will therefore adapt the current DoG task to include the visual presentation of the rewards being offered to participants in order to increase the validity of this task.

Although broadly inconclusive, this first study nevertheless demonstrates that the influence of mood and the way this interacts with impulse/self-control in terms of sweet food choice is one of a complex nature. Despite not reaching statistical significance, the results follow previous observations of theoretical conflict within the literature. That is to say, neither mood congruent nor mood management theories can account for all possible combinations of the affect (positive/negative)-behaviour (induce/inhibit) relationship (Andrade, 2005). However, drawing on an integrative framework to explain circumstances in which one theory will take precedence over the other (Andrade, 2005), those in negative moods choosing chocolate over a magazine and displaying subsequent impulsive behaviour was tentatively interpreted as being in line with mood management theories (Zillmann, 1988); whereas the same behaviour for those in positive moods was tentatively interpreted as being in line with mood congruency theories (Bower, 1981). However, it is reiterated that as the results of this first study did not reach significance, suggested parallels with mood congruent and mood management theories are cautious.

The suggested improvement to the presentation format of the DoG task aims to clarify these results. However, it is posited that refining the theoretical scope of the thesis would facilitate the strengthening of the overall experimental design in other ways. For example, affective evaluation theory (as considered in this first study), states that when making judgments and decisions, people tend to use how they feel as a guide. Broadly speaking, evaluations tend to be more positive when in a positive mood and more negative when in a negative mood (e.g. Schwarz & Clore, 1983). The somatic marker hypothesis (Damasio, 1994), and the affect-as-information theory (Schwarz & Clore, 1983) are examples of more refined approaches that directly consider these congruent informational properties of affect. However, consistent irregularities have been observed concerning the way in which negative affect departs from this theoretical stance. In terms of consumption, for example, negative moods should lead to lowered, (i.e. negative) intake and valuation (Schwarz & Clore, 1983). Yet studies have reported an increase in unhealthy food consumption such as chocolate (e.g. Garg & Lerner, 2013); and higher spending following negative mood inductions (e.g. Lerner, Small & Loewenstein, 2004). This phenomenon has been labelled the ‘misery-is-not-miserly’ effect (Cryder, Lerner, Gross & Dahl, 2008). Drawing upon this phenomenon and the aforementioned informational stance (e.g. Damasio, 1994; Schwarz & Clore, 1983), the second study will incorporate psychological insight from the field of economics with a task designed to explore sweet food choice in the context of financial decisions (based on Becker, DeGroot & Marshak, 1964). It is posited that refining the theoretical scope to strengthen the overall methodology and experimental design will potentially generate more conclusive results concerning the role of affect in sweet food decision making.

3. Study 2: Laboratory-induced positive and negative incidental moods on delaying gratification (DoG) and willingness-to-pay (WTP) in the context of chocolate and sweet food choice

3.1 Overview

The first study described in Chapter 2 investigated the influence of manipulated positive and negative incidental affect (i.e. mood unrelated to a stimulus), on decisions involving chocolate as a commonly craved sweet food. The delay of gratification paradigm (DoG; adapted from Mischel, 1974) was also incorporated in order to consider the influence of impulsivity on sweet food choice. While the mood manipulation procedure successfully altered participants' current mood states, the results specifically concerning the influence of affect as a focal point of interest were largely inconclusive. Therefore, the presentation format of the DoG task was improved for use in this second study. This chapter also sought to refine the theoretical scope of the thesis by drawing more closely upon approaches concerning the informational properties of affect (e.g. Damasio, 1994; Schwarz & Clore, 1983). While these broadly state that mood tends to influence judgments and decisions in a congruent manner, consistent irregularities have been noted in terms of negative moods and consumption. To explore this phenomenon in the context of sweet food decision making, psychological insight from the field of economics was also incorporated in order to strengthen the overall methodology and experimental design.

The willingness-to-pay paradigm (WTP) is specifically designed to capture economic preferences using repeated individual measurements concerning choices relevant to the subject of interest (see Becker et al., 1964). Adapted for the current study, i.e. in the context of sweet food, the WTP task offers a more robust measure of choice than simply using the original DoG task from the first study (which comprised a single choice-response format). This is because measures that allow for precision are preferred in experimental studies (Ranstam, 2008), e.g. those that employ repeated individual measurements of which the WTP task is an example. Using precise measurement techniques allow for a reduction in uncertainty concerning the validity of responses compared to measurements that are accurate but imprecise (Ranstam, 2008). To clarify, whereas the DoG task from the first study obtained only one response regarding chocolate as a sweet food choice from each participant, the WTP task in the current study captured many responses from each participant. To maintain methodological consistency with the DoG task, chocolate items were used as stimuli representing the subject of interest in the WTP task. Given that the overall aim of this thesis is to investigate the influence of mood in the context of sweet food choice in general however, items high in sugar but *not* containing chocolate were also incorporated in this task. The inclusion of two stimuli types therefore broadened the scope of investigation into decision making concerning sweet foods, while the inclusion of the WTP task as a more precise measurement tool strengthened the overall experimental design of this chapter.

3.2 Introduction

It is well established that incidental moods and emotions have the propensity to influence unrelated judgments and decisions (e.g. Loewenstein & Lerner, 2003; Keltner & Lerner, 2010). At low to moderate levels, immediate emotions (which include incidental moods) seem to primarily act in an advisory capacity (Loewenstein

& Lerner, 2003). Several theories state that these advisory or informational properties carried by emotions are used by people in relation to decisions that have to be made (e.g. Damasio, 1994; Schwarz & Clore, 1983). For example, the somatic marker hypothesis (Damasio, 1994) states that when making decisions, rather than relying purely on rational thought processes that are time consuming and laborious, people instead rely on hypothetical thought processes that are mainly constructed from images comprising perceptual and symbolic representations. Lifelong learning causes these images (or thoughts) to become ‘marked’ by positive and negative feelings which are directly or indirectly linked to somatic, (i.e. bodily) states. When a positive somatic marker, (i.e. positive feeling) is linked to a future outcome image, the positive marker becomes a beacon of incentive to pursue the future outcome; whereas when a negative somatic marker, (i.e. negative feeling) is linked to a future outcome image, the negative marker becomes a warning to avoid the future outcome. Thus, the feelings or emotions associated with the future outcome image are what drive decision making (Damasio, 1994).

The affect-as-information theory (Clore, 1992; Schwarz, 1990; Schwarz & Clore, 1983) is another well-developed approach concerning the informational properties of affect (Loewenstein & Lerner, 2003). This states that when making evaluations or judgments, people tend to use how they feel as a guide in making that judgment; and when making decisions, a person’s evaluation of the specific choice tends to be more positive when in a positive mood and more negative when in a negative mood (Clore, 1992; Schwarz, 1990; Schwarz & Clore, 1983). This tendency for emotions to carry over from one situation and subsequently influence unrelated areas has been reliably demonstrated across many areas of judgment and decision making. For example, in a seminal study regarding life satisfaction, positive or negative moods were induced by interviewing people on either warm and sunny days or rainy spring days (Schwarz and Clore, 1983). The results supported the hypothesis that people use their current affective states to inform evaluative judgments in that higher levels of life satisfaction and general well-being were reported on sunny days compared to rainy days (Schwarz & Clore, 1983). Another pioneering study demonstrated this carry-over effect in terms of incidental affect influencing subsequent evaluations of risk perception (Johnson & Tversky, 1983). Newspaper stories designed to induce positive and negative moods were read by participants who were then asked to estimate the frequency of fatality for different causes of death. The results showed that those in the positive mood condition reported more optimistic estimates of risk than those in the negative mood condition; while the opposite was true for those in the negative mood condition, even when the source of the mood had no connection to the evaluation in question (Johnson & Tversky, 1983).

These early examples (Johnson & Tversky, 1983; Schwarz & Clore, 1983) focus on a valence-based approach which refers to the scale of goodness or badness upon which emotions or affect fall (Russell, 2003). This scale allows for a simplified grouping of basic emotion states, for example, placing positive emotions such as joy and happiness on the ‘good’ side of the scale, and negative emotions such as anger and fear on the ‘bad’ side (Lerner & Keltner, 2000). General findings from this valence-based stance show that while positive affective states tend to influence cognitions in a congruent manner leading to facilitative and flexible decision making (Fredrickson & Branigan, 2005; Isen, 2001), the influence of negative affect is less clearly established (Angie, Connelly, Waples & Kligyte, 2011). For example, the relationship between sadness and consumption is one of particular interest given that results seemingly depart from standard valence-based model predictions (Cryder et al., 2008; Garg & Lerner, 2013). These state that negative emotions should lead to general devaluation and perceptions of negativity, as demonstrated earlier in terms of life satisfaction and risk perception (Johnson & Tversky, 1983; Schwarz & Clore, 1983). Regarding consumption, however, studies have shown an increase in unhealthy foods e.g. chocolate following negative compared to positive mood inductions (e.g. Garg et al., 2007; Garg & Lerner, 2013); and an increase in the amount of money spent following negative compared to neutral mood inductions (e.g. Lerner et al., 2004). Specifically, in terms of economic decision making, this curious tendency for incidental sadness to influence unrelated monetary choices in such a way has been labelled as the misery-is-not-miserly effect (Cryder et al., 2008). Importantly, these negative emotions are unrelated or incidental to the decisions under consideration (Cryder et al., 2008); and, rather than making a conscious choice to engage in retail or consumer therapy in order to attenuate the effects of feeling sad, participants state that they are unaware of the possibility of a carry-over effect (e.g. Cryder et al., 2008). Thus, the influence of negative emotions represents an unconscious and potentially maladaptive effect on consumption (Garg & Lerner, 2013). With the overall subject of this thesis in mind, i.e. the influence of affect on decisions concerning sweet foods, the consideration of this effect is therefore pertinent.

Behavioural economics concerns the implementation of psychological insight to the field of economics (Cryder et al., 2008; Lerner et al., 2004). In terms of the way in which financial decisions are constructed, this area has traditionally focused on the application of cognitions rather than emotions, despite the increase in interest concerning the application of emotions to general decision making (Lerner et al., 2004). For example, the endowment effect is a robust economic anomaly stating that people generally demand much more money to relinquish or sell an item already in their possession than they would be willing to pay to acquire it (Thaler, 1980). It is linked to the idea of loss aversion whereby people value the avoidance of loss more than they value the acquisition of an equivalent gain, i.e. losses are psychologically more powerful and hold more salience than gains (e.g. Tversky & Kahneman, 1991). Lerner et al. (2004) incorporated sad and neutral mood inductions in a study investigating the endowment effect to address the lack of research concerning emotions within behavioural economics. Participants in manipulated sad and neutral mood conditions were divided by ‘ownership’ of a highlighter set. Those in the ‘sell’ condition were given (i.e. endowed with) the highlighter set at the start of the experiment and subsequently given the chance to either keep it or sell it back at a range of price options following the mood induction. In order to elicit participants’ true price values, they were informed that one of their choices would be randomly selected to ascertain the amount they received at the end of the experiment (Lerner et al., 2004). This procedure is based on the Becker et al. method (1964) and has been used in numerous studies concerning economic preferences (e.g. Kahneman, Knetsch & Thaler, 1991). Those in the ‘choice’ condition were not endowed with but merely shown the highlighter set at the start of the experiment. They were subsequently shown the same range of price options as those in the ‘sell’ condition and asked to choose between either receiving the highlighter set or instead receiving the money for each amount presented following the mood induction (Lerner et al., 2004). It is noted that a choice price is conceptually different to a buying price as it concerns choosing between receiving the object vs. receiving money, rather than choosing to relinquish money, i.e. pay money, in order to receive the object. However, it allows for a fair comparison between the ‘choice’ and ‘sell’ condition given that the decision under consideration is conceptually identical in terms of deciding whether to receive or reject a cash sum (Lerner et al., 2004). Following previous research concerning the endowment effect (Thaler, 1980), selling prices exceeded choice prices in the neutral condition, i.e. participants in the ‘sell’ condition demanded more money to sell the highlighter set compared to the amount participants in the ‘choice’ condition were willing to pay to buy the highlighter set (Lerner et al., 2004). However, supporting the rationale that sadness is linked to wanting to change one’s circumstance e.g. through the acquisition of new goods, in the sad mood condition selling prices decreased in the ‘sell’ condition, and choice prices increased in the ‘choice’ condition, compared to the neutral mood condition. These results were interpreted as sadness leading to an increase in the amount that people are willing to spend to acquire new items; and provide evidence of sadness reversing the endowment effect entirely (Lerner et al., 2004).

The current study sought to ascertain whether the carry over effects of emotion lead to the misery-is-not-miserly effect (Cryder et al., 2008), specifically in terms of economic decisions regarding sweet foods. It incorporated manipulated positive and negative incidental moods i.e. mood incidental to a stimulus (Robinson et al., 2012) and a willingness-to-pay task (WTP; based on Becker et al., 1964) concerning high-sugar chocolate foods and high-sugar but non-chocolate foods. High-sugar chocolate *and* high-sugar non-chocolate items were included to allow for comparisons of positive and negative manipulated incidental mood on decisions concerning different types of sweet foods. Non-food/neutral items were included as control items to allow for comparisons between responses for the chocolate and high-sugar items. Like the method used by Lerner et al. (2004), the WTP task takes the form of an auction whereby participants indicate their WTP by placing ‘bids’ on the items presented. Because they are later given the chance to win one of the items under consideration it has been argued that such methods reveal true economic preferences (e.g. Hoehn & Randall, 1989). Following past research (e.g. Cryder et al., 2008; Lerner et al., 2004) it was hypothesised that participants in the negative mood condition would be willing to pay more for chocolate and high-sugar items compared to those in the positive mood condition.

The current study also incorporated strengthened versions of the initial choice and delay of gratification tasks (DoG; based on Mischel, 1974) from the first study in this thesis (see Chapter 2). These also firstly assessed the influence of manipulated positive and negative incidental mood on decisions concerning chocolate vs. non-food/neutral rewards; and secondly assessed the influence of manipulated positive and negative incidental mood on the ability to delay the gratification of receiving that chocolate or non-food/neutral reward. In view of the ambiguous nature concerning the presentation of the rewards used in the first study, this second study follows past research involving the DoG paradigm within an adult population in which actual rather than unseen rewards were displayed to participants (e.g. Forstmeier et al., 2011; Knolle-Veentjer, Huth, Ferstl, Aldenoff & Hinze-Selch, 2008; Wulfert, Block, Santa Ana, Rodriguez & Colsman, 2002). In order to further increase the ecological validity of the choice/DoG elements in the current study the choices of rewards were also changed, details of which are reported in the method section below (see Section 3.3.2).

Following past research reviewed in the first study (see Chapter 2) concerning mood, chocolate consumption and impulsiveness (e.g. Garg et al., 2007; Tice et al., 2001), it was firstly hypothesised that participants in the negative mood condition would be more likely to choose chocolate over a non-food/neutral reward while the reverse would be true of those in the positive condition; and secondly, that those in the negative mood condition would be less likely to delay the gratification of receiving that reward and more likely to display impulsive behaviour, while the reverse would be true of those in the positive mood condition.

As chocolate is a commonly and intensely craved food item (Hill et al., 1991; Rozin et al., 1991), higher chocolate craving was expected to be associated with higher WTP scores for chocolate items, and a higher likelihood of choosing chocolate compared to a non-food/neutral reward in the DoG task. As this craving measure is specific to chocolate and not to sugar in general, chocolate craving was not expected to be significantly associated with WTP for high-sugar items in the WTP task. Impulsivity (as less effective response inhibition) and hunger have been linked to higher snack food purchase (Nederkoorn et al., 2009). In a study in which participants were given an imaginary budget to spend in a virtual supermarket, those who were impulsive and hungry bought more palatable and highly caloric snack foods such as chocolate and candy (Nederkoorn et al., 2009). Higher impulsivity and hunger were therefore expected to be associated with higher WTP scores for both chocolate and high-sugar items. BMI was also included as a control variable, as appropriate for a study broadly investigating factors influencing obesity. As BMI is positively associated with the consumption of sweet and fat food types (e.g. Togo, Osler, Sørensen, & Heitmann, 2001), higher BMI was therefore expected to be associated with higher WTP scores for both chocolate and high-sugar items. The DoG paradigm specifically concerns impulse and self-control whereby choosing a smaller, immediate reward over a later, but larger reward demonstrates higher impulsivity (Mischel, 1974). Higher impulsivity was therefore expected to be associated with a lower likelihood of delaying gratification for both chocolate and non-food/neutral items.

3.3 Method

On account of this study building upon the first study, methodological similarities are evident. Where details have been presented previously, the reader will therefore be directed to the appropriate section of the previous chapter, and a brief outline will instead be included in this section. All novel paperwork relevant to this study can be found in the Appendix (see Chapter 7) which comprises:

- Ethics statement, ref: SAS1704e.
- Stimuli used in the WTP task.

3.3.1 Participants

A total of 135 males and females (24 males and 111 females) ranging in age from 18 to 57 years (mean = 25.16, SD = 8.56) were recruited for participation using similar methods to those employed in the first study (see Chapter 2, Section 2.3.1) for full recruitment details). All participants met the necessary inclusion criteria of being aged 18 years or over.

As two participants declined to provide weight and height measurements, body mass index percentile (BMI) was calculated for the 133 remaining participants using the online 'NHS BMI healthy weight calculator' (2018). As stated in the previous chapter, this was deemed appropriate for a study investigating psychological factors influencing sweet food decisions from the perspective of obesity, for example, in order to be able to control for differences in BMI when carrying out analyses of the data. BMI ranged from 16.40 to 44.10 kg/m^2, with a mean of 24.60 kg/m^2 (SD = 5.10). 3.00 per cent of participants were underweight (<18.5 kg/m^2), 59.40 per cent were of a healthy weight (18.5-25 kg/m^2), 25.60 percent were overweight (25-30 kg/m^2) and 12.00 percent were obese (>30 kg/m^2).

The total sample size for the current study was calculated using the effect size obtained from the choice element of the first study (Chapter 2). This allowed for a power analysis to be performed which generated an indication of the sample size needed in order to obtain a statistically significant result for the current study.

Power analysis

The effect size for the choice element of the first study (see Chapter 2) was w = 0.243 which is considered small/medium using Cohen's (1992) criteria. With alpha = .05 and power = 0.80, the projected sample size needed for this element of the current study to also obtain this effect size was therefore approximately n = 133 (GPower 3.1; Faul, Erdfelder, Buchner & Lang, 2009). Based on this calculation, data collection was concluded when the overall sample size of the current study reached *n* = 135.

3.3.2 Materials

The following materials are identical to those used in the first study, (see Chapter 2, Section 2.3.2 for full details):

- The standardised mood induction task (MIT; Robinson et al., 2012).
- Printed visual analogue scales to record current mood ratings.
- Printed visual analogue scale to record current levels of hunger.
- Printed versions of the Attitudes to Chocolate Questionnaire (Benton et al., 1998). Reliability analyses indicated that responses for the craving sub-scale used in the current study had an appropriate level of internal consistency (α = .92).
- Printed versions of Barratt Impulsiveness Scale, Version 11 (BIS-11; Patton et al., 1995). Reliability analyses indicated that responses for the BIS-11 in the current study had an appropriate level of internal consistency (α = .79).
- Participants' verbal response of either 'Yes' or 'No' to the question 'Do you like chocolate?' was recorded by hand. 91.1 per cent of participants responded 'Yes' and 8.9 per cent of participants responded 'No'.
- Printed funnelled debriefing questions (based on Chartrand & Bargh, 1996)

The following materials differ from those used in the first study and are therefore presented here in full detail:

The initial choice and delay of gratification tasks (DoG) from the first study (adapted from Mischel; 1974) were built upon and strengthened for inclusion in the current study. Participant responses were recorded by hand.

A willingness-to-pay task (WTP; based on Becker et al., 1964) was included to assess the relationship between manipulated positive and negative incidental mood and economic decisions concerning sweet foods. High-sugar chocolate items *and* high-sugar non-chocolate items were included to allow for comparisons between positive and negative mood on decisions concerning different types of sweet foods. Non-food/neutral items acted as control items in order to calculate WTP for chocolate and high-sugar items. Participant responses were recorded by hand.

Initial choice and delay of gratification tasks (DoG; adapted from Mischel, 1974)

While similar to the initial choice and DoG tasks used in the first study (see Chapter 2, Section 2.3), elements of these tasks were strengthened for the current study. This followed information gathered from the funnelled debriefing (based on Chartrand & Bargh, 1996) collected during the first study that confirmed suspicion pertaining to the validity of these tasks in that first study. Specifically, the verbal presentation of the rewards was replaced with actual rewards shown to participants; and the rewards themselves were slightly different- small boxes of Quality Street™ chocolates (one box now or two boxes later) and current issues of a range of ten magazines (one magazine now or two magazines later). These items were selected following further analyses of data collected for the online Qualtrics™ desirability pilot study used previously (see Chapter 2, Section 2.3.2). This pilot study was carried out in the first study to ascertain the desirability of items that might be given to an adult to say ‘Thank you’ for something. As far as possible, the data were used again in order to ensure that the new reward items selected for the strengthened DoG task in the current study were of a similar desirability and fulfilled the stipulation of being suitable reward choices to say ‘Thank you’ for taking part in the study.

Online Qualtrics™ desirability pilot study

Ninety-eight adult participants (15 males and 83 females) ranging in age from 18 years-65+ years (54.55 per cent falling between 35-44 years) rated a total of 47 sugar and non-food items (e.g. ‘a bag of sweets,’ or ‘a bunch of flowers’) on a 10-point Likert scale ranging from 1 (least desirable) to 10 (most desirable). One missing response meant that 97 participants were involved in the analysis for items to be used in the current study. A related *t*-test showed that there was a non-significant difference between mean desirability scores for a small box of Quality Street™ chocolates (mean = 4.10, SD = 2.26) and mean desirability scores for a magazine (mean = 3.58, SD = 2.41; $t(96) = 1.89$, $p = .061$).

The results of this pilot study confirmed that the sweet and non-food/neutral items selected as immediate rewards (a small box of Quality Street™ chocolates/a magazine) in the DoG task for the current study were of a similar desirability. As these items were presented in the pilot study as “items that might be given to an adult to say ‘Thank you’ for something,” they also fulfilled the stipulation of being suitable reward choices for the DoG task. Data were not collected concerning the desirability of two boxes of Quality Street™ chocolates or two magazines. However, given that delay of gratification relates to a person’s ability to voluntarily delay the acceptance of a small, immediate reward for a later but larger reward (Mischel, 1974), it is posited that doubling the quantity of the rewards offered therefore fulfils this stipulation.

Willingness-to-pay task (WTP; based on Becker et al., 1964)

The WTP task comprised 20 everyday shopping items, 5 of which were chocolate items e.g. a large bag of M&M's; 5 of which were high in sugar (but did not contain chocolate) e.g. a jar of honey; and 10 of which were non-food (i.e. neutral items) e.g. a pair of socks. High-sugar chocolate *and* high-sugar non-chocolate items were included to allow for comparisons of the influence of positive and negative manipulated incidental mood on decisions concerning different types of sweet foods. Non-food rather than low-sugar items were selected to ensure methodological consistency following the DoG task which also incorporated sweet and non-food/neutral items. Colour-pictures of the 20 everyday shopping items were printed out on picture-quality A4 paper. Each picture had the item name and a clear description to avoid ambiguity printed underneath in black, 36-point Arial font. The 20 items (5 chocolate, 5 high-sugar and 10 non-food) were selected following an initial online Qualtrics^{TM} survey of 40 everyday shopping items (10 chocolate, 10 high-sugar and 20 non-food). This was to ascertain that the desirability and familiarity of the final 20 items (5 chocolate, 5 high-sugar and 10 non-food) were not significantly different.

Online Qualtrics^{TM} willingness-to-pay (WTP) pilot study

Seventy-two adult participants (aged 18 years and over) rated pictures of 40 everyday shopping items (10 chocolate items, 10 high-sugar items and 20 non-food items) in terms of desirability and familiarity. The 40 items were selected in terms of price with the items ranging from a minimum of £0.30 to a maximum of £3.00 (mean = 1.58, SD = .84). This is because the bidding price options used in the WTP task ranged from

£0.00 to £3.00. The price data for the 40 items were analysed using the one-way repeated measures ANOVA. Results showed that there was a non-significant effect of WTP stimuli type (chocolate, high sugar and neutral) on prices (F (2, 18) = .60, p = .560).

For the online Qualtrics™ pilot study, the 40 items were presented in a randomised order, although participants rated each item in terms of desirability followed immediately by familiarity before being shown the subsequent item. Participants were asked 'In your opinion, how desirable/familiar is this item?' A 10-point Likert scale ranging from 1 to 10 was firstly used to ascertain each item's desirability rating with 1 being not desirable at all and 10 being extremely desirable; and secondly to ascertain each item's familiarity with 1 being not familiar at all and 10 being extremely familiar.

Following collection of the desirability and familiarity data for all 40 items, 5 chocolate items, 5 high-sugar items and 10 neutral items were selected by the researcher as being potential final stimuli. These 20 items were then analysed using the one-way repeated measures ANOVA to check that the desirability and familiarity of these possible 20 items were not significantly different.

Results concerning desirability showed that there was a significant effect of WTP stimuli type (chocolate, high-sugar and neutral) on desirability ratings (F (2, 8) = 5.21, p = .036). However, Bonferroni pairwise comparisons found non-significant differences between chocolate item desirability ratings (mean = 5.59, SD = .24) and high-sugar item desirability ratings (mean = 4.31, SD = .93; p = .092); chocolate item desirability ratings and neutral item desirability ratings (mean = 4.09, SD = 1.09; p =

.154); and high-sugar item desirability ratings and neutral item desirability ratings (*p* = 1.00).

Results concerning familiarity showed that there was a non-significant effect of WTP stimuli type (chocolate, high-sugar and neutral) on familiarity ratings ($F(2, 8) = 2.04$, $p = .193$).

The price data for the final 20 items used in the WTP task were also analysed using the one-way repeated measures ANOVA. Results showed that there was a non-significant effect of WTP stimuli type (chocolate, high-sugar and neutral) on prices ($F(2, 8) = 1.17$, $p = .360$).

The results of this online Qualtrics^{TM} pilot study confirmed that the chocolate, high-sugar and neutral items did not differ significantly in terms of desirability, familiarity or price and were therefore suitable for use in the WTP task.

3.3.3 Design and Procedure

The procedure for the current study closely followed that of the first study (see Chapter 2, Section 2.3.3 for full details). A summary of procedural details follows with full details of the initial choice, DoG and WTP tasks which make up the only novel procedural steps in this second study. The initial choice and DoG tasks used an experimental, between-subjects design with manipulated positive and negative mood as the experimental variable. The WTP task used a cross-sectional correlational design with manipulated positive and negative mood as predictor variables and WTP for chocolate vs. neutral items, WTP for high-sugar vs. neutral items and WTP for chocolate vs. high-sugar items as the criterion variables.

Procedural summary

- Consent taken and demographic information recorded
- Hunger levels and current mood state recorded
- MIT completed (Robinson et al., 2012)
- Current mood state recorded for the second time
- Initial choice task completed
- DoG task completed
- WTP task completed
- Questionnaires completed
- Current mood state recorded for the final time
- Funnelled debriefing completed

Procedure: Initial choice and delay of gratification task (DoG; adapted from Mischel, 1974)

In order to assess the influence of mood on sweet and non-food choice, participants were told that they were allowed to choose between a small box of Quality Street™ chocolates or one from a selection of ten magazines as ‘a reward to say “Thank you” for taking part in the study’. The selection of magazines included a broad range of categories in order to allow choice of topic for participants e.g. women’s lifestyle, men’s lifestyle, music, science, psychology, food and home. Participants were told that they would be able to take their choice with them at the very end of the study. The box of chocolates and magazines were placed on the table and participants were asked to decide which reward they would like. When they had selected either the small box of Quality Street™ chocolates or one magazine, the researcher recorded this initial choice (‘Chocolate’ or ‘Magazine’) by hand. If the participant chose the chocolates, all ten magazines were removed from the table (and the chocolates were left on the table); if the participant chose a magazine the chocolates were removed from the table (and the remaining nine magazines were left on the table). The DoG element was then immediately presented as a second choice of either keeping the reward that was initially chosen (i.e. the small box of Quality Street™ chocolates or one magazine) which participants would take with them as soon as the study ended; or instead exchanging that initial reward for the larger reward of either two boxes of Quality Street™ chocolates (instead of one box of Quality Street™ chocolates) or two magazines (instead of one magazine). If the initial choice had been the small box of Quality Street™ chocolates, a second box was therefore added to the table. If the initial choice had been a magazine, participants were invited to choose a second magazine from the remaining selection. Participants were told that if they chose to keep their initial reward they would be able to take that reward with them as soon as the study finished; but if they chose two rewards ‘there is a catch.’ Participants were then told that instead of taking the two rewards with them as soon as the study finished, the researcher would ‘parcel them up and put them in the post so they will take a day or two to arrive.’ To clarify the choice, the researcher asked “So, would you like to take the box of chocolates/magazine with you now? Or can you wait and have two in a couple of days?” The researcher then recorded this second choice (‘Keep first reward’ or ‘Delay gratification’) by hand.

Procedure: Willingness-to-pay task (WTP; based on Becker et al., 1964)

Participants were given printed instructions concerning the willingness-to-pay (WTP) task and any queries were verbally clarified by the researcher before the task commenced.

The WTP task was presented as an auction in which bids would be placed on 20 everyday shopping items using real money. The shopping items comprised 5 chocolate items e.g. a large bag of M&M's; 5 high-sugar items e.g. a jar of honey; and 10 neutral items e.g. a pair of socks. The bids permitted were £0, £1, £2 or £3. Three £1 coins were placed on the table in front of each participant by the researcher. Participants were told that the researcher was interested in how much they would be willing to pay for each of the 20 items, "right now, in this moment." It was made clear that the researcher was only interested in how much the participant was willing to pay and not in the perceived worth of the items. Participants were told that at the end of the auction they would be given the chance to win just one of the items and that they should therefore treat each bid as if it were the only decision that mattered. That is, it was made clear that participants did not have to spread the £3 over the 20 items and could instead treat each bid as if it was the only one that mattered.

Colour-pictures of the 20 everyday shopping items were printed out on picture-quality A4 paper. Each picture had the item name and a clear description printed underneath in black, 36-point Arial font in order to avoid ambiguity. For example, the picture of a bottle of Sprite™ had the description '2 litre bottle of Sprite.' This was to ensure that all participants were basing the amount they were willing to pay for each item on set parameters given that the pictures were not actual size. Each picture was in a transparent document sleeve and bound in an A4 file which was held by the researcher to present the items. The items were presented in a randomised order which was generated using Microsoft Excel™. That is, all 20 items were entered into an Excel™ spreadsheet which then randomly generated 4 different orders of the 20 items. Participants were assigned a presentation order through block randomisation. The researcher sat opposite the participant to present the WTP task and asked, “How much would you be willing to pay for this [item name]?”. The participant’s bid in response to each of the 20 items was noted by hand.

When all 20 bids had been made, the participant had the chance to win one of the items drawn at random using the DecisionRoulette™ app which was presented on the researcher’s smartphone. This app allowed the presentation of all 20 items in a roulette-style wheel which the participant ‘spun’ in order to choose a random item. The order of the 20 items was randomly presented following each spin of the wheel. A separate wheel was then ‘spun’ by the participant to choose a random price of either £0, £1, £2 or £3. If the participants’ original bid was equal to or greater than the random price, they won the item. They were told that at the end of the study they would pay the random price drawn using the money given to them at the start of the WTP task, receive the item and if the random amount drawn was less than £3 they would also keep the remaining money. However, if the participant’s original bid was less than the random price drawn, they lost the auction, did not receive the item but were instead told that they could take the £3 at the end of the study.

Deception

The DoG reward choices and the ‘auction’ element of the WTP task were in fact of a hypothetical nature and participants did not actually keep their choice of DoG reward, receive the WTP item and any remaining money if they won the WTP auction, or keep the £3 if they lost the WTP auction. However, genuine responses to both tasks were integral to the study which is why participants were led to believe that these elements were genuine.

At the very end of the study it was revealed that the DoG task and WTP task had both been of a hypothetical nature and each participant was given an extra £5 Amazon™ voucher to compensate for the deception involved. (Each participant therefore received a total of £10 in Amazon™ vouchers: £5 originally offered as an incentive to participate and £5 to replace the rewards promised during the study.)

3.4 Results: Preliminary analyses

Mood Induction Task (MIT; Robinson et al., 2012)

The mood induction task (MIT; Robinson et al., 2012) comprised positive and negative mood conditions. Preliminary analyses of the data used two related *t*-tests to ascertain whether positive and negative mood ratings were significantly different following the mood induction task.

Happiness ratings were significantly higher after the positive mood manipulation (mean = 6.73, SD = 1.54) compared to before the positive mood manipulation (mean = 5.61, SD = 1.51; $t(67) = -8.36$, $p < .001$).

Sadness ratings were significantly higher after the negative mood manipulation (mean = 3.80, SD = 1.86) compared to before the negative mood manipulation (mean = 1.29, SD = 1.86; $t(66) = -11.63$, $p < .001$).

These analyses confirmed that the positive and negative incidental mood induction tasks were successful in that participants' general happiness ratings (positive condition) and sadness ratings (negative condition) significantly increased following the corresponding induction procedure.

Hunger ratings

An unrelated *t*-test was used to check that hunger ratings did not differ significantly between those in the positive (mean = 4.29, SD = 2.78) and those in the negative mood condition (mean = 3.86, SD = 2.50; $t(133) = -.954$, $p = .342$).

These results confirmed that hunger (which was included as a control variable for the main analyses) did not differ significantly between the two experimental groups.

3.5 Results and Discussion: Initial choice and delay of gratification tasks

The initial choice and delay of gratification (DoG) tasks comprised three elements which were all used for subsequent data analysis: All participants took part in the initial element of choosing between a sweet or non-food/neutral reward (a small box of chocolates vs. one from a selection of ten magazines). Those participants who initially chose the chocolates comprised the sample for the second element of this task (delaying gratification of the sweet reward and instead receiving two boxes of chocolates later); while those participants who initially chose the magazine comprised the sample for the third element of this task (delaying gratification of the non-food/neutral reward and instead receiving two magazines later). Each of the three elements were examined firstly with a chi-square analysis (primary analyses). Then, in order to control for additional factors influencing the choices investigated in the primary chi-square analyses, three binomial hierarchical logistic regression analyses were performed on the data (main analyses).

These elements are presented in the following format:

- ‘Initial choice’ task:
    - Chi-Square analysis: Results and Discussion.
    - Logistic regression analysis: Results and Discussion.
    - ‘Initial choice’ task: Summary.
- ‘Chocolate DoG’ task:
    - Chi square analysis: Results and Discussion.
    - Logistic regression analysis: Results and Discussion.
    - ‘Chocolate DoG’ task: Summary.
- ‘Magazine DoG’ task:
    - Chi square analysis: Results and Discussion.
    - Logistic regression analysis: Results and Discussion.
    - ‘Magazine DoG’ task: Summary.

3.5.1 ‘Initial Choice’ task

Results, ‘Initial choice’ task: Chi-Square analysis

The association between manipulated positive and negative incidental affect and initial choice (small box of chocolates/one from a selection of ten magazines).

A chi-square analysis was used to investigate the association between mood (positive and negative) and initial choice presented (small box of chocolates vs. one from a selection of ten magazines).

Participants in the negative mood condition were more likely to choose chocolates over a magazine when given the choice whereas the reverse was true for participants in the positive mood condition. A chi-square analysis found this association between mood and initial reward choice to be non-significant, $\chi 2$ (1, N = 135) = 3.33, p = .068. The data are presented in figure 3-1.

<u>Discussion, 'Initial choice' task: Chi-Square analysis</u>

It was hypothesised that participants in the negative mood condition would be more likely to choose a sweet reward (small box of chocolates) and less likely to choose a non-food/neutral reward (magazine) and that the reverse would be true of participants in the positive mood condition. Following the first study (see Chapter 2), this was based on affective regulation/mood management theories (see Gross, 1998; Zillmann, 1988) which state that the way in which a person perceives their current feelings in relation to how they will feel as a result of a future behaviour forms the affective guide in making that subsequent behaviour choice (Andrade, 2005). That is, people in a negative mood will seek to alter or repair this feeling in order to feel better, leading to behavioural choices considered capable of achieving this change; whereas

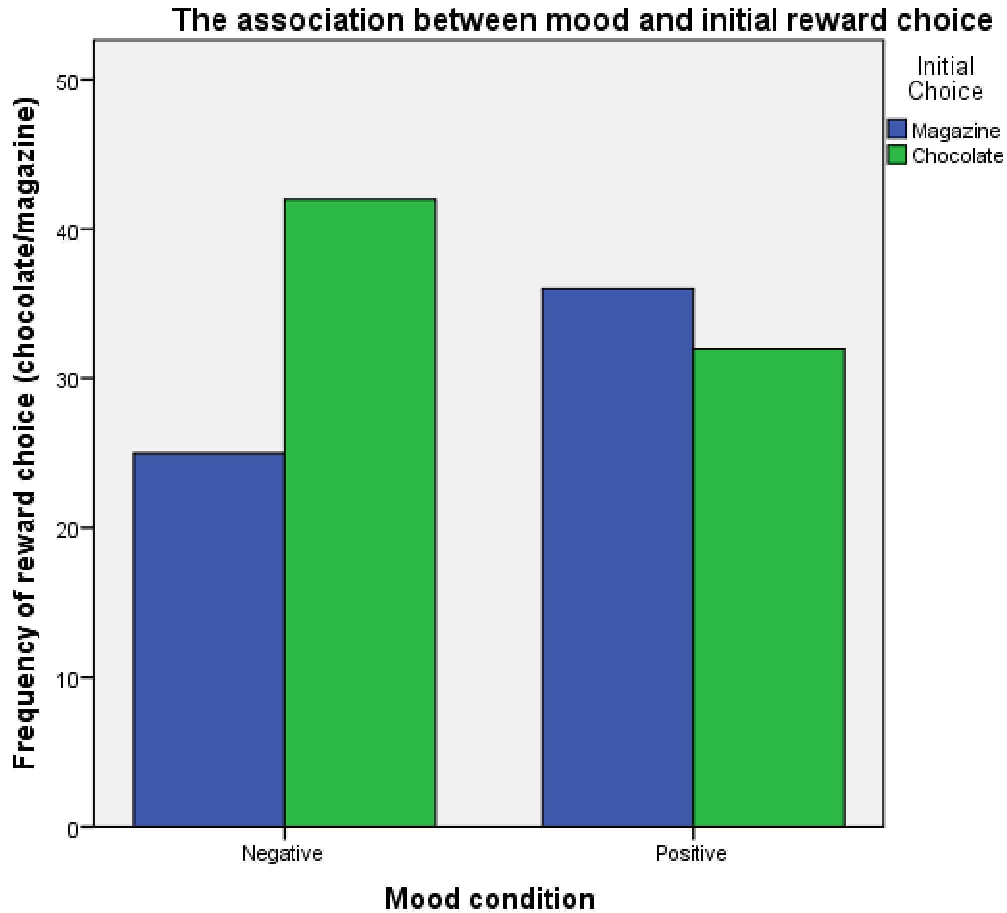

Figure 3-1: Study 2, 'Initial choice' task chi-square data

people in a positive mood will seek to maintain their positive good mood by being less likely to make behavioural decisions considered to be mood-changing and more likely to make choices considered to be more passive (Andrade, 2005). Given that chocolate as a hedonic food is, by definition, mood altering (Garg et al., 2007), choosing the magazine ostensibly becomes the more passive response expressly because it is *not* a hedonic food. The frequencies of co-occurrence in both mood conditions were as expected, i.e. that more participants in the negative condition chose chocolates (compared to a magazine) and more participants in the positive condition chose a magazine (compared to chocolates). However, the association between mood condition and initial choice was non-significant. While these results could therefore be seen to align with affective regulation/mood management theories as hypothesised (see Gross, 1998; Zillmann, 1988), the following interpretations are cautious. For those in the negative mood condition, choosing the box of chocolates as a future sweet reward with hedonic, mood-altering properties was tentatively interpreted as managing or repairing the negative feelings induced by the negative mood manipulation. For those in the positive mood condition, choosing the magazine as a less hedonic future reward was tentatively interpreted as a more passive choice in order to maintain the positive feelings induced by the positive mood manipulation. That is to say, perhaps those in the positive mood condition did not require the potentially mood changing properties of the chocolates and were therefore less likely to choose this reward. While the current study did not investigate subsequent consumption of the rewards, parallels can nevertheless be drawn with past research that also follows these results. For example, significantly higher sweet snack food consumption following negative mood manipulations was also interpreted as being in order to change negative emotions via the consumption of foods with mood-altering properties (Garg et al., 2007; Tice et al., 2001). Conversely, lower sweet snack food consumption following positive mood manipulations was interpreted as being in order to avoid regretting the consumption of an unhealthy food, thereby protecting the positive emotions generated by the mood manipulation (Garg et al., 2007; Tice et al., 2001). However, as previously emphasized, given the non-significance of the current results, such interpretations remain cautious.

Results, 'Initial choice' task: Logistic regression

The probability of choosing a box of chocolates vs. one from a selection of ten magazines when controlling for chocolate craving and mood.

A binomial, hierarchical, logistic regression analysis was performed to assess the probability of choosing a small box of chocolates vs. one from a selection of ten magazines depending on whether the mood manipulation was either positive or negative, and controlling for hunger, BMI and chocolate craving;

Initial hierarchical logistic regression analyses were performed on the data to assess which of the models identified for investigation best fit the data for the final regression model (Field, 2013). The proposed models were to ascertain the likelihood that participants (n = 135) would choose chocolates over a magazine depending on whether the mood manipulation was either positive or negative, and controlling for BMI, hunger and chocolate craving. BMI and hunger were entered into the model in Block 1, chocolate craving was entered into the model in Block 2 and mood was entered into the model in Block 3. As Blocks 2 and 3 significantly improved the logistic regression model but Block 1 did not, Blocks 2 and 3 were selected for the re-run of this logistic regression analysis (Field, 2013). That is, BMI and hunger did not independently predict the choice of chocolates over a magazine or improve the fit of the overall model and were therefore excluded from subsequent analyses. See Tables 1, 2 and 3 for the descriptive statistics of all predictors considered for analysis, the observed frequencies of observations between the categorical predictor variable (mood, positive/negative) and categorical outcome variable (initial choice, chocolates/magazine), and coefficients of the model predicting the choice of chocolates over a magazine. Following the analysis, residual statistics were examined to ensure the assumptions of hierarchical multiple logistic regression had been met (Field, 2013). No points for which the data fit poorly or exerted an undue influence on the model were identified. Full details of the assumption checks are presented in the Appendix, (see Chapter 7, Section 7.2.1).

***Table 1**: Study 2, 'Initial choice' task logistic regression, descriptive statistics*

The mean scores and SDs for BMI, hunger and chocolate craving. Mood as a categorical variable is not included here.

	Minimum	**Maximum**	**Mean**	**Std. Deviation**
Body Mass Index (BMI)	16.40	44.10	24.60	5.10
Hunger levels	00.00	10.80	4.08	2.64
Chocolate Craving (subscale of the Attitudes to Chocolate questionnaire; Benton et al., 1998)	00.00	10.00	3.95	2.28

***Table 2**: Study 2, 'Initial choice' task logistic regression, frequencies of association between mood and choice*

		Initial Choice Chocolates vs. Magazine		
		Mag	Choc	Total
Mood	Negative	25	42	67
	Positive	36	32	68
Total		61	74	135

The logistic regression model was statistically significant, $\chi 2$ (2, n = 135) = 15.58, p < .001. The model explained between 10.9% (Cox & Snell R^2) and 14.6%

(Nagelkerke R^2) of the variance in choosing chocolates over a magazine and correctly classified 65.9% of cases.

Increasing chocolate craving was significantly associated with an increased likelihood of choosing chocolates over a magazine, p = .001. The chance of choosing chocolates increased by 1.33 for every unit increase on the chocolate craving scale.

Those in a positive mood were 0.44 times less likely to choose chocolates than those in a negative mood and this was significant, p = .028.

Table 3*: Study 2, 'Initial choice' task, coefficients of the logistic regression model*

	b (SE)	p	OR	95% CI Lower	95% CI Upper
Constant	-0.51 (0.40)	.202	0.60		
Chocolate Craving	0.29 (0.09)	.001	1.33	1.12	1.58
Mood	-0.82 (0.37)	.028	0.44	0.21	0.92

Discussion, 'Initial choice' task: Logistic regression analysis

In order to control for additional factors influencing the association of mood (positive/negative) with the initial choice presented (a small box of chocolates vs. one from a selection of ten magazines), a binomial hierarchical logistic regression analysis was performed. This was to assess the probability of choosing chocolates over a magazine depending on whether the mood manipulation was either positive or negative, and controlling for chocolate craving. (N.B. BMI and hunger were removed from this analysis following indications that these variables did not improve the overall fit of the regression model). The model was significant, and chocolate craving and mood were both significant independent predictors of initial choice.

As craving for chocolate is associated with chocolate consumption (Benton et al., 1998), the finding that an increase in chocolate craving was significantly associated with an increased likelihood of choosing chocolates was as expected. As mood (as the categorical variable) moved from negative to positive, the probability of choosing chocolates significantly decreased, also as expected. This finding concerning mood is particularly noteworthy following the previous, corresponding chi-square analysis in which the association between mood and initial choice was directionally as expected but did not reach statistical significance. It would appear that the predictive power of mood is only highly statistically evident when controlling for other factors such as levels of chocolate craving. Whereas past research investigating actual sweet food consumption has found conclusive results when considering only mood (e.g. Garg et al., 2007), the preceding step, i.e. the choice of one item over another, or preference, is likely to be more complex. This complexity can perhaps explain the fact that the association between mood and choice did not reach significance until other factors were considered.

The results of this logistic regression therefore firmly align with affective regulation/mood management theories as hypothesised, which state that those in a positive mood will seek to protect or maintain this feeling and will therefore be less likely to make decisions considered to be mood changing (see Gross, 1998; Zillmann, 1988). Again, following the interpretation of the chi-square analysis, this was also interpreted as participants in the positive mood condition not requiring the potentially mood changing properties of the chocolate, therefore explaining the increased likelihood of choosing the magazine. The results of this logistic regression analysis therefore provide further convincing evidence of an association between positive and negative affect and sweet food decisions concerning chocolate in the expected direction set out in the hypotheses for this element of the study.

<u>Summary, 'Initial choice' task</u>

The strengthened 'initial choice' task involving a fully powered sample, the visual presentation of rewards offered to participants and the consideration of manipulated mood made up a central point of focus in this second study chapter. Although the frequencies of co-occurrence in both mood conditions were as expected, results of a chi-square analysis did not reveal a significant association between choice (chocolates vs. a magazine) and mood (positive vs. negative). However, the subsequent logistic regression model did reveal statistically significant findings suggesting that the influence of mood on choices concerning chocolate is only apparent when considering other factors. Consequently, the logistic regression model revealed that both mood and chocolate craving were able to significantly, independently predict the likelihood of choosing chocolate over a magazine, in the expected directions. That is to say, as mood moved from negative to positive, the likelihood of choosing chocolate significantly decreased; while increasing chocolate craving was significantly associated with a higher likelihood of choosing chocolate. These conclusive findings concerning mood are therefore robustly supported by affective regulation/mood management theories (Gross, 1998; Zillmann, 1988), as well previous literature reporting similar findings concerning mood and sweet food consumption (e.g. Garg et al., 2007). Ultimately, the results of the logistic regression provide convincing evidence that people experiencing negative mood states who report a higher craving for chocolate will be more likely to choose chocolate over a magazine, compared to those people experiencing positive moods.

3.5.2 ‘Chocolate DoG’ task

Results, ‘Chocolate DoG’ task: Chi-Square analysis

The association between manipulated positive and negative incidental affect and the ability to delay gratification for a sweet reward (one box of chocolates now/two boxes of chocolates later).

A second chi square analysis was used to investigate the association between mood (positive and negative) and ability to delay gratification for the sweet reward (one box of chocolates now vs. two boxes of chocolates later).

Participants in both the positive and negative mood conditions were more likely to choose to keep one box of chocolates now over delaying gratification and receiving two boxes later when given the choice. A chi-square test therefore found a non-significant association between mood and ability to delay gratification for a chocolate reward, $\chi 2$ (1, N = 74) = .014, p = .905. The data are presented in figure 3-2.

Discussion, ‘Chocolate DoG’ task: Chi-Square analysis

Based on past research (e.g. Tice et al., 2001), it was hypothesised that participants in the positive mood condition would be more likely to demonstrate self-control and delay the gratification of an immediate sweet reward (one box of chocolates) in exchange for a later but larger sweet reward (two boxes of chocolates) and that the reverse would be true of those in the negative mood condition. In line with the results of the first study (Chapter 2), the data showed that participants in both the positive and negative mood conditions were more likely to choose the immediate reward and

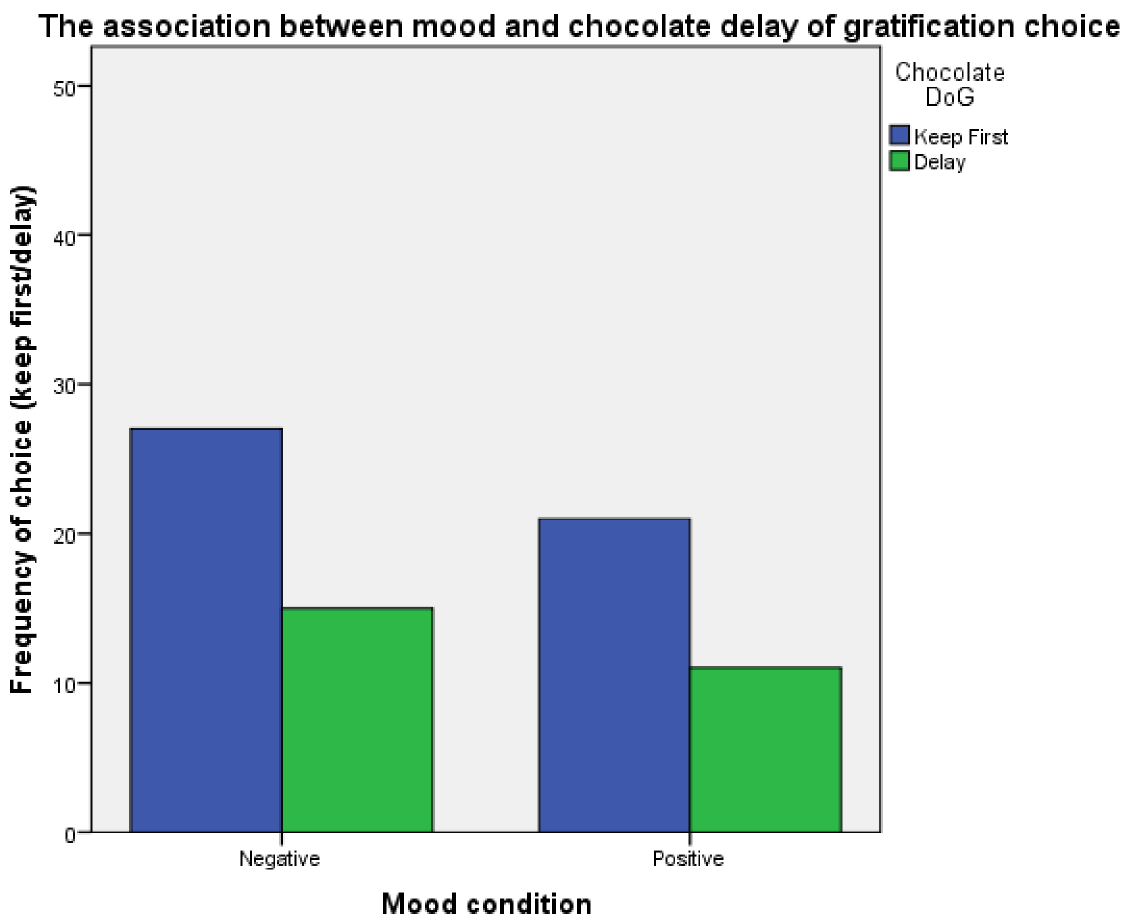

Figure 3-2: Study 2, 'Chocolate DoG' task chi-square data

less likely to delay gratification. Although this association between mood condition and delay of gratification choice was non-significant (and therefore interpretations are cautious), the hypothesis could be seen to be directionally supported by observed frequencies of co-occurrence in the negative mood condition, i.e. that those in the negative mood condition were more likely to display impulsive behaviour (choosing the immediate reward) than exercise self-control (delay gratification). Again, tentatively drawing on affective regulation/mood management theories (see Gross, 1998; Zillmann, 1988), this behaviour could be interpreted as aligning with this theoretical stance which states that people in negative moods will seek to alter or repair these feelings by making decisions deemed to be mood-changing. This is also supported by past research (Tice et al., 2001) which states that in times of emotional distress, impulse control breaks down simply because feeling better in the immediate present (i.e. accepting the box of chocolates now) is more important than pursuing long term rewards (i.e. having to wait to receive the reward of two boxes of chocolates later). However, as previously emphasized, given the non-significance of this analysis, such interpretations are purely speculative.

Observed frequencies of co-occurrence in the positive mood condition did not support the hypothesis with results showing that participants were also more likely to display impulsive behaviour (choosing the immediate reward) than exercise self-control (delay gratification), although this was also non-significant. Again, it is therefore emphasized that interpretations are cautious. Tentatively drawing on affective evaluation/mood congruency theories (see Bower, 1981; Schwarz & Clore, 1983), these state that current mood will influence behaviour in a congruent manner which, in terms of positive emotions leads to positive appraisals of a situation or stimulus and tends to result in action e.g. increasing consumption (Andrade, 2005). Past research that has found chocolate consumption to be significantly higher following positive compared to negative mood manipulations interpreted this affective congruence as heightened positive emotions leading to a corresponding increase in the pleasures associated with eating chocolate, thus explaining the higher consumption (Macht et al., 2002). While it is acknowledged that the current study did not investigate subsequent consumption, heightened or more salient pleasures associated with receiving chocolate in the immediate future potentially also explain the impulsive choice made by those in the positive mood condition. However, as previously emphasized, given the non-significance of this analysis, such interpretations are purely speculative. Ultimately, however, an integrative framework incorporating mood management and mood evaluation theory (Andrade, 2005) can tentatively explain why participants in both positive and negative mood conditions were more likely to choose the impulsive reward over the equally desirable non-food reward. However, it is reiterated that without a significant finding, this theoretical explanation is ultimately unsubstantiated.

A final discussion point concerns the rewards chosen to use as the larger, ‘delayed’ reward choice in this chocolate DoG task. Data concerning the desirability of two boxes of Quality Street™ chocolates were not collected because the desirability pilot study was designed for the DoG task in the first study (see Chapter 2). As desirability ratings for two boxes of Quality Street™ chocolates were not needed in that first study, and it was not foreseen that the original rewards might need altering, those who completed the pilot study were not asked to rate the desirability of two boxes of Quality Street™ chocolates. Instead, given that delay of gratification relates to a person’s ability to voluntarily delay the acceptance of a small, immediate reward for a later but larger reward (Mischel, 1974), it was felt that doubling the quantity of the initial chocolate reward offered, (i.e. one box of Quality Street™ chocolates) therefore fulfilled this stipulation. However, without desirability data concerning two boxes of Quality Street™ chocolates to confirm this, it is of course possible that this larger, 'delayed' reward choice was not in fact significantly more desirable than the smaller 'immediate' reward choice. This would therefore explain the majority of participants in both the positive and negative mood conditions choosing the immediate reward. A clear solution to this would obviously be to ascertain desirability ratings of all rewards to be used in future studies.

Results, 'Chocolate DoG' task: Logistic regression analysis

The probability of delaying gratification and receiving two boxes of chocolates later vs. keeping the initial reward of only one now when controlling for hunger, impulsivity, chocolate craving and mood.

A binomial, hierarchical, logistic regression analysis was performed to assess the probability of being able to delay the receipt of a larger sweet reward (two boxes of chocolates later) vs. keeping the initial sweet reward (one box of chocolates now) depending on whether the mood manipulation was either positive or negative, and controlling for hunger, BMI, impulsivity and chocolate craving. (N.B. Impulsivity was not entered as a predictor variable in the analysis exploring the initial choice data as the decision under consideration (choosing one box of chocolates vs. choosing one magazine) did not involve an impulsive element, whereas the decision under consideration in the second analysis (choosing one boxes of chocolates now vs. two boxes of chocolates later) did involve an impulsive element.)

Initial hierarchical logistic regression analyses were performed on the data to assess which of the models identified for investigation best fit the data for the final regression model (Field, 2013). The proposed models were to ascertain the likelihood that participants (*n* = 74) would delay gratification and choose to receive two boxes of chocolates later vs. keeping only one now depending on whether the mood manipulation was either positive or negative, and controlling for BMI, hunger, impulsivity and chocolate craving. BMI and hunger were entered into the model in Block 1, impulsivity was entered into the model in Block 2, chocolate craving was entered into the model in Block 3 and mood was entered into the model in Block 4. The initial analyses revealed that Block 1 was the only significant block and, of the predictors entered in this block, hunger was the only significant independent predictor of participants' ability to delay gratification. Given the focus of this thesis however, hunger (but not BMI) from Block 1 and Blocks 2, 3 and 4 were nevertheless also included for the re-run of this logistic regression analysis. See Tables 4, 5 and 6 for the descriptive statistics of all predictors considered for analysis, the observed frequencies of observations between mood and ability to delay gratification for chocolate, and coefficients of the model predicting the ability to delay gratification for chocolate. Following the analysis, residual statistics were examined to ensure the assumptions of hierarchical multiple logistic regression had been met (Field, 2013). No points for which the data fit poorly or exerted an undue influence on the model were identified. Full details of the assumption checks are presented in the Appendix, (see Chapter 7, Section 7.2.2).

***Table 4**: Study 2, ‘Chocolate DoG’ task logistic regression, descriptive statistics*

The mean scores and SDs for BMI, hunger, impulsivity and chocolate craving. Mood as a categorical variable is not included here.

	Minimum	**Maximum**	**Mean**	**Std. Deviation**
Body Mass Index (BMI)	16.40	44.10	25.53	5.92
Hunger levels	00.00	10.80	4.13	2.69
Impulsivity (BIS-11; Patton et al., 1995)	39.00	86.00	66.30	9.60
Chocolate Craving (subscale of the Attitudes to Chocolate questionnaire; Benton et al., 1998)	00.00	10.00	4.52	2.07

***Table 5**: Study 2, ‘Chocolate DoG’ task logistic regression, frequencies of association between mood and delay of gratification for chocolate*

		Chocolate Delay of Gratification		
		Keep First	Delay	Total
Mood	Negative	27	15	42
	Positive	21	11	32
Total		48	26	74

The logistic regression model was statistically non-significant, $\chi 2$ (1, *n* = 74) = 6.54, *p* = .162. The model explained between 8.5% (Cox & Snell R^2) and 11.6% (Nagelkerke R^2) of the variance in delaying gratification and receiving two boxes of chocolate later and correctly classified 66.2% of cases.

Increasing hunger levels were significantly associated with an increased likelihood of delaying gratification, *p* = .035. The chance of delaying gratification increased by 1.25 for every unit increase on the general hunger scale.

Decreasing impulsivity levels were associated with a decreased likelihood of delaying gratification although this was non-significant, *p* = .196. The chance of delaying gratification decreased by 0.96 for every unit decrease on the impulsivity scale.

Increasing chocolate craving levels were associated with an increased likelihood of delaying gratification although this was non-significant, *p* = .854. The chance of delaying gratification increased by 1.03 for every unit increase on the chocolate craving scale.

Those in a positive mood were 0.77 times less likely to delay gratification than those in a negative mood although this was non-significant, *p* = .613.

***Table 6**: Study 2, 'Chocolate DoG' task, coefficients of the logistic regression model*

	b (SE)	**p**	**OR**	**95% CI Lower**	**95% CI Upper**
Constant	-1.01 (1.85)	.586	2.74		
Hunger	0.22 (0.11)	.035	1.25	1.02	1.53
Impulsivity	-0.04 (0.03)	.196	0.96	0.91	1.02
Chocolate Craving	0.03 (0.14)	.854	1.03	0.77	1.36
Mood	-0.27 (0.53)	.613	0.77	0.27	2.14

Discussion, ‘Chocolate DoG’ task: Logistic regression analysis

In order to control for additional factors influencing the association of mood (positive/negative) with the ability to delay gratification for a sweet reward (one box of chocolates now vs. two boxes of chocolates later) a binomial hierarchical logistic regression was performed. This was to assess the probability of delaying gratification and receiving two boxes of chocolates later vs. keeping only one box of chocolates now depending on whether the mood manipulation was either positive or negative, and controlling for hunger, impulsivity and chocolate craving. (N.B. BMI was removed from this analysis following indications that this variable did not improve the overall fit of the regression model.) The model was non-significant, and hunger was the only individual predictor to significantly independently predict the ability to delay gratification for the sweet reward. However, as increasing hunger was associated with an increased likelihood in delaying gratification for chocolate, the direction of this relationship was not as expected given that hunger motivates approach tendencies for food and food consumption (Nederkoorn et al., 2009). Of the remaining predictor variables (impulsivity, chocolate craving and mood), all three revealed unexpected associations with delaying gratification for chocolate, which, it is emphasized, were all non-significant. Decreasing impulsivity was associated with a decreased likelihood of delaying gratification; increased chocolate craving was associated with an increased likelihood of delaying gratification; and as mood moved from negative to positive there was a decreased likelihood of delaying gratification. As the association between mood and delay of gratification for chocolate was previously discussed in detail following the results of the corresponding chi-square analysis, discussion of the current logistic regression will therefore be brief. Previous research concerning mood, impulsiveness and chocolate consumption (e.g. Garg et al., 2007; Tice et al., 2001) provided robust findings upon which the hypotheses for this element of the current study were based. While the unexpected and inconclusive nature of the current results could therefore be interpreted as disappointing, it is instead posited that they provide further confirmation of the decision to strengthen the overall methodology used in this second study with the inclusion of the willingness-to-pay task (WTP; based on Becker et al., 1964).

Summary, 'Chocolate DoG' task

The 'chocolate DoG' task extended the strengthened 'initial choice' task element of this study with the inclusion of an impulsive decision, as well as the consideration of both chocolate and mood. The results from this 'chocolate DoG' task logistic regression analysis (and the previous, corresponding chi-square analysis) therefore made up the principal point of interest in this second study chapter. However, the results were broadly inconclusive with both the chi-square and logistic regression analyses revealing non-significant results. While providing confirmation concerning the decision to strengthen the overall design of this second study with the inclusion of a willingness-to-pay task (WTP; based on Becker et al., 1964), a further point is also noted here: the sample size for this second study was calculated with a power analysis using the effect size from the '*initial choice'* task from the first study. The projected sample size was n = 133 and recruitment was therefore terminated after 135 participants had taken part. However, although the entire sample (n = 135) took part in the 'initial choice' task, only those participants who initially chose the chocolates comprised the sample for this subsequent 'chocolate DoG' task, i.e. just over half of the original sample (*n* = 74). It is therefore posited that this smaller participant pool was perhaps not large enough to generate conclusive findings concerning the chi-square and logistic regression analyses of this ‘chocolate DoG’ task. However, the ‘initial choice’ task chi-square results for this second study were also non-significant despite being based on the fully powered sample. It is of course therefore possible that robust associations between mood and both the initial choice *and* chocolate DoG categories are simply not detectable under the current methodology.

3.5.3 ‘Magazine DoG’ task

Results, ‘Magazine DoG’ task: Chi-square analysis

The association between manipulated positive and negative incidental affect and the ability to delay gratification for a non-food/neutral reward (one magazine now/two magazines later).

Analyses of the data concerning those participants who initially chose a magazine were carried out although it is acknowledged that as this did not involve sweet items/chocolate this does not concern the primary focus of this thesis. However, this task nevertheless captured the influence of positive and negative mood on impulsive choice concerning non-food/neutral items. This third chi-square analysis therefore investigated the association between mood (positive and negative) and the ability to delay gratification for the non-food/neutral reward (one magazine now vs. two magazines later).

Participants in the negative mood condition were more likely to choose to keep one magazine now over delaying gratification and receiving two later when given the choice whereas the reverse was found to be true for those in the positive mood condition. A chi-square test found this association between mood and ability to delay gratification for a non-food/neutral reward to be significant, $\chi 2$ (1, N = 61) = 6.69, p = .010. The data are presented in figure 3-3.

Discussion, 'Magazine DoG' task: Chi-square analysis

The data showed that participants in the negative mood condition were more likely to choose the immediate reward of receiving one magazine now and less likely to delay

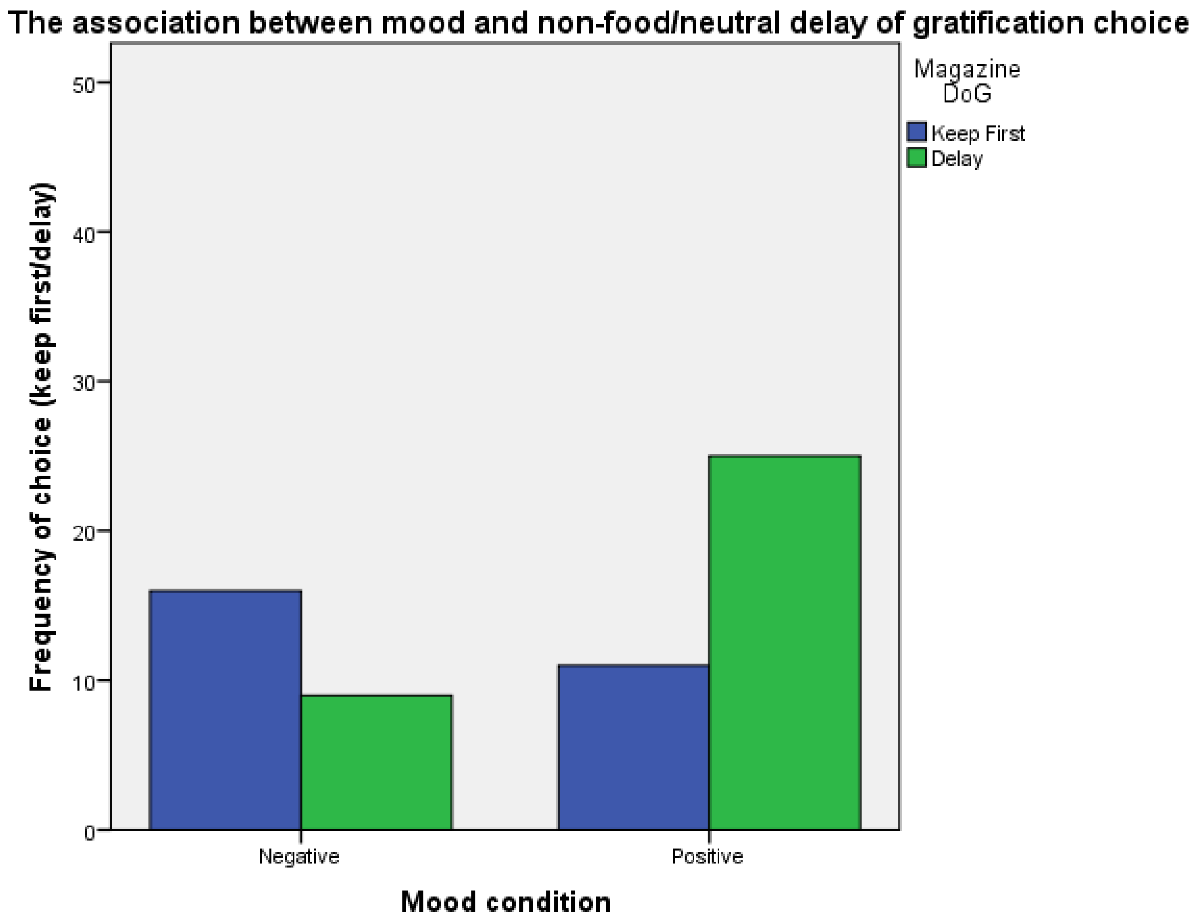

Figure 3-3: Study 2, 'Magazine DoG' task chi-square data

gratification for a later but larger reward (two magazines), whereas the opposite was true of participants in the positive mood condition. The results of a chi-square analysis showed that this association was significant, as hypothesised. However, as this element of the study did not involve sweet items/chocolate and was therefore not the primary focus of this thesis, discussion will be brief. Past research that also investigated impulse control and manipulated mood with tasks that did not involve sweet rewards also found that those in negative mood conditions were more likely to display impulsive behaviour and less likely to demonstrate self-control compared to those in positive mood conditions (e.g. Knapp & Clark, 1991; Tice et al., 2001). Results of the current study seem to align with interpretations of these previous findings, i.e. that impulse control is less likely for those in a negative mood condition because feeling better in the immediate present (i.e. accepting one magazine now) is more important than pursuing long term rewards (i.e. having to wait to receive the reward of two magazines later). The results of this chi-square analysis therefore provide convincing evidence of an association between positive and negative affect and non-food/neutral decisions in the expected direction set out in the hypotheses for this element of the study.

Results, 'Magazine DoG' task: Logistic regression analysis

The probability of delaying gratification and receiving two magazines later vs. keeping only one now when controlling for impulsivity and mood.

It is again acknowledged that although data for those participants who initially chose a magazine were also explored, as this did not involve sweet items/chocolate this does not concern the primary focus of this thesis. The third binomial, hierarchical, logistic regression analysis therefore assessed the probability of delaying the receipt of a larger non-food/neutral reward (two magazines later) vs. keeping the initial non-food/neutral reward (one magazine now) depending on whether the mood manipulation was either positive or negative, and controlling for impulsivity.

Initial hierarchical logistic regression analyses were performed on the data to assess which of the models identified for investigation best fit the data for the final regression model (Field, 2013). The proposed models were to ascertain the likelihood that participants (n = 61) would delay gratification and choose to receive two magazines later vs. keeping only one depending on whether the mood manipulation was either positive or negative, and controlling for impulsivity. Impulsivity was entered into the model in Block 1 and mood was entered into the model in Block 2. The initial analyses revealed that the inclusion of mood in Block 2 significantly improved the model and this block was therefore used for the re-run of the logistic regression analysis (Field, 2013). See Tables 7, 8 and 9 for the descriptive statistics of predictors considered for analysis, the observed frequencies of observations between mood and ability to delay gratification for a non-food/neutral reward, and coefficients of the model predicting the ability to delay gratification for a non-food/neutral reward. Following the analysis, residual statistics were examined to ensure the assumptions of hierarchical multiple logistic regression had been met (Field, 2013). No points for which the data fit poorly or exerted an undue influence on the model were identified. Full details of the assumption checks are presented in the Appendix, (see Chapter 7, Section 7.2.3).

__Table 7__: Study 2, 'Magazine DoG' task logistic regression, descriptive statistics

The mean scores and SDs for impulsivity. Mood as a categorical variable is not included here.

	Minimum	**Maximum**	**Mean**	**Std. Deviation**
Impulsivity (BIS-11; Patton et al., 1995)	42.00	96.00	63.70	10.97

__Table 8__: Study 2, 'Magazine DoG' task logistic regression, frequencies of association between mood and delay of gratification for a magazine

		Non-food Delay of Gratification		
		Keep First	Delay	Total
Mood	Negative	16	9	25
	Positive	11	25	36
Total		27	34	61

The logistic regression model was statistically significant, $\chi 2$ (1, *n* = 61) = 6.80, *p* = .033. The model explained between 10.5% (Cox & Snell R^2) and 14.1% (Nagelkerke R^2) of the variance in delaying gratification and receiving two magazines and correctly classified 67.2% of cases.

Decreasing impulsivity levels were associated with a decreased likelihood of delaying gratification although this was non-significant, p = .869. The chance of delaying gratification decreased by 0.99 for every unit decrease on the impulsivity scale.

Those in a positive mood were 4.08 times more likely to delay gratification than those in a negative mood and this was significant, p = .011.

***Table 9**: Study 2, 'Magazine DoG' task, coefficients of the logistic regression model*

	b (SE)	**p**	**OR**	**95% CI Lower**	**95% CI Upper**
Constant	-0.32 (1.63)	.847	.73		
Impulsivity	-0.004 (0.03)	.869	0.99	0.95	1.05
Mood	1.41 (0.56)	.011	4.08	1.37	12.12

<u>Discussion, 'Magazine DoG' task: Logistic regression analysis</u>

In order to control for additional factors influencing the association of mood (positive/negative) with the ability to delay gratification for the non-food/neutral reward, a binomial hierarchical logistic regression was performed. This was to assess the probability of being able to delay the receipt of a larger non-food/neutral reward (two magazines) vs. keeping the initial non-food/neutral reward (one magazine) depending on whether the mood manipulation was either positive or negative, and controlling for impulsivity. The model was significant, and mood was able to significantly independently predict the ability to delay gratification for the non-food/neutral reward, in the direction expected. That is, as mood moved from negative to positive, the likelihood of delaying gratification increased, i.e. it became more likely for those in a positive mood and less likely for those in a negative mood, as expected. This again follows past research showing that impulse control is less likely for those in a negative mood condition because feeling better in the immediate present (i.e. accepting one magazine now) is more important than pursuing long term rewards (i.e. having to wait to receive the reward of two magazines later; Knapp & Clark, 1991; Tice et al., 2001). However, it is noted that decreasing impulsivity was associated with a decreased likelihood of delaying gratification and while this was non-significant it did not follow the expectation for delaying gratification of a non-food/neutral item. While it is again acknowledged that this element of the current study did not involve the primary focus of this thesis, i.e. sweet food decision making, the results of this logistic regression nevertheless provide convincing evidence of an association between positive and negative affect and non-food/neutral decisions in the expected direction set out in the hypotheses for this element of the study.

Summary, 'Magazine DoG' task

The 'magazine DoG' task concerned those participants who chose the non-food reward element presented in the 'initial choice' task. It is therefore acknowledged again that the subsequent chi-square and logistic regression analyses did not involve sweet food/chocolate and were therefore not the primary focus of interest in this thesis. However, the results of these analyses both conclusively revealed a significant association between mood and the ability to delay gratification for a non-food/neutral reward in the expected directions. That is to say, that those in the negative mood condition were more likely to display impulsive behaviour and keep the smaller, initial reward chosen (one magazine now) and less likely to demonstrate self-control and choose the larger reward (two magazines later), while the reverse was true for those in the positive mood condition. The current findings therefore appear to robustly demonstrate differences in the way manipulated, incidental positive and negative mood influences impulsive decisions concerning non-food/neutral items. However, magazines are not items that are linked with maladaptive health problems in the same way, for example, that sugar consumption has been linked with obesity (e.g. Malik et al., 2013; Te Morenga et al., 2013). The broader implication of these conclusive results concerning non-food/neutral items therefore perhaps further confirms that the way in which mood interacts with choice and impulse/self-control in the specific context of sugar consumption is one of a highly complex nature.

3.6 Results: Main analyses, Willingness-to-Pay (WTP) Task

In order to assess the relationship between manipulated positive and negative incidental mood on economic decisions concerning sweet foods, participants completed a willingness-to-pay task (WTP; based on Becker et al., 1964). High-sugar chocolate items *and* high-sugar non-chocolate items were included to allow for comparisons between positive and negative mood on decisions concerning different types of sweet foods. Non-food/neutral items acted as control items in order to calculate WTP for chocolate and high-sugar items. Three hierarchical multiple linear regression analyses were therefore performed in order to investigate the relationship between positive and negative manipulated incidental mood and WTP for chocolate vs. neutral items, WTP for high-sugar vs. neutral items and WTP for chocolate vs. high-sugar items. These analyses also allowed for consideration of additional factors that might be influencing participants' WTP prices. For all three hierarchical linear regression models, BMI, hunger and impulsivity as continuous predictor variables were entered in the first stages, chocolate craving as a continuous predictor variable was entered in the second stages, and mood as a categorical predictor variable (positive/negative) was entered in the third stages of the models. Given similarities in results across all three hierarchical regression models, these will be discussed simultaneously following presentation of the analyses.

3.6.1 WTP for chocolate vs. neutral items

Willingness-to-pay (WTP) for chocolate vs. neutral items was calculated as the mean WTP price for the five chocolate items minus the mean WTP price for the ten non-food/neutral items.

A multiple hierarchical linear regression was carried out to investigate the relationship between body mass index (BMI), impulsivity, hunger, chocolate craving and mood as predictor variables, and willingness-to-pay (WTP) for chocolate vs. neutral items as the criterion variable. BMI, impulsivity and hunger were entered as predictors in the first stage of the hierarchical regression; chocolate craving was entered in the second stage and mood was entered in the third stage. See Tables 10 and 11 for the descriptive statistics and the linear model of predictors of WTP for chocolate vs. neutral items. Following the analysis, residual statistics were examined to ensure the assumptions of hierarchical multiple regression had been met (Field, 2013). No points for which the data fit poorly or exerted an undue influence on the model were identified. Full details of the assumption checks are presented in the Appendix, (see

Chapter 7, Section 7.3.1).

***Table 10**: Study 2, WTP for chocolate vs. neutral items, descriptive statistics*

The mean scores and SDs for BMI, impulsivity, hunger, chocolate craving and WTP for chocolate vs. neutral items. Mood as a categorical variable is not included here.

	Minimum	**Maximum**	**Mean**	**Std. Deviation**
Body Mass Index (BMI)	16.40	44.10	24.60	5.10
Impulsivity (BIS-11; Patton, 1995)	39.00	96.00	65.13	10.28
Hunger levels	00.00	10.80	4.08	2.64
Chocolate Craving (subscale of the Attitudes to Chocolate questionnaire; Benton et al., 1998)	00.00	10.00	3.95	2.28
WTP for chocolate vs. neutral items	-1.40	2.00	0.30	0.72

***Table 11**: Study 2, linear model of predictors of WTP for chocolate vs. neutral items, with 95% confidence intervals reported in parentheses*

	b	**SE B**	**β**	**p**	**sr^2**
Stage 3					
Constant	-0.46 (-1.40, 0.48)	0.48		.330	
BMI	0.01 (-0.01, 0.03)	0.01	.09	.251	.01
Impulsivity	0.002 (-0.01, 0.01)	0.01	.03	.726	<.01
Hunger	-0.01 (-0.06, 0.03)	0.02	-.04	.629	<.01
Chocolate Craving	0.12 (0.06, 0.17)	0.03	.38	<.001	.14
Mood	-0.14 (-0.37, 0.10)	0.12	-.010	.243	.01

Note. R^2 = .03 for Step 1 (p = .332); ΔR^2 = .12 for Step 2 (p <.001); ΔR^2 = .01 for Step 3 (p = .243).

In stage 1, BMI, impulsivity and hunger were found to be non-significant predictors of WTP for chocolate vs. neutral items (F(3, 134) = 1.15, p = .332) and together they accounted for less than 1 per cent of its variation. When chocolate craving was entered in stage 2 (F(4, 134) = 5.48 p < .001) there was a significant change in the ability to predict WTP for chocolate vs. neutral items (F Change (1, 130 = 18.03, p < .001) and chocolate craving accounted for approximately 11 per cent of additional variation in WTP for chocolate vs. neutral items. When mood was entered in stage 3 (F(5, 134) = 4.67, p = .001) there was a non-significant change in the ability to predict WTP for chocolate vs. neutral items (F Change (1, 129) = 1.37, p = .243) and mood accounted for approximately 1 per cent of additional variation in WTP for chocolate vs. neutral items. While BMI, impulsivity and hunger in stages 1-3 and mood in stage 3 were not significant individual predictors, increasing chocolate craving did significantly predict increasing WTP for chocolate vs. neutral items in stages 2 and 3.

3.6.2 WTP for high-sugar vs. neutral items

Willingness-to-pay (WTP) for high-sugar vs. neutral items was calculated as the mean WTP price for the five high-sugar items minus the mean WTP price for the ten non-food/neutral items.

A multiple hierarchical linear regression was carried out to investigate the relationship between body mass index (BMI), impulsivity, hunger, chocolate craving and mood as predictor variables, and willingness-to-pay (WTP) for high-sugar vs. neutral items as the criterion variable. BMI, impulsivity and hunger were entered as predictors in the first stage of the hierarchical regression; chocolate craving was entered in the second stage and mood was entered in the third stage. See Tables 12 and 13 for the descriptive statistics and the linear model of predictors of WTP for high-sugar vs. neutral items. Following the analysis, residual statistics were examined to ensure the assumptions of hierarchical multiple regression had been met (Field, 2013). No points for which the data fit poorly or exerted an undue influence on the model were identified. Full details of the assumption checks are presented in the Appendix, (see Chapter 7, Section 7.3.2).

Table 12*: Study 2, WTP for high-sugar vs. neutral items, descriptive statistics*

The mean scores and SDs for BMI, impulsivity, hunger, chocolate craving and WTP for high-sugar vs. neutral items. Mood as a categorical variable is not included here.

	Minimum	**Maximum**	**Mean**	**Std. Deviation**
Body Mass Index (BMI)	16.40	44.10	24.60	5.10
Impulsivity (BIS-11; Patton, 1995)	39.00	96.00	65.13	10.28
Hunger levels	00.00	10.80	4.08	2.64
Chocolate Craving (subscale of the Attitudes to Chocolate questionnaire; Benton et al., 1998)	00.00	10.00	3.95	2.28
WTP for high-sugar vs. neutral items	-1.50	1.40	-0.12	0.54

In stage 1, BMI, impulsivity and hunger were found to be non-significant predictors of WTP for high-sugar vs. neutral items ($F(3, 134) = 0.30$, $p = .829$) and together they accounted for less than 1 per cent of its variation. When chocolate craving was entered in stage 2 ($F(4, 134) = 1.54$, $p = .195$) there was a significant change in the ability to predict WTP for high-sugar vs. neutral items (F Change (1, 130 = 5.24, $p = .024$) and chocolate craving accounted for approximately 1 per cent of additional variation in WTP for high-sugar vs. neutral items. When mood was entered in stage 3 ($F(5, 134) = 1.50$, $p = .194$) there was a non-significant change in the ability to predict WTP for high-sugar vs. neutral items (F Change (1, 129) = 1.34, $p = .250$) and mood accounted for approximately 2 per cent of overall variation in WTP for high-sugar vs. neutral items. While BMI, impulsivity and hunger in stages 1-3 and mood in stage 3 were not significant individual predictors, increasing chocolate craving did significantly predict increasing WTP for high-sugar vs. neutral items in stages 2 and 3.

Table 13*: Study 2, linear model of predictors of WTP for high-sugar vs. neutral items, with 95% confidence intervals reported in parentheses*

	b	**SE B**	**β**	**p**	**sr^2**
Stage 3					
Constant	-0.30 (-1.05, 0.45)	0.38		.433	
BMI	0.01 (-0.01, 0.02)	0.01	.08	.352	.01
Impulsivity	-0.002 (-0.01, 0.01)	0.01	-.05	.620	<.01
Hunger	$5.61e^{-5}$ (-0.04, 0.04)	0.02	.000	.998	<.01
Chocolate Craving	0.05 (0.01, 0.10)	0.02	.22	.018	.05
Mood	-0.11 (-0.29, .08)	0.09	-.10	.250	.01

Note. $R^2 = .01$ for Step 1 ($p = .829$); $\Delta R^2 = .04$ for Step 2 ($p = .024$); $\Delta R^2 = .01$ for Step 3 ($p = .250$).

3.6.3 WTP for chocolate vs. high-sugar items

Willingness-to-pay (WTP) for chocolate vs. high-sugar items was calculated as the mean WTP price for the five chocolate items minus the mean WTP price for the five high-sugar items.

A multiple hierarchical linear regression was carried out to investigate the relationship between body mass index (BMI), impulsivity, hunger, chocolate craving and mood as predictor variables, and willingness-to-pay (WTP) for chocolate vs. high-sugar items as the criterion variable. BMI, impulsivity and hunger were entered as predictors in the first stage of the hierarchical regression; chocolate craving was entered in the second stage and mood was entered in the third stage. See Tables 14 and 15 for the descriptive statistics and the linear model of predictors for chocolate vs. high-sugar items. Following the analysis, residual statistics were examined to ensure the assumptions of hierarchical multiple regression had been met (Field, 2013). No points for which the data fit poorly or exerted an undue influence on the model were identified. Full details of the assumption checks are presented in the Appendix, (see Chapter 7, Section 7.3.3).

In stage 1, BMI, impulsivity and hunger were found to be non-significant predictors of WTP for chocolate vs. high-sugar items ($F(3, 134) = 0.86$, $p = .467$) and together they accounted for less than 1 per cent of its variation. When chocolate craving was entered in stage 2 ($F(4, 134) = 2.30$, $p = .062$) there was a significant change in the ability to predict WTP for chocolate vs. high-sugar items (F Change (1, 130 = 6.54, p =.012) and chocolate craving accounted for approximately 3.7 per cent of additional variation in WTP for chocolate vs. high-sugar items.

***Table 14**: Study 2, WTP for chocolate vs. high-sugar items, descriptive statistics*

The mean scores and SDs for BMI, impulsivity, hunger, chocolate craving and WTP for chocolate vs. high-sugar items. Mood as a categorical variable is not included here.

	Minimum	Maximum	Mean	Std. Deviation
Body Mass Index (BMI)	16.40	44.10	24.60	5.10
Impulsivity (BIS-11; Patton, 1995)	39.00	96.00	65.13	10.28
Hunger levels	00.00	10.80	4.08	2.64
Chocolate Craving (subscale of the Attitudes to Chocolate questionnaire; Benton et al., 1998)	00.00	10.00	3.95	2.28
WTP for chocolate vs. high-sugar items	-.80	2.20	0.43	0.65

***Table 15**: Study 2, linear model of predictors of WTP for chocolate vs. high-sugar items, with 95% confidence intervals reported in parentheses*

	b	SE B	β	p	sr^2
Stage 3					
Constant	-0.17 (-1.06, 0.73)	0.45		.713	
BMI	0.004 (-0.02, 0.02)	0.01	.04	.668	<.01
Impulsivity	0.004 (-0.01, 0.02)	0.01	.07	.434	<.01
Hunger	-0.01 (-0.05, 0.03)	0.02	-.04	.609	<.01
Chocolate Craving	0.07 (0.02, 0.12)	0.03	.23	.012	.05
Mood	-0.03 (-0.25, .19)	0.11	-.02	.792	<.01

Note. R^2 = .02 for Step 1 (p = .467); ΔR^2 = .05 for Step 2 (p = .012); ΔR^2 = .001 for Step 3 (p = .792).

When mood was entered in stage 3 ($F(5, 134) = 1.84$, $p = .109$) there was a non-significant change in the ability to predict WTP for chocolate vs. high-sugar items (F Change (1, 129) = 0.07, $p = .792$) and mood accounted for approximately 3 per cent of overall variation in WTP for chocolate vs. high-sugar items. While BMI, impulsivity and hunger in stages 1-3 and mood in stage 3 were not significant individual predictors, increasing chocolate craving did significantly predict increasing WTP for chocolate vs. high-sugar items in stages 2 and 3.

3.7 Discussion: Willingness-to-Pay (WTP) analyses

In order to assess the relationship between manipulated positive and negative incidental mood and economic decisions concerning sweet foods, participants completed a willingness-to-pay task (WTP; based on Becker et al., 1964). High-sugar chocolate items *and* high-sugar non-chocolate items were included to allow comparisons between positive and negative mood on decisions concerning different types of sweet foods. Non-food/neutral items acted as control items in order to calculate WTP for chocolate and high-sugar items. In other words, the inclusion of chocolate items firstly allowed for a direct comparison of positive and negative moods on decisions concerning food containing chocolate vs. neutral items. The inclusion of high-sugar (but non-chocolate) items then allowed for a direct comparison of positive and negative moods on decisions concerning food containing high-sugar vs. neutral items. The final analysis allowed for a direct comparison of positive and negative moods on decisions concerning chocolate vs. high-sugar items. That is to say, the high-sugar items acted as control items against which the chocolate items were compared for the final analysis.

In the first stages of the models, the linear combination of hunger, BMI and impulsivity was not able to predict WTP for chocolate vs. neutral items, high-sugar vs. neutral items, or chocolate vs. high-sugar items which did not support the hypothesis. It is also noted that these variables could not independently predict WTP and could only account for a very small amount of variation (less than one percent) in WTP prices across the first stages of the three analyses. Given these inconclusive results, the following discussion points are therefore made with caution.

As consumption of the foods presented in this study was not investigated, the findings concerning hunger follow what logic might predict. That is to say, hunger motivates approach tendencies for food, and past research has found hunger to be associated with higher snack food purchase (Nederkoorn et al., 2009). However, this previous finding was based on data that was collected using a different method of stimuli presentation to the method used in the current study. Participants in the Nederkoorn et al. study (2009) were given a budget to spend in a virtual supermarket setting. This is perhaps a more ecologically valid scenario than the WTP task in the current study which simply asked participants to make iterative decisions concerning how much they would pay for discrete food items presented pictorially. Further to this, participants in the current study were expressly told that they would only receive one of the items presented, whereas participants in the Nederkoorn et al. study were told to buy “as much food and drink as you believe will be necessary for three whole days in a holiday house” (2009, p. 908) These differences perhaps explain why hunger was previously found to be associated with snack-food purchase (Nederkoorn et al., 2009), but did not independently predict WTP prices in the current study. Extending the current study by including a more ecologically valid presentation format might reveal results in line with what past research has found (e.g. Nederkoorn et al., 2009). Specifically, that increasing hunger would be associated with higher WTP prices for chocolate and high-sugar foods.

As BMI has been positively associated with the consumption of sweet and fat food types (e.g. Togo et al., 2001), it was hypothesised that increasing BMI would be associated with higher WTP prices across all three analyses. However, BMI was not found to be an independent predictor of WTP prices for chocolate vs. neutral items, high-sugar vs. neutral items or chocolate vs. high-sugar items. It is noted that these previously mentioned findings concern consumption rather than just purchase behaviour. As consumption of the foods involved in the current study was not considered, this perhaps explains why BMI was not evident as an independent predictor of WTP prices. Extending the current study to include actual consumption of foods differing in price might reveal more illuminating results concerning the relationship between BMI and consumption patterns of sweet foods that are more or less expensive.

Despite being a non-significant independent predictor of WTP, increasing impulsivity was nevertheless associated with rising WTP prices across the first and third analyses (WTP for chocolate vs. neutral items and WTP for chocolate vs. high-sugar items), and in the first stage of the second analysis (WTP for high-sugar vs. neutral items). That is, as participants' impulsivity increased, their WTP also tended to increase, as hypothesised. This can tentatively be interpreted as aligning with previous research in which higher impulsivity was found to be associated with higher snack food purchase (Nederkoorn et al., 2009). However, it is acknowledged that this speculative alignment warrants further exploration. Given the lack of conclusiveness concerning impulsivity throughout this chapter, it is posited that consideration of the second strand to the delay of gratification paradigm, namely self-control, might help to clarify the influence of this construct. That is to say, impulsivity and self-control represent two sides of the same coin in that higher self-control has been linked with a lower likelihood of maladaptive behaviours such as binge eating (Tangney, Baumeister & Boone, 2004), while higher impulsivity has been linked with a higher likelihood of maladaptive behaviours such as snack food purchase (Nederkoorn et al., 2009). Specifically considering the construct of self-control in a future study would help to clarify whether it is lower self-control rather than higher impulsivity that influences participants' WTP prices in the context of chocolate and high-sugar items.

At the second stages of the models, the inclusion of chocolate craving significantly improved the ability of the regression models to predict WTP across all three analyses. As chocolate craving increased, WTP for chocolate vs. neutral items, high-sugar vs. neutral items, and chocolate vs. high-sugar items also tended to increase. As chocolate is a commonly and intensely craved food item (Hill et al., 1991; Rozin et al., 1991), the hypotheses that higher chocolate craving would be associated with higher WTP scores for chocolate vs. neutral items and chocolate vs. high-sugar items was supported. However, as the craving measure used (Benton et al., 1998) is specific to chocolate and not to sugar in general, the finding that chocolate craving was significantly associated with WTP for high-sugar vs. neutral items was unexpected. These results suggest that craving for chocolate is perhaps not exclusive to foods containing only chocolate but is also linked more generally to foods that are high in sugar but do not contain chocolate. Therefore, while food craving is generally understood to be an intense desire to consume a specific food (Pelchat, Johnson, Chan, Valdez & Ragland, 2004), and chocolate craving is certainly associated with chocolate consumption (e.g. Benton et al., 1998), the current results could be an example of a specific craving, (i.e. chocolate craving), potentially leading to consumption of a different food type. This finding is interesting in terms of strengthening understanding of eating behaviours in general.

Subsequent inspection of the way in which the inclusion of chocolate craving affected the predictive ability of the three models also revealed interesting observations. In the first analysis, chocolate craving alone could account for approximately 11 per cent of the variation in WTP for chocolate vs. neutral items. In the second analysis, this fell sharply to only one per cent of the variation in WTP for high-sugar vs. neutral items, and in the third analysis, this rose slightly to approximately four per cent of the variation in WTP for chocolate vs. high-sugar items. This would suggest that while chocolate craving might also play a role in behaviours concerning foods that are high in sugar but do not contain chocolate, the ability of this measure to account for the highest variation in the task concerning chocolate items follows past research linking higher chocolate craving with higher levels of consumption (Benton et al., 1998). While it is acknowledged that this study did not investigate consumption directly, these results nevertheless appear to align with previous findings concerning the probability of cravings for chocolate and other sweet foods leading to consumption (Hill & Heaton-Brown, 1994). However, it is noted that the chocolate vs. neutral items did not exclusively contain chocolate. In other words, while the items all contained chocolate, they also contained ingredients from other food groups e.g. wheat and dairy. It would be interesting to extend the current study by including food items that solely contain chocolate and comparing WTP prices for these foods with WTP prices for food items containing some chocolate, as well as food items that are high in sugar but do not contain any chocolate. Based on the current findings it is posited that chocolate craving might account for an even higher amount of variation in WTP scores for items containing solely chocolate compared to those containing only some chocolate, and those containing none at all. A study of this nature would certainly help to clarify the role of chocolate craving across different food types, and the extent to which it exerts influence over economic decisions concerning chocolate as well as other sweet foods.

When mood as a categorical variable (positive and negative) was entered at the third stages of the models, there was a non-significant improvement in the ability to predict WTP across all three analyses. Closer inspection of how mood as a categorical variable was associated with participants' WTP prices revealed that directionally this was not as hypothesised. Across all three models, as mood moved from positive to negative, WTP had a tendency to decrease. In other words, those participants in the negative mood condition were willing to pay less for chocolate vs. neutral items, high-sugar vs. neutral items and chocolate vs. high-sugar items compared to those participants in the positive mood condition. It is emphasized firstly that because these results were non-significant, and secondly that standardized betas for mood across all three analyses were close to zero, caution regarding directional interpretation was taken. However, these results do not appear to be supported in terms of past research which has tended to find an increase in the amount of money spent following negative mood inductions (e.g. Cryder et al., 2008; Lerner et al., 2004). However, it is acknowledged here that these previous studies did not investigate this effect in the context of food. Instead, although cautious, the direction of the current findings seems to align with well-established theories such as the somatic marker hypothesis (Damasio, 1994) and the affect-as-information theory (Schwarz & Clore, 1983). These broadly uphold that affect can take on an advisory capacity, and that the informational properties of affect are used by people in relation to decisions that have to be made (Damasio, 1994; Schwarz & Clore, 1983). When making evaluations or judgments from this perspective, people tend to use how they feel as a guide in making that judgment; and when making decisions, people's evaluations of the specific choice tend to be more positive when in a positive mood and more negative when in a negative mood (Damasio, 1994; Schwarz & Clore, 1983). However, as has been emphasized previously, this suggestion is tentative given that the results of this aspect of the current study did not reach statistical significance. Certainly, the lack of conclusiveness concerning affect as the focal point of interest in this element of the current study suggests the need for further clarification. As set out in the summary below, this will be explored in the third and final study in this thesis (see Chapter 4).

3.8 Chapter Summary

Following the first study (see Chapter 2) which broadly investigated the influence of manipulated positive and negative incidental affect (i.e. mood incidental to a stimulus) on impulsive decisions concerning sweet foods, the current study sought to build upon and strengthen the methodology implemented. After an incidental mood induction task which significantly increased current mood ratings in both the positive and negative condition, participants completed two further tasks. The first task comprised an initial choice between a chocolate and non-food/neutral item; and a subsequent choice within the delay of gratification paradigm which included an impulsive element (DoG; based on Mischel, 1974). The second task used a willingness-to-pay task to investigate the influence of manipulated positive and negative incidental mood on economic decisions concerning chocolate and high-sugar foods (WTP; based on Becker et al., 1964).

Although frequencies of co-occurrence between positive and negative manipulated mood and the choice of chocolates over a non-food/neutral item were directionally as expected, primary analyses of the data did not reveal a significant result. However, main logistic regression analyses did reveal a statistically significant association concerning mood and this initial choice when controlling for chocolate craving. As mood moved from negative to positive, the likelihood of choosing chocolate significantly decreased as hypothesised, suggesting that in terms of simple choice, or preference, the influence of mood only becomes evident when considering other factors. However, this was the only conclusive finding in this study as primary and main analyses concerning the delay of gratification element and willingness-to-pay (WTP) task did not reach statistical significance in the context of manipulated mood. It is noted that the first study in this thesis also revealed inconclusive findings concerning mood (see Chapter 2). However, the sample size used in this second study was based on a power analysis generated from the effect size of the first study. It is therefore posited that the overall lack of certainty concerning affect as a focal point of interest is unlikely to be because of inadequate power in this current study. In order to circumvent direct clarification of this construct, a different angle concerning dispositional trait affectivity rather than manipulated state affect will instead be explored in the third study in this thesis. This follows observations that much of the reviewed research concerning the way in which affect influences judgment and decision-making focuses on manipulated, state emotions. However, as well as short-term *states,* i.e. momentary or short-lived changes in mood, both positive and negative affect can be evaluated or measured in terms of long-term *traits*, i.e. dispositions concerning emotionality or the experience of given emotions that are consistent over time (Lerner & Keltner, 2001; Watson & Pennebaker, 1989). Further to this is the observation that the constructs of state and trait affect *both* influence the way in which decisions are made (Damasio, 1994). It is therefore posited that the consideration of affect as a long-term, dispositional trait would allow for a clearer and more rounded view of how these two different affective constructs, (i.e. state and trait affect), influence decision-making. The next study in this thesis will therefore incorporate elements from this second study in order to explore chocolate and sweet food decision-making from the perspective of affect as a dispositional, state construct.

4. Study 3: The relationship between dispositional positive and negative affectivity and willingness-to-pay (WTP) for chocolate and high-sugar foods

4.1 Overview

The first and second studies in this thesis (see Chapter 2 and 3) investigated the influence of laboratory induced positive and negative incidental affect (i.e. state mood unrelated to a stimulus) on decisions concerning chocolate and sweet foods. Following inconclusive results specifically concerning affect, which is a primary focus of the overall thesis, this third study departed from the stance of investigating affect as an experimentally induced, momentary mood state. Instead, this final study sought to investigate positive and negative affectivity as dispositional or long-term traits and the way these relate to economic decisions concerning chocolate and sweet foods. Participants completed the willingness-to-pay task (WTP; based on Becker et al., 1964) designed for the second study (see Chapter 3); as well as measures of affectivity (Thompson, 2007), impulsivity (Steinberg, Sharp, Stanford & Tharp, 2013), self-control (Tangney et al., 2004), and chocolate craving (Cartwright et al., 2007). However, the initial choice and delay of gratification elements included in the first and second studies (DoG; based on Mischel, 1974) were not retained. This was primarily because the correlational nature of the third study meant that the data were able to be collected using an online presentation format, advantages of which are increased speed of data collection and the potential to easily obtain a large participant pool (Evans & Mathur, 2005). It was felt that the delivery of the DoG task without face-to-face presentation with participants could potentially be problematic, and therefore the decision was made to focus on the WTP task as a more precise measure of choice (see Ranstam, 2008).

4.2 Introduction

The two main dimensions that dominate basic emotional experiences have been widely established as the comparatively independent constructs of positive and negative affect (e.g. Watson, 1988; Watson & Tellegen, 1985). As previously mentioned in the literature review chapter (see Chapter 1, Section 1.3), while the terms positive and negative affect might suggest that these two factors are in direct opposition with each other (i.e. negatively correlated), each construct has been shown to be independent and tend not to be related to the other (Watson & Tellegen, 1985; Watson et al., 1988). That is to say, the experience of high positive affect is not found to be simultaneously linked with the experience of low negative affect, or vice versa (Watson & Clark, 1984; Watson et al., 1988). Instead, because each construct runs from high to low (i.e. high to low positive affect and high to low negative affect), an experience at the high end or pole of one dimension will tend to instantaneously correlate highly negatively with the low end or pole of that same dimension (Watson & Tellegen, 1985). In brief, positive affect concerns the extent that a person is pleasurably engaged with the environment, or experiences positive emotional states such as joy (high pleasurable engagement) or sadness (low pleasurable engagement), whereas negative affect concerns unpleasurable engagement with the environment, or the experience of negative emotional states such as anger (high unpleasurable engagement) or calmness (low unpleasurable engagement; Watson, 2002; Watson & Tellegen, 1985).

Concessions are noted later in the literature concerning factors at the low end of the positive dimension (such as sadness) and low end of the negative dimension (such as calmness) being a source of ambiguity given the contradictory connotations with the factor names under which they fall (Feldman Barrett & Russell, 1998; Watson, Wiese, Vaidya, & Tellegen, 1999). That is to say, the terms ‘positive’ and ‘negative’ ostensibly imply completely positively and negatively nuanced mood states, respectively. However, the low end of the positive dimension contains negatively valenced terms such as ‘dull’ and ‘sluggish’; and the low end of the negative dimension contains positively valenced terms such as ‘calm’ and ‘relaxed’ (Watson et al., 1999). Following such contradictions, Larsen and Diener (1992) suggested redefining ‘positive’ and ‘negative’ affect in terms of ‘activation’ and ‘pleasantness’ which was subsequently agreed by others (e.g. Feldman Barrett & Russell, 1998). Under this proposition, ‘high positive/negative affect’ was renamed ‘activated pleasant/unpleasant affect’, and ‘low positive/negative affect’ was renamed ‘unactivated unpleasant/pleasant affect’. In defense of the original terminology, Watson et al. (1999) responded that activation and pleasantness are not the fundamentally defining features of affect, and without the terms ‘positive’ and ‘negative’ the true structure of affect would not be accurately captured. However, the concession was made that positive and negative affect are not completely independent of each other given that high levels of negative affect *can* relate to low levels of positive affect (Watson et al., 1999). It was ultimately intimated that as ‘positive affect’ and ‘negative affect’ are both predominantly conceptualized and understood by terms at the high end of each dimension, these original names were not deemed to be misleading (Watson et al., 1999). That is to say, the defining characteristic of both positive and negative affect is the *presence* of either positive or negative engagement, to which the high pole of each construct relates. While the low poles do point to an *absence* of engagement, these terms are fewer and are not what ultimately characterizes affect (Watson et al., 1999). Therefore, the original names ‘positive’ and ‘negative’ affect were retained (and continue to be widely accepted).

This conceptualization around presence and absence is also supported within other models of affect. Russell and Barrett (1999), for example, state that ‘happy’ incorporates a high level of positivity, (i.e. presence of positivity) and lack of negativity, (i.e. absence of negativity); while ‘sad’ incorporates a high level of negativity, (i.e. presence of negativity) and lack of positivity, (i.e. absence of positivity). Delving deeper still into relationships along the continuum of affect is evidence showing that although negative affect is broadly related to symptoms of both anxiety and depression, lower positive affect is related only to depression (e.g. Watson et al., 1988). Depressive symptoms include the loss of interest or pleasure (i.e. anhedonia) as set out in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013). Studies investigating the role of affect in relation to depression (and anxiety) have therefore concluded that a lack of pleasurable engagement is key, (i.e. low positive affect), certainly when characterizing depression (Ahrens & Haaga, 1993; Brown, Chorpita & Barlow, 1998; Watson et al., 1988). While it is emphasised that depression was not a focal point of interest in this thesis, it is noteworthy that the absence of pleasurable engagement which is symptomatic of depression has also been linked with both positive and negative affect.

In terms of chocolate and sweet food specifically, studies have explored the link between symptoms of depression and the consumption of such foods. Rose, Koperski and Golomb (2010), for example, found that moderate to high depression scores were related to significantly higher chocolate consumption in both males and females, compared to low depression scores. Camilleri et al. (2014) investigated this relationship in the context of emotional eating (i.e. overeating in response to negative emotions; Kaplan & Kaplan, 1957). Results showed that emotional eating was related to a higher intake of sweet, fatty foods, e.g. chocolate and pastries, in females (but not males) who reported symptoms of depression, compared to those who did not. Another study reported a positive association between depressive symptoms and levels of desire for chocolate and sweets, although actual consumption was not investigated (Lester & Bernard, 1991). It is reiterated that these studies concerning chocolate and sweet foods were not carried out in terms of positive and negative affect directly. However, given the similarities concerning low pleasurable engagement that is evident in depressive symptoms and is also a defining feature of positive and negative affect, the results seem applicable in this context.

Both positive and negative affect can be evaluated or measured in terms of short-term *states,* i.e. momentary or short-lived changes in mood, or long-term *traits*, i.e. dispositions concerning emotionality or the experience of given emotions that are consistent over time (Lerner & Keltner, 2001; Watson & Pennebaker, 1989). The Positive And Negative Affect Schedule (PANAS; Watson et al., 1988) is an example of a self-report measure that has been reliably shown to capture both dimensions. As well as measuring affect ‘in the moment’ (i.e. as a state construct) or ‘in general’ (i.e. as a trait construct), the PANAS further acknowledges the transient qualities of affect, in that it can be administered with five additional time instructions that include ‘today,’ ‘the past few days/weeks,’ and ‘the last year’ (Watson et al., 1988). A further example of a self-report measure is the international Positive And Negative Affect Schedule Short Form (I-PANAS-SF; Thompson, 2007) which was developed following the original PANAS scale in order to measure positive and negative affect specifically as a trait construct, and also as a shorter measure that would function well cross-culturally. To capture this dispositional aspect of affect, the only time instruction used in the I-PANAS-SF is therefore ‘in general’ (Thompson, 2007). In support of Watson et al. (1999) who proclaimed that the high poles of both positive and negative affect were more important than the low poles in terms of defining each construct, the terms used in both the PANAS (Watson et al., 1988) and I-PANAS-SF (Thompson, 2007) are all taken from the high ends of each affective dimension. For example, ‘alert’, ‘inspired’ and ‘determined’ relate to high positive affect; whereas ‘upset’, ‘hostile’ and ‘afraid’ relate to high negative affect (Thompson, 2007; Watson et al., 1988).

To differentiate between state and trait emotions, the terms positive and negative *affect* generally relate to momentary, state emotions; whereas long-term affective traits are generally referred to in terms of either positive or negative *affectivity* (Watson, 2002). Thus, trait or dispositional positive affectivity represents stable individual differences (IDs) in the experience of positive emotions, i.e. positive emotionality, or a predilection to experience positive state emotions (Watson, 2002). Conversely, dispositional negative affectivity represents stable IDs in negative emotionality (Watson & Clark, 1984) or a predilection to experience negative state emotions (Watson & Pennebaker, 1989). Lerner and Keltner (2000), for example, demonstrated the relationship between the specific state and trait emotions of both fear and anger in a study concerning affective influences on judgment and evaluations in the context of risk perception. Supporting the hypothesis that levels of *dispositional* fear and anger should correspond to in-the-moment levels of *state* fear and anger, higher and lower scores on the dispositional emotion measures predicted baseline state emotions taken at the start of the study. That is to say, compared to high levels of dispositional fear, low levels were related to significantly lower baseline (i.e. state) levels of fear, and compared to high levels of dispositional anger, low levels were related to lower baseline (i.e. state) levels of anger (although not significantly so; Lerner & Keltner, 2000).

In a wider sense, the link between trait emotions and personality more generally is also noted in that personality as the individual disposition that characterizes a person also concerns components of emotion (Funder, 2004; Mayer, 2007). Indeed, emotions and personality are both so closely related, the items on mood scales and personality inventories are often hard to differentiate (McCrae & Costa, 1991). Given similarities between these phenomena, e.g. that both trait emotions and personality are relatively enduring and consistent (Larsen & Buss, 2005; Lerner & Keltner, 2001), personality therefore warrants a brief comment in order to set the context of affectivity as a trait-like construct. The five-factor model of personality is widely regarded as the most comprehensive system for studying personality traits (McCrae & Costa, 1987). Using the acronym ‘OCEAN’, these ‘Big-Five’ classification dimensions are: openness to experience (O), conscientiousness

(C), extraversion (E), agreeableness (A) and neuroticism (N). Each dimension is further composed of six related sub-factors (or facets) which, taken together, form a broad picture of individual personality (Costa & McCrae, 1992). For example, people who score highly on openness to experience (O) are generally more intellectually curious and creative; those who score highly in terms of conscientiousness (C) tend to be more organized and less impulsive; high extraversion (E) points to elevated levels of sociability and a propensity to experience positive emotions such as joy and happiness; high agreeableness (A) is associated with being more trusting and sympathetic; and high levels of neuroticism (N) are associated with the tendency to experience distress and lack self-control (Costa & McCrae, 1992).

With these sub-factors in mind, research investigating the link between the structure of emotion (as subjective well-being) and personality has understandably concentrated on the dimensions of extraversion and neuroticism (McCrae & Costa, 1991). Specifically, therefore, trait positive and negative affect generally correspond to the dominant personality traits of extraversion and neuroticism, respectively (McCrae & Costa, 1991; Meyer & Shack, 1989; Tellegen, 1985; Watson & Clark, 1992). For example, Costa and McCrae (1980) investigated the relationship between personality and subjective happiness or well-being. As hypothesised, they found that extraversion was related to higher levels of trait positive affect and neuroticism was related to higher levels of trait negative affect (Costa & McCrae, 1980). A further study also revealed the long-term stability of this relationship as data concerning personality obtained ten years previously was shown to still predict subjective well-being in a sample of more than 230 males (Costa & McCrae, 1980). Again, higher neuroticism scores were significantly related to negative but not positive trait affect;

and higher extraversion scores were significantly related to positive but not negative trait affect, ruling out the potential mediating effects of momentary or temporary mood states (Costa & McCrae, 1980). In simple terms, people who report higher levels of trait positive affectivity seem to be more cheerful and experience pleasant moods more frequently than those who report lower levels (Watson, 2002), whereas people who report higher levels of trait negative affectivity seem to experience higher negative affect more often than those who report lower levels (Watson & Clark, 1984). The strength and robust nature of the associations between personality and trait affectivity led to propositions that extraversion and neuroticism could rightly be renamed positive emotionality and negative emotionality respectively (Tellegen, 1985). Certainly, the dimensions of positive and negative affect have been noted as offering a particularly strong framework in research concerning affect at *both* the state and trait level (Watson et al., 1999).

The third study in this thesis departed from the stance of investigating affect as an experimentally induced, momentary mood state (as investigated in Chapters 2 and 3). Instead, this third study specifically explored the relationship between trait positive and negative affectivity and economic decisions concerning chocolate and sweet foods using the willingness-to-pay task designed for the second study (WTP; based on Becker et al., 1964; see Chapter 3). It has been observed that positive and negative affect (as relatively independent constructs), *together* contribute to overall happiness levels (Costa & McCrae, 1980; McCrae & Costa, 1991), and that both dimensions should therefore be considered when studying the way in which mood relates to and influences various aspects of psychological interest (e.g. Watson & Pennebaker, 1989; Watson & Tellegen, 1985). The scale used to measure affect as a trait construct (the I-PANAS-SF; Thompson, 2007), therefore captured both positive and negative affective dimensions for each participant.

It was hypothesised that higher negative affectivity would be significantly associated with higher willingness-to-pay (WTP) prices for chocolate vs. neutral items, high-sugar vs. neutral items and chocolate vs. high-sugar items. This was based on the fact that negative affect has been shown to be associated with higher WTP prices (e.g. Cryder et al., 2008; Lerner et al., 2004), and negative emotions have been shown to be regulated by eating (e.g. Macht, 1999). It is acknowledged that the current study did not investigate actual consumption of the foods used as stimuli in the WTP task. However, it has been suggested that simply being presented with tempting foods can trigger approach behaviours towards those stimuli (Hofmann, Friese & Wiers, 2008). It was therefore posited that higher WTP prices for foods containing chocolate and high-sugar can be interpreted as approach behaviours towards such foods.

Concerning positive affectivity, it is again noted that positive and negative affect are not completely independent of each other given that high levels of negative affect can relate to low levels of positive affect (Watson et al., 1999). To clarify, low positive affect is defined as the absence of pleasurable engagement, and terms used to describe this dimension include sadness and unhappiness (Watson & Tellegen, 1985). As trait constructs, this element of positive affectivity has been linked with negative affectivity in that both have been associated with symptoms of depression (Ahrens & Haaga, 1993; Brown et al., 1998; Watson et al., 1988). As previously mentioned, past research has found a positive association between depressive symptoms and consumption/desire for chocolate and sweet foods (e.g. Camilleri et al., 2014; Lester & Bernard, 1991; Rose et al., 2010). Following this past research and the link between positive and negative affectivity and depression, it was therefore hypothesised that lower positive affectivity would be significantly associated with higher WTP prices for chocolate vs. neutral items, high-sugar vs. neutral items. and chocolate vs. high-sugar items

In order to investigate other factors potentially influencing the relationship between trait positive and negative affectivity and economic decisions concerning chocolate and sweet foods, questionnaires measuring impulse (Steinberg et al., 2013), self-control (Tangney et al., 2004), and chocolate craving (Cartwright et al., 2007) were also included. These differed from the scales used in the first and second studies in that they were all short questionnaire versions. Given the online method of data collection, these versions were chosen in an attempt to minimise the potential carry-over effect of boredom for participants completing numerous, lengthy questionnaires.

The hypothesis concerning impulsivity was again based on past research which has found higher impulsivity (and hunger) to be associated with high-calorie snack food purchases (Nederkoorn et al., 2009). Higher impulsivity (and hunger) were therefore expected to be significantly associated with higher WTP prices for chocolate vs. neutral items, high-sugar vs. neutral items and chocolate vs. high-sugar items. Following the lack of conclusiveness concerning impulsivity in the second study (see Chapter 3), a measure of self-control was also included to strengthen the investigation of this construct in this third study. This is because self-control is ostensibly conversely related to impulse given that it relates to the ability to override undesirable behavioural tendencies such as impulsiveness (Tagney et al., 2004). As impulses happen automatically and without effort, whether a person has high or low self-control will not prevent the impulse from arising (Friese & Hofmann, 2009). Instead, people with high self-control are simply likely to be better at overriding their impulses, whereas people with low self-control are more likely to act upon them (Baumeister & Heatherton, 1996). As past research has shown that people with depleted self-control are willing to spend more in unanticipated buying situations (Vohs & Faber, 2007), lower self-control was therefore expected to be significantly associated with higher WTP prices in this third study.

Following past research that has established chocolate as a commonly and intensely craved food item (e.g. Hill et al., 1991; Rozin et al., 1991), higher chocolate craving was expected to be significantly associated with higher WTP for chocolate vs. neutral items and chocolate vs. high-sugar items. As the items used in the high-sugar vs. neutral items did not contain chocolate, the relationship between chocolate craving and WTP for high-sugar vs. neutral items was expected to be non-significant. It is noted that the results of the second study (see Chapter 3) did find chocolate craving to significantly predict WTP for high-sugar vs. neutral items, (i.e. items *not* containing chocolate). However, as this was an unexpected finding, it is emphasized that the hypothesis concerning the relationship between chocolate craving and WTP for high-sugar vs. neutral items in the current study does not predict a significant association between these two constructs.

4.3 Method

On account of this study building upon the second study, methodological similarities are evident. Where details have been presented previously, the reader will therefore be directed to the appropriate section of the previous chapter, and a brief outline will instead be included in this section. All novel paperwork relevant to this study can be found in the Appendix (see Chapter 7) which comprises:

- Ethics statement, ref: SAS1833.
- Questionnaires included:
    - The International Positive and Negative Affect Schedule Short Form (I-PANAS-SF; Thompson, 2007).
    - The Barratt Impulsivity Scale-Brief (BIS-Brief; Steinberg et al., 2013).
    - The Brief Self-Control Scale (SCS-Brief; Tangney et al., 2004).
    - The Orientation to Chocolate Questionnaire (OCQ; Cartwright et al., 2007).

4.3.1 Participants

A total of 450 males and females recruited via self-selection began the online Qualtrics™ study. In line with the latest General Data Protection Regulations (GDPR; British Psychological Society, 2018), the consent form included precise details concerning the purpose and nature of the study. All participants were required to answer ‘Yes’ in response to five consent statements, and ‘Yes’ in response to one GDPR statement before the study commenced. Those who did not answer ‘Yes’ to all five consent statements or terminated participation part-way through reduced this initial cohort to 285. A further 32 participants were removed for not responding ‘Yes’ to the GDPR statement, or if they had completed the study but failed to respond to one or more response fields during participation. Therefore, a total of 253 people completed the study in full.

Demographic information concerning gender was obtained for 268 participants. Eighty participants were male, 181 were female and seven preferred not to state their gender. Two hundred and seventy participants also completed demographic information concerning age which ranged from 18 to 65+ years. 47.00 per cent were aged between 18 and 24 years; 10.70 per cent were aged between 25 and 34 years; 15.90 per cent were aged between 35 and 44 years; 10.00 per cent were aged between 45 and 54 years; 9.60 per cent were aged between 55 and 64 years; and 6.70 per cent were aged 65 years and over.

The online Qualtrics™ study was advertised in a combination of ways: poster advertisements were displayed within the psychology department at London South Bank University (LSBU) and were also posted on the LSBU Psychology Research Participation Scheme (RPS) website. These advertisements contained a direct anonymous link to the study as well as a quick response (QR) code. Undergraduate psychology students who responded to the posters and RPS advertisements were offered course credits in exchange for participation. The study was also advertised via anonymous links on social media sites e.g. Facebook™. Non-psychology students did not receive a reward for participation.

4.3.2 Materials

The study was created using the online survey software Qualtrics™. Anonymous links and QR codes enabled participants to complete the study using their own mobile device or laptop/personal computer. As previously mentioned, all participants were required to answer ‘Yes’ in response to five consent statements, and ‘Yes’ in response to one GDPR statement before the study commenced. Those who responded ‘No’ to any of the five statements were directed to the final page of the study without viewing or completing any further elements. It was made clear that those participants who did complete the online study would be unable to withdraw their responses following completion due to participation being completely anonymous.

Four questionnaires were included. These were all short versions which were considered to be more suitable than longer versions given the online method of data collection. For example, to minimise the potential carry-over effect of boredom for participants completing numerous questionnaires.

Participants also answered the question: ‘Do you like chocolate?’. 89.6 per cent of participants responded ‘Yes’ and 10.4 per cent of participants responded ‘No’.

The International Positive and Negative Affect Schedule Short Form (I-PANAS-SF; Thompson, 2007)

The international Positive and Negative Affect Schedule Short Form (I-PANAS-SF; Thompson, 2007) measures positive and negative affect as independent trait dimensions of general mood. Following the statement “Thinking about yourself and how you normally feel,” participants are asked to rate the extent they “generally feel” regarding 10 affective items. Five of these relate to positive affect e.g. ‘inspired’; and 5 of these relate to negative affect e.g. ‘upset’. The I-PANAS-SF uses a 5-point Likert scale ranging from 1 to 5 and anchored ‘never’ and ‘always’ (Thompson, 2007). However, due to a misinterpretation of the anchoring terms, the Likert scale used in this study comprised 7-points which enabled participants to rate their feelings using ‘*never*-1-2-3-4-5-*always.’* That is to say, *‘never’* and *‘always’* created two extra scale points where *‘never’* = 1 and *‘always’* = 7. However, previous research comparing responses to the I-PANAS-SF with both 5- and 7-point scales has found responses using a 7-point scale to be clearer and more consistent compared to responses using a 5-point scale (e.g. Agbo, 2016). The lowest/highest possible score for the 5 positive affective statements was therefore 5/35 and the lowest/highest possible score for the 5 negative affective statements was 5/35. A higher score for each affective domain indicates a higher level of that affective trait (Thompson, 2007). Reliability analyses indicated that responses for the two sub-scales of the I-PANAS-SF in the current study had an appropriate level of internal consistency, (positive, $\alpha = .75$; negative, $\alpha = .78$).

<u>The Barratt Impulsivity Scale-Brief (BIS-Brief; Steinberg et al., 2013)</u>

The Barratt Impulsivity Scale-Brief (BIS-Brief; Steinberg et al., 2013) measures impulsivity as a personality construct. The BIS-Brief comprises 8 statements describing 4 common impulsive and 4 common non-impulsive preferences and behaviours. An example of an impulsive statement is: ‘I do things without thinking;’ and an example of a non-impulsive statement is: ‘I am self-controlled.’ The 4 impulsive statements are scored on a 4-point scale from 1 to 4 where 1 = rarely/never; 2 = occasionally; 3 = often; and 4 = almost always/always. The 4 non-impulsive statements are reversed scored on a 4-point scale from 4 to 1 where 4 = rarely/never; 3 = occasionally; 2 = often; and 1 = almost always/always. The lowest possible score was therefore 8 and the highest possible score was 32 with a higher score indicating a higher impulsive response (Steinberg et al., 2013). Reliability analyses indicated that responses for the BIS-Brief in the current study had an appropriate level of internal consistency (α = .78).

The Brief Self-Control Scale (SCS-Brief; Tangney et al., 2004)

Self-control has been conceptualised as the ability to override undesirable behavioural tendencies such as impulsiveness (Tangney et al., 2004). While the BIS-Brief includes statements referring to non-impulsive preferences/behaviours, its primary function is to measure impulsiveness (Steinberg et al., 2013). Rather than extrapolating that participants who scored low on the BIS-Brief were therefore likely to be high in self-control, a measure specific to this construct - the Brief Self-Control Scale (SCS-Brief; Tangney et al., 2004) - was also included in the current study. The SCS-Brief comprises 13 statements, four of which relate to self-control processes and nine of which relate to self-control failures (Tangney et al., 2007). An example of a self-control process statement is ‘I am good at resisting temptation;’ and an example of a self-control failure statement is ‘I am lazy.’ Participants are asked ‘to indicate how much each statement reflects ‘How you typically are’. The four self-control process statements are scored from 1 to 5 where 1 = not at all and 5 = very much; and the nine self-control failure statements are scored from 5 to 1 where 5 = not at all and 1 = very much. The lowest possible score was therefore 13 and the highest possible score was therefore 65, with higher scores indicating a higher level of self-control (Tangney et al., 2007). Reliability analyses indicated that responses for the SCS-Brief in the current study had an appropriate level of internal consistency (α = .82).

The Orientation to Chocolate Questionnaire (OCQ; Cartwright et al., 2007)

The Orientation to Chocolate Questionnaire (OCQ; Cartwright et al., 2007) measures three elements associated with chocolate craving. Of the total 14 statements, six assess approach behaviour e.g. ‘I was thinking about chocolate a lot of the time’; two assess avoidant behaviour e.g. ‘I did things to take my mind off chocolate’; and six assess guilt e.g. ‘After eating chocolate, I often wished I hadn’t’. However, an overall score of the combined three elements indicates general chocolate craving (Cartwright et al., 2007). Participants are asked to indicate the extent they ‘agree with the following statements’ on a 9-point Likert scale where 1 = not at all and 9 = very strongly. The lowest possible score was therefore 14 and the highest possible score was therefore 126, with a higher score indicating a higher level of chocolate craving (Cartwright et al., 2007). Reliability analyses indicated that responses for the OCQ in the current study had an appropriate level of internal consistency (α = .91).

Participants then completed the willingness-to-pay task (WTP) that was created for use in the second study (based on Becker et al., 1964; see Chapter 3, Section 3.3.2 for full design details of this task). For the third study, the WTP task was included in order to assess the relationship between trait/dispositional positive and negative affectivity on economic decisions concerning chocolate and sweet foods. High-sugar chocolate items *and* high-sugar non-chocolate items were included to allow for comparisons between trait positive and negative affectivity on decisions concerning different types of sweet foods. Non-food/neutral items acted as control items in order to calculate WTP for chocolate and high-sugar items. The WTP task comprised 20 every day shopping items, 5 of which contained chocolate e.g. a large bag of M&M's; 5 of which were high in sugar (but did not contain chocolate) e.g. a jar of honey; and 10 of which were non-food (i.e. neutral items) e.g. a pair of socks. The items were presented in pictorial form on the screen and the order of presentation was randomised for every participant. The online instructions asked participants how much they would be willing to pay, 'right now', for each item and allowed them to select '£0,' '£1,' '£2,' or '£3' in response.

4.3.3 Design and Procedure

This study used a cross-sectional correlational design with positive and negative affectivity as predictor variables and WTP for chocolate vs. neutral items, WTP for high-sugar vs. neutral items and WTP for chocolate vs. high-sugar items as criterion variables. Participants completed the study using their own mobile device or laptop/PC. The duration of the study was approximately 20 minutes. Following agreement with five consent statements and one GDPR statement, demographic information was collected regarding participants' gender and age. Participants were then asked to indicate how hungry they were 'at the moment' on a scale of 1 to 10, where 1 = not at all and 10 = extremely. Participants then completed the four questionnaires in the following order: the International Positive and Negative Affect Schedule Short Form (I-PANAS-SF; Thompson, 2007); the Barratt Impulsivity Scale-Brief (BIS-Brief; Steinberg et al., 2013); the Brief Self-Control Scale (SCS-Brief; Tangney et al., 2004); and the Orientation to Chocolate Questionnaire (OCQ; Cartwright et al., 2007).

Finally, participants completed the willingness-to-pay task (WTP; based on Becker et al., 1964) in which they indicated the amount they were willing to pay for 20 every day shopping items which were presented randomly and in pictorial form on the screen. Following the WTP task a debriefing statement was presented. To acknowledge that they had been given the opportunity to read the statement, participants were asked to click ‘Next’ which registered their responses to the study.

4.4 Results: Online Willingness-to-Pay (WTP) task

In order to assess the relationship between positive and negative affectivity on economic decisions concerning sweet foods, participants completed a willingness-to-pay task (WTP; based on Becker et al., 1964). High-sugar chocolate items *and* high-sugar non-chocolate items were included to allow for comparisons between positive and negative mood on decisions concerning different types of sweet foods. Non-food/neutral items acted as control items in order to calculate WTP for chocolate and high-sugar items. Three hierarchical multiple linear regression analyses were therefore performed in order to investigate the relationship between positive and negative affectivity and WTP for chocolate vs. neutral items, WTP for high-sugar vs. neutral items and WTP for chocolate vs. high-sugar items. These analyses also allowed for consideration of additional factors that might be influencing participants’ WTP prices. For all three hierarchical linear regression models, hunger was entered in the first stages, impulsivity and self-control were entered in the second stages, chocolate craving was entered in the third stage and positive affectivity and negative affectivity were entered in the fourth stage of the models. Descriptive statistics are presented in Table 16 and Tables 17-19 present the linear model of predictors for the three analyses. Following each analysis, residual statistics were examined to ensure the assumptions of hierarchical multiple regression had been met (Field, 2013). No points for which the data fit poorly or exerted an undue influence on the model were identified. Full details of the assumption checks are presented in the Appendix, (see Chapter 7, Sections 7.3.4, 7.3.5 and 7.3.6). Given similarities in results across all three hierarchical regression models, these will be discussed simultaneously following presentation of the analyses.

Table 16*: Study 3, WTP analyses, descriptive statistics*

The mean scores and SDs for hunger, impulsivity, self-control, chocolate craving, positive affectivity, negative affectivity, WTP for chocolate vs. neutral items, WTP for high-sugar vs. neutral items and WTP for chocolate vs. high-sugar items.

	Minimum	**Maximum**	**Mean**	**Std. Deviation**
Hunger levels	1.00	10.00	3.74	2.57
Impulsivity (BIS-Brief; Steinberg et al., 2013)	8.00	28.00	16.51	3.98
Self-control (SCS-Brief; Tangney et al., 2004)	17.00	65.00	41.11	8.15
Chocolate Craving (OCQ; Cartwright et al., 2007)	14.00	119.00	40.90	22.89
Positive Affectivity (I-PANAS-SF; Thompson, 2007)	00.00	35.00	22.81	4.83
Negative Affectivity (I-PANAS-SF; Thompson, 2007)	00.00	33.00	14.65	4.85
WTP for chocolate vs. neutral items	-2.10	2.25	-0.05	0.65
WTP for high-sugar vs. neutral items	-1.80	1.10	-0.11	0.56
WTP for chocolate vs. high-sugar items	-1.40	2.00	0.06	0.59

4.4.1 WTP for chocolate vs. neutral items

Willingness-to-pay (WTP) for chocolate vs. neutral items was calculated as the mean WTP price for the five chocolate items minus the mean WTP price for the five neutral items

Table 17*: Study 3, linear model of predictors of WTP for chocolate vs. neutral items, with 95% confidence intervals reported in parentheses*

	b	SE B	β	p	sr^2
Stage 4					
Constant	0.02 (-1.03, 1.07)	0.53		.972	
Hunger	0.04 (0.01, 0.07)	0.02	.16	.007	.03
Impulsivity	0.01 (-0.01, 0.04)	0.01	.07	.375	.005
Self-Control	-0.001 (-0.02, 0.01)	0.01	-.02	.853	.001
Chocolate Craving	0.01 (0.002, 0.01)	0.002	.21	.002	.04
Positive Affectivity	-0.02 (-0.04, -0.003)	0.01	-.15	.022	.02
Negative Affectivity	-0.01 (-0.03, 0.01)	0.01	-.07	.300	.005

Note. R^2 = .03 for Step 1 (p = .004); ΔR^2 = .03 for Step 2 (p =.025); ΔR^2 = .03 for Step 3 (p = .003); ΔR^2 = .02 for Step 4 (p =.048)

In stage 1, hunger was found to be a significant predictor of WTP for chocolate vs. neutral items (F(1, 252) = 8.29, p = .004) and accounted for approximately 3 per cent of variation in WTP for chocolate vs. neutral items. When impulsivity and self-control were entered in stage 2 (F(3, 252) = 5.32, p = .001), there was a significant change in the ability to predict WTP for chocolate vs. neutral items (F Change (3, 249) = 3.74, p =.025) and impulsivity and self-control accounted for approximately 2 per cent of additional variation in WTP for chocolate vs. neutral items. When chocolate craving was entered in stage 3 (F(4, 252) = 6.39, p < .001) there was a significant change in the ability to predict WTP for chocolate vs. neutral items (F Change (1, 248) = 9.08, p = .003) and chocolate craving accounted for approximately 3 per cent of additional variation in WTP for chocolate vs. neutral items. When positive affectivity and negative affectivity were entered in stage 4 (F(6, 252) = 5.35, p < .001), there was a significant change in the ability to predict WTP for chocolate vs. neutral items (F Change (2, 246) = 3.07, p = .048) and positive affectivity and negative affectivity accounted for approximately 1.5% additional variation in WTP for chocolate vs. neutral items. While impulsivity and self-control in stages 2-4 and negative affectivity in stage 4 were not significant individual predictors, increasing hunger in stages 1-4, increasing chocolate craving in stages 3-4 and decreasing positive affectivity in stage 4 all significantly independently predicted increasing WTP for chocolate vs. neutral items.

4.4.2 WTP for high-sugar vs. neutral items

Willingness-to-pay (WTP) for high-sugar vs. neutral items was calculated as the mean WTP price for the 5 high-sugar items minus the mean WTP price for the 5 non-food/neutral items.

In stage 1, hunger was found to be a non-significant predictor of WTP for high-sugar vs. neutral items (F(1, 252) = .48, p = .488) but could not account for any variation in WTP for high-sugar vs. neutral items (ΔR^2 = -.002). When impulsivity and self-control were entered in stage 2 (F(3, 252) = 1.09 p = .353), there was a non-significant change in the ability to predict WTP for high-sugar vs. neutral items (F Change (2, 249) = 1.40, p =.249), and impulsivity and self-control could account for less than 1 per cent of additional variation in WTP for high-sugar vs. neutral items. When chocolate craving was entered in stage 3 (F(4, 252) = 1.09, p = .362), there was a non-significant change in the ability to predict WTP for high-sugar vs. neutral items (F Change (1, 248) = 1.08, p = .300), and chocolate craving could account for less than 1 per cent of additional variation in WTP for high-sugar vs. neutral items.

Table 18*: Study 3, linear model of predictors of WTP for high-sugar vs. neutral items, with 95% confidence intervals reported in parentheses*

	b	SE B	β	p	sr^2
Stage 4					
Constant	0.27 (-0.67, 1.22)	0.48		.568	
Hunger	0.01 (-0.02, 0.04)	0.01	.05	.405	.003
Impulsivity	-0.01 (-0.04, 0.01)	0.01	-.10	.252	.01
Self-Control	0.01 (-0.01, 0.02)	0.01	.08	.366	.01
Chocolate Craving	0.002 (-0.001, 0.01)	0.002	.09	.215	.01
Positive Affectivity	-0.02 (-0.03, -0.001)	0.01	-.15	.034	.02
Negative Affectivity	-0.01 (-0.03, 0.01)	0.01	-.08	.283	.01

Note. R^2 = .002 for Step 1 (p = .488); ΔR^2 = .011 for Step 2 (p =.249); ΔR^2 = .004 for Step 3 (p = .300); ΔR^2 = .02 for Step 4 (p =.066)

When positive affectivity and negative affectivity were entered in stage 4 (F(6, 252) = 1.65, p = .133), there was a non-significant change in the ability to predict WTP for high-sugar vs. neutral items (F Change (2, 246) = 2.75, p = .066), and positive affectivity and negative affectivity could only account for approximately 1.5 per cent of additional variation in WTP for high-sugar vs. neutral items. Decreasing positive affectivity in stage 4 of the model was the only significant independent predictor of increasing WTP for high-sugar vs. neutral items.

4.4.3 WTP for chocolate vs. high-sugar items

Willingness-to-pay (WTP) for chocolate vs. high-sugar items was calculated as the mean WTP price for the five chocolate items minus the mean WTP price for the five high-sugar items.

Table 19*: Study 3, linear model of predictors of WTP for chocolate vs. high-sugar items, with 95% confidence intervals reported in parentheses*

	b	SE B	β	p	sr^2
Stage 4					
Constant	-0.26 (-1.20, 0.69)	0.48		.595	
Hunger	0.03 (0.003, 0.06)	0.01	.13	.029	.02
Impulsivity	0.03 (0.002, 0.05)	0.01	.17	.034	.03
Self-Control	-0.01 (-0.02, 0.01)	0.01	-.10	.268	.01
Chocolate Craving	0.004 (0.000, 0.01)	0.002	.15	.027	.02
Positive Affectivity	-0.003 (-0.02, 0.01)	0.01	-.03	.678	.001
Negative Affectivity	-0.001 (-0.02, 0.02)	0.01	.01	.939	.000

Note. R^2 = .02 for Step 1 (p = .013); ΔR^2 = .08 for Step 2 (p <.001); ΔR^2 = .02 for Step 3 (p = .020); ΔR^2 = .001 for Step 4 (p =.916)

In stage 1, hunger was found to be a significant predictor of WTP for chocolate vs. high-sugar items (F(1, 252) = 6.23, p = .013) and accounted for approximately 2 per cent of variation in WTP for chocolate vs. high-sugar items. When impulsivity and self-control were entered in stage 2 (F(3, 252) = 9.66, p < .001), there was a significant change in the ability to predict WTP for chocolate vs. high-sugar items (F Change (2, 249) = 11.13, p <.001), and impulsivity and self-control accounted for approximately 7 per cent of additional variation in WTP for chocolate vs. high-sugar items. When chocolate craving was entered in stage 3 ($F(4, 252) = 8.74$, $p < .001$), there was a significant change in the ability to predict WTP for chocolate vs. high-sugar items (F Change $(1, 248) = 5.45$, $p = .020$), and chocolate craving could account for approximately 2 per cent of additional variation in WTP for chocolate vs. high-sugar items. When positive affectivity and negative affectivity were entered in stage 4 ($F(6, 252) = 5.81$, $p < .001$), there was a non-significant change in the ability to predict WTP for chocolate vs. high-sugar items (F Change $(2, 246) = 0.09$, $p = .916$). The addition of positive affectivity and negative affectivity could not account for any additional variation in WTP for chocolate vs. high-sugar items and instead reduced the overall variation accounted for in the model by approximately 0.5 per cent. Increasing hunger in stages 1-4, decreasing self-control in stage 2, and increasing impulsivity and chocolate craving in stages 3-4 were significant independent predictors of increasing WTP for chocolate vs. high-sugar items. However, positive and negative affectivity in stage 4 were both non-significant independent predictors of WTP for chocolate vs. high-sugar items.

4.5 Discussion: Online Willingness-to-pay (WTP) analyses

The third study in this thesis investigated the relationship between positive and negative affectivity (i.e. dispositional or trait affectivity) and economic decisions concerning chocolate and sweet foods. Participants completed the willingness-to-pay task designed for the second study (WTP; based on Becker et al., 1964; see Chapter 3) which involved high-sugar chocolate items and high-sugar non-chocolate items. Non-food/neutral items acted as control items in order to calculate WTP for the chocolate and high-sugar items. In other words, the inclusion of chocolate items allowed for a direct comparison of positive and negative affectivity on decisions concerning chocolate vs. non-food/neutral items. The inclusion of high-sugar (but non-chocolate) items then allowed for a direct comparison of positive and negative affectivity on decisions concerning high-sugar vs. non-food/neutral items. The final analysis allowed for a direct comparison of positive and negative affectivity on decisions concerning chocolate vs. high-sugar items. Three multiple, hierarchical, linear regression analyses were carried out in order to also investigate the influence of hunger, impulsivity, self-control and chocolate craving on WTP prices. The same additional variables were included in each analysis; therefore, similarities will be discussed simultaneously.

The first linear regression model investigating the relationship between positive and negative affectivity on WTP for chocolate vs. neutral items was significant at each stage of the hierarchy. That is to say, the linear combination of hunger, impulsivity, self-control, chocolate craving, positive affectivity and negative affectivity was able to accurately predict WTP for chocolate vs. neutral items. Further to this were the findings that hunger, chocolate craving and positive affectivity were independent, significant predictors of WTP for chocolate vs. neutral items in that as hunger and chocolate craving increased, WTP for chocolate vs. neutral items also tended to increase, and as positive affectivity decreased, WTP for chocolate vs. neutral items tended to increase, as hypothesised.

The second linear regression model investigating the relationship between positive and negative affectivity on WTP for high-sugar vs. neutral items was non-significant at each stage of the hierarchy. That is to say, the linear combination of hunger, impulsivity, self-control, chocolate craving, positive affectivity and negative affectivity was not able to accurately predict WTP for high-sugar vs. neutral items. However, in the fourth stage of the model, positive affectivity was found to be an independent, significant predictor of WTP for high-sugar vs. neutral items in that as positive affectivity decreased, WTP for high-sugar vs. neutral items tended to increase, as hypothesised.

The third linear regression model investigating the relationship between positive and negative affectivity on WTP for chocolate vs. high-sugar items was significant at the first three stages of the hierarchy but was non-significant at the final stage when positive and negative affectivity were added to the model. That is to say, the linear combination of hunger, impulsivity, self-control and chocolate craving was able to accurately predict WTP for chocolate vs. high-sugar items, but the addition of positive and negative affectivity was not. While hunger in all four stages, impulsivity in stages 3 and 4, self-control in stages 2 and 3, and chocolate craving in stages 3 and 4 were found to be independent, significant predictors of WTP for chocolate vs. high-sugar items, positive and negative affectivity in stage 4 were not. Directionally, the results of these significant independent predictors were also as hypothesised in that as hunger, impulsivity and chocolate craving increased, WTP for chocolate vs. high-sugar items also tended to increase; while as self-control decreased, WTP for chocolate vs. high-sugar items tended to increase.

Hunger was identified as a significant independent predictor across each stage of the two regression models concerning WTP for chocolate vs. neutral items and WTP for chocolate vs. high-sugar items. As hunger motivates approach tendencies for food and food consumption and has previously been associated with higher snack food purchase (Nederkoorn et al., 2009), these findings were as expected. However, hunger was not found to be a significant independent predictor of WTP for high-sugar vs. neutral items and this was unexpected. Why was hunger so robustly significant for chocolate vs. neutral items and chocolate vs. high-sugar items but not high-sugar vs. neutral items? While an explanation for this finding is not immediately evident, one possibility is put forward: of the food items used across the WTP task, only one beverage was included- a 2 litre bottle of Sprite™. As this does not contain chocolate, it was ostensibly used in the high-sugar vs. neutral element of this task. Beverages of this nature, i.e. sugar-sweetened, carbonated soft drinks (SSBs) have been notably highlighted as contributing to the obesity epidemic (e.g. Malik, Schulze & Hu, 2006). This is not only because of their high sugar content (which is rapidly absorbed in liquid form), but also because of their low ability to trigger feelings of satiety. That is to say, calories consumed as SSBs tend not to be compensated for by reducing calories consumed during subsequent meals, ultimately leading to an overall higher caloric intake (Malik et al., 2013). It is acknowledged that the other items used within the high-sugar vs. neutral element of the WTP task were food rather than beverage items. However, as SSBs do not sate hunger levels it is tentatively posited that the inclusion of this particular item (as a beverage rather than a food item) could have reduced the ability of hunger levels to independently predict overall high-sugar vs. neutral WTP prices. However, although the variance explained by hunger levels for WTP prices concerning high-sugar vs. neutral items ($\beta = .05$) was lower than that explained by hunger levels for WTP prices concerning both chocolate vs. neutral items ($\beta = .16$) and chocolate vs. high-sugar items ($\beta =.13$), subsequent comparisons of the unstandardized hunger coefficients did not reveal significant differences between the three regression analyses. That is to say, unstandardized hunger coefficients for the high-sugar vs. neutral WTP and chocolate vs. neutral WTP analyses were not significantly different (p = .162); for the high-sugar vs. neutral WTP and chocolate vs. high-sugar WTP analyses (p = .147); or for the chocolate vs. neutral WTP and chocolate vs. high-sugar WTP analyses (p = .361). It is again reiterated that hunger did *not* reach significance as a predictor of high-sugar vs. neutral WTP prices and therefore conclusions drawn are cautious. However, given the previously mentioned concern regarding the significant contribution of SSBs to overall daily energy intake and weight gain (e.g. Malik et al., 2006), as well as the finding that consumption of SSB's has increased across all age groups in the UK (Ng, Mhurchu, Jebb & Popkin, 2012), future exploration of this beverage type is perhaps nevertheless warranted. SSBs do not lead to high satiety levels, i.e. feeling full (Malik et al., 2013). This could indicate that hunger might not be a necessary consideration, certainly when presented with an economic decision concerning such sources of sugar, thus explaining the inability of this variable to predict WTP for high-sugar vs. neutral items in the current study. A WTP task comparing a solely high-sugar SSB stimuli group with a solely high-sugar food stimuli group would potentially reveal the influence of hunger more clearly. Based on the fact that SSBs are not a source of satiety (Malik et al., 2013), it might be hypothesised that increasing hunger levels would not be associated with increasing WTP prices for high-sugar SSBs. However, following previous research that has shown hunger to be associated with higher snack food purchase (Nederkoorn et al., 2009), it might be hypothesised that increasing hunger levels would independently predict increasing WTP prices for high-sugar foods.

The results concerning chocolate craving were found to be powerfully robust across the first and third WTP analyses investigating chocolate vs. neutral items and chocolate vs. high sugar items, as hypothesised. Both regression models found chocolate craving to be an independent and highly significant predictor of WTP prices, and in both analyses these findings were also directionally as expected in that as chocolate craving increased, WTP for chocolate vs. neutral items and chocolate vs. high-sugar items also tended to increase. These results are interpreted as being supported by other cited research e.g. that food craving is an intense desire for a specific food (Pelchat et al., 2004), and chocolate craving is associated with chocolate consumption (e.g. Benton et al., 1998). While it is acknowledged that this third study did not investigate consumption directly, these results nevertheless appear to align with previous findings concerning the probability of cravings for chocolate and other sweet foods leading to consumption (Hill & Heaton-Brown, 1994), which is interesting in itself. That is to say, even when consumption is not a factor, chocolate craving is still a powerful predictor of how much a person is willing to pay for items containing chocolate. With regards to the second study in this thesis (see Chapter 3) which incorporated the same WTP task in the context of manipulated positive and negative incidental mood rather than dispositional positive and negative affectivity, the current findings also follow the pattern of results concerning the two corresponding WTP analyses from that second study. These similarities provide robust evidence concerning the relationship between chocolate craving and WTP prices for foods containing chocolate, as well as evidence for this relationship in terms of both manipulated mood states and dispositional trait affect.

Concerning the second regression model which investigated high-sugar vs. neutral items, chocolate craving was not found to significantly independently predict WTP prices, as hypothesised. It is noted that the results of the second study (see Chapter 3) did find chocolate craving to significantly predict WTP for high-sugar vs. neutral items. However, given that the craving scale used was specific to chocolate, but the foods included in this particular regression model did not contain chocolate (and were simply high in sugar), the results of the third study are clearly indicative of what logic might predict. It is noted, however, that the second study in this thesis (see Chapter 3) was in the context of manipulated positive and negative incidental mood rather than dispositional positive and negative affectivity, and perhaps this difference is what accounts for these discrepancies. That is to say, experimentally induced mood states might connect craving for chocolate to higher WTP for foods that are high in sugar but do not contain chocolate, whereas dispositional affectivity might not reveal this unexpected inconsistency. However, it is noted that the craving scale used in the current study (the OCQ; Cartwright et al., 2007) differed from the scale used in the second study (the Attitudes to Chocolate Questionnaire; Benton et al., 1998). It is of course possible therefore, that the OCQ captured a ‘cleaner’ or more accurate measure of chocolate craving whereas the attitudes to chocolate questionnaire might have inadvertently captured elements of craving related to sweet foods (as well as chocolate). As chocolate is a sweet food, preference or liking for foods that are sweet (but do not contain chocolate) have been highlighted as being a potential confound when assessing chocolate preference or liking (Rozin et al., 1991). For example, one study in which separate scales were designed to capture firstly chocolate preference/consumption, and secondly sweet food preference/consumption, reported a positive correlation of 0.75 between the two scales (Schuman, Gitlin & Fairbanks, 1987). If such a relationship exists between chocolate and sweet food *craving*, the lines between the two could ostensibly become blurred. Scales to capture chocolate and sweet food craving separately might help clarify the role of craving in terms of both food types, as well as avoiding potential confounds in future studies.

The results concerning impulsivity and self-control as independent predictors of WTP are a little harder to interpret in that these did not always follow a consistent and logical pattern in terms of direction, and only reached significance in the final stage of the final analysis. It is emphasized therefore, that while these variables warrant a brief discussion, all interpretations are made with caution. Self-control is related to impulsivity in that it concerns the ability to override undesirable behavioural tendencies such as impulsiveness (Tagney et al., 2004), and past research has demonstrated the inverse nature of this relationship. For example, higher impulsivity has been found to be associated with higher snack food purchase (Nederkoorn et al., 2009), whereas lower self-control has been found to be associated with spending more in unanticipated buying situations (Vohs & Faber, 2007). While an increase in impulsivity and decrease in self-control was therefore expected in all three WTP analyses, this was not observed until the final analysis, and even then, this was not a robust finding. To clarify, in the first analysis concerning WTP for chocolate vs. neutral items, and second analysis concerning WTP for high-sugar vs. neutral items, neither impulsivity or self-control reached significance as independent predictors of WTP prices, and as standardized betas for both predictors were close to zero, caution regarding directional interpretation was taken. In the final analysis concerning WTP for chocolate vs. high-sugar items, while impulsivity independently reached significance in stage 3 and 4 of the model, self-control only independently reached significance in stage 2 of the model. Again, however, as standardized betas for both predictors were close to zero, caution regarding directional interpretation was taken.

It is noted here that with regards to the second study in this thesis (see Chapter 3), which incorporated the same WTP task in the context of manipulated positive and negative incidental mood rather than dispositional positive and negative affectivity, inconclusive results concerning impulsivity were also found. (N.B. a measure of self-control was not taken in the second study.) The vagueness of findings across both studies can perhaps be explained in terms of the results concerning chocolate craving in this third study. That is to say, the robust nature of the relationship between chocolate craving and WTP prices (certainly concerning foods containing chocolate) perhaps obscured any meaningful associations between impulsivity, self-control and WTP prices. It is tentatively posited here that parallels between chocolate craving and maladaptive behaviours that also involve craving such as alcohol and drug use can perhaps be made. Incentive models of addiction for example, include craving as a fundamental component (e.g. Robinson & Berridge, 1993). Studies in this area have found social drinkers with high levels of craving for alcohol to have stronger levels of attentional and approach biases for alcohol cues compared to those with lower levels (e.g. Field, Mogg & Bradley, 2005). Given that approach behaviours are defined as reactions towards rewarding stimuli, an example of which is food (Corr, 2013), it is posited that being willing to pay more for foods containing chocolate can be interpreted as an approach behaviour. With this in mind, the strength of the findings concerning chocolate craving in this third study can perhaps also be interpreted as aligning with explanations surrounding approach behaviours observed in other contexts. That is to say, the relationship between craving and approach behaviours concerning alcohol is consistent with addiction models of which craving is a key component (e.g. Field et al., 2005). As parallels between sugar and substances more commonly linked to dependence have previously been made (e.g. Avena, Rada & Hoebel, 2008; Lustig, 2010), the results of this third study suggest that the strength of the influence that chocolate craving generates warrants further investigation in the context of addiction. This point will be explored in detail in the general discussion chapter (see Chapter 5, Section 5.3.3).

In terms of dispositional dimensions of affect, negative affectivity was not found to independently predict WTP prices across all three hierarchical regression analyses. However, positive affectivity was found to independently, significantly predict WTP for chocolate vs. neutral items and WTP for high-sugar vs. neutral items in that as positive affectivity decreased, WTP for chocolate vs. neutral items and high-sugar vs. neutral items tended to increase, as hypothesised. Previous observations acknowledge that the lower limits of the positive affectivity dimension concern an *absence* of positive engagement, in that terms used to describe the lower end of this scale are often of a negative nature e.g. sadness (Watson et al., 1999). Past research has then established a link between lower positive affectivity and symptoms of depression (Ahrens & Haaga, 1993; Brown et al., 1998; Watson et al., 1988); and also found a relationship between symptoms of depression and consumption/desire for chocolate and sweet foods (e.g. Camilleri et al., 2014; Lester & Bernard, 1991; Rose et al., 2010). The current results concerning decreasing positive affectivity and higher WTP prices for chocolate vs. neutral and high-sugar vs. neutral items therefore seem to align with these previous findings.

Although negative affectivity was not a significant independent predictor of WTP across the results of this third study, previous research has shown negative affect to be regulated by eating (e.g. Macht, 1999). It is posited here that the findings concerning lower positive affectivity provide evidence of needing to disentangle exactly which elements connected with negative affect (i.e. lower positive affectivity such as sadness or depression; or negative affectivity more generally) relate to decisions concerning chocolate and high-sugar foods. For example, it is noted that of the terms used to measure each construct as set out in the I-PANAS-SF (Thompson, 2007), those that are arguably the most commonly (or logically) associated with positive and negative affectivity, i.e. joy/happiness and misery/sadness respectively, are not included in this scale. Ultimately, therefore, it is possible that the true essence of both positive and negative affectivity, as widely understood, might not have been captured. Added to this is the acknowledgment that although decreasing positive affectivity was a significant independent predictor of increasing WTP for chocolate vs. neutral items and WTP for high-sugar vs. neutral items, the standardized betas were relatively small in both these analyses. With this in mind, caution regarding directional interpretation was again observed. Perhaps the inclusion of more obvious and widely understood affective terms would capture a more accurate or rounded picture of trait positive affectivity as well as potentially revealing more robust effects. With regard to past research concerning the misery-is-not-miserly effect which has found higher spending in response to negative mood inductions (e.g. Cryder et al., 2008; Lerner et al., 2004), it is acknowledged here that these previous investigations did not investigate this effect in the context of food. This, therefore, leads to the conclusion that when considering chocolate vs. neutral and high-sugar vs. neutral items, higher spending could be more to do with an absence of positivity than a presence of negativity.

4.6 Chapter Summary

The third and final study presented in this thesis sought to investigate positive and negative affectivity as dispositional or long-term traits, and the way these relate to economic decisions concerning chocolate and sweet foods. Participants completed the willingness-to-pay task designed for the second study (WTP; based on Becker et al., 1964; see Chapter 3), as well as measures of affectivity (Thompson, 2007), impulsivity (Steinberg et al., 2013), self-control (Tangney et al., 2004) and chocolate craving (Cartwright et al., 2007). Across three hierarchical regression models, the relationship between chocolate craving, positive affectivity and WTP for foods containing chocolate and high-sugar was found to be particularly noteworthy. Broadly speaking, increasing chocolate craving was found to be significantly associated with increasing WTP for chocolate vs. neutral items and WTP for chocolate vs. high-sugar items, as hypothesised (although not with WTP for high-sugar vs. neutral items); and decreasing positive affectivity was found to be significantly associated with increasing WTP for both chocolate vs. neutral items and high-sugar vs. neutral items, as hypothesised (although not with chocolate vs. high-sugar items).

The results concerning chocolate craving follow the results from the second study in Chapter 3 which also found increasing chocolate craving to be significantly associated with higher WTP for chocolate vs. neutral items, chocolate vs. high-sugar items (and high-sugar vs. neutral items), in the context of experimentally induced positive and negative affect. These similarities provide robust evidence concerning the relationship between chocolate craving and WTP prices for chocolate vs. neutral and chocolate vs. high-sugar items, as well as evidence for this relationship in terms of both experimentally induced and dispositional trait affect.

The results concerning lower positive affectivity seem to align with previous observations linking this lower end of the positive affectivity dimension with negative affectivity, in that both have been associated with symptoms of depression (Ahrens & Haaga, 1993; Brown et al., 1998; Watson et al., 1988). Previously cited research has found a relationship between symptoms of depression and consumption/desire for chocolate and sweet foods (e.g. Camilleri et al., 2014; Lester & Bernard, 1991; Rose et al., 2010); and that negative emotions are regulated by eating (e.g. Macht, 1999). The findings of this third study (i.e. that lower positive affectivity is associated with higher WTP prices in the context of chocolate and high-sugar foods) were therefore interpreted as higher spending providing a potential way to regulate emotions at the low end of the positive affectivity spectrum. In the context of chocolate and high-sugar stimuli therefore, higher spending does not appear to be linked with the presence of negative affectivity, but with the absence of positive affectivity.

The results pertaining to manipulated positive and negative affect in the context of chocolate and high-sugar decision making were largely inconclusive in the first and second studies. The convincing findings from this third study, which instead explored the influence of affect as a dispositional trait construct, therefore provide strong evidence concerning the way in which affectivity influences economic decision making in the context of chocolate and high-sugar foods, from a fresh perspective.

5. General Discussion

5.1 Overview

The overarching aim of the current thesis was to identify and explore psychological factors that can account for the relationship between sugar consumption and obesity. Drawing together two broad literatures from psychology and physiology, the opening review chapter (Chapter 1) identified affect (as the broad construct relating to emotions and mood) as an under-researched area within the psychology of judgment and decision making (JDM; Lerner et al., 2015). As food choice and eating behaviours are intrinsically linked with the cognitive processes involved in JDM (Peters, 2009), the way in which such choices are made, i.e. preference construction, was highlighted as an intrinsic element within JDM to be explored (Lichtenstein & Slovic, 2006). Dual process frameworks incorporating impulse and self-control provided the underlying foundation upon which subsequent studies were based (e.g. Hofmann et al., 2009; Metcalfe & Mischel, 1999; Strack & Deutsch, 2004). Ultimately, the consideration of affect in the context of sweet food choice and decision making presented the opportunity to strengthen research in a relatively new area, whilst broadly considering the question: ‘Why do we choose sugar?’.

Three studies iteratively explored the way in which affect influences decisions concerning chocolate and high-sugar foods. The first and second studies incorporated manipulated positive and negative mood (i.e. state affect); and the third study incorporated dispositional positive and negative affectivity (i.e. trait affect). The first and second studies incorporated a single response choice task to explore momentary sweet food preference construction, and the delay of gratification paradigm (DoG) to explore differences in impulsivity vs. self-control (based on Mischel, 1974). The second and third studies incorporated the willingness-to-pay paradigm (WTP) to explore economic decision-making in the context of sweet foods (based on Becker et al., 1964). Measures of impulsivity and chocolate craving (Benton et al., 1998; Cartwright et al., 2007; Patton et al., 1995; Steinberg et al., 2013) were included in order to assess the influence of these additional variables across analyses of the second and third studies. A measure of self-control (Tagney et al., 2004) was also included in the third study. Broadly speaking, eight hypotheses were put forward:

1. As explored in the first study, manipulated negative mood would be associated with a higher likelihood of initially choosing a chocolate item vs. a non-food/neutral item, while the reverse would be true of manipulated positive mood.
2. As explored in the first study, manipulated positive mood would be associated with a higher likelihood of delaying gratification and receiving a larger chocolate item later vs. receiving the smaller initial chocolate item immediately, while the reverse would be true of manipulated negative mood.
3. As explored in the second study, manipulated negative mood, increasing impulsivity and increasing chocolate craving would be associated with a higher likelihood of initially choosing a chocolate item vs. a non-food item, while the reverse would be true of manipulated positive mood, decreasing impulsivity and decreasing chocolate craving.
4. As explored in the second study, manipulated positive mood, decreasing impulsivity and decreasing chocolate craving would be associated with a higher likelihood of delaying gratification and receiving a larger chocolate item later vs. receiving the smaller initial chocolate item immediately, while the reverse would be true of manipulated negative mood, increasing impulsivity and increasing chocolate craving.

5. As explored in the second study, manipulated negative mood would be associated with higher WTP prices for chocolate vs. neutral items, high-sugar vs. neutral items, and chocolate vs. high-sugar items while the reverse would be true of manipulated positive mood.
6. As explored in the third study, increasing dispositional negative affectivity and decreasing dispositional positive affectivity would be associated with higher WTP prices for chocolate vs. neutral items, high-sugar vs. neutral items, and chocolate vs. high-sugar items while the reverse would be true of decreasing dispositional negative affectivity and increasing dispositional positive affectivity.
7. As explored in the second and third study, increasing chocolate craving would be associated with higher WTP prices for chocolate vs. neutral items and chocolate vs. high-sugar items (although not for high-sugar vs. neutral items), while the reverse would be true of decreasing chocolate craving.
8. As explored in the second and third study, increasing impulsivity and decreasing self-control would be associated with higher WTP prices for chocolate vs. neutral items, high-sugar vs. neutral items, and chocolate vs. high-sugar items while the reverse would be true of decreasing impulsivity and increasing self-control.

This final chapter begins by briefly summarizing the objectives and findings relating to sweet foods from each study.[3] The main implications of these findings in terms of existing theory and literature are then discussed in relation to the overall aims of the thesis to form a cohesive conclusion. Where similarities are evident in terms of methodologies and results between studies, these will therefore be jointly presented. Affect, as the common thread that connects each study, will be discussed where

[3] While findings concerning the choice of non-food/neutral items were obtained, as these did not concern the main focus of the thesis, i.e. sweet food decision making, discussion beyond the corresponding study chapters has not been expanded upon here.

relevant in accordance with each paradigm. General limitations are also considered and recommendations for future research are proposed.

5.2 Study objectives and key findings

Study 1: Objectives and summary of findings

The first study in this thesis (*n* = 48; Chapter 2) used an incidental mood induction task (MIT; Robinson et al., 2012) to investigate the influence of positive and negative manipulated incidental mood (i.e. mood unrelated to a stimulus), on decisions involving chocolate as a commonly craved sweet food. Following the MIT, participants were offered an initial choice between receiving an unseen sweet reward (a small bar of chocolate) vs. receiving an equally desirable unseen non-food/neutral reward (a magazine). The first hypothesis was not directionally supported with results showing that participants in both the positive and negative mood conditions were more likely to choose chocolate over a magazine. This association between mood and initial choice was therefore non-significant.

The delay of gratification paradigm (DoG; adapted from Mischel, 1974) was incorporated by asking participants to make a second choice between receiving the small chocolate reward immediately vs. receiving a larger chocolate reward later (i.e. delaying gratification). The second hypothesis was not directionally supported with results showing that participants in both the positive and negative mood conditions were more likely to choose receiving the small chocolate reward immediately over delaying gratification. This association between mood and DoG choice was therefore non-significant.

Study 2: Objectives and summary of findings

The second study in this thesis (*n* = 135; Chapter 3) also sought to investigate the influence of manipulated positive and negative incidental mood (i.e. mood unrelated to a stimulus), on decisions involving chocolate as a commonly craved sweet food. Following the first study, the second study strengthened the presentation mode of choices offered to participants in the initial choice task (one box of chocolates vs. one from a selection of magazines), and chocolate DoG task (two boxes of chocolates later vs. only one now). The third hypothesis was directionally supported with results showing that participants in the negative mood condition were more likely to choose a box of chocolates over a magazine while the reverse was true for those in the positive mood condition. However, primary chi square analyses showed that this association was non-significant. Subsequent logistic regression analyses of the initial choice data did then reveal that as mood moved from positive to negative, the likelihood of choosing a box of chocolates over a magazine significantly increased; and increasing chocolate craving was also significantly associated with an increased likelihood of choosing chocolate, as set out in the third hypothesis.

Regarding the chocolate DoG element, the fourth hypothesis was not directionally supported with results following the same pattern observed in the first study. Specifically, that again participants in both the positive and negative mood conditions were more likely to choose receiving the smaller chocolate reward immediately over delaying gratification and that this association was non-significant. Subsequent logistic regression analyses of the chocolate DoG data also revealed that associations concerning mood, chocolate craving and impulsivity did not support the fourth hypothesis and were all non-significant.

Three willingness-to-pay tasks (WTP) were included to investigate the relationship between positive and negative incidental, manipulated mood on economic decisions concerning chocolate vs. neutral items, high-sugar vs. neutral items and chocolate vs. high-sugar items. Across all three analyses, the fifth hypothesis was not supported as manipulated mood did not significantly, independently predict WTP prices. However, while impulsivity was not found to predict WTP prices, increasing chocolate craving was found to be a highly significant independent predictor of increasing WTP prices across all three analyses. This supported the seventh hypothesis in terms of WTP prices for chocolate vs. neutral items and chocolate vs. high-sugar items but was unexpected in terms of WTP prices for high-sugar vs. neutral items.

Study 3: Objectives and summary of findings

The third study in this thesis (*n* = 253; Chapter 4) investigated the way in which positive and negative dispositional affectivity relates to willingness-to-pay (WTP) prices concerning chocolate vs. neutral items, high-sugar vs. neutral items and chocolate vs. high-sugar items. Negative affectivity was not independently associated with WTP prices across the three analyses, and positive affectivity was not independently associated with WTP prices for chocolate vs. high-sugar items. However, decreasing positive affectivity was found to significantly independently predict increasing WTP prices for chocolate vs. neutral items and high-sugar vs.

neutral items, as set out in the sixth hypothesis. Increasing chocolate craving was found to significantly, independently predict WTP prices for chocolate vs. neutral items and chocolate vs. high-sugar items as set out in the seventh hypothesis, but not for high-sugar vs. neutral items. Increasing impulsivity was found to significantly, independently predict WTP prices for chocolate vs. high-sugar items, as set out in the eighth hypothesis, but not for chocolate vs. neutral items or high-sugar vs. neutral items.

5.3 Main Implications in terms of existing theory and literature

5.3.1 Preference or the choice of one item over another

A central concept within research concerning preference is that rather than being fixed, or permanent, preferences are often constructed ‘on the spot’ through a process of elicitation. This process is context dependent and based on external and internal information or cues (Peters, 2009; Slovic, 1995). To incorporate this constructive stance, it has been observed that research should shift from a standpoint concerned with measuring existing preferences, to one that focuses on the way in which preference formation occurs (Peters, 2009). Within the psychology of food choice, this understanding is especially prudent (Peters, 2009), perhaps particularly so in terms of maladaptive food choice. The first two studies in the current thesis therefore explored momentary preference construction as an intrinsic element within judgment and decision making (JDM) in the context of sweet food choice. A single response task was presented involving a choice between a chocolate and non-food reward. This presentation format also incorporated the observation from a sensory perspective that calls for emphasis to be placed on actual food-choice observations instead of depending on more traditional question- and answer-based methodology (Köster, 2009). Chocolate was selected as it is a commonly craved, sweet food (Hill et al., 1991; Rozin et al., 1991) that has been shown to have hedonic, mood altering properties (Garg et al., 2007). A magazine was selected as a suitable non-food alternative expressly because it is *not* a hedonic food but was rated at a similar desirability level to the chocolate in a preliminary pilot study. That is to say, in terms of desirability the magazine was considered suitably similar, but in terms of mood-altering properties it was considered suitably different to chocolate. Experimentally induced affect, i.e. incidental mood, was incorporated in order to extend understanding of this under-researched element within JDM (Lerner et al., 2015). Specifically, interest lay in whether the choice under consideration, i.e. construction, would be influenced by mood as independent, or incidental, to that choice.

Theoretically speaking, affective regulation/mood management models state that the way in which a person perceives their current feelings in relation to how they will feel as a result of a future behaviour forms the affective guide in making that subsequent behaviour choice (e.g. Gross, 1998; Zillmann, 1988). When in a negative mood, people will seek to alter or repair this uncomfortable internal feeling state, which tends to lead to behavioural choices considered to be mood-changing; whereas people in a positive mood will seek to protect or maintain this pleasant internal feeling state, which tends to inhibit mood-changing behaviour (Andrade, 2005). Following past research in support of affective regulation theory (e.g. Garg et al., 2007), those in a negative mood were expected to be more likely to choose the chocolate compared to the non-food reward, whereas those in a positive mood were expected to be more likely to choose the non-food compared to the chocolate reward across both the first and second studies. That is to say, as chocolate has been shown to have hedonic properties and is defined as mood altering (Garg et al., 2007), the magazine as a non-food represented the more passive choice.

Frequencies of co-occurrence in the first study did not follow the expected direction with participants more likely to choose chocolate in both mood conditions. Consequently, a chi-square analysis revealed this association to be non-significant. It is noted that the small sample size (n = 48) was an obvious limitation in this first study. However, using the effect size from this choice task element, a subsequent GPower analysis meant the second study involved a fully powered sample size (n = 135). Despite this, the results of the corresponding primary analysis in the second study were again non-significant. However, the data were directionally as expected in that those in the negative mood tended to choose the chocolate reward, whereas those in the positive mood tended to choose the non-food reward. A further logistic regression analysis did then find this association to be significant when controlling for chocolate craving in that as mood moved from positive to negative the likelihood of choosing chocolate increased, as hypothesised. It is emphasized that as the results of the two analyses were not consistent, discussion remains cautious. However, it would appear that the predictive power of mood in terms of sweet food choice is only highly statistically evident when controlling for other factors. Whereas past research investigating actual sweet food consumption has found conclusive results when considering only mood (e.g. Garg et al., 2007), the preceding step, i.e. the choice of one item over another, or preference, is likely to be more complex. This complexity can perhaps explain the fact that the association between mood and choice did not reach significance until other factors (i.e. chocolate craving) were considered. Nevertheless, it is posited that, simply when presented with a choice between a chocolate and non-food reward item, it is possible to infer or imply that mood appears to influence the choice that is made in line with past research in the area (e.g. Garg et al., 2007). In terms of theory, this pattern of association (although inconclusive), also appears to offer support for affective regulation or mood management theories (Gross, 1998; Zillmann, 1988), as hypothesised. That is to say, that those in a negative mood tended to choose chocolate over a non-food reward item, which was interpreted as being in order to alter or repair this uncomfortable internal feeling state, i.e. by making a choice considered to be mood-changing; whereas those in a positive mood tended to choose the non-food which was interpreted as a more passive response, given that people experiencing positive mood states are less likely to make behavioural decisions considered to be mood-changing (Andrade, 2005).

The pattern of the current findings (although inconclusive) follow previously reported associations such as Garg et al. (2007) who found that a significantly higher amount of chocolate was eaten (compared to raisins) after negative compared to positive mood manipulations. Within the current studies, choosing between the chocolate and magazine was in order to investigate the influence of mood on momentary preference construction (i.e. the actual choice between two options). Therefore, consumption was not a necessary consideration (or indeed a viable one, given that a magazine is not consumed in the same way as chocolate). (A further point to mention is that this choice task preceded the delay of gratification (DoG) task that was subsequently investigated. The DoG task required participants to make a second decision concerning when they would receive their rewards, and therefore consumption was not practicable.) However, extending the choice task to include subsequent consumption would be a logical progression in order to deepen understanding of how mood influences both actual preference construction and subsequent consumption.

It is noted that although consumption was measured in the Garg et al. study (2007), participants were not given the opportunity to choose the food to be consumed. That is to say, the design of the study meant that participants in each mood condition were simply endowed with either the chocolate or raisins (Garg et al., 2007). As the current study attempted to tap into the step that precedes consumption, i.e. the actual choice made, it would be interesting to see whether a future study that then incorporated a consumption element similar to the one from the Garg et al. study (2007), revealed similar results. It might be hypothesised that those in negative moods would be more likely to choose a sweet reward over a suitably consumable alternative (as indicated in the current study), and then also consume significantly more of both rewards compared to those in positive moods (as demonstrated by Garg et al., 2007). For those in positive moods, it might be hypothesised that choosing the alternative reward over the sweet reward would be more likely (as indicated in the current study), and that consumption levels of both rewards would then be significantly lower compared to those in negative moods (as demonstrated by Garg et al., 2007).

Alternatively, as the choice element from the current study was not conclusive, but the consumption element from the Garg et al. study (2007) was a robust finding, perhaps mood simply does not exert as strong an influence over simple choice as it does over consumption. That is to say, perhaps the actual act of making a choice is not what enables people to regulate and manage mood and emotions, thereby explaining the failure of the current study to reveal consistently robust associations in line with previous theory. In order to investigate this observation, as well as taking a measurement of mood immediately *before* the choice is made, (i.e. just after the mood manipulation), taking a measurement of mood again immediately *after* the choice is made is suggested. This would clarify the way in which mood and preference construction interrelate even more closely. Because the current findings did not provide conclusive evidence of affective regulation strategies concerning the choice under consideration, it might be hypothesised that mood levels would not differ significantly before and after the choice was made. Perhaps, it is the subsequent behaviour of actually consuming those choices that assist in mood regulation. It might then be hypothesised that there would only be a significant difference in mood levels after actual consumption of the reward received.

Another point to consider is that affective regulation/mood management theories are based on whether or not the choices and behaviours under scrutiny are considered to be mood-changing (e.g. Gross, 1998; Zillmann, 1988). In the current study, as chocolate has been shown to have hedonic, mood altering properties (Garg et al., 2007), the chocolate reward fulfilled this stipulation. The magazine was considered to be a suitable alternative expressly because it was *not* a hedonic food but was rated at a similar desirability level to the chocolate in a preliminary pilot study. However, the possibility that magazines also have mood-changing properties cannot be ruled out and this potential limitation is acknowledged. That is to say, if in fact both chocolates and magazines contain similar mood-changing properties, to use them as suitably comparable items is futile. For example, those in the negative mood condition to whom a magazine is considered mood-changing might very well have chosen this reward in order to repair their negative mood, as stated by affective regulation/mood management theories (Gross, 1998; Zillmann, 1988). In future, a pilot study to ascertain the mood-changing properties of the items used would ensure that they were included because they were of a similar desirability, but differing mood-changing qualities. For example, Garg et al. (2007) designed a pretest in order to clarify the hedonic, mood-altering levels of the foods used in their study concerning mood and consumption. Extending the desirability pilot study used in the current thesis (see Chapter 2, Section 2.3.2) to also measure the hedonic properties of the items used, would then allow for clearer interpretation of the choices made in this theoretical context.

Whether or not a magazine has mood-changing properties per se, the presentation of both this and the chocolate reward items as a ‘Thank you’ present will have generated an affective response regardless of the mood manipulation. Whereas the mood manipulation is an example of incidental affect which is unrelated to a stimulus or decision under consideration (often conceptualised simply as general mood), integral affect occurs as a direct result of a decision under consideration; in this case, being asked to choose between the chocolate and non-food reward. That is to say, integral affect is directly evoked by a stimulus, or is integral to a given situation (Peters, 2006; Västfjäll et al., 2016). The subsequent emotional feelings from incidental and integral affect can influence the processing of available information and thus, *both* types of affect can exert an influence on decision making (Peters, 2009).

Given the broad lack of conclusiveness concerning incidental affect across the first and second studies in this thesis, integral affect will be discussed in the context of the current findings.

Integral affect and decision-making

The impact of incidental affect on decision-making is interesting precisely because this type of affect is unrelated to the task under consideration yet has been shown to be a reliably evident influence across many areas relevant to JDM (Garg & Lerner, 2013). For this reason, it was chosen as a focal point of interest within the current thesis. For example, a classic example previously mentioned (see Chapter 3, Section 3.2) found that people rated life satisfaction as being higher on sunny days when they were in a better general mood, compared to rainy days (Schwarz & Clore, 1983). This was interpreted as wrongly attributing the feelings stemming from their general mood, to the unrelated question that was asked (Schwarz & Clore, 1983). However, it has been observed that incidental and integral affect *simultaneously* guide judgment and decision-making (e.g. Bechara, 2011; Neumann, Seibt & Strack, 2001; Västfjäll et al., 2016).

For example, when a new stimuli is experienced, the subsequent affective response (integral affect) will be a product of the type and intensity of the mood state already being experienced at the time of the new encounter (incidental affect), as well as the type and intensity of the affective response generated by the new stimuli (Neumann et al., 2001). How effective that new integral response is in terms of subsequent decision-making depends on the strength of the original ‘background’ mood state (Bechara, 2011). Therefore, in the current thesis, it is likely that the integral affect stemming from being offered a ‘Thank you’ present, as well as the incidental affect generated from the mood induction will have influenced the final decision made. Given the lack of research into how incidental and integral affect jointly influence judgments and decisions (Västfjäll et al., 2016), this is clearly a potential area for further research. However, it has been shown that the strength of pre-existing feelings, i.e. incidental affect, can determine the strength of subsequent feelings, i.e. integral affect (e.g. Neumann et al., 2001). Specifically, that pre-existing feelings increase the strength of subsequent congruent feelings but decrease or even eliminate the strength of subsequent incongruent feelings. For example, Neumann et al. (2001) found that participants who received positive feedback following an unrelated positive mood manipulation (incidental affect) felt higher levels of pride (integral affect) compared to those participants who received positive feedback following an unrelated negative mood manipulation. However, those participants who received negative feedback following a positive mood manipulation (incidental affect) did not report any feelings of pride (integral affect). In an earlier study, Branscombe (1985) asked participants to watch two movies and rate their emotional responses after each viewing. The results showed that the second movie generated higher happiness levels if the first one had also generated happiness, but higher sadness if the first one had also generated sadness. And, like Neumann et al. (2001), Branscombe (1985) found that opposing emotions cancelled each other out. So, sad feelings were eliminated by watching a subsequent happy movie, and happy feelings were eliminated by watching a subsequent sad movie (Branscombe, 1985).

The main difference between these two studies is that Neumann et al. (2001) made one important distinction between the pre-existing and subsequent feelings that were investigated. While both mood and emotion can be grouped together under the general term of affect, there are subtle differences. For example, both share an experiential *feeling* component, but crucially, *knowledge* about the cause of the feeling separates an emotion from a mood. (Neumann et al., 2001). As Branscombe (1985) investigated the way in which *emotions* from the first movie influenced *emotions* from the second, and emotions contain both knowledge and feelings, it was later observed that clarification was needed in order to ascertain which component the final ratings were based on (Neumann et al., 2001). By using an unobtrusive mood manipulation technique that did not elicit *discrete emotions* but simply a difference in subjective *mood state,* Neumann et al. (2001) were able to confirm the separate influences of both incidental and integral affect on subsequent judgments. This unobtrusive technique was developed in a previous set of studies (Neumann & Strack, 2000) and involves listening to the human voice which has been found to be affectively contagious (Hatfield, Cacioppo & Rapson, 1992). In this previous set of studies, mood ratings completed after simply hearing an abstract philosophical speech delivered in either a subtly happy or subtly sad voice confirmed that participants' general mood had increased or decreased, respectively. However, no significant effects were reported concerning the specific emotional adjectives: 'cheerful', 'happy', 'angry', 'anxious', 'bored' and 'sad'. This therefore confirmed that only subjective general mood and not discrete emotions had been influenced by listening to the speech (Neumann & Strack, 2000).

Taking these earlier conclusive results as sufficient evidence that this method of general mood transfer would be successful in future investigations, Neumann et al. (2001) did not assess participants' mood states after the manipulation had taken place in their later study, thereby ensuring that this technique was completely unobtrusive. That is to say, in the later study, participants were exposed to the mood-altering speech but not subsequently asked to rate their general mood states, thereby not directing attention to the source of their subjective mood (Neumann et al., 2001). Instead, immediately after listening to the speech, participants received feedback designed to elicit feelings of achieving either above or below average in a previously completed, unrelated dexterity task, i.e. feedback to generate either positive or negative integral affect concerning their task performance (Neumann et al., 2001). They were then asked to indicate the extent to which they were experiencing five discrete emotions (but not subjective, general mood), under the guise of capturing potential affective influences on this dexterity task. Subsequent analyses revealed that ‘pride’ was the only emotion to be influenced. That is to say, the sense of achievement that had been elicited from the feedback did not influence other emotions (Neumann et al., 2001). This therefore confirmed that integral affect (i.e. the feedback) influenced subsequent integral judgments, as expected. Evidence that the unobtrusive incidental mood manipulation was also affecting these judgments came from differences in the strength and intensity of the integral judgments which changed depending on whether the manipulation had been either positive or negative (Neumann et al., 2001). Had judgements concerning pride been based only on the knowledge component from the feedback received, there should not have been differences between those who received above average feedback in either the positive or negative mood condition; or between those who received below average feedback in either the positive or negative mood condition. To clarify, positive/negative integral feedback should have led to similar corresponding ratings of pride across mood conditions, i.e. regardless of the incidental mood induction. However, as those in the positive mood condition reported higher levels of pride following above average feedback compared to those in the negative mood condition who also received above average feedback, Neumann et al. (2001) were able to conclude that ratings concerning integral affect were under the influence of the previous incidental mood manipulation.

The examples reviewed here (e.g. Branscombe, 1985; Neumann et al., 2001) provide evidence that incidental and integral affect concurrently play a part in *judgment formation*. In terms of the current study, the consideration of both affective influences would provide a more rounded view of momentary preference construction, i.e. *decision making*, in the context of sweet food. Based on this past research, pre-existing feelings, i.e. incidental affect, increase the strength of subsequent congruent feelings, but decrease or even eliminate the strength of subsequent incongruent feelings (Neumann et al., 2001). Therefore, it might be hypothesised that those in a positive incidental mood condition would report higher levels of integral affect when presented with a ‘Thank you’ present (i.e. a source of positive integral affect), but those in a negative incidental mood condition would report lower levels of integral affect when presented with the same ‘Thank you’ present. Within the current study design, it would not be practicable to then investigate this effect in terms of negative integral affect, because being offered a ‘Thank you’ present is presumed to be a positive event. However, altering the way in which the choice task was presented to incorporate a negative integral affective component would allow this. As research previously mentioned has demonstrated the maladaptive influence of negative *incidental* affect on decisions concerning sweet foods (e.g. Garg et al., 2007), also considering the negative *integral* affect would strengthen this understanding of how both feeling and knowing exert influence on the intensity of affective responses; and how this in turn influences choice and decision making in the context of sweet foods.

5.3.2 Delay of Gratification (DoG), or impulse vs. self-control

The delay of gratification paradigm (DoG) specifically refers to a person's ability to voluntarily delay the acceptance of a small, immediate reward for a later but larger reward. The length of time that a person is able to wait is widely interpreted as self-control, therefore, choosing the immediate reward conversely demonstrates higher impulsivity (Mischel, 1974). The inner 'tug-of-war' conflict between impulse and self-control has been noted as being particularly evident when faced with tempting scenarios (Hofmann et al., 2009; Hofmann et al., 2008). As sugar consumption can be reasonably included within this context, the DoG paradigm was used to investigate these constructs in the context of sweet food decision making.

During the initial choice task in the first and second studies, participants either chose a chocolate or non-food/neutral reward as a 'Thank you' for taking part in the research.[4] The DoG paradigm was then incorporated by asking participants who initially selected the chocolate to make a second choice between receiving that chocolate reward immediately (demonstrating impulsivity), or instead receiving a larger chocolate reward later (demonstrating self-control). The influence of mood was

[4] As sweet food is the focus of this thesis, those participants who initially chose the non-food/neutral reward will not be discussed here.

again considered, with interest lying in whether differences in delay of gratification would be evident depending on whether the incidental mood manipulation had been either positive or negative. Following past research that has demonstrated a break-down in self-control following negative mood manipulations (e.g. Tice et al., 2001), participants were expected to be more likely to make the impulsive choice in the negative mood condition, whereas the reverse was expected for those in the positive mood condition. Across both the first and second studies, frequencies of co-occurrence did not follow the expected directions with participants in both mood conditions more likely to display impulsive behaviour and accept the first choice presented. The corresponding chi-square analyses were consequently both non-significant. Given the inconclusive nature of these results, discussion is again emphasized as being cautious. Therefore, rather than dwell on tentative parallels with past research, a point more worthy of discussion concerns the overarching framework within which the DoG element was proposed.

Traditional models of health are based on the assumption that human behaviour is under conscious, rational control (e.g. Fishbein & Ajzen, 1975; Ajzen, 1985). Subsequent criticisms highlighting the need to consider other, *less* reasoned and conscious pathways (e.g. Conner & Sparks, 2002; Köster, 2009) have led to the expansion of such models to incorporate more implicit drivers of behaviour. Such expansions are concerned with dual-process theories of behaviour which stem from the perspective of social psychology (e.g. Metcalfe & Mischel, 1999; Strack & Deutsch, 2004). These account for the fact that the human mind is actually driven by two distinct operating systems, the first of which is characterized as being slow, reasoned and reflective, i.e. *controlled*; while the second is characterized as being fast, automatic and nonconscious, i.e. *impulsive* (Frankish & Evans, 2009). Understanding the way in which these two systems operate have been noted as being especially relevant in terms of health-related behaviours given that many problems that arise as a consequence of unhealthy choices can be ultimately illustrated as conflict between impulse and self-control (Hofmann et al., 2008; Wiers et al., 2010). For example, despite understanding the long-term risks associated with smoking, drinking or risky sexual behaviours, people often fail to curb their impulses when presented with such temptations (Hofmann et al., 2008; Hofmann et al., 2009). And, in terms of sugar consumption, foregoing the tempting dessert in exchange for long term weight loss ultimately comes down to being able to exercise self-control (Hofmann et al., 2008; Hofmann et al., 2009).

As the DoG paradigm specifically demonstrates the conflict between impulse and self-control (Mischel, 1974), it was deemed suitable to investigate such choices within the context of sugar consumption. However, one obvious shortfall concerning the way in which participant responses were captured is now apparent. After an explanatory section to summarise relevant aspects concerning dual-system explanations of behaviour, this will be discussed.

Within such dual-system explanations, the system or process concerning impulse is always under the direct influence of automatic rather than reasoned processes (e.g. Metcalfe & Mischel, 1999; Strack & Deutsch, 2004). For example, within Metcalfe and Mischel's Hot/Cool framework (1999), while the cool, 'know' system is ruled by slow, controlled processes, it is the hot, 'go' system ruled by fast, automatic processes that incorporates impulsive, affective responses. As this system is predominantly under stimulus control, the probability of a given behaviour becomes more likely when confronted with a stimulus, and, over time, becomes a conditioned or 'learnt' response (Metcalfe & Mischel, 1999). Similarly, within the reflective-impulsive model (RIM; Strack & Deutsch, 2004), associative links within the impulsive system elicit impulsive behaviour via automatic rather than conscious processes, as the name suggests. Like the hot 'go' system (Metcalfe & Mischel, 1999), the associative links or clusters gradually become strengthened over time, meaning behavioural tendencies associated with external stimuli become more likely (Strack & Deutsch, 2004). Hofmann et al. (2009) explain the 'learning' aspect of the impulsive system (that is evident within both frameworks) using chocolate as a specific example: via repeated experience with chocolate, an associative link could be formed connecting the concept of chocolate firstly with the resulting positive affect related to that concept (i.e. positive feelings about chocolate), and secondly to the patterns of behaviour that led to the positive affect (i.e. eating the chocolate). In a future scenario, simply encountering chocolate could then reactivate the cluster which would trigger a corresponding impulse involving the positive affect attached to the chocolate, and the corresponding pattern of behaviour to approach it (Hofmann et al., 2009).

Impulses, then, differ from general impulsivity (as the behavioural trait of acting upon impulses; Hofmann et al., 2008). They arise when an underlying motivation (e.g. a liking for chocolate) meets an activating stimulus that is capable of fulfilling this motivation (e.g. the presence of chocolate). They are specific in that they manifest as a desire to perform a particular behaviour (e.g. eat the chocolate; Friese & Hofmann, 2009), and typically contain a hedonic or liking component (e.g. Loewenstein, 1996). Impulses will usually drive behavioural tendencies to act upon or approach the stimulus, and they happen automatically and without effort (Baumeister, Heatherton & Tice, 1994). The ability to override and refrain from acting upon impulses therefore involves self-control (Tagney, et al., 2004). Thus, whether a person possesses high or low self-control will not prevent impulses from arising; rather that those high in self-control will be better at overriding or controlling them compared to those who have low self-control (Friese & Hofmann, 2009). While general impulsivity is obviously related to impulse, it concerns the other side of the coin, i.e. a *lack* of control. That is to say, those high in impulsivity lack the ability to control the behaviours associated with the activation of a given impulse, therefore leading to a higher likelihood of acting on that impulse (Friese & Hofmann, 2009). Certainly, the underlying processes which cause tempting stimuli to trigger impulsive behaviour (i.e. those that are fast and automatic) are fundamentally different from the processes concerned with self-control (i.e. those that are slow and controlled; e.g. Metcalfe & Mischel, 1999; Strack & Deutsch, 2004). However, past research has taken measures of impulsivity to indicate self-control, i.e. that high impulsiveness corresponds to low self-control, or vice versa (e.g. Duckworth & Seligman, 2005; Tagney et al., 2004). Indeed, besides the DoG element, the first two studies in this thesis only included an additional, further measurement of impulsivity (BIS-11; Patton et al., 1995). A separate measurement of self-control (SCS-Brief; Tagney et al., 2004) was not specifically included until the third study. Whether measuring both impulsivity and self-control or relying on one as an indicator of the other, an important observation has been made in the literature (e.g. Hofmann et al., 2008). This concerns the way in which these personality constructs interrelate and subsequently indicate the maintenance or regulation of health behaviours: that the underlying implicit/explicit processes which drive the success or failure of self-regulation are often not mentioned when presenting results (Hofmann et al., 2008). It is acknowledged that discussion points in the corresponding study chapters of this thesis are examples of this failure to expressly consider these underlying processes. Clearly, it is likely that implicit as well as explicit processes may have influenced participants' responses. However, the way in which impulse and self-control were assessed and measured relied purely on capturing explicit responses: the adaption of the original delay of gratification paradigm (DoG; Mischel, 1974); and the inclusion of a self-report measure of impulsivity, (BIS-11; Patton et al., 1995). It is therefore also acknowledged that alternative methods might have more accurately captured responses concerning both implicit and explicit processes involved in sweet food decision making.

Both the DoG task and the BIS-11 (Patton et al., 1995) are examples of direct measurement methods, i.e. asking participants to make a considered verbal response and complete a questionnaire. Such direct methods are traditionally used to capture reflective processes (Hofmann et al., 2009; Wiers et al., 2010) and have been noted as being appropriate for accessing constructs under the influence or control of this system (Hofmann et al., 2008; Hofmann et al., 2009). This is because the content of reflective processes forms the basis of conscious experience which can be easily communicated to others, literally via conscious reflection (Hofmann et al., 2008). However, as previously detailed, impulses are assumed to originate in the *impulsive* system (e.g. Strack & Deutsch, 2004). Therefore, a measure of this construct should ideally access the associative links that generate the specific type of reaction that is triggered when presented with a relevant stimulus (Hofmann et al., 2008). That is to say, because such reactions occur automatically, i.e. without conscious reflection or control, a suitable measure should ideally capture this type of response without the possible interference of conscious control (Hofmann et al., 2009). This is because conflict between a person's conscious, (i.e. explicit), and impulsive, (i.e. implicit) reactions can occur. For example, while controlled reflection concerning a given subject results in controlled, reflective responses, these can be subject to a higher likelihood of introspective limits (e.g. Nisbett & Wilson, 1977), or socially desirable responses (e.g. Baumeister, 1982). Thus, measures of self-report might not accurately capture a person's true feelings or attitudes towards the subject under scrutiny.

Indirect methods of measuring implicit/impulsive processes, on the other hand, refer to the outcome of the measures involved being uncontrollable by the participant, thus offering a more accurate and rounded presentation of human behaviour (De Houwer, 2006; Hofmann et al., 2009). The Implicit Association Test (IAT; Greenwald, McGhee & Schwartz, 1998) is perhaps the best example of an implicit measure which avoids such direct measurement problems and has led to prolific work of this nature within implicit social cognition (Teige-Mocigemba, Klauer & Sherman, 2010). For example, as a way of capturing racial attitudes using reaction time measures, given that socially desirable responses often mask true attitudes (e.g. Greenwald et al., 1998). The IAT assesses the strength of associations between target categories, e.g. African American and European American; and categories assigned with an attribute, e.g. pleasant words and unpleasant words. The response times to key presses for the different combinations of categories; e.g. black and pleasant; white and pleasant; black and unpleasant; and white and unpleasant; should reflect the strength of the association in that the stronger the association, the quicker the response time

(Greenwald et al., 1998). While not without criticism (see Teige-Mocigemba et al., 2010), the IAT has nevertheless provided a robust methodology for indirectly measuring implicit attitudes, as well as a basis for further implicit measurement methods. For example, the Go/No-go Association Task (GNAT; Nosek & Banaji, 2001); and the Single Category Implicit Association Test (SC-IAT; Karpinski & Steinman, 2006) use similar techniques to capture implicit aspects of social cognition. However, as dual-system frameworks account for both impulsive *and* reflective precursors of behaviour (e.g. Metcalfe & Mischel, 1999; Strack & Deutsch, 2004), it is the opportunity to incorporate both direct and indirect measures which will offer the most rounded picture of how these processes interrelate in terms of behaviour regulation (Hofmann et al., 2008; Hofmann et al., 2009). In the context of eating behaviours, for example, Roefs and Jansen (2002) incorporated both direct and indirect measures in a study designed to assess whether attitudes of obese and normal weight participants towards high and low-fat foods converged or diverged. Questionnaires were used as a direct measure; and an IAT was used as an indirect measure (based on Greenwald et al., 1998). The IAT used six high fat foods (potato chips, French fries, peanut butter, chocolate, ice cream and sausage); and six low fat foods (popcorn, rice, jelly, liquorice, strawberries and chicken) as the target categories. Six positive words (love, smile, kiss, friend, holidays and peace); and six negative words (crime, hate, torture, war, murder and accident) were used as the attribute categories. The same 12 food words were used to directly assess palatability ratings on a 9-point scale ranging from -9 (very unpalatable) to +9 (very palatable); and a questionnaire was developed to directly assess habits and attitudes relating to the fat content of foods. This consisted of five statements (e.g. ‘high-fat foods taste good') which were rated by participants from 1 (totally agree) to 7 (totally disagree; Roefs & Jansen, 2002). The results of the explicit measures showed that participants preferred low fat foods compared to high fat foods, as hypothesised. However, the hypothesis that obese participants would implicitly show an association with high fat foods and positive words was not supported: the results showed that *both* normal weight and obese people hold implicit *negative* attitudes towards high fat foods. Interestingly however, this effect was stronger, i.e. more pronounced, for obese people. While this might be in contradiction to behaviour associated with being obese, e.g. that obese people consume high fat foods because of their preference for such foods (e.g. Drewnowski, Brunzell, Sande, Iverius & Greenwood, 1985), it potentially shows that while obese people prefer the taste of high fat foods, they have nevertheless 'learned' the negative connotations associated with such foods (Roefs & Jansen, 2002).

Although the results from the first and second studies were inconclusive, (and therefore conclusions are cautious), inconsistent patterns emerged concerning the delay of gratification results (DoG; based on Mischel, 1974) and the additional measure of impulsivity (BIS-11; Patton et al., 1995) in the second study. Frequencies of observation from the DoG chi-square analyses in both studies indicated that participants were more likely to display impulsive behaviour when asked to make a single, considered response (regardless of whether their mood was positive or negative). However, the subsequent logistic regression analysis in study 2 indicated that *decreasing* impulsivity was associated with a decreased likelihood of delaying gratification. This seems inconsistent in that as the majority of participants displayed impulsive behaviour, one would expect this to be reflected in the additional measure.

In other words, that *increasing* (rather than decreasing) impulsivity would then be associated with a decreased likelihood of delaying gratification. Following the observation that explicit and implicit processes should both be considered when presenting results (Hofmann et al., 2008), this is therefore applied in terms of the current findings. It is posited that the discrepancies between the DoG results and BIS-11 questionnaire findings could be an example of possible conflict between these two processes. As previously mentioned, the underlying mechanisms which cause tempting stimuli to trigger impulsive behaviour (i.e. those that are fast and automatic), are fundamentally different from the processes concerned with self-control (i.e. those that are slow and controlled; e.g. Metcalfe & Mischel, 1999; Strack & Deutsch, 2004). Therefore, although the direct questioning format of the DoG task sought to evoke a controlled response from participants, it is possible that the presentation of the rewards (i.e. the tempting stimuli) unwittingly evoked a more implicit response. And, although direct measures are appropriate when wanting to capture reflective determinants of health behaviours (Hofmann et al., 2008), as impulsivity is ruled by implicit, impulsive processes (e.g. Metcalfe & Mischel, 1999; Strack & Deutsch, 2004), using a reflective measure to tap into this impulsive construct is potentially futile. It is therefore possible that responses to the self-report questionnaire were subject to interference from conscious control, or social desirability bias, thereby not capturing an accurate measure of this construct.

It is posited that including indirect as well as direct measures would provide a more suitable methodology for future investigation into how impulsive and reflective determinants of behaviour interrelate in the context of impulsive sweet food choice. Certainly, the inclusion of an IAT (or similar) could potentially provide clarity concerning the results of the current DoG tasks. Retaining a direct measure of impulsivity might then conclusively confirm whether discrepancies still exist between implicit and explicit attitudes in this context. Based on the directions of the current findings, and the tentative suggestion that the DoG tasks actually captured implicit responses, the following hypotheses are put forward: that an indirect measure such as an IAT (Greenwald et al., 1998) would confirm the impulsive nature of people's implicit attitudes towards sweet, tempting stimuli in that 'smaller now' would have a faster reaction time compared to 'larger later'; whereas a direct measure such as the impulsivity questionnaire (BIS-11; Patton et al., 1995) would confirm that people's explicit attitudes are in opposition to this.

Concerning the influence of affect, the first and second studies did not reveal conclusive findings concerning manipulated, incidental mood within the DoG paradigm. However, the third study in this thesis did reveal interesting and conclusive results concerning affect as a trait, dispositional construct within the willingness-to-pay paradigm (WTP; based on Becker et al., 1964). In this final study, participants were shown pictures of chocolate and high-sugar foods and asked to indicate how much they would be willing to pay for each item. A dispositional measure of affect was used to assess trait positive and negative affectivity (I-PANAS-SF; Thompson 2007). Low positive affectivity has been associated with symptoms of depression (Watson et al., 1988), which, in turn have been linked with an increased desire and consumption for chocolate and sweet foods (e.g. Camilleri et al., 2014; Lester & Bernard, 1991; Rose et al., 2010). Because simply being presented with tempting foods can trigger approach behaviours towards those stimuli (Hofmann et al., 2008), higher WTP prices were interpreted as being an indicator of approach behaviours.

The finding that decreasing positive affectivity was significantly associated with increasing WTP prices for chocolate and high-sugar foods therefore supported the hypothesis. As findings concerning manipulated, incidental mood were broadly inconclusive in the first and second studies, it is posited that the robust findings from this third study concerning low positive affectivity should instead be focused on. These findings offer the opportunity to build upon the suggested study involving an IAT as an indirect measure of implicit attitudes concerning impulsive sweet food choice. Past research has linked symptoms of depression with a desire for chocolate (Lester & Bernard, 1991) as well as differences between obese and normal weight participants concerning the strength of implicit attitude (Roefs & Jansen, 2002). Following these findings, the following hypothesis is put forward: that while both high and low levels of positive affectivity might both be associated with the same, positive, implicit, impulsive attitudes towards sweet foods, this effect might be more pronounced for those with lower levels of positive affectivity. This would not only strengthen understanding of implicit attitudes in the context of impulsive sweet food choice, but also specifically in terms of how positive affectivity as a marker of depressive symptoms influences such attitudes.

5.3.3 Willingness-to-Pay (WTP) and chocolate craving

The second and third studies explored the relationship between manipulated incidental positive and negative mood (see Chapter 3); and dispositional positive and negative affectivity (see Chapter 4) on economic decisions concerning chocolate and sweet foods. Participants completed a willingness-to-pay task (WTP; based on Becker et al., 1964) involving high-sugar chocolate items and high-sugar non-chocolate items to allow for comparisons between positive and negative affectivity on decisions concerning different types of sweet foods. Non-food/neutral items acted as control items in order to calculate WTP for the chocolate and high-sugar items. The results of both studies revealed powerfully robust findings concerning chocolate craving, as assessed using self-report measures (Benton et al., 1998; Cartwright et al., 2007). Across all three hierarchical multiple regression analyses in the second study, increasing chocolate craving significantly independently predicted higher WTP for chocolate vs. neutral items, high-sugar vs. neutral items and chocolate vs. high-sugar items. In the third study, increasing chocolate craving significantly independently predicted higher WTP for chocolate vs. neutral items and chocolate vs. high-sugar items. As mentioned briefly in the discussion section of the third study (see Chapter 4, Section 4.5), parallels between chocolate craving and areas more commonly connected with craving such as addiction can perhaps be drawn. Incentive-motivational models of addiction for example include craving as an integral component (e.g. Robinson & Berridge, 1993). Such models postulate that cues relevant to the behavior under consideration acquire ‘incentive salience’ over time. Those cues then ‘capture’ or ‘grab’ the attention leading to automatic approach tendencies which tend to ultimately result in consumption (Robinson & Berridge, 1993, 2001). Studies in this area have found strong links between craving and both attentional and approach biases for related cues (e.g. Field et al., 2005). Approach behaviours are defined as reactions towards rewarding stimuli, of which food is an example (Corr, 2008). In the current thesis, higher WTP prices were therefore interpreted as an indication of approach behavior towards foods containing chocolate.

The strength of the findings concerning chocolate craving led to the conclusion that this element warrants further discussion in the context of addiction.

Ways of assessing selective attention in areas concerned with more common addictions involve tasks designed to assess the phenomenon of attentional bias. Following the previous section (Section 5.3.2), such tasks are another example of using reaction time measures to demonstrate that the salience of relevant stimuli affect cognitive processing in an *unconscious* manner (Robinson & Berridge, 1993). This phenomenon has been demonstrated in terms of maladaptive health behaviours with *slower* reaction times indicating higher attentional bias towards relevant stimuli, e.g. within populations of problem and high-level social drinkers (Sharma, Albery & Cook, 2001). In this example, attentional bias was established using a modification of the classic colour-naming Stroop task (Stroop, 1935). Participants were shown alcohol and neutral words presented in different font colours on a computer screen. They were instructed to ignore the words and react only to the font colour by pressing a corresponding key as quickly as possible. The results showed that problem and high-level drinkers were significantly slower than controls when reacting to alcohol- compared to neutral-words, indicating attentional interference from the alcohol stimuli prevailing over the colour-naming task (Sharma et al., 2001). Such tasks have also been used to establish selective attention in the context of eating behaviours, e.g. females with eating disorders (Stormark & Torkildsen, 2004) and overweight and obese children (Matthias, Pollatos & Koch, 2014).

Ways of assessing approach behaviours also use response times to demonstrate the salience of relevant stimuli capturing attention. In this type of task, *faster* response times indicate that relevant stimuli initiate approach behaviours in an unconscious manner (Robinson & Berridge, 2001). The ‘stimulus-response-compatibility’ (SRC) task is one example that involves participants categorizing addiction-related and control pictures by moving a stick figure either towards or away from each picture, as instructed. For example, Mogg, Bradley, Field and De Houwer (2003) used an SRC task to demonstrate smokers’ approach behaviours towards relevant stimuli. Results showed that smokers (compared to non-smokers) were faster at categorizing pictures when asked to make the stick figure ‘approach’ smoking-related pictures but ‘avoid’ control pictures. This indicates that pictorial smoking-related cues induce approach rather than avoidance behaviours in smokers compared to non-smokers (Mogg et al., 2003). The SRC task has also been used to demonstrate the incentive salience of related cues in populations of social drinkers with findings consistently showing an association between approach bias for alcohol pictures and increased alcohol consumption (e.g. Christiansen et al., 2012; Field, Kiernan, Eastwood & Child, 2008). These results support incentive-motivational models of addiction which predict that drug-related cues will capture an experienced drug user’s attention, thus eliciting approach behaviours towards those cues (Robinson & Berridge, 2001). However, although selective attention, i.e. attentional bias, has been demonstrated in the context of eating behaviours, (e.g. Matthias et al., 2014; Stormark & Torkildsen, 2004), approach biases have been less clear in this area. For example, Brignell, Griffiths, Bradley and Mogg (2009) investigated the relationship between both attentional and approach biases for food cues and the trait of external eating (eating in response to external food cues). While higher external eating was associated with higher attentional and approach biases for food cues, the approach bias as measured with an SRC task did not remain significantly associated with external eating after controlling for other variables (such as emotional eating scores; Brignell et al., 2009). It is therefore posited that incorporating the craving element with the stimuli from the WTP task in the current thesis in a ‘chocolate-SRC’ task might potentially reveal biases more consistent with incentive models of addiction (e.g. Robinson & Berridge,1993). For example, following Field et al. (2005) and Mogg et al. (2003) it might be hypothesised that participants with higher levels of chocolate craving (as measured using a questionnaire such as the OCQ; Cartwright et al., 2007) would show faster approach biases towards chocolate stimuli compared to non-food stimuli in a ‘chocolate-SRC’ task, while the reverse would be true of participants with low levels of chocolate craving. As such relationships between craving and approach biases have been previously interpreted as markers of addictive behaviours (e.g. Field et al., 2005), similar findings concerning chocolate might also indicate addictive qualities of this specific food.

Extending this suggestion further, impulsivity as well as craving has been linked with the development of addictive behaviours such as alcohol consumption (Wiers et al., 2007). Christiansen et al. (2012) specifically considered this construct in the context of hazardous drinking using behavioural and trait measures of impulsivity and an alcohol-related SRC task. All measures of impulsivity as well as higher SRC scores were associated with higher alcohol consumption levels as hypothesised (Christiansen et al., 2012). The second and third studies in this thesis did not reveal conclusive findings concerning the role of impulsivity in terms of WTP prices. It is therefore posited that as well as considering craving and approach behaviour using an SRC task, retaining a trait measure of impulsivity, e.g. the BIS-11 (Patton et al.,

1995) or the BIS-Brief (Steinberg et al., 2013) might also reveal a relationship between this construct and approach behaviours in the context of chocolate. Following Christiansen et al. (2012), it might be hypothesised that higher trait impulsivity (as well as higher chocolate craving) would be associated with faster approach biases towards chocolate stimuli. Identifying such relationships could indicate addictive qualities of chocolate in line with substances more commonly linked with dependence. For example, if chocolate-related cues then motivate actual chocolate consumption, (and particularly in those with higher impulsivity and craving), this would align with incentive-motivational models of addiction (e.g. Robinson & Berridge, 1993). Confirming addictive qualities specific to chocolate could ultimately go some way towards explaining causal mechanisms driving the relationship between sugar consumption and excessive weight gain.

A final discussion point draws upon individual motives behind hedonic food consumption which have also been linked with behaviours more commonly associated with substance abuse (e.g. Baines, Jones & Christiansen, 2016; Reaves et al., 2019). In the context of obesity, hedonic eating or over-consumption of palatable foods in the absence of hunger or metabolic need is a clear contributor to excessive weight gain (Burgess et al., 2014; Reaves et al., 2019). Research has recently focused on motives behind this style of eating to explain individual differences in palatable food intake (e.g. Boggiano et al., 2014; Burgess et al., 2014). The Palatable Eating Motives Scale (PEMS; Burgess et al., 2014) is an example of one such measure that captures four unique motives (Social, Coping, Enhancement and Conformity) for eating hedonic foods. Dispositional similarities have previously been noted linking maladaptive eating behaviours and alcohol use such as personality traits and impulsive tendencies (e.g. Benjamin & Wulfert, 2005). The PEMS closely adapted the Drinking Motives Questionnaire Revised (DMQ-R; Cooper, 1994) and crucially, provides evidence that these four motivations correspond with hedonic eating as well as alcohol use (Burgess et al., 2014). While the PEMS includes positive constructs that explain the propensity to eat hedonic foods, e.g. the social motive to enjoy gatherings or celebrations with friends, negative constructs are also included e.g. the coping motive to deal with negative emotions such as worry, depression or bad moods (Burgess et al., 2014). Such negative emotions include hopelessness (the tendency to anticipate negative events), and anxiety sensitivity (distress arising from an awareness of anxiety symptoms; Reaves et al., 2019). This tendency to resort to over-consumption of palatable food in order to cope with negative affect, or negative reinforcement patterns, has been linked to higher BMI (Burgess et al., 2014) and the propensity to engage in binge-eating (Boggiano et al., 2014). Further corroborating the link between maladaptive eating behaviours and alcohol use, Reaves et al. (2019) explored coping motivations as mediators of the association between dispositional traits and overconsumption of food or alcohol in a single study. As hypothesised, those higher in hopelessness and anxiety sensitivity were more likely to use either food or alcohol to cope, and that this then significantly predicted a higher likelihood to engage in respective unhealthy snacking and hazardous drinking behaviours (Reaves et al., 2019).

As the current thesis explored dispositional trait (as well as state) affect in the context of sweet-food, direct consideration of such motives in future research could reveal an important link between these constructs. A particular point to potentially explore is the finding in Study 3 that lower positive affectivity was significantly associated with higher willingness-to-pay (WTP) prices for chocolate and high-sugar foods. This construct of positive affect is linked to symptoms of depression (Ahrens & Haaga, 1993; Brown et al., 1998; Watson et al., 1998), i.e. negative emotions. Following previous research (e.g. Reaves et al., 2019), the consideration of coping as a motivation to consume chocolate and sweet foods would perhaps mediate the relationship between positive affectivity and WTP prices, as well as the actual consumption of such foods.

5.4 Limitations

The method chosen to experimentally manipulate participants' incidental mood states involved the presentation of mood-congruent sentences, (i.e. positive or negative), while listening to appropriate pieces of classical music (Robinson et al., 2012). This particular method has been reliably shown to successfully alter participants' current mood states in previous works (e.g. Robinson et al., 2010). The two studies using this method in the current thesis were also successful in that related *t*-tests showed that participants' sadness and happiness ratings were significantly higher following the corresponding mood induction. However, broadly speaking, subsequent results concerning the association between manipulated, incidental affect and other elements under investigation were largely inconclusive throughout this thesis. As previous work specifically in the area of mood manipulation and sweet food investigation has revealed consistently reliable results (e.g. Garg et al., 2007; Macht et al., 2002; Tice et al., 2001), this lack of conclusiveness was unexpected. The first study had a notably small sample size (n = 48) which is likely to go some way in explaining the association of mood not reaching significance in this study. However, as the sample size for the second study (n = 135) was calculated with a GPower analysis using the effect size generated from the first, the subsequent lack of conclusiveness concerning mood was all the more surprising. One potentially limiting factor worthy of mention therefore concerns noted criticisms surrounding the validity of sad mood manipulation procedures, the implications of which extend broadly to the induction of affect (e.g. Rottenberg, Kovacs & Yaroslavsky, 2018).

It has been put forward that while participants' collective mean scores before and after such procedures might reveal significant differences in mood ratings of the overall sample, on the individual level, mean scores do not always show significant differences (Rottenberg et al., 2018). For example, Kovacs et al., (2015) used another method of mood induction which required participants to watch a 3-minute clip from the movie *The Champ.* This particular clip has been used extensively within the field of affect investigation to successfully induce sadness (e.g. Gross & Levenson, 1995). However, because Kovacs et al. (2015) were specifically interested in mood *repair*, it was essential to check that the participants involved in their study had firstly undergone the mood manipulation successfully. That is to say, successful mood repair could not be confirmed unless there was a sad mood to repair in the first place (Kovacs et al., 2015). Although initial analyses showed a significant increase in the overall sadness ratings of the sample, closer investigation of the raw data revealed an unexpected finding: that of the 371 participants involved, 110 reported no sadness at all in response to the mood induction (Kovacs et al., 2015). This intimates that 'successful' mood manipulations could potentially be due to differences in a small number of participants that create a substantial enough change in the group mean to achieve overall statistical significance (Rottenberg et al., 2018). The obvious implication of this is the potentially misleading impression that current mood manipulation methods are giving: by only reporting the mean change in pre- and post-mood ratings, the manipulation appears to be successful when it might not have been effective for a notable proportion of the sample. This then ostensibly leads to possible misinterpretations of subsequent findings (Rottenberg et al., 2018).

While this criticism concerns a method of mood manipulation that is different to the one used in the current thesis studies, it is posited that the points raised are certainly valid in terms of potential limitations concerning the current findings. That is to say, that although analyses of the mood data indicated that both the positive and negative manipulations had been successful, subsequent associations concerning other elements of interest were not conclusive. It is of course therefore possible that the manipulations were in fact not effective for the entire participant pool which would explain the inconclusive nature of the subsequent elements under scrutiny. It is suggested that future research removes ‘nonresponders’ i.e. those participants who do not report an increase of the intended affective state following the mood induction, as suggested by Kovacs et al. (2015) and Rottenberg et al. (2018).

5.5 Suggestions for future research

Referring again to dual-system models of behaviour, impulses are ruled by automatic, implicit processes whereas self-control is under the influence of conscious, explicit resources (e.g. Metcalfe & Mischel, 1974; Hofmann et al., 2009; Wiers et al., 2010). The earlier proposal in this discussion chapter for future studies to consider both processes more equally would therefore provide a more rounded view of how both impulse and self-control interrelate to produce behaviour (see Section 5.3.2). This is based on previous suggestions that measuring attitudes using direct, explicit methods are the superior choice when wanting to predict conscious and controlled behaviour, whereas measuring attitudes using indirect, implicit methods are better for predicting more impulsive behaviour (Friese, Hofmann & Wanke, 2008; Hofmann et al., 2008; Hofmann et al., 2009). In the context of impulsive sweet food choice, for example, the way in which both impulsive and reflective processes translate into actual eating behaviour could potentially then be used to inform future healthy eating campaigns concerning sweet food consumption. However, extending this suggestion further with the consideration of other relevant influences on choice behaviours presents the opportunity to cast an even wider net in terms of future research opportunities.

Daily life presents multiple situations in which the ability to effectively regulate behaviour is necessary, for example, controlling the consumption of unhealthy food or drinks, impulse buying, or risky sexual behaviours (Friese et al., 2008). Yet excessively smoking, eating and drinking are among the most common and problematic examples of self-control failure (Baumeister et al., 1994). Self-control, then, is the “exertion of control over the self by the self” (Muraven & Baumeister, 2000, p.247). It is the internal act of overriding or refraining from behaving in a desired manner in order to achieve long-term goals or interests (e.g. Mischel, 1974). Such desires are largely under the control of more automatic processes (Baumeister et al., 1994). As it is likely that the majority of human behaviour happens automatically with very little active participation from the person (Bargh, Chen & Burrows, 1996), self-control as a conscious act is therefore necessary to prevent such automatic behaviours occurring (Muraven & Baumeister, 2000). However, the resources needed to exercise self-control over one's own behaviour and override automatic responses are not without limits. As finite resources they become depleted which leads to poor self-regulation, and in turn, increases the likelihood of impulsive behavioural decisions (Friese et al., 2008; Muraven & Baumeister, 2000). Crucially, after one challenging attempt to exercise self-control, the ability to exercise self-control in another area is subsequently reduced (Muraven & Baumeister, 2000). Thus, anything that restricts controlled processing resources is likely to increase the occurrence of more impulsive behaviours (Shiv & Fedorikhin, 1999). Mood regulation, as a relevant example in terms of this thesis, has been noted as influencing the resources necessary for exercising self-control (Muraven & Baumeister, 2000). In terms of bad moods, for example, Isen (1984) observes that people attempt to change or regulate negative feelings and that therefore the induction of mood using laboratory manipulations can actually be framed as manipulations of self-control. Whatever the source, i.e. inside or outside the laboratory, it is therefore possible that those in negative moods are having to exercise self-control which could lead to the depletion of this resource, and ostensibly then to lowered self-control in other areas (Muraven & Baumeister, 2000). Two studies in this thesis specifically used a mood induction task (MIT; Robinson et al., 2012) to investigate the influence of positive and negative affect on impulsive, sweet food choice. In terms of the negative mood manipulation, this is therefore a possibility. That is to say, that those in the negative mood condition might actually have been using self-control to regulate their mood which then led to more impulsive decision-making, rather than the mood itself exerting an influence on subsequent decisions. However, the results of this aspect of the studies showed that participants in *both* mood conditions were more likely to display impulsive behaviour, i.e. less likely to exercise self-control, (although it also noted that these associations were non-significant). Although reduced self-control might therefore explain impulsive decision-making in the negative mood condition, it does not explain why those in the positive mood condition also made impulsive choices. While the question of whether negative moods cause breakdowns in self-control is a potential avenue to explore in the context of the current thesis, another potential influence on processing resources is turned to for the purpose of recommendations for future research.

Stress, for example, has been shown to impair cognitive reasoning abilities (Arnsten, 2015). As previously mentioned in the opening literature review of this thesis (see Chapter 1), Shiv and Fedorikhin (1999) demonstrated the influence of cognitive load as a type of stressor on decisions in the separate area of food choice. When processing resources were restricted via manipulation of cognitive load, choosing chocolate cake over fruit salad was more likely. This was interpreted as a more spontaneous, affective choice, i.e. driven by impulsive processes. When processing resources were available however, choosing fruit salad became more likely, interpreted as a more controlled choice (Shiv & Fedorikhin, 1999). This phenomenon has also been reported in areas concerning other types of stressor, for example, a reduction in self-control on proofreading performance following exposure to unpredictable noise (Glass, Singer & Friedman, 1969); and reduced willingness to persist with unsolvable tasks following exposure to a crowded situation (Sherrod, 1974).

The consequences of psychological stress present significant health problems in modern society (Kudielka & Wüst, 2010; Schneiderman, Ironson & Siegel, 2005). In terms of behaviours linked with common self-control failures such as eating, drinking and smoking, (Baumeister et al., 1994), additionally having to cope with general, psychological stress often leads to relapses in all these areas (Muraven & Baumeister, 2000). In terms of eating behaviours specifically for example, dieters trying to limit food intake whilst simultaneously coping with stress are more likely to fail (Muraven & Baumeister, 2000), and consumption of high-fat, sweet foods has been shown to increase during periods of acute, emotional stress in healthy populations. For example, Oliver et al. (2000) used the anticipation of performing a speech to induce stress in emotional and unemotional eaters and then measured consumption of sweet, salty and bland foods during an ad libitum meal. The results showed that although overall energy intake did not differ, stressed, emotional eaters ate significantly more sweet, high-fat and energy-dense food types compared to a non-stressed, non-emotional control group. As these foods were predominantly of the snack variety, (e.g. cake and chocolate biscuits), this would suggest that stress potentially results in higher, unhealthy food intake (Oliver et al., 2000). A further study investigated the longitudinal association between work stress and food intake (Wardle, Steptoe, Oliver & Lipsey, 2000). Participants were assessed four times over a six-month period using measures of diet, weight and perceived stress. Workload stress was calculated using the number of hours that had been worked during the week immediately preceding the four measurement assessments. This allowed for real-life high- and low-work-stress periods to be compared within subjects. As well as higher levels of perceived stress, higher total energy intake as well as higher fat, saturated fat and sugar intake were all recorded during the high-work-stress compared to the low-work-stress periods (Wardle et al., 2000). Such findings demonstrate the effect of stress in a real-world situation, the implications of which suggest that frequent or recurring stress could result in a higher risk of dietary related problems such as excessive weight gain (Wardle et al., 2000).

While Muraven and Baumeister (2000) suggest that having to deal with stress leads to a decrease in a person's ability to exercise self-control, they then go on to put forward an alternative suggestion: that instead of decreasing self-control, coping with stress actually causes an increase in the desire or impulse to eat (or drink or smoke; Muraven & Baumeister, 2000). In terms of dual-system models of behaviour for example (e.g. Strack & Deutsch, 2004), if conscious resources governing self-control are being taken up in one area (e.g. due to stress), it is possible that impulses simply become more salient in unrelated areas (e.g. food consumption; Friese et al., 2008). This then raises the question of interpretation, i.e. does stress lead to a decrease in self-control, or increase in impulsivity? It is noted that examples presented here concerning the influence of stress on sweet food choice and consumption (e.g. Shiv & Fedorikhin, 1999; Wardle et al., 2000) stop short of truly investigating impulsivity and self-control as separate constructs, and the opportunity to consider both sides of this question is therefore missed. For example, in Shiv and Fedorikhin's study (1999), participants choose between chocolate cake and fruit salad after manipulation of cognitive load. Choosing the chocolate cake when processing resources were restricted was interpreted as being driven by impulsive processes (Shiv & Fedorikhin, 1999). However, it is noted that both items were offered as *immediate* choices, and therefore the opportunity to specifically exercise self-control was not present. In this sense, either choice could be interpreted as impulsive. In terms of actual food consumption, Wardle et al. (2000) measured food intake at times of real-life high and low stress finding that higher sugar (and fat) consumption was reported during times of high, compared to low stress. While self-control and impulse were not directly investigated, eating is a common example of a self-control failure (Baumeister et al., 1994), and additionally having to cope with general stress often leads to relapse in this area (Muraven & Baumeister, 2000). Therefore, higher sugar (and fat) intake during times of stress could be interpreted as an example of self-control failure. Again, however, without directly considering whether participants exercised self-control or acted impulsively before consumption of these foods, both sides of this question cannot be fully considered.

It is posited that the delay of gratification paradigm (DoG) from the current thesis offers a highly viable framework to investigate this question of interpretation given that it concerns both impulse *and* self-control (e.g. Mischel, 1974). In an experimental design, and following Shiv and Fedorikhin (1999), the addition of a processing resources procedure to manipulate cognitive load could be used to induce either high or low levels of stress. In the high-stress group, participants would be asked to memorize a seven-digit number (leaving low processing resources available). In the low-stress group, participants would be asked to memorize a two-digit number (leaving high processing resources available). Whilst under this stress, asking participants to firstly choose between receiving a sweet food or non-food reward; and to secondly choose between receiving that initial reward immediately, or a larger reward later would incorporate both sweet food choice and impulse/self-control using the DoG paradigm (e.g. Mischel, 1974). Based on previous findings (e.g. Shiv & Fedorikhin, 1999; Wardle et al., 2000), it is hypothesised that those in the high-stress group would be more likely to choose the initial sweet food reward compared to those in the low-stress group. As having to cope with stress often leads to relapse concerning food intake (Muraven & Baumeister, 2000), it might then be hypothesised that those in the high-stress group would be more likely to display impulsive behaviour and choose the smaller sweet reward now, compared to the low-stress groups.

As suggested following previous discussion points in this chapter, measuring attitudes using direct, explicit methods are the superior choice when wanting to predict conscious and controlled behaviour, whereas measuring attitudes using indirect, implicit methods are better for predicting more impulsive behaviour (Friese et al., 2008; Hofmann et al., 2008; Hofmann et al., 2009; see Section 5.3.2). Also including an indirect measure such as an IAT (Greenwald et al., 1998) might therefore reveal differences in the strength of implicit responses between the high- and low-stress groups which would go even further in attempting to answer the question of interpretation put forward by Muraven and Baumeister (2000). That is to say, whether coping with stress in one area leads to a decrease in self-control in another; or if in fact coping with stress in one area actually leads to an increase in impulsivity in a separate area (Muraven & Baumeister, 2000). If, for example, the hypothesis that compared to the low-stress group, those in the high-stress group will make more impulsive *explicit* choices concerning sweet food items is correct, implicit responses could then confirm whether or not this choice stems from impulsive processes. If those in the high-stress group display stronger implicit associations for a ‘sweet-food-positive-impulsive’ category than a ‘sweet-food-negative-controlled’ category, this could indicate that stress in one area actually leads to an increase in impulse salience in a separate area. If, however, those in the high-stress group display stronger implicit associations for a ‘sweet-food-positive-controlled’ category compared to an ‘sweet-food-negative-impulsive’ category, this could indicate that stress in one area *does* lead to a decrease in the ability to exercise self-control in a separate area.

Stress has been firmly established with self-control failures or relapses concerning excessive eating (Muraven & Baumeister, 2000). The consideration of this factor in relation to elements already examined in this thesis, i.e. impulsive, sweet food decision making is therefore certainly worthy of future attention. It is acknowledged that the suggested study does not include the role of affect which was a focal point of interest in the present thesis. This is because considering stress and mood simultaneously could present problems when interpreting results given that both constructs have been linked with reduced self-control (Muraven & Baumeister, 2000). However, general psychological stress is a source of significant health problems in modern society (Kudielka & Wüst, 2010; Schneiderman et al., 2005). The opportunity to clarify the way in which this construct influences sweet food choice from the perspective of impulse and self-control is therefore perhaps more ecologically valid than simply considering mood. Certainly, the way in which stress impacts impulsive, sweet food choice has practical implications in terms of answering the causality question of what is driving the relationship between sugar consumption and excessive weight gain in a real-world way.

5.6 Conclusion

The link between sugar consumption and excessive weight gain has been well established in recent times (e.g. Bray & Popkin, 2014; Ludwig et al., 2001; Malik et al., 2013; Te Morenga et al., 2013). However, it is difficult to identify causal factors driving this relationship (Lean et al., 2018). The main aim of this thesis was therefore to explore psychological factors influencing sugar consumption, in order to address the question ‘Why do we choose sugar?’ Following a review of relevant literature, affect (as the broad construct pertaining to emotions and mood) was identified as a relatively under-researched area within the psychology of judgment and decision making (JDM; Lerner et al., 2015). Mood and emotions have also been specifically highlighted as influencing over-eating and consequently obesity (Evers et al., 2013; Singh, 2014). Affect was therefore chosen as the context within which to explore sweet food choice. Using the delay of gratification (DoG; based on Mischel, 1974) and willingness-to-pay paradigms (WTP; based on Becker et al., 1964), manipulated positive and negative incidental mood and affect as a dispositional trait were explored across three iterative studies.

Past research has consistently shown higher sweet food consumption following negative compared to positive mood manipulations (e.g. Garg et al., 2007; Tice et al., 2001). However, the current thesis attempted to tap into the step preceding consumption, which ultimately comes down to preference, or the choice of one item over another (Birch, 1999). The exploration of how such choices are made, i.e. the construction of preference, has been observed as lacking within the JDM literature, and specifically in the context of food and eating behaviours (Peters, 2009).

Broadly speaking, the results of the second study provided conclusive evidence of positive and negative mood states influencing sweet food choice in the manner hypothesised. Compared to those in positive moods, those in negative moods were more likely to choose chocolate over a non-food/neutral item, which, theoretically speaking, aligned with affective regulation/mood management models (e.g. Gross, 1998; Zillmann, 1988). Although primary analyses did not reach significance (p = .068), this association was then robustly clarified following subsequent analyses of the data. That is to say, the main logistic regression analysis conclusively revealed that as mood moved from negative to positive, the likelihood of choosing chocolate significantly decreased, when controlling for the influence of chocolate craving. Compared to previous research concerning actual consumption (e.g. Garg et al., 2007), the conclusive nature of the findings from this study therefore indicate that the influence of manipulated mood is also evident in the context of the current thesis (i.e. sweet food preference construction). In terms of adding to the evolving areas of both affect (Lerner et al., 2015) and preference construction (Peters, 2009), it appears that the actual act of making a simple choice concerning sweet food is also influenced by manipulated mood in the same way that consumption appears to be (e.g. Singh, 2014; Garg et al., 2007; Tice et al., 2001).

Following the initial choice of chocolate or a non-food/neutral item, participants were given the opportunity to delay the gratification of receiving their initial choice in exchange for a later but larger reward. It was hypothesised that those in negative moods would be more likely to display impulsive behaviour, i.e. choose to keep the smaller, immediate reward, compared to those in positive moods. However, the results showed that all participants, regardless of mood condition were more likely to keep their first impulsive choice. Therefore, it was concluded that robust associations between positive and negative manipulated mood states and the delay of gratification task categories (i.e. impulsive vs. controlled behaviours) were simply not detectable under the current methodology. This lack of conclusiveness concerning manipulated mood was further corroborated in the context of the WTP paradigm (based on Becker et al., 1964) as the influence of positive and negative mood was also inconclusive in the second study.

As well as short-term states, both positive and negative affect can be evaluated in terms of long-term traits, and both constructs influence the way in which decisions are made (Damasio, 1994). This observation led to the consideration of affect as a long-term, dispositional trait in the third study in order to obtain a clearer and more rounded view of how this type of affective construct influences sweet food decision making. Terms related to the lower positive affect pole (such as sadness) are related to depression, and in this sense are related to negative affect (e.g. Watson et al., 1988; Watson et al., 1999). Past research has revealed higher spending in response to negative mood inductions (e.g. Cryder et al., 2008; Lerner et al., 2004), and also identified a link between depression and the consumption/desire for chocolate and sweet food (e.g. Camilleri et al., 2014; Lester & Bernard, 1991; Rose et al., 2010). Decreasing positive affectivity was as such expected to be associated with higher WTP prices. Across two analyses, this hypothesis was supported with decreasing positive affectivity significantly, independently predicting increasing WTP prices for chocolate vs. neutral items and high sugar vs. neutral items. Although it is again acknowledged that the current study did not investigate actual consumption, the conclusive results nevertheless provide evidence that in terms of chocolate and high-sugar items, higher spending could be more to do with an absence of positivity than a presence of negativity. This is potentially interesting within normal populations (i.e. those undiagnosed with depression) in that understanding that simply feeling sad could lead to higher spending for chocolate and sweet foods, which could then potentially lead to higher consumption.

As well as conclusive findings concerning lower positive affectivity and higher WTP prices, robust findings concerning increasing chocolate craving and higher WTP prices were evident throughout this thesis. This variable was highly significant concerning WTP in the context of both manipulated state mood, and dispositional, trait affectivity. This willingness-to-pay more was interpreted as evidence of an approach bias towards chocolate and high-sugar foods given that such behaviours are defined as reactions towards rewarding stimuli, of which food is an example (Corr, 2013). Similarities between chocolate craving and areas more commonly connected with craving such as addictive behaviours were then explored. As parallels between sugar and substances more commonly linked to dependence have previously been made (e.g. Avena et al., 2008; Lustig, 2010), the robust influence of chocolate craving led to the suggestion that the potentially addictive qualities of chocolate perhaps warrant future investigation.

The results of this thesis provide robust evidence firstly, that manipulated mood states influence the way in which choices concerning chocolate are built or constructed; and secondly, that lower positive trait affectivity influences economic decisions concerning chocolate and high-sugar foods, in ways that align with past research (e.g. Camilleri et al., 2014; Garg et al., 2007; Lester & Bernard, 1991; Rose et al., 2010; Tice et al., 2001). These findings can therefore conclusively add to the under-researched areas of preference construction (Peters, 2009) and the way in which affect influences decision making (Lerner et al., 2015) in the context of sweet food choice. The results concerning the influence of manipulated mood on both impulsive sweet food choice, and economic decision making did not reveal robust findings. However, the lack of conclusion in this area ultimately seems to confirm the noted difficulty in establishing factors that are driving the relationship between sugar consumption and obesity (e.g. Lean et al., 2018), as well as previous observations concerning the complex and mysterious nature of human emotions (e.g. Keltner & Lerner, 2010; Russell, 2003). This thesis therefore confirms that the "vibrant quest to identify the effects of emotion on judgment and decision making…" (Lerner et al., 2015; p.800) is still very much ongoing in the context of sugar consumption. Given concerns over negative consequences of excessive weight gain which have, in turn, been directly linked with sugar consumption (e.g. Malik et al., 2013; Must & Strauss, 1999; Must et al., 1999; Te Morenga et al., 2013), findings from this thesis have the potential to inform continued exploration into causal mechanisms behind this relationship. Broadening knowledge of how choices and decisions are made in this specific area will achieve deeper understanding of sweet food consumption from a psychological perspective, ultimately moving closer towards finding an answer to the question: 'Why do we choose sugar?'.

6. References

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7. Appendix

7.1 Ethics Statements

Study 1 ethics statement, ref: SAS1704.

London South Bank
University

Direct line: 0207 815 5422
E-mail: dawkinl3@lsbu.ac.uk
Ref: SAS1704

Friday 12th May 2017

Dear Stella

RE: The interaction of impulsive personality and emotion in the context of food choice

Thank you for submitting your amendments.

I am pleased to inform you that full Chair's Approval has been given by Dr. Lynne Dawkins, on behalf of the School of Applied Sciences.

I wish you every success with your research.

Yours sincerely,

L. Dawkins

Dr. Lynne Dawkins
Chair, Research Ethics Coordinator
School of Applied Sciences

Study 2 ethics statement, ref: SAS1704e.

Direct line: 0207 815 7959

London South Bank University

EST 1892

School of Applied Sciences

E-mail:r.oliveira@lsbu.ac.uk
Ref:SAS1704e

Friday 23rd November 2018

Dear Stella,

RE: The role of affect and emotion in sugar consumption

Thank you for submitting your application.

I am pleased to inform you that full Chair's Approval has been given by Dr. Rita De Oliveira on behalf of the School of Applied Sciences.

I wish you every success

with your research.

Yours sincerely,

Become what you want to be

Study 3 ethics statement, ref: SAS1833.

Direct line: 0207 815 7959

London South Bank University
EST 1892

School of Applied Sciences

E-mail:r.oliveira@lsbu.ac.uk
Ref: SAS1833

Monday 17th December 2018

Dear Stella

RE: The role of affect and emotion in sugar consumption

Thank you for submitting your application.

I am pleased to inform you that full Chair's Approval has been given by Dr. Rita De Oliveira on behalf of the School of Applied Sciences.

I wish you every success

with your research.

Yours sincerely,

Become what you want to be

7.2 Study 2 logistic regression assumption checks (Field, 2013)[5]

7.2.1 Study 2 'Initial Choice' task

Regression diagnostics

- Standardized residuals: No cases fell between +/-1.96 and +/-2.58 and only 1 case was identified with a value >+/-2.58. As these fell within the accepted range, all cases were included for the final analysis.
- Cook's Distance: All points were identified as being <1.
- Leverage statistics: These are calculated as $(k+1)/n$, where k = the number of predictors and n = sample size. In this case, (2+1)/135 = 0.02. Stephens (2002) recommends taking values three times the leverage as a cut-off point (i.e. 0.06). No cases were identified with a value >0.06.
- Standardized DfBetas: For all predictors, these were <1.

[5] Assumption Checks recommended for hierarchical logistic regression (Field, 2013) and used for corresponding analyses throughout study 2:
Regression diagnostics:
Standardized residuals: These assess and then express error in the model as standard deviations. Only 5% should lie outside +/- 1.96 and only 1% should lie +/- 2.58. Absolute values >+/-3.29 cause for concern.
Cook's Distance: This measures the overall influence of individual cases on the model. All points should be less than 1.
Leverage statistics: These assess the observed values of the outcome variable over the predicted variables.
Standardized DfBetas: A standardized version of DFBeta which measures the influence of a case on b_i in the regression model. Cases above 1 are cause for concern.

7.2.2 Study 2 'Chocolate DoG' task

Regression diagnostics

- Standardized residuals: Only one case was identified with a value between >+/-1.96 and +/-2.58. As this fell within the accepted range, it was included for the final analysis.
- Cook's Distance: All points were identified as being <1.
- Leverage statistics: These are calculated as (k+1)/n, where k = the number of predictors and n = sample size. In this case, (4+1)/74 = 0.07. Stephens (2002) recommends taking values three times the leverage as a cut-off point (i.e. 0.20). No cases were identified with a value >0.20.
- Standardized DfBetas: For all predictors, these were <1.

7.2.3 Study 2 'Magazine DoG' task

Regression diagnostics

- Standardized residuals: No cases were identified with a value >+/-1.96.
- Cook's Distance: All points were identified as being <1.
- Leverage statistics: These are calculated as (k+1)/n, where k = the number of predictors and n = sample size. In this case, (2+1)/61 = 0.05. Stephens (2002) recommends taking values three times the leverage as a cut-off point (i.e. 0.15). In this instance, one cases was identified with a value >0.15. However, values exceeding the recommended limit will not necessarily be exerting undue influence on the regression coefficients as these are measured on the criterion rather than the predictor variables (Field, 2013).
- Standardized DfBetas: For all predictors, these were all <1.

7.3 Study 2 and 3 linear regression assumption checks (Field, 2013)[6]

7.3.1 Study 2 'Chocolate vs. neutral item WTP' task

Regression diagnostics

- Standardized residuals: Two cases were identified as having values >+/-2.58. As these fell within the accepted range, all cases were included for the final analysis.
- Cook's Distance: All points were identified as being <1.
- Leverage statistics: These are calculated as $(k+1)/n$, where k = the number of predictors and n = sample size. In this case, (5+1)/135 = 0.04. Stephens (2002) recommends taking values three times the leverage as a cut-off point (i.e. 0.13). In this instance, 2 cases were identified with a value >0.13.

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[6] Assumption Checks recommended for hierarchical linear regression (Field, 2013) and used for corresponding analyses throughout studies 2 and 3:
Regression diagnostics:
Standardized residuals: These assess and then express error in the model as standard deviations. Only 5% should lie outside +/- 1.96 and only 1% should lie +/- 2.58. Absolute values >+/-3.29 cause for concern.
Cook's Distance: This measures the overall influence of individual cases on the model. All points should be less than 1.
Leverage statistics: These assess the observed values of the outcome variable over the predicted variables.
Mahalanobis distances: These measure the influence of a case by assessing the distance of cases from the means of the predictor variables. Values exceeding 25 are accepted as being problematic for large samples (N = 500) with five predictors (Barnett & Lewis, 1978).
Standardized DfBetas: A standardized version of DFBeta which measures the influence of a case on b_i in the regression model. Cases above 1 are cause for concern.
Multicollinearity diagnostics:
Collinearity statistics: These check for multicollinearity which exists when there is a strong correlation between two or more predictors. The correlation matrix, zero-order, partial and part correlations should first be investigated; none should correlate more highly than .80.
Variance inflation factor (VIF): This indicates whether there is a strong relationship between predictors. A VIF larger than 10 is cause for concern, and the average VIF should not be substantially greater than 1.
Tolerance: This is related to the VIF and should not fall below 0.2.
Durbin-Watson: This tests for independence of errors and should be close to 2.

However, values exceeding the recommended limit will not necessarily be exerting undue influence on the regression coefficients as these are measured on the criterion rather than the predictor variables (Field, 2013).

- Mahalanobis distances: No cases were identified as being >25.
- Standardized DfBetas: For all predictors, these were <1.

Multicollinearity diagnostics

- Correlation matrix: In this case, none correlated more highly than .37
- Zero-order, partial and part correlations: None correlated more highly than .37
- Variance inflation factor (VIF): In this case, all individual VIF's were well below 10, and average VIF's were close to 1.
- Tolerance: All were well above 0.2.
- Durbin-Watson: Durbin-Watson = 1.97.

7.3.2 Study 2 'High-sugar vs. neutral item WTP' task

Regression diagnostics

- Standardized residuals: Only 2 cases were identified with a value >+/-2.58. As these fell within the accepted range, all cases were included for the final analysis.
- Cook's Distance: All points were identified as being <1.
- Leverage statistics: These are calculated as $(k+1)/n$, where k = the number of predictors and n = sample size. In this case, (5+1)/135 = 0.04. Stephens (2002) recommends taking values three times the leverage as a cut-off point (i.e. 0.13). In this case 2 cases were identified with a value >0.13. However, values exceeding the recommended limit will not necessarily be exerting undue influence on the regression coefficients as these are measured on the criterion rather than the predictor variables (Field, 2013).
- Mahalanobis distance: No points were identified as being >25.
- Standardized DfBetas: For all predictors, these were <1.

Multicollinearity diagnostics

- Correlation matrix: None correlated more highly than .29.
- Zero-order, partial and part correlations: None correlated more highly than .21.
- Variance inflation factor (VIF): In this case, all individual VIF's were well below 10, and average VIF's were close to 1.
- Tolerance: In this case, all were well above 0.2.
- Durbin-Watson: In this case, Durbin-Watson = 2.04.

7.3.3 Study 2 'Chocolate vs. high-sugar item WTP' task

Regression diagnostics

- Standardized residuals: No cases were identified with a value >+/-2.58.
- Cook's Distance: All points were identified as being <1.
- Leverage statistics: These are calculated as (k+1)/n, where k = the number of predictors and n = sample size. In this case, (5+1)/135 = 0.04. Stephens (2002) recommends taking values three times the leverage as a cut-off point (i.e. 0.13). In this instance, 1 case was identified with a value >0.13. However, values exceeding the recommended limit will not necessarily be exerting undue influence on the regression coefficients as these are measured on the criterion rather than the predictor variables (Field, 2013).
- Mahalanobis distances: No points were identified as being >25.
- Standardized DfBetas: For all predictors, these were <1.

Multicollinearity diagnostics

- Correlation matrix: None correlated more highly than .49.
- Zero-order, partial and part correlations: None correlated more highly than .24.
- Variance inflation factor (VIF): In this case, all individual VIF's were well below 10, and average VIF's were close to 1.
- Tolerance: In this case, all were well above 0.2.

- Durbin-Watson: In this case, Durbin-Watson = 1.88.

7.3.4 Study 3 ‘Chocolate vs. neutral item WTP’ task

Regression diagnostics

- Standardized residuals: Ten cases were identified with a value between +/-1.96 and +/-2.58; and two cases were identified with a value >+/-2.58. As these fell within the accepted range, all cases were included for the final analysis.
- Cook’s Distance: All points were identified as being <1.
- Leverage statistics: These are calculated as $(k+1)/n$, where k = the number of predictors and n = sample size (Field, 2013). In this case, (6+1)/253 = 0.03. Stephens (2002) recommends taking values three times the leverage as a cut-off point (i.e. 0.09). One case was identified with a value >0.09. However, values exceeding the recommended limit will not necessarily be exerting undue influence on the regression coefficients as these are measured on the criterion rather than the predictor variables (Field, 2013).
- Mahalanobis distances: One case was identified as being >25. However, because all other diagnostic checks for this case fell within the accepted ranges, it was included in the final analysis.
- Standardized DfBetas: For all predictors, these were <1.

Multicollinearity diagnostics

- Correlation matrix: None were more highly correlated than .65.
- Zero-order, partial and part correlations: None were more highly correlated than .22.
- Variance inflation factor (VIF): All individual VIF’s were well below 10 and average VIF’s were not substantially greater than 1.

- Tolerance: All were well above 0.2.
- Durbin-Watson: Durbin-Watson = 1.81.

7.3.5 Study 3 'High-sugar vs. neutral item WTP' task

Regression diagnostics

- Standardized residuals: Seven cases were identified with a value between +/-1.96 and +/-2.58; and three cases were identified with a value >+/-2.58. As these fell within the accepted range, all cases were included for the final analysis.
- Cook's Distance: All points were identified as being <1.
- Leverage statistics: These are calculated as $(k+1)/n$, where k = the number of predictors and n = sample size. In this case, (6+1)/253 = 0.03. Stephens (2002) recommends taking values three times the leverage as a cut-off point (i.e. 0.09). In this instance 1 case was identified with a value >0.09. However, values exceeding the recommended limit will not necessarily be exerting undue influence on the regression coefficients as these are measured on the criterion rather than the predictor variables (Field, 2013).
- Mahalanobis distances: One case was identified as being >25. However, because all other diagnostic checks for this case fell within the accepted ranges, it was included in the final analysis.
- Standardized DfBetas: For all predictors, these were <1.

Multicollinearity diagnostics

- Correlation matrix: None correlated more highly than .65.
- Zero-order, partial and part correlations: None correlated more highly than .10.
- Variance inflation factor (VIF): All individual VIF's were well below 10, and average VIF's were not substantially greater than 1.
- Tolerance: All were well above 0.2.
- Durbin-Watson: Durbin-Watson = 1.93.

7.3.6 Study 3 'Chocolate vs. high-sugar item WTP' task

Regression diagnostics

- Standardized residuals: Nine cases were identified with a value between +/- 1.96 and +/-2.58; and three cases were identified with a value >+/-2.58. As these fell within the accepted range, all cases were included for the final analysis.
- Cook's Distance: All points were identified as being <1.
- Leverage statistics: These are calculated as (k+1)/n, where k = the number of predictors and n = sample size. In this case, (6+1)/253 = 0.03. Stephens (2002) recommends taking values three times the leverage as a cut-off point (i.e. 0.09). One case was identified with a value >0.09. However, values exceeding the recommended limit will not necessarily be exerting undue influence on the regression coefficients as these are measured on the criterion rather than the predictor variables (Field, 2013).
- Mahalanobis distances: One case was identified as being >25. However, because all other diagnostic checks for this case fell within the accepted ranges, it was included in the final analysis.
- Standardized DfBetas: For all predictors, these were <1.

Multicollinearity diagnostics

- Correlation matrix: None were correlated more highly than .65.
- Zero-order, partial and part correlations: None were correlated more highly than .27.
- Variance inflation factor (VIF): All individual VIF's were well below 10, and average VIF's were not substantially greater than 1.
- Tolerance: All were well above 0.2.
- Durbin-Watson: Durbin-Watson = 2.02.

7.4 Mood manipulation stimuli

<u>Positive mood statements (Velten, 1967) used in the mood manipulation task (Robinson et al., 2012).</u>

Today is neither better nor worse than any other day.

I do feel pretty good today, though.

I feel light-hearted.

This might turn out to have been one of my good days.

If your attitude is good, then things are good and my attitude is good.

I feel cheerful and lively.

I've certainly got energy and self-confidence to share.

On the whole, I have very little difficulty in thinking clearly.

My parents are pretty proud of me most of the time.

I'm glad that I'm in college - it's the key to success nowadays.

For the rest of the day, I bet things will go really well.

I'm pleased that most people are so friendly to me.

My judgments about most things are sound.

It's encouraging that I get farther into my major, it's going to take less study to get good grades.

I'm full of energy and ambition - I feel like I could go a long time without sleep.

This is one of those days when I can grind out schoolwork with practically no effort at all.

My judgment is keen and precise today. Just let someone try to put something over me.

When I want to, I can make friends extremely easily.

If I set my mind to it, I can make things turn out fine.

I feel enthusiastic and confident now.

There should be opportunity for a lot of good times coming along.

My favourite songs keep going through my mind.

Some of my friends are so lively and optimistic.

I feel talkative - I feel like talking to almost anybody.

I'm full of energy, and am really getting to like the things I'm doing on campus.

I feel like bursting with laughter - I wish somebody would tell a joke and give me an excuse.

I feel an exhilarating animation in all I do.

My memory is in rare form today.

I'm able to do things accurately and efficiently.

I know good and well that I can achieve the goals I set.

Now that it occurs to me, most of the things that have depressed me wouldn't have if I'd just had the right attitude.

I have a sense of power and vigour.

I feel so vivacious and efficient today - sitting on top of the world.

It would really take something to stop me now.

In the long run, it's obvious that things have gotten better and better during my life.

I know in the future I won't over-emphasize so-called "problems".

I'm optimistic that I can get along very well with most of the people I meet.

I'm too absorbed in things to have time for worry.

I'm feeling amazingly good today.

I am particularly inventive and resourceful in this mood.

I feel superb! I think I can work to the best of my ability.

Things look good. Things look great!

I feel that many of my friendships will stick with me in the future.

I feel highly perceptive and refreshed.

I can find the good in almost everything.

In a buoyant mood like this one, I can work fast and do it right the first time.

I can concentrate hard on anything I do.

My thinking is clear and rapid.

Life is so much fun; it seems to offer so many sources of fulfilment.

Things will be better and better today.

I can make decisions rapidly and correctly; and I can defend them against criticisms easily.

I feel industrious as heck - I want something to do!

Life is firmly in my control.

I wish somebody would play some good loud music!

This is great -- I really do feel good. I am elated about things!

I'm really feeling sharp now.

This is just one of those days when I'm ready to go!

God, I feel great!

<u>Negative mood statements (Velten, 1967) used in the mood manipulation task (Robinson et al., 2012).</u>

Today is neither better nor worse than any other day.

I feel rather sluggish now.

Every now and then I feel so tired and gloomy that I'd rather just sit than do anything.

Sometimes I wonder whether school is all that worthwhile.

I can remember times when everybody but me seemed full of energy.

Too often I have found myself staring listlessly into the distance, my mind a blank, when I definitely should have been studying.

It has occurred to me more than once that study is basically useless, because you forget almost everything you learn anyway.

People annoy me; I wish I could be by myself.

I've had important decisions to make in the past, and I've sometimes made the wrong ones.

I do feel somewhat discouraged and drowsy - maybe I'll need a nap when I get home.

Perhaps college takes more time, effort, and money than it's worth.

I just don't seem to be able to get going as fast as I used to.

I couldn't remember things well right now if I had to.

Just a little bit of effort tires me out.

I've had daydreams in which my mistakes kept occurring to me - sometimes I wish I could start over again.

I'm ashamed that I've caused my parents needless worry.

I feel trembly tired and indifferent to things today.

Just to stand up would take a big effort.

I'm getting tired out. I can feel my body getting exhausted and heavy.

I'm beginning to feel sleepy. My thoughts are drifting.

At times I've been so tired and discouraged that I went to sleep rather than face important problems.

My life is so tiresome - the same old thing day after day depresses me.

There have been days when I felt weak and confused and everything went miserably wrong.

I can't make up my mind; it's so hard to make simple decisions.

I want to go to sleep - I feel like just closing my eyes and going to sleep right here.

I'm not very alert; I feel listless and vaguely sad.

I've doubted that I'm a worthwhile person.

I feel worn out. My health may not be as good as it's supposed to be.

It often seems that no matter how hard I try, things still go wrong.

I've noticed that no one seems to really understand or care when I complain or feel unhappy.

I'm uncertain about my future.

I'm discouraged and unhappy about myself.

I've lain awake at night worrying so long that I hated myself.

Things are worse now than when I was younger.

The way I feel now, the future looks boring and hopeless.

My parents never really tried to understand me.

Some very important decisions are almost impossible for me to make.

I feel tired and depressed; I don't feel like working on the things I know I must get done.

I feel horribly guilty about how I've treated my parents at times.

I have the feeling that I just can't reach people.

Things are easier and better for other people than for me. I feel like there's no use in trying again.

Often people make me very upset. I don't like to be around them.

It takes too much effort to convince people of anything. There's no point in trying.

I fail in communicating with people about my problems.

It's so discouraging the way people don't really listen to me.

I've felt so lonesome before, that I could have cried.

Sometimes I've wished I could die.

My thoughts are so slow and downcast. I don't want to think or talk.

I just don't care about anything. Life just isn't any fun

Life seems too much for me - my efforts are wasted.

I'm so tired.

I don't concentrate or move. I just want to forget about everything.

I have too many bad things in my life.

Everything seems utterly futile and empty.

I feel dizzy and faint. I need to put my head down and not move.

I don't want to do anything.

All of my unhappiness of my past life is taking possession of me.

I want to go to sleep and never wake up.

Neutral mood statements (Velten, 1967) used in the mood manipulation task (Robinson et al., 2012).

Oklahoma city is the largest city in the world in area, with 631.166 square miles.

Japan was elected to the United Nations almost fourteen years after Pearl Harbor.

At the end appears a section entitled “Bibliography notes.”

We have two kinds of nouns denoting physical things: individual and mass nouns.

This book or any part thereof must not be reproduced in any form.

Agricultural products comprised seventy per cent of the income.

Saturn is sometimes in conjunction, beyond the sun from the earth, and is not visible.

Some streets were still said to be listed under their old names.

The system is supervised by its board of regents.

There is a large rose-growing center near Tyler, Texas.

Many states supply milk for grammar school children.

It is God’s will that the fittest survive.

The typography, paper, and bind were of the highest quality.

The machine dominated county posts for as long as anyone could remember.

The desk was old, and scratched into its surface was a profusion of dates, initials, and pleading messages.

The Orient Express travels between Paris and Istanbul.

When the Banyan bent down under its own weight, its branches began to take root.

There isn’t a scientific explanation for every U.F.O. sighting.

The Hope diamond was shipped from South Africa to London through the regular mail service.

The review is concerned with the first three volumes.

The ship was ancient, and would soon be retired from the fleet.

Slang is a constantly changing part of the language

There is a small article in the local newspaper which indicates acceptance of the kidnappers' terms.

There are some forms in which no oath is required.

Entramatics find mates for the lonely.

99.1% of Alaska is owned by the federal government.

Two men dressed as repairmen will appear shortly after the van pulls up.

The wood was discolored as if it had been held in a fire.

A light was noticed in the dark outside, and it moved eerily towards the house.

Painting in a few other non-European countries is treated in a separate volume.

A recent study revealed that one half of all college students were unable to find summer jobs.

Provoked arousal and orientation are accompanied by steeper negative shifts.

The names on the Christmas mailing list are alphabetically ordered.

Significantly, these changes occur during the full moon.

West Samoa gained its independence in 1965.

The magazine's report was slanted, as usual.

The map would prove useless as a beginning guide.

The speaker outlined a plan whereby the current deficits could be eliminated.

Black and white pictures are arranged in ten sections.

The voices come only at night, and whisper words, terrible words.

The papers had been front-paging it for days.

The notice made it clear that coffee breaks were being limited.

No man worked harder than he.

Potter wrote numerous satires on social cynicism.

Boeing's main plant in Seattle employs 35,000 people.

The doorkeeper was dressed in red.

During the next ten years, the group participated in politics.

The organization depended on the people for support.

In 1965, Elizabeth made the first state visit by a British monarch to Germany in 56 years.

It was their sixth consecutive best seller.

It all fitted in with the officer’s story.

The merges did not change the company’s policy.

The mansion was rented by the delegation.

Ninety occupations were listed as eligible for the grads in business.

Utah is the beehive state.

Changes were made in transport of lumber after the border incident.

The Chinese language has many dialects, including Cantonese, Mandarin, and Wu.

Things were booming once again in the little gold rush town of Angel.

At low tide the hulk of the old ship could be seen.

A free sample will be given to each person who enters the store.

The following visual scales were used to record participants’ happiness and sadness ratings immediately before and after the positive, negative and neutral mood manipulation tasks (Robinson et al., 2012):

How happy are you?

Not happy at all | Extremely happy

How sad are you?

Not sad at all | Extremely sad

7.5 Questionnaires used in Studies 1 and 2

The 'craving' subscale of the Attitudes to Chocolate questionnaire (Benton et al., 1998).

Statements included:

I eat chocolate to cheer me up when I am down.

My desire for chocolate often seems overpowering.

The thought of chocolate often distracts me from what I am doing (e.g. watching TV).

I usually find myself wanting chocolate in the afternoon.

Chocolate often preys on my mind.

Nothing else but chocolate will satisfy my chocolate cravings.

Even when I do not really want any more chocolate I will often carry on eating it.

I often go into a shop for something else and end up buying chocolate.

I often eat chocolate when I am bored.

I like to indulge in chocolate.

The following visual scale was used to record participants' responses to each statement:

Not at all like me Very much like me

Barratt Impulsiveness Scale (BIS-11; Patton et al., 1995).

DIRECTIONS: People differ in the ways they act and think in different situations. This is a test to measure some of the ways in which you act and think. Read each statement and put an X on the appropriate circle on the right side of this page. Do not spend too much time on any statement. Answer quickly and honestly.

1	2	3	4
Rarely/Never	Occasionally	Often	Almost Always/Always

1 I plan tasks carefully.	1 2 3 4
2 I do things without thinking.	1 2 3 4
3 I make-up my mind quickly.	1 2 3 4
4 I am happy-go-lucky.	1 2 3 4
5 I don’t “pay attention.”	1 2 3 4
6 I have “racing” thoughts.	1 2 3 4
7 I plan trips well ahead of time.	1 2 3 4
8 I am self controlled.	1 2 3 4
9 I concentrate easily.	1 2 3 4
10 I save regularly.	1 2 3 4
11 I “squirm” at plays or lectures.	1 2 3 4
12 I am a careful thinker.	1 2 3 4
13 I plan for job security.	1 2 3 4
14 I say things without thinking.	1 2 3 4
15 I like to think about complex problems.	1 2 3 4
16 I change jobs.	1 2 3 4
17 I act “on impulse.”	1 2 3 4
18 I get easily bored when solving thought problems.	1 2 3 4
19 I act on the spur of the moment.	1 2 3 4
20 I am a steady thinker.	1 2 3 4
21 I change residences.	1 2 3 4
22 I buy things on impulse.	1 2 3 4
23 I can only think about one thing at a time.	1 2 3 4
24 I change hobbies.	1 2 3 4
25 I spend or charge more than I earn.	1 2 3 4

26 I often have extraneous thoughts when thinking.	1 2 3 4
27 I am more interested in the present than the future.	1 2 3 4
28 I am restless at the theater or lectures.	1 2 3 4
29 I like puzzles.	1 2 3 4
30 I am future oriented.	1 2 3 4

7.6 Willingness-to-pay (WTP) stimuli pictures

<u>Pictures and descriptions of the chocolate and high-sugar stimuli for the WTP task (based on Becker et al., 1964).</u>

1. Caramel Slice

2. Single Custard pot

3. Large M&M's Pouch

4. Single Cornetto

5. Packet of Hobnobs

6. Jar of Honey

7. 2 Litre Bottle of Sprite

8. 500g Frosted Shreddies

9. Jar of Marmalade

10. Box of Maltesers Teasers

<u>Pictures and descriptions of the non-food/neutral stimuli for the WTP task (based on Becker et al., 1964).</u>

1. Bar of Dove Soap

2. Pencil

3. Bic Biro

4. Keyring

5. Pair of Socks

6. Mug

7. Birthday Card

8. Photo Frame

9. Houseplant

10. Pencil Case

7.7 Questionnaires used in Study 3

International Positive and Negative Affect Schedule, Short Form (I-PANAS-SF; Thompson, 2007).

Question: Thinking about yourself and how you normally feel, to what extent do you generally feel:

Upset
Hostile
Alert
Ashamed
Inspired
Nervous
Determined
Attentive
Afraid
Active

Interval measure: 1 = Never, 2, 3, 4, 5, 6, 7 = Always

Barratt Impulsiveness Scale-Brief (BIS-Brief; Steinberg et al., 2013).

People differ in the ways they act and think in different situations. This is a test to measure some of the ways in which you act and think. Read each statement and indicate the extent to which you agree with each statement. Do not spend too much time on any statement. Answer quickly and honestly.

I plan tasks carefully
I do things without thinking.

I don't "pay attention."

I am self-controlled.

I concentrate easily.

I am a careful thinker.

I say things without thinking.

I act on the spur of the moment.

Interval measure: 1 = Rarely/Never, 2 = Occasionally, 3 = Often, 4 = Almost Always/Always

Brief Self-Control Scale (SCS-Brief; Tangney et al., 2004).

Using the scale provided, where 1 = 'Not at all' and 5 = 'Very much' please indicate how much each of the following statements reflects how you typically are.

I am good at resisting temptation.

I have a hard time breaking bad habits.

I am lazy.

I say inappropriate things.

I do certain things that are bad for me, if they are fun.

I refuse things that are bad for me.

I wish I had more self-discipline.

People would say that I have iron self-discipline.

Pleasure and fun sometimes keep me from getting work done.

I have trouble concentrating.

I am able to work effectively towards long-term goals.

Sometimes I can't stop myself from doing something, even if I know it is wrong.

I often act without thinking through all the alternatives.

Interval measure: 1 = Not at all, 2, 3, 4, 5 = Very much

<u>Orientation to Chocolate Questionnaire (OCQ; Cartwright et al., 2007).</u>

Question: To what extent do you agree with the following statements?

I felt guilty after eating chocolate.

I considered myself weak when I gave in to my chocolate cravings.

I felt unhealthy after I'd eaten chocolate.

I felt dissatisfied with myself after eating chocolate.

After eating chocolate I often wished I hadn't.

I felt unattractive after eating chocolate.

I wanted to eat chocolate as soon as I had the chance.

I liked to indulge in chocolate.

My desire to have some chocolate seemed overwhelming.

I wanted to eat chocolate so much that one bite would not have been enough.

I was thinking about chocolate a lot of the time.

I usually found myself wanting chocolate in the afternoons.

I deliberately occupied myself so I would not want chocolate.

I did things to take my mind off chocolate.

Interval measure: 1 = Not at all, 2, 3, 4, 5, 6, 7, 8, 9 = Very strongly