THE UNIVERSITY OF HULL

Implicit and Explicit Attitudinal Consequences of False Autobiographical Memories and Beliefs

being a Thesis submitted for the degree of Doctor of Philosophy in the University of Hull

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December 2017

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Declaration

The research presented in this thesis has been submitted to the University of Hull in support of my Doctor of Philosophy degree. However, the results of Experiment 3 (Section 5.1) have also been published as a research article in an academic journal. The reference for this article is provided below.

Howe, D., Anderson, R. J., & Dewhurst, S. A. (2017). False memories, but not false beliefs, affect implicit attitudes for food preferences. *Acta psychologica*, *179*, 14-22.

Acknowledgments

I would like to thank my supervisors, Steve and Rachel, for their consistently excellent and regular feedback and support. Thank you for always being available and replying to my emails so quickly! I would also like to thank all of the postgrads I have shared an office with over the past three years for creating a great environment to work in and making the time absolutely fly by.

And big thanks to Sam and all of my family for being endlessly supportive and encouraging in my efforts to drag out being a student for as long as humanly possible!

Abstract

Previous research has reliably demonstrated that people can form false memories or beliefs of certain events from their personal past, and that these false memories and beliefs can have effects on attitudes and behaviour. When someone forms a false memory or belief of a positive/negative experience relating to a specific attitude object, they tend to change their attitude (and sometimes their behaviour) towards that attitude object accordingly. The research presented in this thesis attempted to build on past research by determining whether false memories and beliefs reliably elicited explicit attitude change across a range of attitudinal domains, whether they affected implicit attitudes as well as explicit attitudes, and whether certain individual difference variables and phenomenological characteristics of false memories had an influence on explicit or implicit attitudinal effects. It was consistently found that false memories and beliefs of a positive experience regarding an attitude object resulted in participants reporting significantly more preferential explicit attitudes towards that attitude object. Tentative evidence was found that false memories may be sufficient to affect implicit attitudes, but false beliefs may not. Results highlighted the potential influence of certain phenomenological characteristics of false memories on attitude change, but found limited evidence to suggest any influence of individual difference factors. The predictions and results of these experiments were considered within the context of theoretical frameworks of social cognition.

General Introduction

It has been known for some time that individuals can be led to believe in the occurrence of events in their personal past which never actually happened, and under some circumstances come to form detailed recollections of these fictitious events. While research over the past several decades has created numerous experimental paradigms in which they can be elicited and provided a detailed literature on the conditions and processes which can give rise to them, less attention has been given to the effects that these types of false autobiographical memories and beliefs can have on our social cognition and behaviour. While a string of publications have attempted to measure the attitudinal and behavioural consequences of false memories and beliefs using a "false-feedback" paradigm, numerous methodological and theoretical gaps in the literature currently remain. The research presented in this thesis aims to replicate previously-observed explicit attitudinal effects of false memories and beliefs, investigate the effects of false memories and beliefs in domains that have not hitherto been explored, extend the standard false-feedback paradigm to consider implicit as well as explicit attitudes, and examine the influence of factors such as individual differences and phenomenological characteristics of false memories on these attitudinal effects. Additionally, the thesis aims to address certain methodological issues associated with the false-feedback paradigm, predominantly aimed at increasing the efficiency and generalisability of the design. The thesis also aims to provide a novel interpretation of these effects by considering them within theoretical frameworks of social cognition relating to explicit and implicit attitudinal processes and change.

Chapter 1 focuses on reviewing the current literature relating to false autobiographical memories and their attitudinal consequences. Chapter 2 reviews the relevant social cognition literature relating to explicit and implicit attitudinal processes

and change. Chapter 3 then aims to outline the core aims of the thesis and how each experiment intends to address these aims.

Chapter 1: False Autobiographical Memories/Beliefs and their Consequences

1.1. False autobiographical memories and beliefs in the lab

1.1.1. Defining false memory

In a seminal piece of research, Bartlett (1932) had a sample of British participants hear a Native American legend called ‘The War of the Ghosts’ before instructing them to repeatedly reproduce it, first after a short delay, and then over days, weeks, months or years. Whilst participants tended to retain the gist of the story, they were found to make changes to unfamiliar elements to be more consistent with their own culture, with the story also becoming shorter for each reproduction. From these findings, Bartlett concluded that memories are not veridical records of our experiences, but are reconstructions of past events which draw upon various disparate sources of stored information. Since then, memory research has corroborated this conclusion, and a wide range of studies have investigated the various forms of errors and distortions that can result from this reconstructive system. In a taxonomy of these errors and distortions, Schacter (1999, 2001) delineates between ‘errors of omission’ (types of forgetting) and ‘errors of commission’ (in which a memory is present, but partially or entirely erroneous). These errors of commission are more broadly referred to as ‘false memories’. Schacter defines various subtypes of errors of commission; bias, misattribution and suggestibility. Bias refers to distortions of memory influenced by current knowledge, beliefs and feelings upon recollection, such as those encountered in Bartlett’s study (the participants’ prior knowledge influenced their memory for the story). Errors of misattribution occur when a form of memory is present, but attributed to an incorrect source (such as time, place or person), such as an individual remembering seeing a piece of information in a newspaper when it was actually

provided by the experimenter (Schacter, Harbluk, & McLachlan, 1984) or remembering experiencing an event themselves when in fact they had only imagined it (Garry, Manning, Loftus, & Sherman, 1996). Whilst the categories of bias and misattribution typically refer to false memories which occur spontaneously, false memories which fall under the category of 'suggestibility' arise when an individual incorporates misleading information from external sources into their memory of an event.

The research presented in this thesis is predominantly concerned with false *autobiographical* memories; that is, false memories of personal episodes from the individual's life (the concept of autobiographical memory is discussed in greater detail in Section 1.2.3). These memories are typically elicited via a combination of false suggestion and the type of memory error encountered in the aforementioned study by Garry et al. (this effect is known as 'imagination inflation', and will be explored further in Section 1.1.2). As such, the false memories in the presented research can generally be considered as errors of suggestibility, but in some cases may also be errors of misattribution (or a combination of the two). The literature concerning false autobiographical memories and the experimental paradigms in which they can be consistently generated are discussed in the following section.

1.1.2. Paradigms of false autobiographical memory research

The experimental study of false autobiographical memories emerged largely on the basis of a series of studies by Elizabeth Loftus and colleagues during the 1970s, and the development of what would become known as the 'misinformation' technique. In the earliest of these studies, Loftus and Palmer (1974) had participants view films of traffic accidents, before asking a series of leading questions to probe participants' memories of the films. It was found that when participants were asked how fast the cars were travelling when they 'smashed' into each other, participants gave much higher

estimates than when they were asked the same question with different verbs (e.g. ‘collided’, ‘bumped’, or ‘contacted’ in place of ‘smashed’). In a similar study, Loftus, Miller, and Burns (1978) showed participants a slideshow depicting a traffic accident before asking them a series of questions about it. Half of the participants were asked a question with a misleading presupposition regarding the type of sign that the car was stopped in front of in the critical slide. When given a recognition test, participants who received the misleading information regarding the sign were more likely to incorrectly identify the slide consistent with the misinformation as the one that they were originally presented with. The misinformation effect has been replicated extensively in a wide range of scenarios (see Ayers & Reder, 1998, for a review). The results of these studies, like those of Barlett (1932), support the notion that our memories of our experiences involve constructive process and can be distorted based upon information encountered post-encoding.

Whilst studies of the misinformation effect provide valuable information regarding the malleability of memory, they do exclusively generate false memories for certain details of events which were nonetheless actually experienced. Building on these studies, Loftus and colleagues later investigated whether it was possible to elicit false memories for personal events which were entirely fictitious. Loftus and Pickrell (1995) presented participants with brief descriptions of four events from their childhood and encouraged them to remember these events. Participants were told that the descriptions of the events had been provided by family members, although in reality, only three of the events were real; one of the events was a false suggestion that they had become lost in a shopping mall as a child, becoming very upset before they were reunited with their family by a stranger (an event which participants’ family members confirmed had never happened). Approximately 25% of participants reported full or partial memories of this

fictitious event (partial memories being categorised as memories for certain details of the event or speculations as to how and when it may have happened, without full, cohesive recollection). Subsequent studies replicated this finding using a similar procedure to elicit false memories of other fictitious childhood events, including salient and/or potentially traumatic events such as an overnight hospitalisation (Hyman, Husband, & Billings, 1995) and being saved from drowning by a lifeguard (Heaps & Nash, 2001). Lindsay, Hagen, Read, Wade, and Garry (2004, p. 149) refer to this method of false memory generation as the "familial-informant false-narrative procedure". This method's combination of personalised interviews conducted over multiple sessions and corroboration from an authoritative source such as a parent/family member tends to be successful at generating large quantities of recollective experiences in participants (Brewin & Andrews, 2016), although it is a time consuming procedure which is not suited to generating false memories in large numbers of participants. For this reason (as well as certain other methodological considerations), the methods used in the experiments presented in this thesis are drawn from other experimental paradigms.

A recent review by Brewin and Andrews (2016) of studies claiming to have elicited false autobiographical memories of childhood events identifies two further paradigms typically used; imagination inflation and false feedback. The term 'imagination inflation' was coined by Garry et al. (1996) in reference to their finding that imagining the occurrence of a series of hypothetical childhood events 'inflated' participant confidence that they had actually experience these events. The general procedure of this paradigm is for participants to be presented with a series of childhood events and rate on a scale their confidence that the event had happened to them. Participants then undergo guided imagination exercises for certain events before participants re-rate their confidence in the event's occurrence, with confidence typically

being increased post-imagination. Many studies have replicated this effect of imagination on confidence in an event's occurrence (Heaps & Nash, 1999; Paddock et al., 1998; Pezdek, Blandon-Gitlin, & Gabbay, 2006). These beliefs in the occurrence of the event are sometimes (although not always) accompanied by detailed memories of the event (Mazzoni & Memon, 2003; Sharman & Barnier, 2008). The distinction between false belief in an event's occurrence and false memory for the event will be covered in greater detail in Section 1.2.3). In addition to the previously-cited studies which have found imagination-inflation effects for various childhood events, some studies have used imagination inflation techniques to elicit false memories and beliefs for novel events either experienced or imagined in the laboratory; for example, Goff and Roediger (1998) had participants either perform or imagine performing a series of simple actions (e.g. "open the book", "break the toothpick"), finding that imagining these actions multiple times increased participants' belief that they had performed the action when they actually had not. Although the extent to which results from these types of studies which elicit false memories for brief, singular actions can be directly compared with those which aim to elicit false memories of entire autobiographical episodes is debatable, this approach does provide useful corroborating evidence; whilst there is the (albeit unlikely) possibility that events in some imagination studies did actually occur and that the imagination of this event has triggered genuine memories, this approach demonstrates that imagination inflation effects are reliable for events which the experimenters can be certain did not actually occur.

The final paradigm identified in Brewin and Andrews (2016) typically used to elicit false memories and beliefs of childhood experiences is the false feedback paradigm. Similarly to the imagination inflation procedure, participants initially complete (amongst other tasks) a questionnaire in which they rate their confidence that

a series of childhood events occurred to them, before being provided with false feedback in a subsequent experimental session suggesting that they had experienced a certain event (regardless of their initial confidence rating). Participants then re-rate their confidence in the critical event as well as reporting whether they have a memory or belief of it. This procedure has largely been used by experiments which have aimed to not only elicit false autobiographical memories and beliefs, but also measure their attitudinal consequences (e.g. Bernstein, Laney, Morris, & Loftus, 2005a; Clifasefi, Bernstein, Mantonakis, & Loftus, 2013; Geraerts et al., 2008; Laney, Kaasa, et al., 2008; Laney, Morris, Bernstein, Wakefield, & Loftus, 2008). Subsequently, this is the procedure followed by the experiments presented in this thesis (with some additional elements of imagination inflation incorporated), and will be covered in more detail in the following section.

1.2. Consequences of false autobiographical memories and beliefs

1.2.1. Negative attitudinal and behavioural consequences of false memories and beliefs

In recent years, false memory research has gone beyond merely attempting to elicit false memories and beliefs, and begun to question whether experimentally generated false memories and beliefs can have consequences for our social cognition. This line of research was originally intended as means of determining whether true and false autobiographical memories could be differentiated by way of their attitudinal and behavioural consequences; if false autobiographical memories and beliefs were found to not have the same consequences for our attitudes and behaviours as would be expected of true autobiographical memories, this may have proved a useful tool in differentiating the two (Laney & Loftus, 2013). However, the evidence available on this topic suggests

that false memories and beliefs do, in fact, appear to have significant consequences for attitudes and behaviours. In one of the first studies to address this topic, Bernstein, Laney, Morris, & Loftus (2005b) used the false feedback procedure described in the previous section to falsely suggest to participants that they had become sick as children after eating pickles or hard-boiled eggs. High numbers in both groups (25% of the 'pickle' group and 31% of the 'egg' group) went on to endorse the false suggestion, with these "believers" showing subsequently diminished preference across a range of measures for their relevant food, relative to participants who received the false suggestion but did not believe it ("non-believers") and control participants who did not receive the false suggestion. Other studies have replicated these negative, aversive effects of false memories and beliefs upon attitudes. Using a very similar paradigm, Clifasefi et al. (2013) found that false memories and beliefs increased participants' aversion to alcohol; when given the false suggestion that they had been sick from drinking a certain type of alcohol, those who reported a false memory or belief of this suggestion subsequently went on to report decreased ratings for that type of alcohol (relative to their pre-suggestion baseline).

Other studies have gone beyond attitudinal measures and found evidence to suggest that false memories and beliefs may have behavioural consequences as well. Scoboria, Mazzoni, and Jarry (2008) and Geraerts et al. (2008) found that as well as indicating decreased self-reported preferences, participants who formed false memories/beliefs of being sick from certain foods consumed less of these foods than controls when given opportunities (such as at an ostensibly unrelated study involving a "taste-test"). Geraerts et al. found that these attitudinal and behavioural effects persisted in their final experimental session which was run four months after the initial false

feedback, suggesting that the aversive effects of false memories and beliefs upon attitudes and behaviours could be potentially long-lasting.

1.2.2. Positive attitudinal consequences of false memories and beliefs.

Whilst the majority of studies investigating the attitudinal and behavioural consequences of experimentally-generated false autobiographical memories and beliefs have used negative events (e.g. being sick from consuming a certain food/drink) and consequently focused on aversive attitudinal effects, some studies have used false suggestions of positive events and subsequent positive attitudinal effects. Using the same general false feedback paradigm as the aforementioned studies (and the procedure most closely followed by the studies reported in this thesis), Laney, Morris, et al. (2008) invited participants for what they were told was a study investigating the link between food preferences and personality. In addition to a large amount of filler data (collected to disguise the true nature of the experiment), they obtained ratings from participants on how confident they were that they had loved asparagus the first time they tried it as well as several measures of their current preference for asparagus. Approximately a week later, participants completed another set of questionnaires, at the start of which the experimental group were given the suggestion that they had loved asparagus as children (an assertion ostensibly generated by a computer program based on data they provided in the first session), and were instructed to imagine the scenario before listing where they may have been and who they may have been with. Twenty-two participants (48% of the experimental group who received the false suggestion) subsequently increased their confidence that this event had occurred (having initially reported baseline confidence lower than or equal to the midpoint of the scale) and reported a memory or a belief of loving asparagus as children. Post-suggestion, these participants (labelled

"believers") also reported significantly higher preference for asparagus across a range of measures than "non-believers" (participants who received the false suggestion but did not meet the criteria to be labelled "believers") and controls (who received no false suggestion), whereas pre-suggestion, there was no significant difference between the groups. In a similar study, Laney, Fowler, Nelson, Bernstein, and Loftus (2008) found the same attitudinal effects, as well as finding that these effects persisted two weeks after the false suggestion (albeit to a slightly lesser extent than immediately post-suggestion). Laney, Kaasa, et al. (2008) carried out another study to replicate these effects whilst making some methodological changes to address the criticism that these findings may be due to demand characteristics. In addition to the original cover story to disguise the true nature of the experiment (that the study was investigating the relationship between food preferences and personality), the authors included another layer of deception by providing strong hints that the study had a different (also false) purpose (a 'red herring' that the study was actually concerned with the obesity crisis in the United States). Interviews with the participants after the experiment had taken place found that the majority of those who did not believe the initial cover story were instead convinced by the red herring explanation, with comparatively few participants identifying the actual nature of the study. It was also found that participants who *did* identify the true nature of the study did not differ in their likelihood of reporting a false memory or belief than those who did not identify the true nature of the study. These results strongly suggest that demand characteristics are in all likelihood not a significant factor in the results of false feedback studies.

1.2.3. Dissociation of memories and beliefs in their attitudinal consequences.

As alluded to in earlier sections, a critical feature of much false memory research is the distinction between false memories and false beliefs. The origin of this distinction in the literature can be traced back to the theoretical conception of autobiographical memory (Tulving, 1985). Tulving (1972, as cited in Tulving, 1985) had previously distinguished between episodic and semantic memory; episodic memory was categorised as memory for personal experiences rooted in time and place (with specific reference to people, objects, events, etc), while semantic memory referred to knowledge and memory for facts about the external world. Under original definitions, autobiographical memory (memory for personal events) could be considered a subsystem of episodic memory, although it soon became apparent that there are various scenarios under which the episodic/semantic distinction becomes blurred in reference to self-referent memories. For instance, in remembering a holiday to a specific country, one is both recalling a personal event specific to time and place (falling under the original definition of episodic memory), as well as knowledge of the external world such as geographical locations, the concept of a "holiday" etc (which would fall under the original definition of semantic memory). Tulving (1985) revised the concept of episodic memory, highlighting 'autonoetic consciousness' (a detailed recollective experience containing associated sensory re-experiencing and a sense of 'mental time travel') as the definitive feature, with autobiographical memory consisting of complex interplay between episodic and semantic features. This reclassification of episodic and semantic memory paved the way for the "remember-know" paradigm's introduction into the experimental study of memory, which allows participants to categorise whether they had a distinct recollection of a stimulus or event, or whether their judgment is

based on a knowledge of the stimulus or event without the accompanying recollective experience.

This distinction between having a belief that an event occurred in one's personal history and having an episodic memory of the event has been important in much modern research into false autobiographical memories. As mentioned earlier, early experiments by Loftus and colleagues classified participant reports into "full" or "partial" memories depending on levels of detail and extent to which they could be classified as recollective experience (e.g. Loftus & Pickrell, 1995), but more recent false autobiographical memory studies have more clearly delineated between memories and beliefs in occurrence (Hart & Schooler, 2006; Pezdek et al., 2006). Recent evidence has suggested that memory and belief may be more even more strongly dissociated than previously thought. For instance, Scoboria et al. (2014) measured the phenomenological characteristics of participants' self-reported memories and beliefs and found a double dissociation in the extent to which these variables predicted memory for an event or merely belief in its occurrence; whilst perceptual and emotional factors predicted memory but not belief, event plausibility strongly predicted belief in an event and only weakly predicted recollection. There is also a growing literature on the phenomenon of 'non-believed memories', where memory for an event persists even when the individual no longer believes the event actually occurred (Mazzoni, Scoboria, & Harvey, 2010; Otgaar, Scoboria, & Mazzoni, 2014). Therefore a clear distinction between whether an event is actually remembered or whether it is merely believed to have occurred is essential in modern memory research; memory cannot necessarily be inferred from belief, and vice versa. With regards to studies which have investigated the attitudinal consequences of false autobiographical memories and beliefs, despite having participants make the distinction in their self-reports as to whether they have a specific

memory or just a belief that the critical event occurred, the experimenters typically group the two together in analyses; either using the term “false memory” to refer to both false memories and false beliefs, or grouping those with a false memory and a false belief together under the umbrella term of “believers” (Bernstein et al., 2005b; Clifasefi et al., 2013; Laney, Morris, et al., 2008). This limitation, presumably enforced by insufficient numbers of false memories and beliefs to separate the two in statistical analyses, is addressed in a recent mega-analysis of “false food memory” studies (Bernstein, Scoboria, & Arnold, 2015), who were able to combine data from several false-feedback studies to assess the consequences of false memories and beliefs separately. They found that while participants who reported a false memory tended to increase their confidence in the false suggestion event to a greater degree than those who subsequently formed a false belief without recollection, changes in attitudinal and behavioural intention (i.e. hypothetical likelihood of consuming the critical food item) variables were virtually indistinguishable between the two groups. The finding that memories and beliefs are indistinguishable in their attitudinal consequences supports the idea put forward by Bernstein et al. that *belief* in the occurrence of the false suggestion event is the critical factor in influencing attitudes and behaviours, and ultimately it makes little difference whether this belief is accompanied by recollective experience or not. This notion is of central importance to the hypotheses of Experiments 2, 3 and 4 reported in this thesis.

1.2.4. Why is further research important?

It is understandable that the question may be raised as to why it is important to continue to study the attitudinal consequences of false memories and beliefs. As previously mentioned, one of the reasons this line of research was initiated was to

determine whether false memories could be distinguished from true memories via their effects on cognition and behaviour (Laney & Loftus, 2013). The available research to date has suggested false memories have similar consequences to those that may be expected from true memories, and so any possibility there may have been of using attitudinal/behavioural after-effects of memories to verify their veracity seems to be gone. However, there are still theoretical and practical reasons why adding to this line of research may be beneficial. As pointed out by Leding (2012) and Nash, Wheeler, and Hope (2015), despite sharing a variety of underlying theoretical similarities, the false memory literature and the persuasion/attitude change literature have to date remained almost entirely dissociated. Despite early memory distortion research employing what could be considered as a social psychological viewpoint (e.g. Barlett, 1932), over time it has become more entrenched within a cognitive psychological framework (Roediger, 2010), whilst attitudes and attitude change have settled firmly within the separate domain of social psychology. Even the studies discussed earlier which investigated the attitudinal consequences of false memories and beliefs did not discuss any of their findings in the context of social psychological models of attitudes, instead discussing the effects in terms of their meaning for the broader consequences of false memories and beliefs and their potential application (see below). A continuation of research into the attitudinal consequences of false memories and beliefs would benefit from a more integrative approach which considers these effects within the context of models of social cognition; this would be likely to provide a greater insight into how and why false memories and beliefs result in attitude change, and underlying factors which may moderate these effects. Considering the social psychological literature when interpreting the consequences of false memories and beliefs can also provide insight into different aspects of attitudes that cannot be assessed through the simplistic, explicit attitude

measures employed by past studies (for instance, the concept of implicit attitudes, discussed in Section 2.1.2). This is an issue the research in this thesis has tried to address. Certain theoretical frameworks within which the attitudinal effects of false memories and beliefs could potentially be interpreted are discussed in Chapter 2.

From a practical perspective, the possibility of applying the findings of this line of research with the aim of eliciting heathier attitudes and behaviours via false memories and beliefs has been raised in various papers (Bernstein et al., 2005b; Bernstein, Pernat, & Loftus, 2011; Clifasefi et al., 2013; Geraerts et al., 2008). Obviously with deception being critical to the elicitation of false memories and beliefs, any practical application of this research raises significant ethical issues. A recent study by Nash, Berkowitz, and Roche (2016) investigated public perceptions of this potential application by measuring the attitudes of 922 UK/US residents to a fictitious 'False Memory Therapy'. Participants were instructed to imagine that they were morbidly obese, that they had undergone therapy in which they had discussed food-related childhood memories with a therapist. This hypothetical therapy had started to result in healthier eating behaviours, but they were then informed that the discussed memories had been intentionally-planted false memories elicited with the aim of modifying their behaviour. Nash et al. found participant reaction to this hypothetical False Memory Therapy was highly polarised, with the most common responses being at the extreme end of either strong objection or enthusiastic support. It is this author's personal view that intentionally eliciting false memories via deception with the aim of behavioural modification will always be too ethically problematic to be justified as a fully-implemented therapeutic technique, regardless of the technique's efficacy. However, the fact that this possibility is being raised in the literature means that the question of whether the ends would justify the means needs to be carefully considered. To this end,

further investigation of the attitudinal and behavioural effects is needed to fill certain gaps in the literature (explored further in *Chapter 3: Research Focus*), adding to the evidence as to whether the attitudinal and behavioural effects of false memories and beliefs are significant and robust enough to potentially justify their ethically-controversial application.

Chapter 2: Implicit attitudes, explicit attitudes and associated theoretical frameworks

Experiments 2, 3 and 4 of this thesis extend the false feedback paradigm from the domain of explicit attitudinal measures to implicit attitudinal measures. Section 2.1 contains a brief summary of how attitudes are defined, the development of implicit attitude measures and arguments concerning their validity and dissociability from explicit attitude measures. Section 2.2 considers some of the theoretical frameworks within which implicit and explicit attitude change resulting from false memories and beliefs could be considered. Because there is a vast literature in this area, the summaries contained in this chapter will not be comprehensive, but will focus primarily on the aspects of social cognition models most relevant to the findings in this thesis.

2.1. The conceptual development of implicit attitudes and associated measures

2.1.1. A basic definition of attitudes.

Social psychological research has defined attitudes in a wide variety of ways; for example, Eagly and Chaiken (1993, p. 1) define an attitude as “a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour”, whilst Fazio (1995, p. 247) defines attitudes as “associations in memory between an attitude object and one’s evaluation of the object”. Despite differences in definition and conceptualisation of attitudes, Maio and Haddock (2010, p. 4) point out that all definitions emphasise the aspect of an evaluative judgment of an attitude object along a positive/negative dimension, and thus provide the umbrella definition of an attitude as “an overall evaluation of an object that is based on cognitive, affective, and

behavioural information" (a more in-depth discussion of the conceptualisation of attitudes will be provided in Section 2.2).

2.1.2. The development of an implicit measure of attitudes.

Early attitude research was dominated by explicit, self-reported measures of attitudes such as the Likert scale (Likert, 1932), and the extent to which these explicit attitude measures could predict behaviour (LaPiere, 1934). The cognitive revolution in psychological research in the 1960s and 70s was key in bringing about models of social cognition which considered attitudes from an information processing perspective, paving the way for models such as the Elaboration Likelihood Model (Petty & Cacioppo, 1986) and the MODE (motivation and opportunity as determinants of the attitude/behaviour relation) model (Fazio, 1990) which considered the cognitive processes involved in attitude formation and change. However, attitude research was still largely dependent on self-report measures, which have long been considered to have limited validity under certain circumstances. In one early example, LaPiere (1934) documented his experience of travelling across American with Chinese companions at a time of widespread anti-Asian prejudice. Contrary to their expectations, after visiting over 250 different establishments, only once were they denied service. However, when LaPiere later wrote to each of the establishments they visited asking if they would serve Chinese customers, only one replied in the affirmative. Despite numerous methodological issues with this paper, it is a seminal piece on the potential disparity between attitudes and behaviours, which has since been reviewed in much greater detail (Wicker, 1969). Since explicit, self-report measures of attitudes are obviously prone to individuals giving inaccurate representations of their attitudes under various circumstances (for instance, when the topic of the attitude is a socially-sensitive issue, or when demand characteristics are a factor), there was a subsequent desire to create an

‘implicit’ measure of attitudes which was not subject to these problems (Maio & Haddock, 2010). It is generally agreed that it is this methodological demand that resulted in the first measures of implicit attitudes, rather than any theoretical rationale as to what implicit attitudes were or how they were (or were not) different to explicit attitudes.

It has been argued that the methodology behind how implicit attitudes were first measured took inspiration from the associationist theories of memory which arose during the cognitive revolution (Glaser & Finn, 2013); namely, the idea that upon the activation of one mental construct, associated mental constructs are automatically activated outside of conscious awareness, as evidenced by studies in which word/non-word judgments were found to be facilitated if presentation of the target word was preceded by a semantically associated prime (Meyer & Schvaneveldt, 1971; Neely, 1977). Fazio, Sanbonmatsu, Powell, and Kardes (1986) were amongst the first to apply a similar paradigm to the domain of attitudes, following the logic that just as presentation of a word automatically activates cognitive representations of related words, presentation of an attitude object should automatically activate associated evaluations of that object. Fazio et al. designed a task in which participants were tasked with making evaluations of whether a presented target word was “good” or “bad”, with each target word being preceded by either a congruently or incongruently valenced prime word. Results indicated that participants were faster to categorise target words when their valence was congruent with the prime; thus an implicit measure of the individual’s attitude towards the item could be inferred from the degree of this facilitation effect. This technique became known as “affective priming”, and the results of Fazio et al. have been observed in various other studies, with the effect even proving robust when the primes are presented subliminally (Greenwald, Draine, & Abrams,

1996; Greenwald, Klinger, & Liu, 1989). This supports the idea that the facilitation was caused by automatic activation of associated concepts.

Various other measures of implicit attitudes have been devised, predominantly working on a similar associationist logic to the priming procedure developed by Fazio and colleagues, and similarly employing a form of response-latency paradigm (see Bar-Anan & Nosek, 2014 for a psychometric review of the seven most commonly used methods). The most commonly used is the Implicit Associated Test (IAT, Greenwald, McGhee, & Schwartz, 1998), and it is this procedure (or a variant of this procedure) which is used as the implicit attitude measure in the experiments presented in this thesis. The typical procedure for this measure asks participants to assign stimuli into two opposing attitude object categories (e.g. Democrats vs Republicans), then categorise other stimuli into an attribute dimension (e.g. positive words vs negative words). In the critical blocks of the task, one of the attitude objects shares a response key with one of the attributes (e.g. Liberals and positive words) whilst the other attitude object and attribute are paired together on another response key (Conservatives and negative words). The participants' task is to categorise the presented stimuli from the four categories into one of these combined categories as quickly and accurately as possible. Implicit attitudes towards an attitude object are essentially inferred from which response mapping participants found easier; for instance, if participants are faster to categorise stimuli when Liberals share a response key with positive stimuli and Conservatives share a response key with negative stimuli, they can be said to have a more positive implicit attitude towards Democrats.

2.1.3. Validity of implicit attitude measures.

Despite initially being methodologically rather than theoretically driven, there has since been debate over the validity and underlying assumptions of implicit attitude

measures. There has been some debate as to whether implicit attitude measures based on associationist logic (such as the affective priming procedure and IAT), being free from the effects of social desirability, represent a more "true" measure of an individual's attitudes than explicit measures (Fazio, Jackson, Dunton, & Williams, 1995). This assertion is primarily based on implicit attitude data which show that implicit and explicit attitude measures tend to correlate on socially uncontroversial topics such as 'maths versus art' or political party preference (Nosek, Banaji, & Greenwald, 2002), but tend to have significantly reduced correlations when involving socially-sensitive topics (e.g. race/prejudice) when they may not wish to reveal controversial opinions (Fazio et al., 1995; Greenwald et al., 1998; Rudman & Kilianski, 2000). However, there are numerous reasons why this view of implicit attitudes as a more "true" measure of attitudes may not be valid. For one, there is evidence that implicit measures may not be entirely immune from the influence of external factors. For instance, Boysen, Vogel, and Madon (2006) measured participants implicit attitudes towards homosexual men using an IAT, finding that participants registered more favourable scores when they were led to believe that the experimenter would be examining their responses than when they were led to believe that their scores would remain private. Whilst it is evidently the case that implicit measures such as the IAT are considerably less prone to the effects of social desirability/demand characteristics than explicit self-report measures, if (as this evidence suggests) implicit measures can be influenced by external factors to a certain extent, then it suggests that they are not necessarily a more "true" assessment of attitudes than explicit measures.

Even if implicit measures were entirely immune from the effects of social desirability/demand characteristics, this is not necessarily evidence that implicit measures reflect a more "true" measure of attitudes, but also fits into the explanation

that implicit measures simply assess different aspects of attitudes which would be impossible to measure via explicit methods (Greenwald & Banaji, 1995). As Fazio and Olson (2003) point out, the debate over whether implicit attitudes represent "real" attitudes has considerable ambiguity, and instead the focus of the debate should be centred on the extent to which these measures predict behaviour. There are numerous examples of studies demonstrating the predictive validity of implicit attitude measures. For instance, Fazio et al. (1995) used an affective priming procedure to assess racial attitudes in a white sample and rated the participants 'friendliness' (as assessed according to factors such as smiling, eye contact, spatial distance) during an interaction with a black confederate. Negative implicit attitudes towards black people predicted less friendly behaviour during the interaction. Dovidio, Kawakami, Johnson, Johnson, and Howard (1997) also used an affective priming procedure to measure racial attitudes, in addition to observing non-verbal behaviours of participants whilst they interacted with black or white interviewers. Similarly to Fazio et al. (1995), negativity towards black people in the priming measure was found to positively correlate with frequency of participants blinking their eyes and negatively correlate with time spent making eye contact made with the interviewer. Bessenoff and Sherman (2000) found that implicit attitudes towards fat/thin women as measured by priming procedure predicted how far participants later sat from a fat woman in a waiting area. Collectively, this evidence supports the predictive validity of implicit attitudes (as measured by affective priming techniques) for behaviours linked to attitudes which may be considered socially sensitive or controversial.

Being the more commonly used measure, there is a wider body of evidence concerning the predictive validity of the IAT. Numerous studies have found the IAT to be predictive of certain behaviours, including for behaviours linked to less socially

sensitive attitudes than those in the previously considered affective priming studies. For example, Maison, Greenwald, and Bruin (2001) found that IAT scores measuring participants' relative preference for sodas versus juices corresponded with self-reported frequency of consuming these drinks. Similarly, Wiers, Van Woerden, Sumlders, and De Jong (2002) measured implicit attitudes towards alcohol through both a standard valence IAT (positive versus negative), and an arousal IAT which assessed automatic associations between alcohol-related stimuli and either arousal-related words (e.g. "lively", "energetic") or sedation-related words (e.g. "relaxed", "sleepy"). In regression analyses assessing the extent to which these implicit measures and several explicit measures predicted drinking behaviour, it was found that although explicit attitudes strongly predicted drinking behaviour, implicit attitudes uniquely contributed to the predictive value of the regression model. However, there have also been studies which have failed to find any relationship between IAT scores and related behaviour. For example, Karpinski & Hilton (2001) measured implicit attitudes towards chocolate bars versus apples before giving participants a choice of these items to take away with them at the end of the study. No association was found between implicit attitude measures and food choice. Given the mixed results in the literature, Greenwald, Poehlman, Uhlmann, and Banaji (2009) performed a meta-analysis of predictive validity, taking into consideration 122 research reports with a total of 14,900 participants. An overall effect size of $r = .274$ was found for the IAT's predictive validity of behavioural, judgment and physiological measures, which may be considered a moderate effect size by convention (Cohen, 1988). Critically, IAT and explicit measures were both found to predict unique variance in outcome measures (thus displaying incremental validity), and it was also found that the more highly IAT and explicit attitude measures correlated with each other, the greater the predictive validity of each. Overall, there is strong

evidence that implicit measures such as affective priming and the IAT measure attitudinal processes which are dissociable from those gauged by explicit, self-report measures, and that both implicit and explicit measures are important in predicting behaviour.

2.2. Theoretical frameworks of implicit and explicit attitudes and attitude change.

The discussion of explicit and implicit attitudes and their associated measures presented thus far has been predominantly methodological. As previously mentioned, this somewhat reflects the atheoretical nature of the early research which dissociated the two. However, since this early research, a number of theoretical frameworks have emerged which accommodate implicit and explicit attitudes, as well as the processes which can result in attitude change (a concept central to the research presented in this thesis). The main theoretical framework within which the results presented in this thesis are interpreted is the Associative-Propositional Evaluation model (APE, Gawronski & Bodenhausen, 2006). The decision to predominantly interpret results within this framework was arrived at for numerous reasons, including methodological consistency with past studies which have found implicit attitude change as a result of brief, explicit interventions (Markland, Hall, Duncan, & Simatovic, 2015), the APE's fine-grained account of the differential processes involved in implicit and explicit attitude change, and subsequent strong rationale for how false memories and beliefs may impact both implicit and explicit attitudes. A discussion of theoretical frameworks of social cognition and the advantages of the APE to the research at hand is presented below.

2.2.1. Stable-entity versus constructionist models of attitudes.

Obviously, a crucial element of any theoretical framework of attitudes and attitude change is the model's conceptualisation of what an attitude is. Section 2.1.1 presented a basic umbrella definition of attitudes, the fundamentals of which would be agreed on by the vast majority of researchers. However, a more elaborative conceptualisation of attitudes reveals considerable variation between models. Bohner and Dickel (2011) argue that there is a split between theoretical accounts which characterise attitudes as stable entities which are stored in memory, and theoretical accounts which characterise attitudes as judgments constructed in the moment based on available information. Models which argue the stable-entity viewpoint include the MODE model (Fazio, 1990; 2007) and Petty, Briñol, and DeMarree's (2007) meta-cognitive model (MCM), both of which argue that attitudes represent associative links in memory between an object and an evaluation. Conversely, accounts such as those offered by Schwarz (2007) and Gawronski and Bodenhausen's (2006) APE model have argued that attitudes are simply evaluative judgments which are constructed in the situation using currently available information; stored evaluations associated with an attitude object might be part of this information, but under the constructionist account, other relevant information available when making an attitude judgment can be equally as important (rather than the object/evaluation association being considered definitive of the attitude itself).

As pointed out by Shwarz (2007), any theoretical framework of attitudes must be able to account for the abundance of evidence regarding the context-sensitivity of attitude judgments, as well as evidence which demonstrates attitudes remaining stable under varying situations. The constructionist viewpoint clearly explains the former (relevant contextual information will be incorporated into the construction of an attitude

judgment) with the greater challenge coming in explaining the latter, whilst the stable-entity viewpoint clearly explains the latter (attitude-object associations remain constant over differing scenarios) whilst struggling to explain the former. One way that stable-entity accounts aim to explain context effects is through the concept of "attitude strength", which Maio and Haddock (2010, p. 42) describe as being defined by an attitude's persistence, resistance to change, and propensity to influence information processing and behaviour. The logic is that stronger attitudes can be considered more stable across contexts, whereas weaker attitudes can be considered less stable and more susceptible to contextual factors (Bassili, 2008; Petty & Krosnick, 1995). Another explanation presented by Petty et al. (2007) is that an attitude object may have multiple associated stored evaluations, which themselves could be associated with a validity tag which determines whether the attitude is consciously endorsed. On the other hand, a constructionist explanation for the stability of attitudes across varying contexts is that if information used to construct a judgment has been previously used multiple times, this renders the information more accessible, and the more accessible the information used to construct an attitude is, the more stable this attitude will be across contexts (Schwarz & Bohner, 2001). Whilst both stable-entity and constructionist accounts have theoretical explanations for context effects on attitudes (or lack thereof), a constructionist approach seems to offer considerable explanatory range whilst offering parsimony and assumptions which fit well with the account's internal logic.

In relation to research on the attitudinal consequences of false memories and beliefs, the available evidence suggests that the consequences of false memories and beliefs (as well as the false memories and beliefs themselves) can be potentially long-lasting, although the attitudinal effects are not as strong after a prolonged period of time as they are immediately post-feedback, with attitudinal measures reverting slightly

towards baseline (pre-suggestion) measures (Geraerts et al., 2008; Laney, Fowler, et al., 2008). From this perspective, a constructionist account appears to fit the data better than a stable entity account; in the experimental sessions in which the false feedback is provided, the information relevant to the suggestion (and any false memory or belief that may be formed during the session) increases in accessibility, and contributes towards attitude judgments made during the session. In the cited studies which have provided longitudinal data on the attitudinal consequences of false memories and beliefs, when participants returned for their final session after three weeks (Laney, Fowler, et al.) or four months (Geraerts et al.) post-suggestion, participants were not provided with false feedback or encouraged to deliberatively process information relevant to the false feedback (as they had been in the previous session), although they were presented with some information which may have put participants in mind of the false feedback or false memory/belief prior to making attitudinal judgments (such as a repetition of the questionnaire which contains an item gauging participants confidence that the false suggestion occurred to them). Thus in the final follow-up sessions, information which facilitated the construction of suggestion-congruent attitude judgments for the critical item was accessible, but not to the extent of the experimental session in which false feedback was originally administered. This may explain why attitude judgments were suggestion-congruent relative to the pre-feedback baseline, but to a lesser extent than immediately post-feedback. This constructionist account seems a compelling and parsimonious explanation for the persistent but reduced attitudinal effects of false memories and beliefs over time.

However, an attitude strength explanation of these effects which may be offered from a stable-entity viewpoint would also explain these attitudinal effects of false memories and beliefs. Both Geraerts et al. and Laney, Fowler et al. found that mean pre-

suggestion preference measures for their critical items were approximately at the mid-point of the scale (exact means were not reported, but figures in both studies showing mean preference ratings across experimental sessions shows pre-suggestion preference averaging at approximately 4 out of 8). This is indicative that attitudes towards the critical item were largely ambivalent pre-suggestion, and could therefore be considered "weak" attitudes which are susceptible to the contextual influence of false memories and beliefs.

Ultimately, both constructionist and stable-entity frameworks have their advantages and disadvantages. While both accounts have potential explanations that fit well with the existing data regarding the attitudinal consequences of false memories and beliefs, a constructionist conceptualisation of attitudes has considerable explanatory range whilst also being somewhat more parsimonious in its assumptions than the stable-entity viewpoints. However, it is in its account for the distinction between implicit and explicit attitudes and attitude change (considered in the following section) that the constructionist account of the APE has its greatest advantages.

2.2.2. Theoretical approaches to implicit and explicit attitude change.

As well as having great relevance to explicit attitudes, the stable-entity versus constructionist debate also has implications for the conceptualisation of implicit attitudes. As pointed out by Bohner and Dickel (2011), if one assumes a strictly stable-entity viewpoint (that attitudes represent stored object-evaluation associations), this feeds into the view that implicit attitude measures (presumed to represent automatic object-evaluation associations) are the optimal means of measuring an individual's "true" attitudes. If one assumes a constructionist viewpoint such as that of the APE,

then implicit attitudes are viewed simply as another process/source of information in the construction of an attitude judgment. As previously discussed, there has been some past debate as to whether implicit attitudes represent "true" attitudes; the argument was put forward that this debate is largely ambiguous and that the general conclusion should be that implicit and explicit attitudes represent at least partially dissociable processes. A constructionist account of attitudes such as the APE is more fitting with this conceptualisation of implicit attitudes.

Perhaps the most relevant benefit of the APE to the research presented in this thesis is in its approach to implicit and explicit attitude *change*. Similarly to the measurements themselves (as discussed earlier), correlations between implicit and explicit attitude change are inconsistent. Some researchers have incorporated results which demonstrate correlations between implicit and explicit attitude change into classical models of attitude change such as the elaboration likelihood model (ELM, Petty & Cacioppo, 1986); for instance, a study which found that carefully considered, strong arguments for a policy to integrate black professors into a university resulted in implicit and explicit attitude change (Briñol, Petty, & McCaslin, 2009, as cited in Bohner & Dickel, 2011), fitting with the ELM's assumption that argument quality and level of processing are critical factors in general attitude change. However, numerous studies have provided evidence that implicit and explicit attitude change are often dissociated; some have found explicit but not implicit attitude change (e.g., Gawronski & Strack, 2004), while others have found implicit but not explicit attitude change (e.g. Olson & Fazio, 2006).

Whilst classical theories of attitude change such as the ELM have incorporated selective findings from studies of implicit attitudes into their models, they are largely accounting for these results via predominantly unitary theories of attitudes, and as such

fail to offer theoretical explanations for why implicit and explicit change are often dissociated. This is the primary reason Gawronski and Bodenhausen (2006) give for developing the APE model. The APE model argues that attitudes are underpinned by two distinct types of processes; associative processes and propositional processes. Associative processes can be considered the underlying basis of implicit attitudes; they are activated automatically on presentation of an attitude object, and are considered to be determined by the interaction between pre-existing associations stored in memory and the particular input of the presented stimulus. As such, associative processes can be affected by context, with different automatic associations resulting from different contextual factors. A critical aspect of associative processes is that they are not subject to "truth" values; associative evaluations are activated outside of conscious control, and are independent of what the individual consciously considers to be their "true" attitude.

Propositional processes, on the other hand, can be considered the basis of explicit attitudes. These processes involve contributing to attitude judgments via syllogistic inferences from any propositional information which is considered relevant. As well as integrating explicit information relevant to a given attitude judgment, propositional processes are also said to interact with associative processes. Citing Strack and Deutsch (2004), Gawronski and Bodenhausen propose that these syllogistic inferences are formed via a reflective system which is superordinate to an associative store; the reflective system is responsible for transforming associative inputs into propositions (for instance, if positive associative activations result from the presentation of attitude object X, the reflective system may transform this information to the proposition "I like X"). Critically, these propositions can subsequently be checked for validity via further syllogistic inferences, explaining why automatically activated implicit attitudes are not always endorsed by the individual. It is also proposed that

associative and propositional processes can interact in the other direction. Consistent with research which has demonstrated the malleability of implicit attitudes via high-level, explicit cognitive processing such as mental imagery (Blair, Ma, & Lenton, 2001) and concrete learning/abstract supposition (Gregg, Seibt, & Banaji, 2006), Gawronski and Bodenhausen claim that “merely entertaining a particular proposition increases the momentary activation level of corresponding associations in memory” (p. 694), thereby allowing for a potential influence of propositional reasoning on associative activations. Therefore, the APE provides a fine-grained account of attitude change, which accounts for both the dissociability, yet interconnectivity of implicit and explicit attitudinal processes. This makes the APE framework ideal for comparing the implicit and explicit consequences of false memories and beliefs.

With regards to the theoretical predictions concerning the implicit and explicit attitudinal consequences of false memories and beliefs, the APE model provides a basis for predicting that false memories and false beliefs may both result in highly comparable explicit attitudinal effects; a prediction which is supported by recent research (Bernstein et al., 2015). However, the APE provides a logic that certain phenomenological factors of false memories may mean that they are able to elicit implicit attitude change whilst false beliefs without accompanying recollective experience may not. The theoretical rationale behind these predictions is fully explored in Section 5.1.1.

Chapter 3: Research Focus

The research presented in this thesis aims to replicate the explicit attitudinal and behavioural effects of false memories and beliefs observed by previous studies (outlined in Section 1.2), before expanding the paradigm in order to determine whether false memories and beliefs can affect implicit attitudes as well as explicit (as well as determining whether effects are generalisable to other attitudinal domains besides food and drink). The thesis also aims to examine the influence of certain individual difference factors and phenomenological characteristics of false memories on observed attitudinal effects. Additionally, the research makes numerous methodological changes to the false-feedback procedure (predominantly in Chapter 5) in order to improve the efficiency of the design (in terms of usable participant data, as well as the number of false memories and beliefs elicited).

The following sections of this chapter give an overview of how each experiment attempts to address these overarching aims.

3.1. Experiment 1.

The first experiment focuses on replication of the findings that positive false memories and beliefs affect explicit attitudes towards the relevant attitude object. The methods for this study were almost identical to those employed by Laney, Morris, et al. (2008), with several minor procedural modifications. It was decided that initial replication of the attitudinal effects was important for several reasons. Predominantly, these reasons concern certain limitations within the existing literature. Firstly, there has

been a tendency for studies to use false suggestions of negative childhood events (e.g., being sick from consuming a certain food) and measure subsequent decreases in preference for their relevant items, whilst relatively few studies have used positive suggestions and observed subsequent increases in preference for the relevant item. In addition to this, all studies which have used positive false suggestions have used the exact same suggestion/critical item, thus limiting their generalisability. Also, studies utilising positive suggestions have largely failed to demonstrate genuine behavioural consequences of false memories and beliefs, focusing instead on measures of hypothetical behaviour. In addition to aiming to address these limitations, replicating previous results using near-identical methods was considered necessary; if various aspects of experimental procedure had been altered (as they were in subsequent experiments) from the start, it would have been difficult to interpret any failure to replicate the main effects. Therefore the first experiment can be considered a replication of Laney, Morris, et al. (2008), with a modified critical false suggestion item and a measure of suggestion-relevant behaviour.

3.2. Experiment 2.

One of the limitations of the existing literature on the attitudinal consequences of false memories and beliefs is that all current studies have elicited false memories about (and measured attitudes towards) certain foods and drinks. While providing methodological consistency between studies, this restriction limits the generalisability of the results. The second experiment presented in the thesis aims to use the false feedback procedure utilised in the first experiment in order to determine whether the explicit attitudinal effects observed by past studies extend to other domains of attitude

besides food (in this case, the experiment assesses attitudes within the domain of exercise).

But perhaps the greatest limitation of the existing literature is that it has only considered the effects of false memories and beliefs on explicit attitudes, without considering whether there are also implicit attitudinal effects. As discussed, implicit attitudes represent dissociable processes from explicit attitudes and accounting for both implicit and explicit attitudes tends to result in maximal predictive validity. Because of this, it was considered important to extend the false feedback paradigm to take into account any implicit attitudinal effects of false memories and beliefs. Therefore, in addition to the adapted explicit attitude measures which were included in Experiment 1, Experiment 2 also included a post-feedback IAT which aimed to assess whether false memories and beliefs affected participants' implicit attitudes towards certain exercises.

3.3. Experiments 3 and 4.

Experiment 3 aimed to address certain issues with the measurement of implicit attitudes encountered in Experiment 2, as well as making a variety of minor procedural adjustments with the aim of improving the efficiency of the design by minimising the amount of excluded data and maximising the number of false memories and beliefs elicited. For several reasons, it became clear retrospectively that the IAT used in Experiment 2 was not the optimal measurement of implicit attitudes for the false feedback paradigm, and a 'Single-Target' IAT (ST-IAT, Bluemke & Friese, 2008) was utilised instead, allowing for distinct implicit measurements for individual attitude objects. The procedural modifications made in this experiment also meant that, unlike the first two experiments, Experiment 3 generated sufficient numbers of false memories

and false beliefs to statistically analyse the attitudinal effects of each separately (as opposed to grouping memories and beliefs together in analyses). Experiment 3 also introduced questionnaires measuring various individual difference variables and phenomenological characteristics of reported false memories (see Sections 3.5 and 3.6 for more details). These measures were relevant to analyses conducted in Chapter 6.

The aim of Experiment 4 was primarily to replicate the implicit attitudinal effects found in Experiment 3, assessing whether they were consistent across attitude domains (Experiment 3 had returned to the attitudinal domain of food as in Experiment 1, whilst Experiment 4 returned to the attitudinal domain of exercise as in Experiment 2). Experiment 4 also addressed a key limitation of Experiment 3 by including a pre-suggestion, baseline measurement of implicit attitudes towards the relevant attitude objects, thus more directly assessing whether implicit attitudes were actually *changed*. Experiment 4 also contained the same measures of individual differences and phenomenological characteristics of false memories as Experiment 3.

3.4. The influence of phenomenological factors and individual difference measures in attitude change resulting from false memories and beliefs

Chapter 6 includes two sections which take a quasi-experimental approach, analysing data collected over Experiments 3 and 4 concerning individual differences and phenomenological characteristics of false memories, and how these factors impact upon explicit and implicit attitude change resulting from false memories and beliefs. Experiment 5 assesses whether phenomenological variables of false memories such as the level of vividness, coherence, accessibility, and sensory detail have any relationship with the degree of attitude change resulting from the memory. The phenomenological

characteristics of visual perspective (i.e., whether the individual views the memory from a personal perspective or experiences the event as an "observer"), distancing (how similar/dissimilar the individual considers themselves to currently be from themselves in the memory), and valence are also considered. Section 6.2 analyses the relationship between the individual difference variables of Need for Cognition, Need to Evaluate, and mental imagery ability with false memory/belief formation and subsequent explicit and implicit attitude change. The potential role of certain interactions between individual difference measures and phenomenological characteristics of false memories in subsequent attitude change is also considered.

Chapter 4: Replication and extension of the false feedback paradigm for measuring the attitudinal consequences of false memories and beliefs

4.1 Experiment 1

4.1.1. Introduction

As was outlined in the previous chapters, the existing literature examining the attitudinal consequences of false memories and beliefs has produced largely consistent findings. Bernstein et al. (2005b) utilised the false feedback paradigm to suggest to participants that they had been sick after eating pickles or hard-boiled eggs, and found significantly decreased (relative to pre-suggestion measures) desire to consume and general preference for those foods in participants who went on to form false memories or beliefs of the event. Clifasefi et al. (2013) were able to replicate this effect using a highly similar suggestion and procedure, but changing the item in the false suggestion (and subsequent measures of preference) to different alcoholic drinks instead of eggs or pickles. Scoboria et al. (2008) and Geraerts et al. (2008) suggested to participants that they had been sick as a child after eating peach yoghurt and egg salad respectively, with both studies finding the expected attitudinal effects of false memories and beliefs, as well as finding behavioural consequences. Scoboria et al. invited participants to an ostensibly unrelated "taste-test" study one week after they had received their false feedback, giving participants the opportunity to eat various types of food including the critical item of peach yoghurt. They found that those who had formed a false memory or belief of being sick from eating peach yoghurt consumed significantly less of it than controls or non-believers. Geraerts et al. found similar behavioural effects; they measured how many egg salad sandwiches participants consumed when offered them (amongst other items) immediately after their second experimental session (in which

they had received the false suggestion), and four months later in an ostensibly unrelated taste-test study similar to that used by Scoboria et al. At both time points, participants who had formed a false memory or belief of the false suggestion event consumed significantly less egg salad sandwiches than non-believers or controls.

In addition to these studies which demonstrate aversive attitudinal consequences of negative false memories, there is some evidence that positive false memories can result in positive attitudinal effects. Using the same false feedback paradigm as the previously mentioned studies, Laney, Morris, et al. (2008) gave participants in their experimental group the false suggestion that they had loved asparagus the first time they tried it. Participants who went on to form a false memory or belief of this event expressed higher preference ratings for asparagus, as well as higher desire to (hypothetically) eat asparagus in a restaurant setting. Laney, Kaasa, et al. (2008) replicated this study with the addition of an extra layer of deception (the 'red herring' technique) and participant interviews which effectively demonstrated that the results were not due to demand characteristics (see Section 1.2.2 for a more detailed description of this procedure). Laney, Fowler, et al. (2008) again replicated this effect using a virtually identical procedure with the addition of a third experimental session two weeks post-suggestion, finding that the attitudinal effects of positive false memories and beliefs persisted, although to a slightly lesser extent (attitude ratings remained significantly higher than baseline ratings, although less so than they had been immediately post-suggestion).

The current literature presents a very consistent body of evidence regarding the attitudinal consequences of false memories and beliefs. However, there are limitations to the existing literature that justify a replication. Firstly, while a range of studies demonstrate the aversive attitudinal effects of negative false memories and beliefs using

a variety of attitude objects/critical items, there are fewer studies which measure the attitudinal consequences of positive false memories; only the three experiments mentioned in the preceding paragraph by Laney and colleagues do this, and in each study, the exact same false suggestion is used ("You loved asparagus the first time you tried it"), which is potentially damaging for the generalisability of these results. In a review of their false-feedback studies by Bernstein et al. (2011), the authors report on the results of several studies in which they attempted to see if false memories of being sick from eating certain items such as crisps or cookies could result in aversive attitude change. These data were never published because the studies had difficulty in eliciting a sufficient number of false memories, and even when false memories were elicited, they reportedly had no impact on preferences for these items. The notion that false memories and beliefs regarding some items are easier to elicit than false memories and beliefs regarding other items, as well as the potential for variation in attitudinal consequences between items, highlights that it is important for research in this area to use a wide variety of critical items in their experimental designs. That the only studies to date investigating the attitudinal consequences of positive false memories and beliefs use the same critical item is a limitation in this regard.

In addition to this, the relative lack of studies using positive false suggestions is potentially problematic because of evidence which suggests a differential effect for positive and negative *true* autobiographical memories on reported attitudes and behaviours. Biondolillo and Pillemer (2015) investigated the effect of a memory-based intervention designed to increase levels of exercise. In their first session, participants recalled either a positive or a negative autobiographical memory which they felt could motivate them to do more exercise. A week later, participants returned for a second session and reported their levels of exercise over the past week. Participants who

recalled a positive memory in the first session reported significantly higher levels of exercise than controls (who did not recall a memory), whilst those who recalled a negative memory did not significantly differ from controls. The finding that positive memories may be more influential in guiding our attitudes and behaviours than negative memories is supported by other studies (e.g. Kuwabara & Pillemer, 2010), and there is also evidence to suggest that the same may be true of false memories; Bernstein et al.'s (2015) mega-analysis of false-feedback studies suggests that the attitudinal effects of positive false memories and beliefs are greater than those of negative false memories and beliefs. However, this finding is based on data from just three studies which have used positive false memories; all of which used almost exactly the same procedure.

A further limitation of the current false-feedback studies using positive false memories is that they do not measure genuinely behavioural outcomes. Whilst there is some evidence demonstrating behavioural consequences of negative false memories and beliefs (e.g. Geraerts et al., 2008; Scoboria et al., 2008), studies using positive memories and beliefs have only measured behavioural intention (i.e. hypothetical desire to consume the critical item in a restaurant environment). Laney, Morris, et al. (2008) note this as a limitation of their study and state that it should not be assumed that changes in self-reported attitudes would necessarily lead to changes in behaviour. Given the evidence presented in the preceding paragraph regarding the behavioural consequences of positive true memories, it would be beneficial to determine whether positive false autobiographical memories can have similar behavioural effects.

Existing research has also failed to investigate whether false memories and beliefs can have more general attitudinal consequences (or failed to publish this, at least). All relevant studies published thus far investigated changing attitudes towards an individual food/drink item that was central to the false memory/belief being elicited.

However, these studies did not report whether these attitudinal effects extend to other, similar types of items. As was discussed in Section 1.2.4, various papers have raised the possibility of applying these attitudinal effects of false memories and beliefs as a means of behavioural modification. If false memories and beliefs were found to have more general attitudinal effects which extended to other attitude objects distinct from (although similar to) the item central to the false memory or belief being elicited, this finding would support the argument for applying this research. Failure to find more general effects, however, would damage this argument; in reality, any behavioural effects of false memories and beliefs (especially for positive false memories and beliefs) are unlikely to be of any substantial benefit to individuals if attitudes are exclusively affected for the individual item central to the false memory or belief.

Given the listed limitations of past research, Experiment 1 aimed to replicate the findings of Laney, Morris, et al. (2008); that false memories and beliefs of a positive experience regarding an attitude object lead to increases in explicit preference for that item. It was predicted that participants who formed a false memory or belief of the false suggestion event would report significantly higher (more preferable) ratings for the critical item (broccoli, in this case) on all measurements of explicit attitudes post-suggestion than they had reported pre-suggestion. In addition to this, it was investigated whether any observed attitudinal effects of false memories and beliefs were observed for items similar to the false suggestion (i.e. other vegetables within the explicit attitude measures). The experiment also aimed to establish whether false memories and beliefs of this positive event would have behavioural consequences by offering participants a choice of several "food rewards" (including the critical item) after they had completed their final experimental session. We hypothesised that those who formed a false memory or belief of the critical item would be more likely to select the critical item as a

food reward than those who did not form a false memory or belief or control participants.

4.1.2. Method

4.1.2.1. Participants

A total of 128 participants (101 female, 27 male) took part in the study, all of whom were first or second year undergraduate Psychology students from the University of Hull who participated in return for course credit. The first 94 participants to be recruited were randomly assigned to either the control or Suggestion group. Because subdivisions of the Suggestion group at later stages of analyses meant that more Suggestion group participants were required than control group participants, the final 33 participants were assigned directly to the Suggestion group. The final number of Suggestion group participants was 81, whilst the final number of control participants was 47. Because the study was only interested analysing the attitudinal consequences of *false* memories and beliefs, an exclusion criterion was applied to ensure that only participants who had low baseline confidence that the false suggestion event had happened to them were included in analyses. Similarly to the criterion applied by Laney, Morris, et al. (2008), participants who gave a confidence rating > 4 for the critical item ("You loved broccoli the first time you tried it") on the Food History Inventory (see Materials section for more information) were excluded from analyses. This resulted in the exclusion of 45 participants, giving this study a functional $n = 83$ (53 Suggestion group participants, 30 controls). The participants included in analyses consisted of 65 females and 18 males, with a mean age of 21.36 years ($SD = 5.43$).

4.1.2.2. Design

This study employed a mixed design, with Session (Session 1/pre-suggestion vs Session 2/post-suggestion) as the within-subjects factor and group serving as a between-subjects factor. In initial analyses concerning the formation of false memories and beliefs, this between-subjects factor of "group" involves a comparison of Suggestion group and control participants. Later stages of analyses involve various subdivisions of the Suggestion group; for instance, a comparison of "believers" (participants in the Suggestion group who were considered to have formed a false memory or belief), "non-believers" (participants in the Suggestion group who were not considered to have formed a false memory or belief) and controls. The dependent variables in this study were measures of explicit attitudes towards the critical item (broccoli), explicit attitudes towards similar items (other vegetables contained within the questionnaires) for the purposes of analysing general explicit attitudinal effects, as well as a behavioural measure concerning the participants' chosen "food reward" at the end of the study. The DVs are described in more detail in the Materials section.

4.1.2.3. Materials

This study measured explicit attitudes towards the critical item using questionnaires which were highly similar to those used by Laney, Morris, et al. (2008). The minor changes made to the questionnaires were with regards to the critical item (Laney, Morris, et al. measured attitudes towards asparagus, we changed this to broccoli) and several minor changes made to certain items on the questionnaire to make them more familiar to a predominantly British sample. The questionnaires included in the first experimental session were the Food History Inventory (FHI, see Appendix A),

which measured participants' confidence on a scale of 1-8 that a series of 24 distinct, food-related events had happened to them before the age of 12 (for example, "ate too much ice cream" or "ate dinner at a very fancy restaurant"). The critical item in this questionnaire was the "you loved broccoli the first time you tried it" item.

Session 1 also included two questionnaires designed to measure explicit attitudes towards a series of foods. The first of these was the "Restaurant" questionnaire, which asked participants to imagine themselves "at a nice restaurant for a special dinner" before asking them to indicate how likely they would be on a scale of 1-8 to order a series of 32 different dishes assuming price was no object. The critical item in this questionnaire was "stir-fried broccoli", although the items "mixed green salad" and "roasted butternut squash" were also analysed to assess whether any attitudinal effects generalised to other vegetables. In addition to the Restaurant questionnaire, a general "Food Preferences" questionnaire was also included, which asked participants to rate their general preference on a scale of 1-8 for 64 different foods, including the critical item of broccoli (although ratings were also analysed for the items 'Carrots', 'Green Beans', 'Cauliflower' and 'Asparagus' to assess any general attitudinal effects). There were also three filler questionnaires included to help disguise the true nature of the study. These included a "food habits" questionnaire and two personality-related questionnaires. One of the personality questionnaires was a subset of the Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1960), whilst the other was a novel questionnaire created for use as filler material by Laney, Morris, et al. (2008).

Session 2 contained repeated administrations of the FHI, Restaurant and Preferences questionnaires, as well as a false feedback questionnaire which was administered at the start of the session. This questionnaire informed each participant that their responses in Session 1 had been analysed, and that based on this information,

a personalised profile of four food-related events that they were confident had occurred to them as a child had been generated. However, in reality, participants were always given pre-prepared feedback which was not based on their Session 1 answers. Suggestion group participants were given three filler events which could be considered as highly plausible for most children ("You disliked spinach", "You enjoyed eating pizza" and "You felt happy when a classmate brought sweets to school"), as well as the false suggestion item "You loved broccoli the first time you tried it". Control group participants were given the same feedback, but with another filler event in place of the false suggestion ("You disliked asparagus"). After listing the events, the false feedback questionnaire stated that two events had been randomly selected for participants to elaborate on; in reality, these items were always the same, with false suggestion item always featuring for those in the Suggestion group. Participants were asked to imagine the setting in which the event may have taken place before giving elaborative details, including where they were, who they were with, and a 1-8 rating reflecting the extent to which they believe the event influenced their personality (included to maintain the deceptive story regarding the nature of the experiment; see Procedure section).

Session 2 also included a "Food Costs" questionnaire, which asked participants to indicate the maximum amount that they would be willing to pay for a series of 21 different food items in a supermarket (the critical item being a "500g pack of broccoli"). The price that participants would be willing to pay for each item was measured on a scale which started at 0 (indicating that participants would never chose to buy the item), followed by 0.75 (British pounds), and then increasing in intervals of 0.25 up to a maximum option of 2.25. Session 2 questionnaires ended with a "Memory or Belief" questionnaire (see Appendix G), which listed three items from the FHI (including the false suggestion item "You loved broccoli the first time you tried it") and asked

participants to indicate whether they had a memory of the event, a belief that the event had occurred without having a memory of it, or were absolutely certain that the event did not occur. If participants indicated that they had a memory of the event, they were asked to describe the memory with as much detail as possible. If participants indicated that they had a belief that the event occurred but no memory of it, they were asked to describe why they believed the event occurred to them. If the participants were certain that the event did not occur, they were asked to indicate why they believed that this was the case.

Finally, the study also included a "food reward" which participants were offered at the end; in reality, this was a measure of whether false memories and beliefs could influence food choice behaviour. The items available as a food reward included small (approximately 150g) bags of fresh vegetables, including the critical item of broccoli, as well as carrots, green beans and cauliflower.

4.1.2.3. Procedure

Upon arriving for Session 1, participants were informed that they would be taking part in a study investigating the association between food preferences and personality. This is essentially the same deceptive cover story that was used by Laney, Morris, et al. (2008), and which the results of Laney, Kaasa, et al. (2008) revealed to be an effective means of disguising the true nature of the experiment. Participants then proceeded to complete a series of questionnaires, including the FHI, Restaurant and Food Preference questionnaires, interspersed with three filler questionnaires (two personality-related, as well as one concerning 'food habits').

Participants returned for Session 2 approximately one week after their Session 1 appointment (a minimum of 5 days afterwards, a maximum of 9 days afterwards). The first 94 participants were randomly assigned to either the Suggestion group or the control group. For the reasons explained in Section 4.1.1, all subsequent participants were assigned directly to the Suggestion group. The only difference between the two groups was the content of the false feedback questionnaire; Suggestion group participants received the false suggestion that they had loved broccoli the first time they tried it, whereas control participants did not (receiving different, unrelated feedback). The false feedback questionnaire was completed first, followed by repeats of the FHI, Restaurant and Food Preferences questionnaires, as well as the Food Costs and Memory or Belief questionnaires. After each participant in the session had finished all questionnaires, participants were told that as a reward for their participation, they could each take away a bag of fresh vegetables. Participants were given a choice of broccoli, carrots, green beans or cauliflower, and told that if they wanted to take away a reward, they should mark their choice on a piece of paper and hand it to the experimenter. After all participants had done this, they were thanked and fully debriefed.

4.1.3. Results

As previously mentioned, in order to restrict analyses to participants who were confident that the false suggestion event did not actually occur to them, data were only analysed for participants who reported a low baseline confidence that they had loved broccoli the first time they tried it (a Session 1 FHI rating of ≤ 4). This restricted analyses to $n = 83$ participants.

4.1.3.1. Were false memories and beliefs elicited?

The FHI and Memory or Belief questionnaires were analysed in order to determine whether the false feedback was effective in eliciting false memories and beliefs of the false suggestion event. At Session 1 (pre-suggestion), the Suggestion group (n = 53) and control group (n = 30) reported similarly low confidence in the false suggestion; the Suggestion group reported a mean confidence rating of 1.62 (SD = .95), whilst the control group reported a mean confidence rating of 1.80 (SD = 1.13). At Session 2 (post-suggestion), the Suggestion group participants reported a mean confidence rating of 3.83 (SD = 2.58), whilst the control group a mean confidence rating of 2.00 (SD = 1.17). These means and their associated standard errors are displayed in Figure 1.

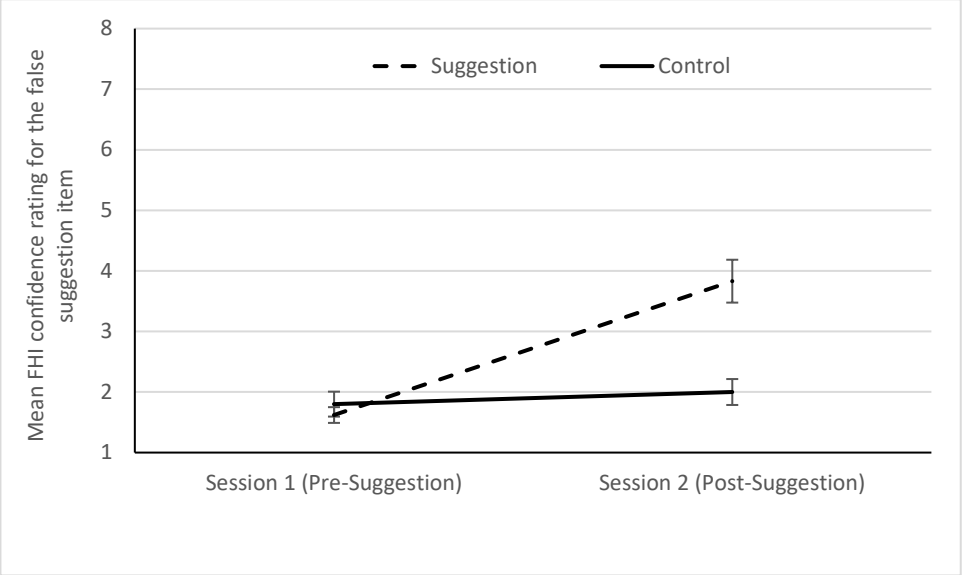

Figure 1. Mean FHI confidence ratings for the false suggestion item for Suggestion and Control groups both pre- and post-feedback. Error bars represent standard error of the mean.

A 2x2 mixed-design ANOVA (with Session as a within-subjects factor and group as a between-subjects factor) found a significant main effect of session, $F(1, 81) = 25.16$, $p < .001$, $\eta_p^2 = .24$, a significant main effect of group, $F(1, 81) = 7.31$, $p =$

.008, $\eta_p^2 = .08$, and a significant Group x Session interaction, $F(1, 81) = 17.49$, $p < .001$, $\eta_p^2 = .18$. Planned comparisons revealed that Suggestion group participants reported significantly higher confidence ratings in Session 2 (post-suggestion) than in Session 1 (pre-suggestion), $p < .001$, whilst control participants confidence ratings did not significantly differ between sessions, $p = .446$.

The Memory or Belief questionnaire data were analysed to assess whether frequency of participants reporting a false memory or belief of the false suggestion event (or being certain that it did not occur to them) differed significantly as a function of group. Within the Suggestion group, 11 (20.8%) reported a false memory, 24 (45.3%) reported a false belief, and 18 (34%) were certain that it did not happen. Within the control group, no participants reported a false memory, 4 (13.3%) reported a false belief, and 26 (86.7%) were certain that the event did not happen. It was found that likelihood of reporting a false memory, belief or being certain that the event did not happen differed significantly as a function of group, $\chi^2 = 22.06$, $p < .001$. In combination with the FHI ratings, these data suggest that the false suggestion was effective in eliciting false memories and beliefs that participants had loved broccoli the first time they tried it.

4.1.3.2. Attitudinal consequences of false memories and beliefs.

In order to assess the attitudinal consequences of the false memories and beliefs elicited, the Suggestion group was subdivided into those who formed a memory or belief of the false suggestion event (“Believers”) and those who did not (“Non-Believers”). Using the same criteria as used by Laney, Morris, et al. (2008), Believers were classified as any participants who received the false suggestion, increased their

confidence in the event post-suggestion, and reported a false memory or belief of the event in the Memory or Belief questionnaire. Non-Believers were classified as any participants who received the false suggestion but did not increase their confidence in its occurrence and/or were certain that the event did not happen. Of the 53 Suggestion group participants included in the analysis, 29 met the criteria to be classified as Believers, whilst 24 were classified as Non-Believers.

4.1.3.2.1. Restaurant Questionnaire. This questionnaire assessed participants' desire to eat a broccoli-based dish in a restaurant setting on a 1-8 scale, and was administered in both Session 1 and Session 2. The mean responses for each subgroup are displayed in Figure 2. Participants later classified as Believers reported a mean pre-suggestion rating of 3.76 (*SD* = 2.44) before increasing this to a mean rating of 5.48 (*SD* = 2.28) post-suggestion. Non-Believers reported a mean pre-suggestion rating of 2.46 (*SD* = 2.13) before marginally increasing this post-suggestion to 2.92 (*SD* = 2.28). Control participants gave a mean rating of 4.20 (*SD* = 2.50) in Session 1, which marginally decreased to 3.77 (*SD* = 2.24) in Session 2.

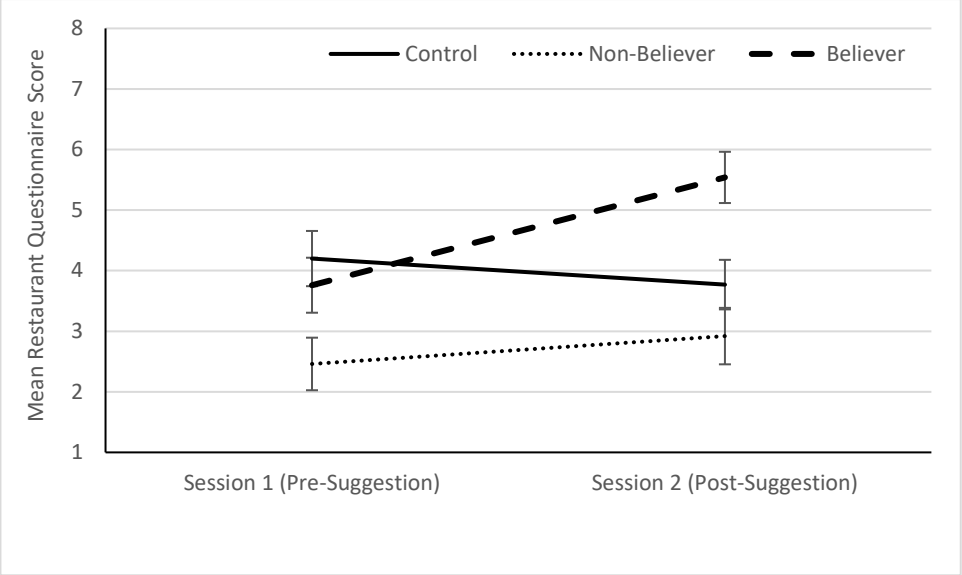

Figure 2. Mean Restaurant questionnaire scores for Believers, Non-Believers and controls in both Session 1 (Pre-Suggestion) and Session 2 (Post-Suggestion). Error bars represent standard error of the mean.

A 3x2 mixed-design ANOVA was performed to assess the effect of session (Session 1 vs Session 2, within-subjects) and group (Believers vs Non-Believers vs Controls, between-subjects) on restaurant questionnaire ratings. A significant main effect of session was found, $F(1, 80) = 11.01$, $p = .001$, $\eta_p^2 = .12$, as well as a significant main effect of group, $F(2, 80) = 5.27$, $p = .007$, $\eta_p^2 = .12$, and a significant Session x Group interaction, $F(2, 80) = 13.61$, $p < .001$, $\eta_p^2 = .25$. Planned comparisons revealed that whilst Session 1 and Session 2 ratings did not significantly differ for Non-Believers, $p = .163$, and controls, $p = .140$, Believers' ratings in Session 2 were significantly higher than in Session 1, $p < .001$.

4.1.3.2.2. Food Preferences Questionnaire. This questionnaire assessed participants' general preference for broccoli (amongst other filler items). Mean ratings are displayed in Figure 3. Participants later classified as Believers reported a mean preference rating of 4.38 ($SD = 2.03$) in Session 1 before increasing this to a mean of

5.97 (*SD* = 1.96) in Session 2. Non-Believers reported a mean preference of 2.63 (*SD* = 2.03) in Session 1, slightly increasing this to 2.75 (*SD* = 2.31) in Session 2. Controls reported a mean preference of 4.33 (*SD* = 2.06) in Session 1, which slightly decreased to 4.27 (*SD* = 2.08) in Session 2.

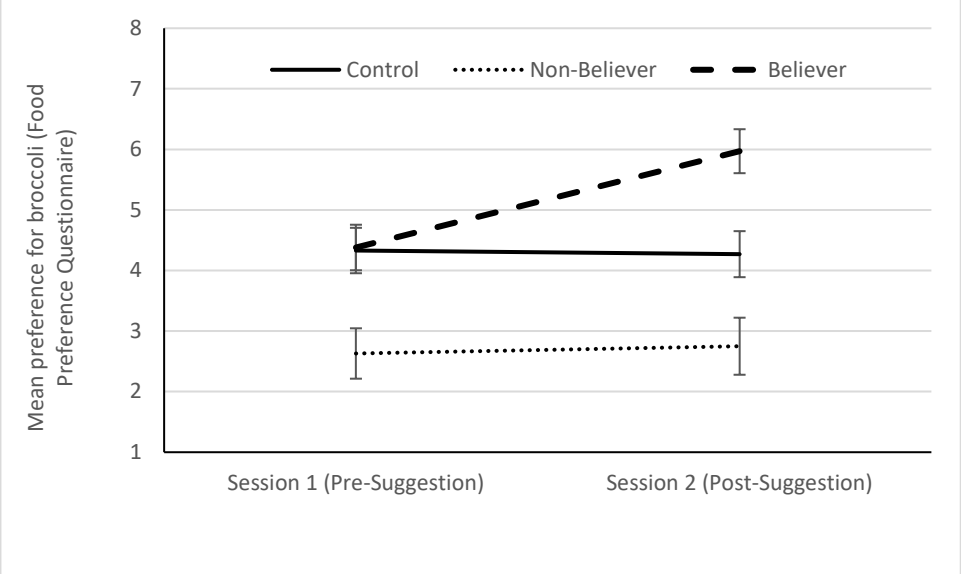

Figure 3. Mean general preference for broccoli (as measured by the Food Preferences Questionnaire) for Believers, Non-Believers and Controls in Session 1 and Session 2. Error bars represent standard error of the mean.

A 3x2 mixed-design ANOVA with group (Believers vs Non-Believers vs Controls) as the between-subjects factor and session (1 vs 2) as the within-subjects factor revealed a significant main effect of group, $F(2, 80) = 10.98$, $p < .001$, $\eta_p^2 = .22$, a significant main effect of session, $F(1, 80) = 11.13$, $p = .001$, $\eta_p^2 = .12$, and a significant Group x Session interaction, $F(2, 80) = 10.56$, $p < .001$, $\eta_p^2 = .21$. Planned comparisons revealed that whilst Session 1 and 2 ratings did not significantly differ for non-believers, $p = .682$, or controls, $p = .807$, the mean ratings of Believers were significantly higher in Session 2 than in Session 1, $p < .001$.

4.1.3.2.3. Food Costs Questionnaire. This questionnaire measured the maximum that participants would be willing to pay for the critical item of broccoli (amongst other filler items). This was measured in Session 2 only, so analyses concern solely post-suggestion differences between groups. Due to unequal intervals in the scale, this was assessed using the non-parametric Kruskall-Wallis H test. Believers had a mean rank score of 53.76, Non-Believers had a mean rank score of 32.13 and controls had a mean rank of 38.53. The amount that participants were willing to pay for the critical item of broccoli was found to significantly vary as a function of group, $\chi^2 = 11.89$, $p = .003$. Planned pairwise comparisons found that Believers were willing to pay significantly more than Non-Believers, $p = .003$, and controls, $p = .042$.

4.1.3.2.4. General attitudinal effects. In order to assess whether false memories and beliefs of loving broccoli as a child had attitudinal effects extending to other similar items (vegetables), pre- and post-suggestion explicit attitudes were also analysed for various filler items. These included ratings for ‘Mixed Green Salad’ and ‘Roasted Butternut Squash’ from the Restaurant questionnaire, and ‘Carrots’, ‘Green Beans’, ‘Cauliflower’ and ‘Asparagus’ from the Food Preferences questionnaire. For each item, a 3x2 mixed-design ANOVA was conducted assessing the effect of session (Session 1 vs Session 2, within-subjects) and group (Believers vs Non-Believers vs Controls, between-subjects) on attitude ratings. No significant main or interaction effects were found for any item (all $p > .05$). Results of these ANOVAs are included in Table 1.

Table 1.

Results of the 3x2 ANOVAs assessing the general attitudinal effects of false memories and beliefs. F and p values are displayed for the main effect of session (1 vs 2), group (Believers vs Non-Believers vs Controls), and the session x group interaction.

	Session (*df* = 1)		Group (*df* = 2)		Session x Group (*df* = 2)	
	F	*p*	F	*p*	F	*p*
Mixed Green Salad (Restaurant Questionnaire)	.05	.820	.23	.797	.13	.881
Roasted Butternut Squash (Restaurant Questionnaire)	.10	.755	.48	.621	.11	.895
Carrots (Preferences Questionnaire)	.50	.480	1.59	.211	1.35	.266
Green Beans (Preferences Questionnaire)	.20	.656	1.74	.183	.65	.527
Cauliflower (Preferences Questionnaire)	1.57	.213	1.21	.305	.12	.886
Asparagus (Preferences Questionnaire)	1.48	.228	2.30	.107	.08	.927

4.1.3.3. Behavioural consequences of false memories and beliefs.

The behavioural consequences of false memories and beliefs were assessed by comparing the frequency of "food reward" choice between Believers and controls. A total 11 out of 29 believers (37.9%) chose the critical item (broccoli), whilst 4 out of 24 non-believers (16.7%) and 3 out of 30 control participants (10%) did likewise. A chi-square test of independence found that frequency of food choice differed significantly as a function of group, $\chi^2(2, n = 83) = 7.27$, $p = .026$.

4.1.4. Discussion

The main aim of this experiment was to determine if the positive explicit attitudinal effects of false memories and beliefs found by Laney, Morris, et al. (2008) were replicable. Results indicated that participants who went on to form a false memory or belief of loving broccoli the first time they tried it as a child (Believers) significantly

increased their hypothetical desire to eat broccoli, their general preference for broccoli, and reported that they would be willing to pay significantly more money for broccoli than controls or participants who were not susceptible to the false suggestion (Non-Believers). In both explicit attitudinal measures with pre- and post-suggestion ratings, it was found that although the ratings of Non-Believers increased marginally post-suggestion in each scenario, these increases were not significant. This supports the conclusion that explicit attitudinal effects were a consequence of false memories and beliefs, and not purely of the false suggestion itself. Control group ratings on these attitudinal measures (and the FHI) were highly similar across Session 1 and 2, indicating that the reliability of these measures.

The study also aimed to assess whether any observed attitudinal effects of false memories and beliefs were generalizable to similar attitude objects. Analyses revealed no evidence to suggest that false memories and beliefs had significant effects on attitudes towards any of the other vegetables for which desire to eat / general preference ratings were analysed. That no significant effects of group, session or Group x Session interactions were found in these analyses demonstrates that false memories and beliefs of loving broccoli as a child had no impact on attitude ratings for other items. Post-hoc analyses of ratings for these other items found highly significant (all $p < .001$) positive correlations between Session 1 and Session 2 attitudinal measures for all items, demonstrating the reliability of the measures.

It was also investigated whether these positive false memories and beliefs could have immediate behavioural consequences. It was found that participants' likelihood of choosing broccoli as a food reward over the other options available differed significantly as a function of group, with the proportion of Believers choosing broccoli being more than twice that of Non-Believers, and more than three times that of controls.

These results are consistent with previous studies which have found behavioural consequences of false memories and beliefs, and contributes novel evidence that positive false memories and beliefs can have significant behavioural effects in addition to negative ones. However, conclusions based on this data should be relatively tentative due to limitations of the behavioural variable; primarily that the behaviour measured was not particularly naturalistic. Rather than measuring actual eating behaviour in an ostensibly-unrelated setting like Geraerts et al. (2008), the behavioural variable measured in this experiment reflected a choice of one of four different items which were taken away with the participant, but may never have been consumed. In addition to this, although the instructions regarding the "food reward" did not suggest that participants were forced to choose any of the items, the fact that no participants declined to take an item away with them suggests that some may have perceived it to be a forced choice. If this is the case, it is not certain whether a participant choosing a certain food item over another is reflection of their positive attitude towards the food itself. So whilst the results may indicate that positive false memories and beliefs can have significant behavioural effects, it would be beneficial to determine whether these are replicable using more natural and less ambiguous behavioural variables

As was discussed in Section 1.2.4, some have raised the question of applying these attitudinal effects of false memories and beliefs as therapeutic interventions. Leaving aside the significant ethical problems that would be involved with such an application, the fact this is being raised as a possibility in the literature means that it needs to be considered whether the ends could ever justify the means; would giving people false memories or beliefs regarding certain foods be likely to result in significant attitudinal and behavioural changes and result in a healthier lifestyle? Despite finding significant attitudinal and behavioural effects for the critical false suggestion item, from

a practical and applied viewpoint, the results of Experiment 1 cast doubts on this potential application. The lack of evidence for extended attitudinal effects for other related items raises doubts over whether false memories and beliefs could have truly beneficial effects for an individual's lifestyle; if attitudinal and behavioural effects are limited to a single item which is central to the false memory/belief being elicited, this seems unlikely to justify intentionally manipulating memories. Also, as can be seen in Figure 2 and Figure 3, while Non-Believers have very negative baseline attitudes towards the false suggestion item which do not change post-suggestion, Believers have much higher baseline attitudes towards the false suggestion item. Although these attitudinal ratings increase significantly post-suggestion, their baseline ratings suggest that they were relatively ambivalent towards the false suggestion item to begin with. This is problematic for the argument of applying false memories and beliefs to elicit healthier attitudes and behaviours; these data suggest that eliciting a false memory may be difficult if participants have strong pre-existing attitudes towards the item which run contrary to the false suggestion. While false memories and beliefs have been found to have significant attitudinal effects in this experiment, from an applied viewpoint, there would be limited benefit in changing attitudes towards items which people are ambivalent to start with.

The results of this experiment, and the methods used in data collection and analysis, are very consistent with existing studies which have used the false feedback paradigm to elicit false autobiographical memories and measure their attitudinal consequences. There are, however, methodological issues which arose in this study which are also present in previous experiments. The main issue is that the paradigm is extremely inefficient in terms of usable data. The criterion which excludes all participants who have relatively high baseline confidence in the false suggestion event

resulted in the exclusion of 45 participants; approximately 35% of all participants tested. This is highly impractical and causes problems in the analysis stage. Analyses of attitudinal effects of false memories and beliefs requires that the Suggestion group participants who meet the initial inclusion criteria be subdivided into Believers and Non-Believers; in this case, sample sizes of each subgroup (29 and 24, respectively) were marginally sufficient for statistical analyses. Ideally, in line with the aims of this thesis, it would beneficial to be able to further subdivide the Believers group to separately assess the attitudinal effects of memories and beliefs. However, the resulting sample sizes would have been too small for these analyses (10 memories and 19 beliefs). This is a problem that has been encountered by other studies using the false feedback paradigm, as well; for instance, Laney, Morris, et al. (2008) excluded 31 of their 128 participants on the basis of high baseline confidence in the false suggestion. Therefore, it seems that it will be difficult to make inferences regarding how memories and beliefs differ in their explicit attitudinal consequences without making adaptations to the paradigm which enable it to be more efficient.

4.2. Experiment 2

4.2.1. Introduction

Whilst the existing literature examining the attitudinal consequences of false memories and beliefs has produced very consistent results, there are several key limitations to the existing studies. Experiment 2 can be considered an attempt to address two of these limitations. Firstly, that the existing literature has only assessed the attitudinal consequences of false memories and beliefs with regards to food preferences, and secondly, that the existing literature has only examined the effects of false memories and beliefs on explicit attitudes. This experiment aimed to see if the attitudinal effects that have been consistently observed over past studies can extend to different attitudinal domains, as well as whether they impact on implicit attitudes as well as explicit attitudes.

There are numerous potential reasons why past studies investigating the attitudinal effects of false memories and beliefs have remained focused on obtaining attitudinal measures relating to food/drink preferences. One of the advantages of this approach is methodological consistency; maintaining the same basic measures between studies allows experimenters to explain any possible variations in attitudinal effects between studies in terms of differing methodological factors, rather than potentially being due to a change of attitude domain. Other reasons for persisting with food-related attitudes may have involved the idea of potentially applying this research as a means of eliciting healthier eating behaviours; the so-called “false memory diet” (Bernstein et al., 2011). Additionally, there is the possibility that counter-attitudinal false memories and

beliefs may be easier to elicit when they are related to food than many other attitude objects; attitudes towards food change over time, so suggesting to participants that they enjoyed a certain food as a child which they do not enjoy now is perhaps more plausible than counter-attitudinal suggestions involving other attitude objects may be. False memory and belief rates in these false feedback studies is still low, but largely comparable with those of other false autobiographical memory studies in which the false suggestion events do not necessarily run contrary to participants' current attitudes (Brewin & Andrews, 2016).

However, restricting this line of research to solely measuring attitudes related to food is problematic for the generalisation of these attitudinal effects; it is currently unknown whether similar effects can be observed outside of the domain of food/drink attitudes. Hypothetically, it would be expected that if a false memory or belief of a positive/negative experience concerning any particular attitude object can be elicited in a participant, it should impact upon that individual's explicit attitude judgments. However, it is possible that the domain of food attitudes possesses some quality which makes these effects particularly consistent; there is the possibility alluded to earlier that counter-attitudinal false memories and beliefs for food-related events may be easier to elicit than they would be for events related to other objects, or food attitudes may differ in their malleability to attitudes relating to other domains. The false feedback paradigm can be easily adapted to measure attitudes towards and elicit false memories concerning virtually any form of attitude objects, and so it is somewhat surprising that, to date, it has not been adapted beyond its original design.

Perhaps the biggest limitation of the existing literature, however, is that all studies to date have exclusively measured the effects of false memories and beliefs on explicit attitudes. As outlined in Chapter 2, many modern models of social cognition

view explicit, self-reported attitude measurements such as those measured in previous false-feedback studies as one aspect of attitudinal processing, whilst simultaneously highlighting the importance of automatic, implicit attitudinal processes. Whilst specific models may differ on their conceptualisation of implicit and explicit attitudes and the nature of their interactions (Gawronski & Bodenhausen, 2006; Olson & Fazio, 2008; Schwarz, 2007), almost all would agree that implicit and explicit attitude measures reflect at least partially dissociable processes. There is strong evidence that explicit and implicit attitudes each predict unique variance in outcome measures (behavioural/judgment variables), and that the greater explicit and implicit measures correlate, the greater their overall predictive validity (Greenwald et al., 2009). To date, the question of whether implicit attitudes can be affected by false memories and beliefs in a similar way to explicit attitudes has not been addressed.

Implicit attitudes are generally thought to represent associations in memory which have formed over time, and so the extent to which they could be expected to be modifiable via transient, explicit interventions is subject to debate. There is, however, some evidence that implicit attitudes can be affected by mental imagery exercises. For instance, Blair et al. (2001) used an IAT to assess the strength of automatic associations regarding various stereotypes. They found that participants who engaged in counter-stereotypical mental imagery for several minutes subsequently exhibited significantly weaker implicit stereotypes compared with controls who engaged in neutral or no mental imagery exercises. More recently, Markland et al. (2015) found that guided mental imagery exercises concerning positive exercise-related experiences resulted in participants exhibiting significantly more positive implicit attitudes towards exercise. This evidence suggests that although implicit attitude change is typically considered to be a gradual process involving changes in associative evaluations over a prolonged

period of time (Olson & Fazio, 2001; Wilson, Lindsey, & Schooler, 2000), implicit attitudes can be affected by brief, experimental manipulations. Given that implicit attitudes towards exercise can be affected by mental imagery of a positive exercise-related experience, it seems possible that a false memory or belief of a positive exercise-related experience could have similar effects.

The aims of this experiment were to determine whether the explicit attitudinal effects observed in previous studies are replicable with a novel attitudinal domain, and to determine whether false memories and beliefs can impact implicit attitudes as well as explicit. The false-feedback materials utilised in Experiment 1 were adapted to measure attitudes towards and elicit false memories and beliefs concerning exercise; specifically, we aimed to elicit false memories and beliefs that participants had enjoyed cross country running (CCR) at school. It was hypothesised that those who formed a false memory or belief of this event would report significantly more preferable explicit attitudes towards CCR post-suggestion than they had done pre-suggestion.

The question of whether false memories and beliefs can affect attitudes in general beyond the individual item relevant to the false memory/belief was revisited. In a change from the way this question was addressed in Experiment 1, a simple measure of how often participants intended to exercise in the near future was obtained. This can be considered a measure of behavioural intention (similar to the Restaurant Questionnaire of Experiment 1), and thus an explicit attitudinal variable rather than a behavioural variable. It is also a more valid means of assessing general explicit attitudes towards exercise than assessing attitudes towards a several random related items, as was done in Experiment 1. It was hypothesised that those who formed a false memory or belief of loving CCR at school would report a greater number of intended exercises session than those who did not form a false memory or belief or controls.

In order to assess implicit attitudes towards exercise an Implicit Association Test (IAT, Greenwald et al., 1998) was also included at the end of the second experimental session. It was hypothesised that participants who formed a false memory of enjoying CCR at school would exhibit significantly greater implicit attitudes towards exercise than those who were no susceptible to the false suggestion and control participants.

4.2.2. Method

4.2.2.1. Participants

A total of 119 participants were recruited for the experiment (93 female, 26 male), with the sample predominantly made up of undergraduate Psychology students from the University of Hull who participated in return for course credit. Again, due to the necessity of subdividing the Suggestion group in later analyses, more Suggestion group participants were required than control group participants. Because of this, participants were only partially randomised to an experimental condition. The first 87 participants were randomly assigned to either the Suggestion group or control group. After this point, it was deemed that a sufficient number of eligible control participants for analyses had been recruited, and all subsequent participants recruited were assigned directly to the Suggestion group. Again, participants who reported high baseline confidence in the false suggestion event were excluded from analyses; this included anyone who reported a rating of > 4 on the 'Exercise History Inventory' (see Materials section). This resulted in 31 participants being excluded from analyses, leaving an eligible sample of n = 88 (59 Suggestion group, 29 control group). The participants eligible for analyses had a mean age of 22.27 years (SD = 5.45).

4.2.2.2. Materials

The questionnaires used were highly similar to those used in Experiment 1, but adapted to measure attitudes towards various sports/exercises rather than food. The 'Food History Inventory' was changed to an 'Exercise History Inventory' (see Appendix B), which measured participant confidence on a scale of 1-8 that a series of 24 separate sport/exercise related events (including the critical false suggestion event 'You loved cross-country running at school') had happened to them before the age of 15. This age cut-off was increased from that used in the FHI in Experiment 1 (12 years old) because this was considered a more realistic age range for some of the events (including the false suggestion event) to have occurred within.

The 'Restaurant Questionnaire' included in Experiment 1 was adapted to the 'Gym questionnaire'. This asked participants to imagine they had joined a new gym, and the gym had given them a list of sports/exercises that were available for them to sign up to. Participants were asked to indicate the extent to which they would like to participate in each sport/exercise on a scale of 1-8. Similar to the Restaurant questionnaire, there were 32 separate items, including the critical item 'cross-country running'. An adaptation of the 'Food Preferences Questionnaire' was also included, changed to the 'Exercise Activity Preferences Questionnaire', which asked participants to rate how much they enjoy (or how much they think they would enjoy, for items which they had never participated in) 64 different sports/exercises on a scale of 1-8 (1 representing 'definitely would *not* enjoy doing' to 8 representing 'definitely would enjoy doing').

The construction of the false feedback questionnaire was highly similar to Experiment 1. Participants were informed that the responses they gave in Session 1 had been analysed and a personalised profile of sport/exercise-related experiences which

they indicated had occurred to them had been constructed. In reality, the items listed included several general events which could probably be considered true of most people ("you went on a long hike", "you did regular exercise with your friends", "you went on a long bike ride"). Additionally, the Suggestion group were given the false suggestion item "you loved cross country running at school", whilst the control group were given an additional filler item ("you felt happy after winning a sports game"). The 'Memory or Belief?' questionnaire was again included in the second session; similar to Experiment 1, the questionnaire presented participants with three events from the EHI, including the critical false suggestion event "You loved cross-country running at school" and asked them to indicate whether they had a memory relating to this, a belief that this was the case but no relevant memory, or were certain that this was not the case.

Additionally, Session 2 contained the novel "Exercise Intention Questionnaire", which was included as an additional measure of behavioural intention. Participants were asked to indicate how many times they intended to participate in 20 different sports/exercises (including the critical item 'cross-country running') over the next two months. An additional measure of how much participants *generally* intended to exercise over the next month was also included. This was based on Verplanken and Melkevik's (2008) "Behavioural Intention to Exercise" questionnaire, and asked participants to first specify how often they would like to participate in "moderate-to-strenuous physical exercise for periods of 15 minutes or more" per week over the next month. They were then presented with the following statements, in each case substituting 'x' for the number of times they had said that they wanted to exercise per week; "I intend to exercise x times per week during the coming month", "I will try to exercise x times per week during the coming month" and "I am motivated to exercise x times per week during the coming month". Participants rated the extent to which they agreed with each

statement on a 1-7 scale (1 representing ‘disagree completely’, 7 representing ‘agree completely’).

To assess the behavioural effects of any elicited false memories and beliefs, we assessed participants’ willingness to sign up for an unrelated, fake (although ostensibly real) study which would involve them engaging in physical activity. Participants were presented with an information sheet for this study (containing full details of the purpose and rationale of the study, the procedures, length of participation, payment and ethical considerations) at the end of the second session. The information sheet ended by asking participants if they would be interested in taking part in the study in the near future, and stating that if they answered in the affirmative, they would be contacted after the current experimental session to arrange a time for their participation. The fake study offered entry into a prize draw for a £30 book voucher (which was provided as incentive for participants to sign up, but was not considered to be a significant enough reward as to be a participant’s sole motivation for signing up).

Similar to Experiment 1, various filler questionnaires were included throughout Session 1 to disguise the nature of the study. These included the two of the same generic ‘personality questionnaires’ used in Experiment 1, a ten-item personality inventory (Gosling, Rentfrow, & Swann, 2003), the ‘Leisure Time Exercise Questionnaire’ (Godin & Shephard, 1985), and Rhodes and Courneya's (2005) “Exercise Attitudes” questionnaire.

The Implicit Association Test (IAT, Greenwald et al., 1998) was used to measure implicit attitudes towards exercise. The IAT is designed to measure an individual’s automatic associations between concepts, and was found to possess the best psychometric qualities out of the seven most commonly used implicit attitude measures

(Bar-Anan & Nosek, 2014). Full details of the IAT can be found in Section 4.2.2.3, but the general procedure involved participants assigning pictorial stimuli representing either sports/exercises or sedentary activities into their appropriate category of either 'exercise' or 'not exercise', assigning unambiguously positive or negative words to their appropriate categories of "positive" or "negative", and then (in the critical blocks of the task) performing the categorisation task whilst attitude object and valence stimuli share a response key. There were 10 different exemplar images in each attitude object category. Exercise pictorial stimuli depicted individuals performing various exercises such as running on a treadmill, weight-lifting, and CCR. "Not exercise" pictorial stimuli depicted individuals engaged in sedentary activities such as reading a book or working on a laptop. As in Markland et al.'s (2015) study, male and female versions of the IAT were administered to each respective gender, the difference being the gender of the individual(s) performing the action in each exemplar image. Valenced stimuli was made up of 10 unambiguously positive and 10 unambiguously negative words.

4.2.2.3. Procedure

Similar to Experiment 1, participants were falsely informed at the start of Session 1 that they were participating in a study investigating the association between exercise attitudes and personality. They then proceeded to complete the EHI, Gym Questionnaire, Exercise Activity Preferences Questionnaire, as well as the exercise- and personality-related filler questionnaires.

Participants returned for Session 2 between 5 and 9 days following their Session 1 appointment. As previously mentioned, the first 87 participants were randomly assigned to either the Suggestion group or the control group, with all subsequent participants being assigned directly to the Suggestion group. At the start of Session 2, participants were given the false feedback questionnaire, within which Suggestion

group participants were provided with the false suggestion that they had loved CCR at school (control group participants did not receive this suggestion). After the false feedback questionnaire had been completed, participants again completed the EHI, Gym and Exercise Activity Preferences questionnaires, before completing the Exercise Intention and Memory or Belief questionnaires and the sign-up sheet for the fake study involving running.

After completing all questionnaires, participants then moved on to the IAT, run using E-Prime 2.0 (Schneider, Eschmann, & Zuccolotto, 2002). Participants were informed that they would need to categorise picture and word stimuli into the appropriate categories of either Exercise/Not Exercise or Positive/Negative using the 'Z' and 'M' keys on the keyboard. Before each block of trials was presented, participants were informed which response key would represent which category, and a reminder remained on screen during the task (the name of the appropriate category/categories was displayed in the top right of the screen if it was assigned to the 'M' key, and the top right of the screen if it was assigned to the 'Z' key. Participants were instructed to respond as quickly and accurately as possible, and to ask the experimenter if they had any questions before beginning the block of trials. Instructions remained on screen until participants pressed the space bar to indicate that they were ready to begin the task.

Trials were separated into seven separate blocks. A summary of one of the two possible block orderings can be found in Table 2. Blocks 1 and 2 were practice blocks to familiarise the participants with the initial key mappings; Block 1 contained 20 trials, displaying each stimulus representing 'Exercise' and 'Not Exercise' in a randomised order, and participants were tasked with categorising the task via the appropriate key. Block 2 followed the same procedure, but for the valenced stimuli instead of

Exercise/Not Exercise stimuli. Blocks 3 and 4 were the first critical blocks, combining the attitude object stimuli and the valenced stimuli. In the example ordering given in Table 2, this involved Exercise/Positive stimuli being assigned to the 'Z' key, whilst Not Exercise/Negative stimuli were assigned to the 'M' key. Block 3 contained 20 trials, Block 4 contained 40 trials.

Table 2.

One of the two possible orderings of stimuli presentation (the alternative order swapped Exercise/Not Exercise key mappings such that Not Exercise was paired with positive and Exercise paired with negative in blocks 3 and 4, and vice versa for blocks 6 and 7).

Block	Description	'Z' key mapping	'M' key mapping
1	Practice	Exercise	Not Exercise
2	Practice	Positive	Negative
3	Combined block (20 trials)	Exercise or Positive	Not Exercise or Negative
4	Combined block (40 trials)	Exercise of Positive	Not Exercise or Negative
5	Practice (reversed mapping)	Not Exercise	Exercise
6	Reversed combined block (20 trials)	Not Exercise or Positive	Exercise or Negative
7	Reversed combined block (40 trials)	Not Exercise of Positive	Exercise or Negative

Block 4 was an additional practice block in which the key mapping of the Exercise / Not Exercise stimuli was reversed. Blocks 6 and 7 were the critical combined blocks for this reversal; in the ordering given in Table 2, Not Exercise/Positive stimuli were assigned to the 'Z' key, whilst Exercise/Negative stimuli were assigned to the 'M' key. Like Blocks 3 and 4, Blocks 6 and 7 contained 20 and 40 trials respectively. The alternative ordering to the exemplar presented in Table 2 initially assigned Not Exercise stimuli to the 'Z' key and Exercise stimuli to the 'M' key in Block 1 (reversing this in

Block 5), before combining Not Exercise/Positive stimuli to the ‘Z’ key and Exercise/Negative stimuli to the ‘M’ key in Blocks 3 and 4 (and reversing this accordingly in Blocks 6 and 7). The two orderings were counterbalanced between participants.

Stimulus presentation within each block was randomised. For each trial, the stimulus remained on screen until the participant categorised it using either the ‘Z’ or ‘M’ key. If participants incorrectly categorised a stimulus, the word “Error” appeared in red text in the centre of the screen. The interstimulus interval was 250ms across all blocks. Participants were given self-paced rest breaks in between each block of trials, and instructed to take their time between blocks if they felt tired. After participants had completed all of the questionnaires and the IAT, they were thanked and fully debriefed.

4.2.3. Results

Similar to Experiment 1, participants who reported above the midpoint (> 4) on the EHI confidence scale for the critical “you loved cross country running at school” item were excluded from analyses. This resulted in 31 participants being excluded from analyses, leaving n = 83 participants eligible for analyses.

4.2.3.1. Were false memories and beliefs elicited?

Initial analyses focused on the EHI and Memory or Belief questionnaires in order to determine whether the false suggestion efficiently elicited false memories and beliefs of loving CCR. In Session 1, both the Suggestion and control groups reported low baseline confidence of loving CCR at school; the Suggestion group (n = 59) gave a mean confidence rating of 1.36 (SD = .76), whilst the control group (n = 29) gave a mean rating of 1.52 (SD = .91). In Session 2 (post-suggestion), the Suggestion group

increased their mean confidence rating to 3.44 (*SD* = 2.42), whilst the control group marginally increased their mean rating to 1.72 (*SD* = 1.07). These mean ratings are displayed in Figure 4.

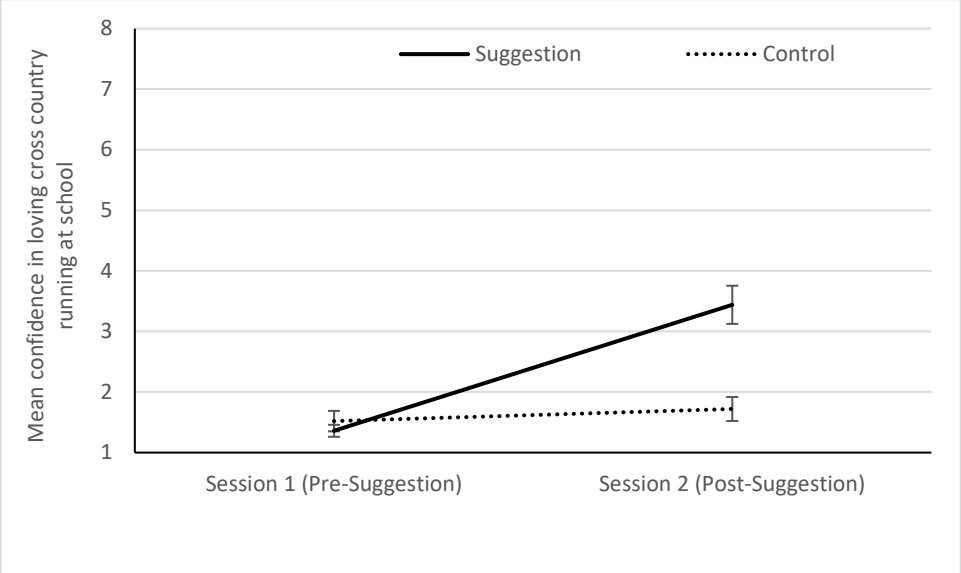

Figure 4. Mean confidence in loving cross country running at school (as measured by the EHI) for Suggestion group and control group participants both pre- and post-suggestion. Error bars represent standard error of the mean.

A 2x2 mixed-design ANOVA (with session as a within-subjects factor and group as a between-subjects factor) found a significant main effect of session, $F(1, 86) = 25.88$, $p < .001$, $\eta_p^2 = .23$, a significant main effect of group, $F(1, 86) = 7.80$, $p = .006$, $\eta_p^2 = .08$, and a significant Group x Session interaction, $F(1, 86) = 17.38$, $p < .001$, $\eta_p^2 = .17$. Planned comparisons revealed that whilst the difference between Session 1 ratings and Session 2 ratings did not significantly differ for control participants, $p = .576$, Suggestion group participants gave significantly higher ratings in Session 2 than Session 1, $p < .001$.

Of the 59 Suggestion group participants included in analyses, 14 (23.7%) reported a false memory of loving CCR at school, 12 (20.3%) reported a false belief,

and 33 (55.9%) were certain that this did not happen. Of the 29 control participants included in analyses, only 1 (3.4%) reported a false memory, 3 (10.3%) reported a false belief, and 25 (86.2%) were certain that it did not happen. It was found that likelihood of reporting a false memory, false belief or being certain that the event did not occur varied significantly as a function of group, $\chi^2 = 8.54$, $p = .014$. These data imply that the false suggestion manipulation was moderately successful at eliciting false memories and beliefs of loving CCR.

4.2.3.2. Explicit attitudinal consequences of false memories and beliefs.

Before analysing the impact of false memories and beliefs on the explicit and implicit attitudinal measures, the Suggestion group was first subdivided into those who formed a false memory or belief of the false suggestion event ("Believers") and those who did not ("Non-Believers"). As in Experiment 1, a participant was considered a Believer if they received the false suggestion (i.e. were in the Suggestion group), increased their confidence in the critical item on the EHI post-suggestion, and indicated a memory or belief of the false suggestion event in the Memory or Belief questionnaire. Non-Believers were again classified as any Suggestion group participants who did not meet the EHI or Memory or Belief criteria. Of the 59 Suggestion group participants included in analyses, 26 met the criteria to be classified as Believers, whilst 33 were classified as Non-Believers.

4.2.3.2.1. Gym Questionnaire. This questionnaire measured participants' hypothetical desire to participate in CCR (amongst other filler sports/activities). In Session 1, participants who would later be classified as Believers gave a mean rating of 2.88 (*SD* = 2.02), participants who went on to be classified as Non-Believers gave a

mean rating of 1.91 (*SD* = 1.47), and control group participants gave a mean rating of 2.48 (*SD* = 2.08). In Session 2, Believers increased their mean rating to 5.19 (*SD* = 2.15), Non-Believers increased their mean rating to 2.18 (*SD* = 1.72) whilst the control group very marginally increased their rating to 2.55 *(SD* = 2.18). These means are displayed in Figure 5.

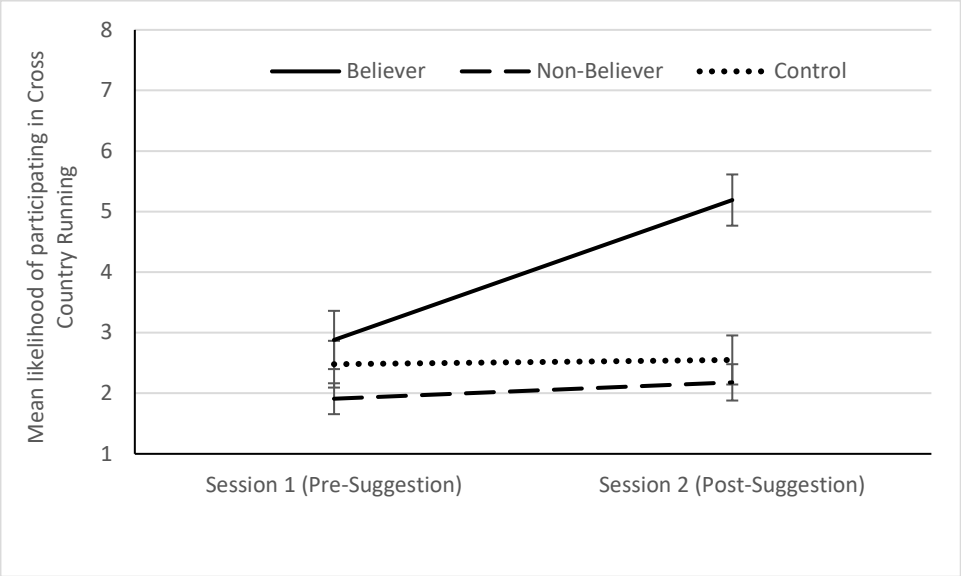

Figure 5. Mean likelihood of participating in cross country running (Gym Questionnaire ratings) for Believers, Non-Believers and Controls both pre-suggestion and post-suggestion. Error bars represent standard error of the mean.

A 3x2 mixed-design ANOVA assessed the effects of session (Session 1 vs Session 2, within-subjects) and group (Believer vs Non-Believer vs Control, between-subjects) on likelihood of participating in CCR. The ANOVA revealed a significant main effect of session, $F(1, 85) = 27.27$, $p < .001$, $\eta_p^2 = .24$, a significant main effect of group, $F(2, 85) = 8.96$, $p < .001$, $\eta_p^2 = .17$, and a significant Group x Session interaction, $F(2, 85) = 16.80$, $p < .001$, $\eta_p^2 = .28$. Planned comparisons found that whilst Session 1 and Session 2 ratings did not differ significantly for controls, $p = .815$, and

Non-Believers, $p = .324$, it was found that Believers' ratings significantly increased post-suggestion, $p < .001$.

4.2.3.2.2. Exercise Activity Preferences. This questionnaire measured the extent to which participants believed they would enjoy CCR (and various other filler sports/exercises). Participants who would later be classified as Believers gave a mean rating in Session 1 of 2.88 (*SD* = 2.10), whilst Non-Believers gave a rating of 1.67 (*SD* = 1.27) and controls gave a mean rating of 2.38 (*SD* = 1.94). In Session 2, Believers increased their mean rating to 4.77 (*SD* = 2.36), Non-Believers marginally increased their mean rating to 1.91 (*SD* = 1.83), whilst controls slightly decreased their mean rating to 2.31 (*SD* = 1.76). These means are displayed in Figure 6.

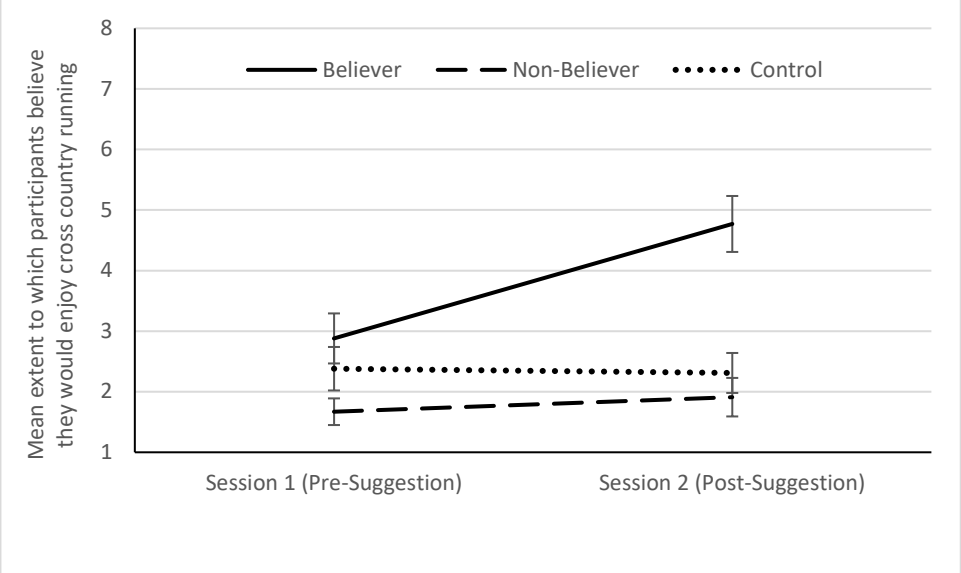

Figure 6. Mean rating reflecting the extent to which participants they would enjoy cross country running, displayed for Believers, Non-Believers and Controls across Session 1 and Session 2. Error bars represent standard error of the mean.

A 3x2 mixed-design ANOVA was performed to assess the effect of false memories and beliefs on participants' self-reported hypothetical enjoyment of CCR. A significant main effect of session (Session 1 vs Session 2, within-subjects) was found,

$F(1, 85) = 16.72$, $p < .001$, $\eta_p^2 = .16$, as was a significant main effect of group (Believer vs Non-Believer vs Control, between-subjects), $F(2, 85) = 10.75$, $p < .001$, $\eta_p^2 = .20$, and a significant Group x Session interaction, $F(2, 85) = 12.24$, $p < .001$, $\eta_p^2 = .22$. Planned comparisons found that ratings did not differ significantly between sessions for Non-Believers, $p = .377$, or controls, $p = .813$, but were significantly increased in Session 2 relative to Session 1 for Believers, $p < .001$.

4.2.3.2.3. Behavioural intention (CCR). Participants were asked in Session 2 how many times they intended to participate in CCR (as well as other filler sports/exercises) over the next 2 months. Believers responded with a mean of .19 times (*SD* = .64), non-believers gave a mean of .12 times (*SD* = .70) and controls gave a mean of .28 times (*SD* = .70). A one-way analysis of variance found that there was no significant effect of group (Believer vs Non-Believer vs Control) on how many times participants' intended to go CCR over the next two months, $F(2, 87) = .44$, $p = .643$.

4.2.3.2.4. Behavioural Intention (General). Participants were also asked how many times they intended to engage in general physical activity over the next month. Believers indicated that they would engage in a mean of 4.23 periods of exercise (*SD* = 1.45), Non-Believers indicated that they would engage in a mean of 3.55 periods of exercise (*SD* = 2.00) and controls indicated that they would participate in a mean of 4.17 periods of exercise (*SD* = 3.88). A one-way ANCOVA (with strength of exercise intention as a covariate) indicated that there was no significant effect of group on the number of times participants intended to engage in general exercise over the next month, $F(2, 84) = .62$, $p = .542$.

4.2.3.3. Implicit attitudinal consequences of false memories and beliefs.

In scoring responses from the IAT, the 'D-algorithm' devised by Greenwald, Nosek, and Banaji (2003) was used. This exclusively uses data from blocks 3, 4, 6 and 7, treating all other blocks as training trials. Initially, trials with a response latency greater than 10,000ms are deleted. Participants who register a response latency of less than 300ms in more than 10% of their trials are then eliminated from analyses (in order to minimise the impact of random responses). On this basis, 17 participants were eliminated from IAT analyses, leaving a total of 71 participants eligible for IAT analyses; 19 Believers, 26 Non-Believers and 26 controls.

After this initial data treatment, the mean latency for correct trials was computed for each block included in analyses, with a pooled standard deviation being computed for blocks 3 and 6, and another pooled standard deviation being computed for blocks 4 and 7. Error latencies were replaced with the appropriate blocks mean latency plus 600ms, before means of the resulting latencies were computed for each block. Two differences were then computed; one for block 6 minus block 3, and the other for block 7 minus block 4. Each difference was divided by its associated pooled standard deviation. The mean of these two quotients represented the final D-Score.

Believers exhibited a mean D-Score of .60 (SD = .47), non-believers had a mean score of .56 (SD = .52) and controls had a mean score of .44 (SD = .53). A one-way ANOVA found no significant effect of group (Believer vs Non-Believer vs control) on implicit attitudes towards exercise, $F(2, 70) = .62$, $p = .539$.

4.2.3.4. Behavioural consequences of false memories and beliefs.

In order to assess whether the elicited false memories and beliefs had any immediate behavioural effects, we measured whether participants were willing to sign up to participate in a fake study which would require them to engage in physical activity (running on a treadmill). A total of 4 Believers (15.4%) answered in the affirmative, whilst 1 Non-Believer (3.1%) and 4 controls (14.3%) did likewise. Because some expected counts were below 5, Fisher's exact test was used to assess whether likelihood of signing up for the fake study differed by group; no significant effect was found, p = .219.

4.2.4. Discussion

This experiment aimed to determine whether similar explicit attitudinal effects of false memories and beliefs to those observed in past studies could be replicated in a new attitudinal domain. The false feedback paradigm again proved able to elicit false memories and beliefs, albeit not quite as efficiently as in Experiment 1. This may have been because baseline confidence in the false suggestion event and attitudes towards the critical item were both moderately lower in this experiment, which may have resulted in slightly less frequent endorsement of the false suggestion. Nevertheless, sufficient false memories and beliefs for analyses were elicited, and similar explicit attitudinal effects to those observed in Experiment 1 were observed; participants who formed false memories and beliefs of enjoying CCR at school reported significantly higher likelihood of hypothetically signing up for CCR at a gym and hypothetically enjoying CCR in general. These results replicate the explicit attitudinal effects of false memories and beliefs found in previous studies within a novel domain of attitudes, and thus support

the notion that false memories and beliefs can significantly affect implicit attitudes towards a wide variety of attitude objects (as opposed to just food).

However, one self-reported explicit attitudinal measure did not exhibit any significant effects; participants who formed a false memory and belief did not report that they intended to participate in CCR more over the next two months than those who did not form a false memory or belief and controls. However, the data suggests that this variable may not be a valid representation of explicit attitudes towards CCR. The mean number of times participants indicated they intended to participate in CCR was close to 0 across all groups; there was considerable variability in other explicit measures of CCR (Gym Questionnaire, Exercise Activity Preferences Questionnaire), especially at Session 2 (when this measure was taken), and so even participants who indicated favourable attitudes towards CCR indicated little intention of actively engaging in it in the near future. Retrospectively, this does make sense; CCR is not an activity which many engage with on a regular basis, even those who have favourable attitudes towards it. In light of this, the lack of a significant effect of false memories and beliefs on this variable is unsurprising.

With regards to the question of whether false memories and beliefs can affect explicit attitudes in general, the lack of a significant effect of false memories or beliefs on the number of times participants reported they would exercise in the near future supports the view that explicit attitudinal effects may be limited to the specific item relevant to the false suggestion event. This is consistent with the results of Experiment 1, which showed that positive false memories and beliefs of loving broccoli as a child had little influence on explicit attitudes for a variety of other vegetables. Again, this has implications for any potential application of false memories and beliefs for behavioural modification; if false memories and beliefs can only affect attitudes towards the specific

item central to the false memory/belief, this is not likely to have behavioural effects significant enough to justify the associated ethical issues.

This study also aimed to assess whether the positive false memories and beliefs elicited had immediate behavioural effects within this new attitudinal domain by measuring participants' willingness to participate in an unrelated (fake) study in which they would have to engage in physical activity (running on a treadmill). It was found that those with a false memory or belief were no more likely to sign up to this fake study than those who did not form a false memory or belief or controls. This failure to replicate the behavioural effects observed in Experiment 1 and by past studies in the "false food memory" domain (Geraerts et al., 2008; Scoboria et al., 2008) may be due to problems with the behavioural measure. Explicit attitudinal results have consistency found that effects of false memories and beliefs appear to be restricted to the individual item within the false suggestion, and this behavioural measure assess participants' willingness to engage in a behaviour (running on a treadmill) which is relatively loosely associated with the critical item (CCR). In addition to this, similarly to the CCR behavioural intention measure, very few participants across all groups indicated that they would be willing to sign up for the fake running study (even those who had expressed preferable attitudes both pre- and post-suggestion towards CCR). There are also a variety of reasons why participants may not have wished / not been able to sign up for the study; for instance, a substantial number of participants participated in this study in close proximity to holidays or exam periods, which may have resulted in them being less likely to sign up for participation in additional studies. Other participants may have not wished to participate in a study in which they would have to run in front of an experimenter (regardless of their attitudes and behaviour regarding running in general).

These numerous issues are potential reasons why this behavioural measure failed to yield any significant effects.

Perhaps the most novel question investigated in this study was whether false memories and beliefs of a positive exercise-related experience would be able to affect implicit attitudes towards exercise in general. As was the case for general explicit attitudinal effects, no significant effect of false memories and beliefs was found on implicit attitudes towards exercise. Whilst it would be beneficial to assess whether implicit attitudes were affected towards the critical item only (as has been the case in explicit attitudinal results), the IAT is not designed for this type of analyses; there is strong evidence that the standard IAT does not produce conceptually distinct measures for subsets of stimuli (Nosek, Greenwald, & Banaji, 2005). The initial prediction that false memories and beliefs elicited in this study may be able to affect implicit attitudes towards exercise in general was based on recent research which revived the idea that mental imagery exercises of positive experiences could affect implicit attitudes towards exercise in general (Markland et al., 2015). In retrospect, however, it seems that this prediction may have been flawed. In reality, only memory is conceptually and phenomenologically similar to mental imagery exercises; a belief in the occurrence of an event without accompanying recollective experience is conceptually quite different. In light of this, a more suitable prediction may have been that whilst false memories may be able to affect implicit attitudes, false beliefs alone may not. Unfortunately, effectively testing whether the false memories elicited in this experiment had any effect on implicit attitudes towards exercise in general is not possible due to the small sample size; only 14 of the 26 participants who could be classified as Believers reported a false memory of loving cross country running. Even if those numbers were sufficiently high, the weight of evidence from the explicit attitudinal data across Experiment 1 and 2

suggests that a form of IAT which can measure implicit attitudes towards individual attitude objects may be more appropriate.

The finding that explicit attitudinal effects of false memories and beliefs are generalizable to new attitudinal domains (in this case, exercise rather than food) is a useful one; whilst the adaptation of the paradigm to exercise-related attitudes was not as efficient at eliciting false memories and beliefs as the food-related design in Experiment 1, it nonetheless demonstrated that the false feedback paradigm can be adapted to elicit false memories and beliefs about (and measure subsequent attitudes towards) a different range of attitude objects. Whilst the behavioural intention measure for the critical item and the behavioural consequence variable yielded no significant effects of false memories and beliefs, there are numerous issues with the variables which means relatively little can be concluded from these results. Similar to Experiment 1, the results appear to indicate that the explicit attitudinal effects of false memories and beliefs are restricted to the central item of the false suggestion event rather than having more general attitudinal effects. That no significant effects of false memories and beliefs were found on IAT D-Scores appears to imply that this lack of a generalizable attitudinal effect may also be the case in the domain of implicit attitudes. However, this experiment had numerous issues with its theoretical predictions and means of measurement regarding implicit attitudes, which will aim to be addressed in Experiment 3.

4.3. Chapter 4 Discussion

The main aims of Experiments 1 and 2 were to determine whether the explicit attitudinal effects of false memories and beliefs observed by previous studies were replicable, whether false memories and beliefs had immediate behavioural consequences, whether false memories and beliefs had more general attitudinal effects as opposed to being restricted to the individual false suggestion item, and whether false memories and beliefs had implicit attitudinal consequences as well as explicit. With regards to replicating the explicit attitudinal results of previous studies, the results were very consistent. Both experiments consistently demonstrated that participants who formed false memories or beliefs of a positive experience regarding a certain attitude object went on to report significantly more preferential explicit attitudes towards the item post-suggestion. These effects were reliable across both the standard false-feedback procedure eliciting false memories concerning and measuring attitudes towards foods, and in the modified procedure which changed the attitudinal domain from food to exercise. Results regarding the experiments' other predictions were more mixed.

Regarding the immediate behavioural consequences of false memories and beliefs, Experiment 1 found that those who formed a false memory or belief were more likely to choose the critical item (broccoli) as a food reward at the end of the experiment than non-believers or controls, suggesting that the false memories and beliefs did have behavioural consequences. Experiment 2's behavioural measure revealed no significant effect of false memories and beliefs, although there were a number of flaws with this measure which limit any conclusions which can be drawn from these results. Therefore, if only considering the results of Experiment 1, there is some evidence which tentatively

suggests that positive false memories and beliefs can result in behavioural effects, although this finding may require replication.

The results across both studies appear to suggest that false memories and beliefs do not have more general attitudinal effects which extend beyond the individual item pertinent to the false suggestion. In Experiment 1, Believers (as well as Non-Believers and controls) did not exhibit any significant changes in attitudes towards various other items which fell under the same general category as the critical item (i.e. vegetables), and in Experiment 2, participants' attitudes towards exercise in general were not affected by the formation of false memories or beliefs of enjoying cross-country running. In addition to this, the false memories and beliefs elicited in Experiment 2 were not found to have any impact on implicit attitudes towards general exercise. This consistent failure to find any general attitudinal effects of false memories and beliefs suggests that effects may be restricted solely to the critical item central to the memories or beliefs. Interpreted retrospectively within the APE (Gawronski & Bodenhausen, 2006) framework, this finding makes sense. In terms of explicit attitudes, the APE model would suggest that immediate attitudinal changes are likely the result of syllogistic inferences made using current available information; if a person has a false memory of a positive experience concerning a certain attitude object, this serves as information which may serve to form the inference that they like the attitude object. However, within this conceptualisation of attitude change, this is unlikely to affect explicit processes regarding other attitude objects.

With regards to implicit attitudes, the APE model suggests that implicit attitudinal changes result from changes to underlying associative activations triggered upon presentation of the attitude object. In order for there to be general implicit attitudinal effects of false memories and beliefs (such as a positive shift in implicit

attitudes towards exercise resulting from a positive memory or belief of enjoying cross-country running), associative activations would have to be modified to the extent that presentation of the attitude object triggers not just positive associations for that one object, but for related objects as well. As the results of Experiment 2 suggest, this may not be possible in the immediate aftermath of forming a false memory or belief. Additionally, the logic behind the prediction that false memories and beliefs may affect implicit attitudes is flawed if considered within the APE framework; the rationale behind this will be further explored in Experiment 3 (section 5.1.1), but there is reason to believe that only false memories may affect implicit attitudes, whereas false beliefs may not. This prediction is impossible to address using the Experiment 2 data, since insufficient numbers of false memories and beliefs were elicited to analyse each separately. This problem is a result of the inefficient nature of the paradigm; something which Experiments 3 and 4 aimed to address.

Chapter 5: Refinement of the false-feedback paradigm and implicit attitudinal measures.

The first two experiments of this thesis provided evidence that the positive explicit attitudinal effects of false memories and beliefs were replicable, as well as finding that these results appear to be specific to the individual item central to the false suggestion. Some tentative evidence for behavioural effects of false memories and beliefs was also found. However, the studies encountered numerous methodological issues. Perhaps the biggest problem was the inefficiency of the paradigm in terms of usable participant data. Since the paradigm is designed to measure the attitudinal effects of *false* memories and beliefs, any participants for whom the false suggestion event is in fact likely to be true are immediately excluded from analyses. In Experiment 1, this resulted in 45 out of 128 participants (just over 35%) being immediately excluded, with 31 out of 119 participants (just over 26%) being excluded in Experiment 2. In both experiments, this inefficiency contributed towards relatively small group sizes for subsequent analyses, and made it impossible to separately analyse attitudinal effects for those who formed a false memory of the false suggestion event and those who formed a false belief only. Given that separating these two groups was essential for assessing the theoretical predictions concerning implicit attitudes in Experiment 3 (explained in Section 5.1.1.), it was decided that certain procedural modifications would need to be made (please note that the precise details of the procedure can be found in the Method sections of each experiment; what follows is a brief description of the general changes made).

In order to maximise the amount of usable participant data (i.e. data which was not excluded because of high baseline confidence in the false suggestion event), the false feedback questionnaire was adapted so that there were multiple potential critical

items as opposed to just one. In the original design of the false feedback paradigm (as used in Experiments 1 and 2), there was one uniform false suggestion given to all participants in the experimental group. In Experiments 3 and 4, the false suggestion followed a uniform template (e.g. “you loved __ the first time you tried it”), but the critical item within the false suggestion was adapted to one of four potential items based on the participants’ responses in Session 1 (with the FHI being modified to measure participants’ confidence that they had loved a series of different foods the first time they had tried it, instead of just one). Subsequently, the DV’s measured were the explicit/implicit/behavioural measures pertaining to the critical item within each individual’s false suggestion. This maximised the chances of being able to use the participants’ data; the only participants who were excluded from analyses on the basis of having high baseline confidence in the false suggestion were participants who had selected high baseline confidence in every possible permutation of the false suggestion.

Two other modifications were made to the false feedback questionnaire, with the aim of eliciting as many false memories and beliefs as possible (given that the questions Experiments 3 and 4 aimed to address required separating the two in analyses). The first of these changes involved the filler events provided at the start of the feedback. As per previous false feedback studies, the feedback questionnaire administered at the start of the second experimental session in Experiments 1 and 2 claimed that participants’ responses in Session 1 had been analysed, and based on these responses, a series of events likely to have happened to them had been prepared. In reality, the same feedback was given to each participant, consisting of several events which could generally be considered to have been experienced by most people (plus the false suggestion for the experimental group). In order to maximise the credibility of the false feedback, the filler events provided in the questionnaire in Experiments 3 and 4 were actually based on

participants' responses from Session 1; that is, all filler items provided in the feedback were events which participants had indicated high baseline confidence of. Past research has found that including self-relevant details within false suggestions significantly increases the likelihood of participants forming false memories or beliefs (Desjardins & Scoboria, 2007), and although the events contained within the FHI are quite general, it was reasoned that tailoring each participants feedback to reflect their actual responses would increase the credibility of the false suggestion.

Another aspect of the false feedback questionnaire which was modified with the aim of maximising the chances of participants forming false memories or beliefs were the instructions regarding imagining the false suggestion item (and a filler item). In Experiments 1 and 2, participants were informed that two events of the four given in the feedback had been randomly chosen for them to give some elaborative details on; in reality, the Suggestion group always received the same filler item plus the false suggestion, whilst the control group always received the same two filler items. The instructions asked participants to "imagine the setting in which [the] experience might have happened", before encouraging them to list where they may have been and who may have been with them. These were the same instructions given in past false-feedback studies (Bernstein et al., 2005a; Laney, Morris, et al., 2008), which were presumably included on the basis of imagination inflation; the finding that detailed imagination of an event tends to increase confidence that the event actually occurred (Garry et al., 1996). However, these instructions are quite vague and do not encourage detailed imagination. It has been found that the imagination inflation effect is optimal when participants imaginations of the event are rich in sensory details (Thomas, Bulevich, & Loftus, 2003), and so the instructions in the false feedback questionnaire were adapted to encourage more detailed imaginations. Participants were encouraged to

spend more time imagining each event with as much detail as possible, before being instructed to provide an open-ended list of any sensory details associated with their imagining of the event. Full details of these instructions can be found in the methodology of Experiment 3.

In addition to these changes which were made to maximise usable participant data and increase the likelihood of participants forming a false memory or belief of the false suggestion event, Experiments 3 and 4 also replaced the filler personality questionnaires of Experiments 1 and 2 with various measures of individual differences. These were included for the purposes of analyses performed in Section 6.2. A questionnaire was also added after the Memory or Belief questionnaire which assessed various phenomenological characteristics of any reported false memories. These data were analysed in Section 6.1. The precise questionnaires used will be briefly discussed in the methodology of Experiment 3, and discussed in more detail in Sections 6.1.2 and 6.2.2.

The final major methodological change made in Experiments 3 and 4 was the method used to analyse the implicit attitudinal effects of false memories and beliefs. Experiment 2 utilised the IAT, which is the most commonly used and psychometrically robust measure of implicit attitudes (Bar-Anan & Nosek, 2014). However, this method is only an effective means of analysing implicit attitudes for items/concepts relative to the comparison item/concept, and thus is only effective when the two categories are naturally opposed. Thus, whilst the IAT may have been an effective means of analysing implicit attitudes towards exercise in general (which had the opposition category of sedentary activities), it is not an appropriate measure of implicit attitudes for individual items which may lack a natural opposite (e.g. cross-country running). Given the lack of evidence for generalised attitudinal effects of false memories and beliefs in the current

literature and the first two experiments of the thesis, it was decided that Experiments 3 and 4 would focus on item-specific rather than general effects. In order to determine whether false memories and beliefs could affect implicit attitudes towards individual items which lacked naturally-opposing items/concepts, the Single-Target Implicit Association Test (ST-IAT) as used by Bluemke and Friese (2008) was used instead of the standard IAT. This test works in a broadly similar way to the standard IAT, but without the need for a comparison category. Specific details of the procedure can be found in the methodology of Experiment 3.

5.1. Experiment 3

5.1.1. Introduction

The general conclusions that can be reached after the first two experiments are that the explicit attitudinal effects of false memories and beliefs found by previous studies appear to be reliable (within both the food domain as used in previous studies, and the novel domain of exercise attitudes), and these attitudinal effects appear to be restricted to the individual items which are central to the false memory or belief being elicited, rather than having more general effects extending to other, related items. The findings relating to implicit attitudinal and behavioural effects of false memories and beliefs were less conclusive, although in both cases, there were some methodological limitations which may have led to these inconclusive results. Experiment 3 aimed to refine the predictions and methods regarding the potential impact of false memories and beliefs on implicit attitudes, with a stronger theoretical grounding and more appropriate means of measurement.

As discussed in Experiment 2, the prediction that false memories and beliefs may be able to affect implicit attitudes as well as explicit was partially influenced by an experiment by Markland et al. (2015). Reviving a finding first detailed by Blair et al. (2001), Markland et al. found that mental imagery of a positive exercise-related experience was associated with participants exhibiting more positive implicit attitudes towards exercise. Markland et al. interpreted their results in reference to Gawronski and Bodenhausen's (2006) APE model (discussed in Section 2.2). Within this framework, implicit attitude change can be considered to result from a change in underlying associative structures which form the basis of automatic evaluations. Importantly, the APE model states that this can be at least partially dependent on immediately available

information/contextual cues. This explains how transient manipulations such as mental imagery can affect implicit attitudes; as Markland et al. argued, detailed mental imagery affected implicit attitudes by creating associations between the attitude object and positively-valenced details generated during the imagery exercises (for instance, positive sensory or affective details).

This theoretical consideration was regrettably ignored in Experiment 2, but is potentially of great relevance to predictions regarding the potential effects of false memories and beliefs on implicit attitudes. In recent years, a line of research has emerged emphasising the shared characteristics of remembering past events and imagining hypothetical future scenarios. Both memory and imagination can contain rich episodic details pertaining to a specific time and place (Addis, Wong, & Schacter, 2007) and have strong phenomenological similarities. For example, D'Argembeau and Van der Linden (2004) found that both episodic memories of past events and imagination of hypothetical future events were associated with feelings of re-experiencing (or "pre-experiencing") and that in both cases, temporally-close events were associated with stronger sensory and contextual details relative to temporally-distant events. In a related study, D'Argembeau and Van der Linden (2006) investigated whether individual difference measures which have been previously found to affect episodic memory were similarly influential in participants' imaginations of future scenarios. They found that participants with a higher capacity for visual imagery reported more visual/sensory details in their imagined events. In addition to phenomenological similarities, there is also strong evidence that episodic memory of past experiences and imagination of future experiences are supported by similar neural substrates (see Schacter et al., 2012 for a review).

Given these strong similarities between episodic memory and imagination, it seems logical that false memories may be able to affect implicit attitudinal processes in a similar way to the mental imagery exercises of Markland et al. (2015) and Blair et al. (2001); in terms of the APE, underlying associative structures may adapt to accommodate the associative information provided by the memory (positive sensory/affective details). However, there is reason to suggest that false beliefs may not impact upon implicit attitudes in the same way. A lack of accompanying recollective experience in a false belief seems unlikely to produce sufficient details/information necessary to change automatic associations generated upon presentation of the attitude object. Therefore, whilst there is strong theoretical rationale to suggest that false memories may be able to sufficiently impact implicit attitudes, it seems unlikely that false beliefs would be able to do likewise.

The APE framework can also inform predictions regarding how false memories and beliefs may (or, more appropriately, may not) differentially affect explicit attitudes. According to the APE model, explicit attitudes are based on “propositional processes”, which contribute towards attitude judgments through syllogistic inferences concerning information considered relevant to the judgment at hand. Therefore, within this framework, whether an individual has a false memory or a false belief of an event regarding an attitude object, both of these may serve as effectively identical propositions in an explicit attitudinal judgment (e.g. “I remember loving broccoli as a child / I believe I loved broccoli as a child, therefore I like broccoli”). As a result of this, there is reason to believe that false memories and beliefs may be virtually indistinguishable in their explicit attitudinal effects. This notion is supported by the current literature. No previous individual study has investigated the explicit attitudinal consequences of false memories and false beliefs separately, instead consistently

grouping both into the same group (an issue which is most likely due to insufficient sample sizes to separate the two groups). However, a recent mega-analysis of the false-feedback studies by Bernstein et al. (2015) was able to do this after combining data from eight published experiments. It was found that the explicit attitudinal effects of false memories and beliefs were highly comparable. This finding fits well within the APE model's conceptualisation of explicit attitudes and attitude change.

This experiment aimed to re-examine the question of whether false memories and beliefs can affect implicit attitudes as well as explicit attitudes, taking a revised approach from that considered in Experiment 2. A highly similar false-feedback paradigm to that used in Experiments 1 and 2 was used, with a variety of aforementioned procedural changes which aimed to maximise the amount of usable data and the number of false memories and beliefs elicited (the precise details of the procedural modifications can be found in the Method section). Similar to Experiment 1, this experiment aimed to elicit false memories and beliefs of loving a certain food as a child, and assessed their effects on explicit and implicit attitudes towards the relevant item. It was predicted that, as in previous experiments, participants who formed a false memory or belief would report significantly more preferable explicit attitude ratings for the critical item post-suggestion. Based on the aforementioned theoretical rationale that false memories may be sufficient to alter implicit attitudes but false beliefs alone may not, it was predicted that those who formed a false memory would exhibit significantly more preferable implicit attitudes towards the critical item than those who formed a false belief only (and controls). Again, as in Experiment 1, a behavioural measure was obtained in the form of participants choosing a "food reward" at the end of the experiment. Although various issues were identified with this behavioural measure in Section 4.1.4, significant results were previously observed in this measure

(demonstrating sensitivity to elicited false memories and beliefs), and there is a lack of clear alternatives for relevant, realistic, behavioural measures obtainable immediately post-experiment. It was again predicted that those who formed a false memory or belief would be more likely to choose their critical item as a food reward. Additionally, consistent with the findings of Greenwald, et al. (2009), it was predicted that implicit and explicit attitudes would each significantly predict food choice, but prove more effective predictors in a combined regression model.

5.1.2. Method

5.1.2.1. Participants

The overall sample consisted of 120 participants, predominantly made up of undergraduate Psychology students from the University of Hull who participated in return for course credit. As in the preceding experiments, allocation to either the Suggestion group or control group was only partially randomised. The first $n = 96$ participants were randomly allocated to either the Suggestion or control group at a ratio of two Suggestion group participants to one control group participant. After a sufficient number of eligible control participants had been recruited for analyses ($n = 32$), all subsequently recruited participants ($n = 24$) were allocated directly to the Suggestion group. Again, as in previous experiments, participants were only eligible for analyses if they reported low baseline confidence in the false suggestion event; however, the modifications made to the FHI (see Materials and Procedure sections) meant that in order to be excluded, participants needed to report higher than midline confidence in loving all four of the potential critical items the first time they tried it to be excluded from analyses. After excluding participants for whom this was the case, there were a

total of *n* = 106 participants eligible for analyses (75 Suggestion group, 31 control group). This sample was made up of 88 females and 18 males, with a mean age of 21.88 (*SD* = 6.33). Up to five participants were tested simultaneously in each experimental session.

5.1.2.2. Design

The design of the experiment was similar to the previous experiments; a mixed-design with session (Session 1/pre-suggestion vs Session 2/post-suggestion) serving as a within-subjects factor and group serving as a between-subjects factor. The factor of 'group' is made up of different subgroups at various stages of analyses; initial analyses compares Suggestion group vs control group participants, with later analyses comparing various subdivisions of the Suggestion group and controls.

The dependent variables differed slightly from the previously reported studies. Whilst in Experiments 1 and 2, the explicit attitudinal DVs were the appropriate questionnaire ratings for the item critical false suggestion item ('broccoli' in Experiment 1, and 'cross-country running' in Experiment 2), this experiment introduced the procedural modification of multiple potential critical false suggestion items. Thus, the explicit attitudinal DVs measured were the corresponding questionnaire ratings for any given participant's allocated false suggestion item. Similarly, the implicit attitudinal DV was the outcome value of the ST-IAT for the participants' allocated false suggestion item.

5.1.2.3. Materials

The pen-and-paper questionnaires utilised in Experiment 1 were again utilised for this experiment, although various procedural modifications were applied to improve the efficiency of the design (in terms of usable participant data) and increase the

likelihood of eliciting false memories and beliefs. One of the most important methodological changes was the introduction of multiple potential critical false suggestion items. Multiple changes were made to the questionnaires in order to achieve this. Firstly, the "Food History Inventory" (FHI) questionnaire (included across both sessions to measure pre- and post-suggestion confidence in the false suggestion) was adapted (see Appendix C for the modified version of the FHI used in this experiment). In Experiment 1, this measured the participants' confidence in the occurrence of 24 different food-related events from their childhood, one of which was the item which would later serve as the false suggestion ("you loved broccoli the first time you tried it"). In the current experiment, the FHI measured the participants' confidence that 24 separate food-related events had happened to them before the age of 12 (all filler items), with an additional section asking participants to rate how confident they were (on the same 1-8 scale) that they had loved a series of foods the first time they tried them. Within this list of 20 different foods were the four potential critical items; broccoli, carrots, green beans, and cauliflower.

Session 1 also contained the "Restaurant Questionnaire", which was largely the same as it was in Experiment 1, measuring participants' desire to eat 32 different dishes in a restaurant setting on a 1-8 scale. This was slightly modified to include dishes pertaining to each of the potential critical items; in addition to "stir-fried broccoli" (which already appeared in the questionnaire), the items of "carrot salad", "buttered green-beans" and "roasted cauliflower salad" were included. The "Food Preferences" questionnaire was also used again, measuring participants' general preference for 64 different foods on a 1-8 scale. All four potential critical items were already represented in this questionnaire, so no modification was necessary. In addition to these, participants also completed five "personality questionnaires" (some of which are relevant to

analyses in Chapter 6). These included the revised Need for Cognition scale (Cacioppo, Petty, & Kao, 1984), the Need to Evaluate scale (Jarvis & Petty, 1996), the revised Self-Consciousness scale (Scheier & Carver, 1985), the Plymouth Sensory Imagery Questionnaire (Andrade, May, Deeprose, Baugh, & Ganis, 2014) and the Dissociative Experience Scale (Bernstein & Putnam, 1986). Session 1 also contained the same filler "Food Habits" questionnaire from Experiment 1.

The questionnaires utilised in the second session consisted of repeats of the FHI, Restaurant and Food Preference questionnaires, as well as the false-feedback questionnaire. This contained several changes from the false-feedback questionnaires used in Experiments 1 and 2 (see Appendix D for the modified false-feedback questionnaire used in this experiment). Similarly, it was presented as personalised to each individual participant; participants were informed that their responses from Session 1 had been analysed, and a series of childhood events they indicated they were confident had happened were presented below. For this experiment, the Suggestion group were presented with three event items from the FHI which they in fact *did* indicate that they were confident had occurred to them (as determined by Session 1 FHI ratings of 6 or more), whilst one of the items was the false suggestion (control participants received four events which they had indicated high confidence in in Session 1, with no false suggestion). The false suggestion event given to Suggestion group participants was that they had loved their assigned critical item the first time they had tried it (see Procedure for details on how critical items were assigned).

After presenting the four events, the feedback questionnaire then informed participants that two events had randomly been chosen for them to elaborate on; in reality, control groups were presented with two experiences chosen at random from the four presented in the feedback, whilst Suggestion group participants were given one

experience from the feedback chosen at random and the false suggestion. The elaboration instructions were changed from those included in Experiments 1 and 2 to encourage more in-depth imagination of the false suggestion event. Instructions were adapted from Grilli and Glisky's (2010) “self-imagining” technique, which was found to significantly increase recollection of imagined experiences. Participants were encouraged to imagine themselves at the scene in which the event may have occurred with as much detail as possible, before listing “any information on sensory details (sights, sounds, etc), thoughts or feelings” associated with the event. Participants were encouraged to list “at least 3 details”. After doing this, they were asked to rate on a 1-8 scale how vividly they were able to imagine the event, followed a filler question regarding the extent to which they feel the event influenced their personality (designed to disguise the true nature of the study).

Session 2 also featured the “food costs” questionnaire used in Experiment 1, which presented participants with a series of foods with 8 accompanying prices (in ascending order) and asked them to indicate the maximum they would be willing to pay for each item in a supermarket setting. The Memory or Belief questionnaire used in the previous experiments was also featured. All participants were presented with three events (again, ostensibly chosen at random, but in fact always including the false suggestion event), and asked to indicate whether they had a memory of the event, a belief that the event occurred but no associated memory, or whether they were certain that the event did not happen. If participants indicated a memory of the event, they were encouraged to give us many details of the memory as possible, if they indicated a belief but no memory, they were encouraged to explain why they thought they event had happened, and if they indicated that they were certain the event did not happen, they were asked to explain why they were sure of this.

Session 2 also included a questionnaire which assessed various phenomenological characteristics of any reported memories. Participants were presented with the three events which were contained within the Memory or Belief questionnaire (critically including the false suggestion), and for any event they had reported a memory of, they were instructed to complete a 15 item questionnaire. These questionnaires were constructed from various subsets of the short-form Memory Experiences Questionnaire (MEQ-SF, Luchetti & Sutin, 2015) for the purposes of Experiment 5 (the Materials section of which contains further details of the questionnaires).

To measure implicit attitudes, the Single-Target Implicit Association test (ST-IAT) initially developed by Karpinski, and Steinman (2006) was used. This works on a similar principle to the standard IAT used to measure implicit attitudes in Experiment 2; it is based on participants' response times in categorising pictures or words representing an attitude object when paired with positively or negatively valenced stimuli, with the underlying assumption that positive implicit attitudes towards the attitude object should facilitate faster response times when the object is paired with positively valenced stimuli than when it is paired with negatively valenced stimuli. The benefit of the ST-IAT in this experiment is that it does not require a comparison item/category as in the standard IAT, and so is more suited to measuring implicit attitudes towards individual items, as opposed to measuring implicit attitudes for an item/concept relative to an opposing item/concept. The procedures used in the ST-IATs (see Procedure section for details) was based on those used in Bluemke and Friese (2008), who over two studies containing several thousand participants found that the ST-IAT displayed adequate construct and discriminant validity in measuring implicit attitudes to the conceptually-related, but individually distinct concepts of various political parties. All participants completed four ST-IATs; one for each of the potential critical items.

5.1.2.4. Procedure

Session 1. As in Experiment 1, participants were informed when they signed up for the study and when they completed the information and consent forms that they were participating in a study regarding the relationship between food preferences and personality. The first session involved participants completing the FHI, Restaurant and Food Preference questionnaires, interspersed with the five individual differences questionnaires and filler "Food Habits" questionnaire.

In between completing Session 1 and Session 2, participants were randomly assigned to the Suggestion or control groups at a ratio of two Suggestion group participants for every one control group participant (although, as previously mentioned, when sufficient control participants had been recruited for analyses, all subsequently recruited participants were assigned directly to the Suggestion group). At the same time as being assigned to a group, participants were assigned a critical food item which they had indicated low baseline confidence in enjoying the first time they tried it (a Session 1 rating of 4 or less for that item on the FHI). When multiple potential critical items were available, preference was given to an item which also had low explicit attitude ratings on the Restaurant and Preference questionnaires. Where multiple items were available which also matched this attitudinal criterion, preference was given to the item which had currently been assigned to the fewest participants (with the aim of balancing the number of participants assigned to each item as much as possible). In the event that a participant gave a Session 1 FHI rating of > 4 for all potential critical items, they were assigned whichever critical item they had rated lowest, and where multiple options were rated similarly, they were assigned the critical item which had currently been assigned to the fewest participants (although, as previously mentioned, any participants that gave

a Session 1 FHI rating of > 4 for all potential critical items were excluded from analyses anyway, since low baseline confidence in the false suggestion event was required).

Session 2. Participants scheduled their Session 2 appointments for approximately one week after Session 1 (a minimum of 5 days and a maximum of 9 days afterwards). Suggestion group participants received the false feedback questionnaire, including the false suggestion that they had loved their specific critical item the first time they tried it, as well as three filler events which they had indicated they were confident had happened to them based on their Session 1 answers (FHI rating of 6 or higher). Control group participants received the same feedback, except with a fourth filler item in place of the false suggestion. After this point, the questionnaires were identical for both groups. The false feedback questionnaire was followed by repeats of the FHI, Restaurant and Food Preferences questionnaires, followed by the Food Costs, Memory or Belief and S-MEQ questionnaires.

After participants had completed all questionnaires, they were instructed to proceed with the ST-IATs (presented as a "picture/word categorisation task"), which were run using E-Prime 2.0 (Schneider, Eschmann, & Zuccolotto, 2002). Participants were instructed to categorise target category stimuli (pictures of the critical food items) and evaluative stimuli (positive or negative words) as quickly and accurately as possible using two different categorisation keys on the keyboard (Z and M). Before each block of trials, participants were informed which key would represent each category, and the categories remained on screen in the top left (Z key) and top right (M key) corners of the screen during the categorisation task as a reminder. The first block of trials was a training block, in which only evaluative stimuli were presented; participants were instructed to press the 'Z' key in response to positive words and the 'M' key in response to negative words. This was followed by the first ST-IAT, in which stimuli for the first

target and positive words were categorised together, whilst negative words were categorised separately; participants were instructed to press the ‘Z’ key in response to either positive words or pictures of the critical food item, or press the ‘M’ key in response to negative words. This initial block was followed by a “reversed” block, in which positive words alone were mapped to the Z key, whilst target stimuli and negative words were mapped to the M key. This procedure was repeated for each of the remaining three target items, with positive and negative words swapping category keys each time. The order in which each of the four foods was presented was counterbalanced between participants. The sides on which target and evaluative stimuli were first presented (Z or M keys) was also counterbalanced, whilst maintaining that target stimuli and positive words were always paired together first. This created 8 different orders in which stimuli were presented, balanced between participants.

Evaluative stimuli consisted of five unambiguously positive and five unambiguously negative words, presented in 24pt. black font against a white background in the centre of the screen. The target category stimuli consisted of five different 700 x 500 resolution pictures of the appropriate foods, displayed uncooked on white plates. For each block of trials, all stimuli were presented at least twice, and in a randomised order. For the initial evaluative block, a total of 20 evaluative stimuli were presented; 10 words were positive, 10 were negative (see Appendix H for word lists used). For each of the following initial and reversed blocks, a total of 35 stimuli were presented (10 being the pictures of the target food, 10 being the words from the evaluative category which *was* currently sharing a categorisation key with the target food, and 15 being words from the evaluative category which was *not* currently sharing a categorisation key with the target food). The interstimulus interval after responses was 300ms, with incorrect responses triggering the word ‘Error’ which was presented in

bold, red 24 pt. text in the centre of the screen. After each block of trials, participants were instructed to take a self-paced rest break if they were fatigued, as well as being given the new categorisation instructions for the next block of trials which they started whenever they were ready. After all ST-IATs were completed, participants were thanked and fully debriefed.

5.1.3. Results

5.1.3.1. Allocation of false suggestion items

Participants who had indicated that they were confident they had loved all four of the potential false suggestion items the first time they tried them (FHI ratings of 5 or more for each one) were excluded from analysis. Fourteen participants were excluded on this basis, giving a functional *n* of 106 (75 Suggestion group participants and 31 controls). The remaining participants were allocated a critical false suggestion item based on the criteria discussed in the Procedure section. A cross-tabulation showing the numbers of participants assigned to each potential false suggestion item split by group can be found in Table 3.

Table 3.
Cross-tabulation of false suggestion item by group allocation.

	False Suggestion Item			
Group	Broccoli	Green Beans	Cauliflower	Carrots
Control	11 (35.5%)	13 (41.9%)	4 (12.9%)	3 (9.7%)
Suggestion	29 (38.7%)	17 (22.7%)	26 (34.7%)	3 (4%)

Preliminary analyses were conducted to ensure that there were no significant differences between the four false suggestion items in pre-suggestion attitudinal

measures of confidence in the false suggestion event, and the extent to which these measures changed post-suggestion. A series of one-way ANOVAs found no main effect of false suggestion item on Session 1 FHI, Restaurant or Preferences scores, or on the level of post-suggestion change in these measures (all $p > .05$). These results suggested that all four false suggestion items were suitable for grouping together into a single DV in subsequent analyses.

5.1.3.2. Were false memories and beliefs elicited?

FHI and Memory or Belief questionnaires were analysed to assess whether giving participants a false suggestion of loving their relevant critical food item was successful in eliciting false memories and beliefs of this event. The Suggestion and Control groups both gave similar pre-suggestion confidence ratings for the false suggestion item (see Figure 7); the Suggestion group gave a mean rating of 2.01 (*SD* = 1.11) whilst the control group gave a rating of 2.23 (*SD* = 1.20). However, after the false feedback was given at the start of Session 2, Suggestion group participants increased their ratings by an average of 3.39 points to a mean of 5.40 (*SD* = 2.54), whilst the ratings of control participants who did not receive the false suggestion at the start of Session 2 reported very similar level ratings as in Session 1 (*M* = 2.29, *SD* = 1.19).

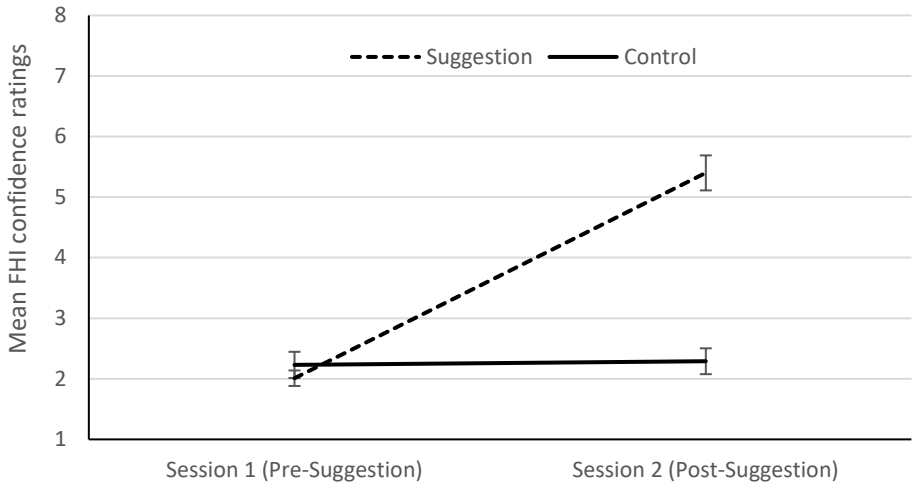

Figure 7. Mean FHI confidence ratings that participants loved their critical false suggestion item the first time they tried it, both in Session 1 (pre-suggestion) and Session 2 (post-suggestion). Error bars represent standard error of the mean.

A 2x2 mixed-design ANOVA (with group as the between-subjects factor and session as the within-subjects factor) found a significant main effect of group on confidence ratings, $F(1, 104) = 21.52$, $p < .001$, $\eta_p^2 = .17$, a significant main effect of session, $F(1, 104) = 69.37$, $p < .001$, $\eta_p^2 = .40$, and a significant Group x Session interaction, $F(1, 104) = 64.28$, $p < .001$, $\eta_p^2 = .38$. Planned comparisons found that Session 2 (post-suggestion) FHI ratings were significantly higher than Session 1 (pre-suggestion) ratings for the Suggestion group, $p < .001$, whilst control group ratings did not significantly differ between sessions, $p = .854$.

Analysis of the Memory or Belief questionnaire revealed that, within the Suggestion group, 27 participants (36%) reported a false memory of the false suggestion event at the end of the Session 2 questionnaires, whilst an additional 26 (34.7%) reported a false belief only and 22 (29.3%) reported that they were positive that the event did not happen. Within the control group, no participants reported a false

memory, 3 (9.7%) reported a false belief, and 28 (90.3%) were positive that the event did not happen. A Pearson's chi square test found that participants' likelihood of reporting a false memory, false belief, or being positive that the event did not happen differed significantly as a function of group, $\chi^2(2, n = 106) = 33.46$, $p < .001$. Combined with the FHI data, these results indicate that false memories and beliefs were sufficiently generated within the Suggestion group.

5.1.3.3. Explicit attitudinal consequences of false memories and beliefs (Believers vs Non-Believers vs controls).

Explicit attitudinal consequences of false memories and beliefs were initially compared between participants who formed either a false memory *or* a false belief ("Believers"), participants who received the false suggestion but did not form a false memory or belief ("Non-believers") and control participants. The criteria for determining whether a participant formed a false memory or false belief was the same as that used in Experiments 1 and 2; any participants remaining after the initial exclusion criteria (confidence rating of 4 or lower for their false suggestion item on the FHI) who received the false suggestion at the beginning of Session 2 and subsequently went on to report a higher rating for the relevant FHI item than they did in Session 1 as well as reporting a memory or belief of the false suggestion event in the Memory or Belief questionnaire. Any Suggestion group participants who did not meet the criteria to be classified as Believers were classified as Non-Believers. Of the 75 Suggestion group participants remaining after the initial FHI exclusion criterion was applied, 52 (69.33%) met the criteria to be classified as Believers, with the remaining 23 (30.66%) classified

as Non-Believers. Data for these subgroups were compared with the 31 control participants who met the initial FHI criteria.

Restaurant Questionnaire. Participants' desire to eat a dish containing their relevant food in a restaurant setting was assessed on a 1-8 scale. The mean ratings for each subgroup of participants across both sessions are displayed in Figure 8. In Session 1, participants who would go on to be classified as 'Believers' gave a mean rating of 3.38 (*SD* = 2.18), those who would later be classified as 'non-believers' gave a mean rating of 2.13 (*SD* = .1.89) and control participants gave a mean rating of 2.87 (*SD* = 2.09). In Session 2 (post feedback), believers increased their mean rating to 5.12 (*SD* = 2.52), whilst non-believers' ratings increased only marginally to 2.26 (*SD* = 1.82), and control participants' ratings decreased marginally to 2.68 (*SD* = 1.85).

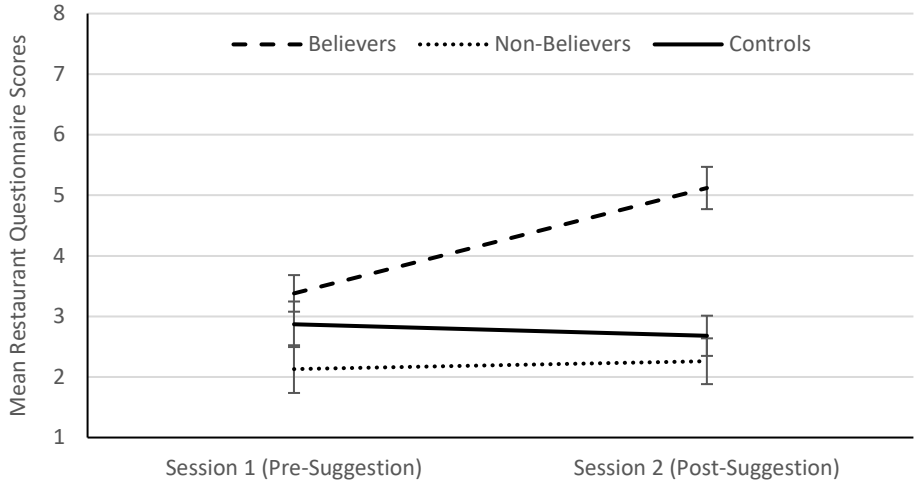

Figure 8. Mean likelihood of ordering critical food-based dish in a restaurant setting ('Restaurant Questionnaire Scores') for Believers, Non-Believers and Control participants in Session 1 (pre-suggestion) and Session 2 (post-suggestion). Error bars represent standard error of the mean.

A 3x2 mixed ANOVA was carried out to assess whether restaurant questionnaire ratings differed significantly as a function of session (Session 1 vs Session 2, within-subjects factor) and group (Believers vs Non-Believers vs Controls, between-subjects factor). Significant main effects were found for session, $F(1, 103) = 8.03$, $p = .006$, $\eta_p^2 = .07$, and group, $F(2, 103) = 11.20$, $p < .001$, $\eta_p^2 = .18$, as well as a significant Session x Group interaction, $F(2, 103) = 11.78$, $p < .001$, $\eta_p^2 = .19$. Planned comparisons revealed that Session 1 and Session 2 ratings did not differ significantly for non-believers ($p = .744$) and controls ($p = .574$), whilst for believers, Session 2 ratings were found to be significantly higher than Session 1 ratings, $p < .001$.

Food Preferences Questionnaire. This questionnaire measured participants' general preference for their false suggestion item (as well as 63 other filler items) on a 1-8 scale, and was completed both pre-feedback (Session 1) and post-feedback (Session 2). The mean ratings for each subgroup are displayed in Figure 9.

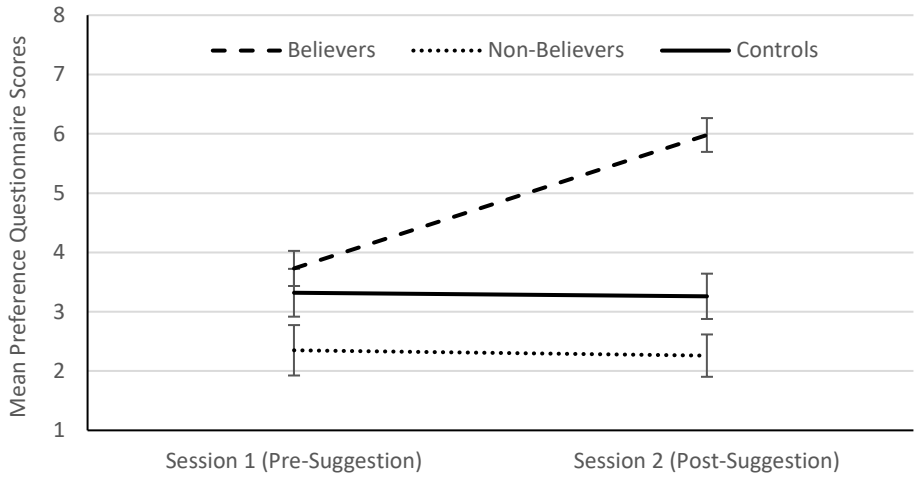

Figure 9. Mean ratings of general preference for the critical food item given in both Session 1 (pre-suggestion) and Session 2 (post-suggestion) for Believers, Non-Believers and Controls. Error bars represent standard error of the mean.

In Session 1, participants who would later be classified as Believers gave their critical items a mean preference rating of 3.73 (*SD* = 2.13), participants later classified as Non-Believers gave a mean rating of 2.35 (*SD* = 2.04), and controls gave a mean rating of 3.32 (*SD* = 2.24). In Session 2, the mean preference rating given by believers increased to 5.98 (*SD* = 2.05), whilst mean ratings for non-believers (*M* = 2.26, *SD* = 1.71) and controls (*M* = 3.26, *SD* = 2.13) remained highly similar to their pre-feedback scores. A 3x2 mixed ANOVA with group (Believers vs Non-Believers vs Controls) as the between-subjects factor and session (Session 1 vs Session 2) as the within-subjects factor revealed significant main effects of both group, $F(2, 103) = 17.18$, $p < .001$, $\eta_p^2 = .25$, and session, $F(1, 103) = 12.79$, $p = .001$, $\eta_p^2 = .11$, with a significant Group x Session interaction, $F(2, 103) = 19.73$, $p < .001$, $\eta_p^2 = .28$. Planned comparisons were carried out to assess the differences in preference ratings between Session 1 and Session 2 for each of the subgroups. Whilst no significant differences were found between Session 1 and Session 2 preference ratings for non-believers ($p = .827$) and controls ($p = .851$), Session 2 preference ratings were found to be significantly higher than Session 1 ratings for believers, $p < .001$.

Food Costs Questionnaire. This questionnaire was only administered in Session 2, and the unequal intervals meant that a non-parametric test was used to analyse differences between groups. A Kruskal-Wallis H test that there was a significant difference between groups in the maximum amount they were willing to pay for their relevant food, $\chi^2 = 9.70$, $p = .008$, with mean rank scores of 61.93 for believers, 41 for non-believers and 46.53 for controls. Planned pairwise comparisons revealed that believers gave significantly higher ratings than controls, $p = .023$, and non-believers, $p = .006$.

5.1.3.4. Explicit Attitudinal Consequences of False Memories and Beliefs (Memories vs Beliefs vs Controls).

To assess the differences in explicit attitudinal consequences of false memories and false beliefs without an associated memory, the subgroup of 'believers' was further subdivided into those who reported a false memory of the false suggestion event in the Memory or Belief questionnaire, and those who reported a false belief only with no specific memory. The 3 control group participants who claimed to have a belief of the false suggestion event despite not having received the false suggestion in their feedback were treated as controls for these analyses rather than as participants having false beliefs. After applying this criterion, there were 27 participants who were classified as having a false memory and 25 who were classified as having a false belief, as well as the 31 control participants. Thus, the functional *n* for this set of analyses was 83.

Restaurant Questionnaire. The mean scores for the Restaurant questionnaire across both sessions is displayed in Figure 10. In Session 1, those who later formed a false memory of the false suggestion event gave a mean rating of 3.26 (*SD* = 2.30), those who later formed a false belief only gave a mean rating of 3.52 (*SD* = 2.08) and controls gave a mean rating of 2.87 (*SD* = 2.09). In Session 2 (post-feedback), participants who later reported a false memory increased their mean rating to 5.30 (*SD* = 2.45), those who reported a false belief increased their mean rating to 4.92 (*SD* = 2.63), and the mean rating of controls decreased slightly to 2.68 (*SD* = 1.85).

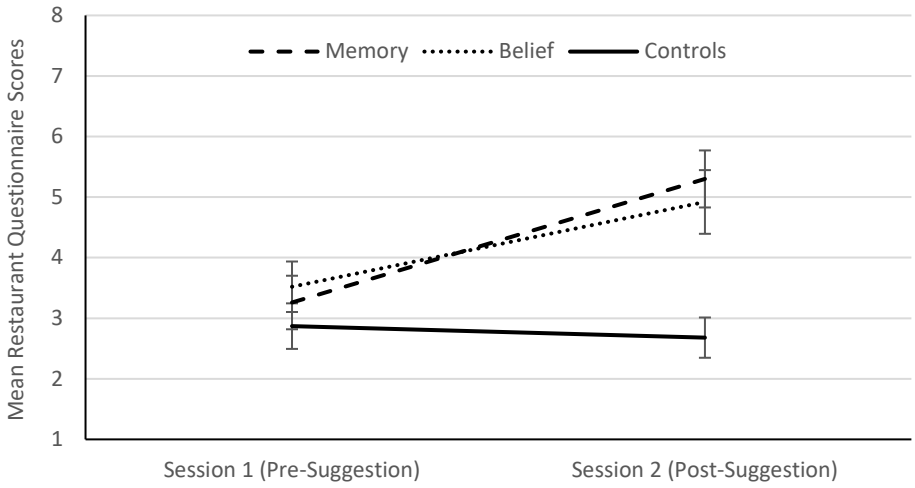

Figure 10. Mean likelihood of ordering critical food-based dish in a restaurant setting in Session 1 (pre-suggestion) and Session 2 (post-suggestion) for participants who reporeted a false memory of the false suggestion event, a false belief of the event only, and control participants. Error bars represent the standard error of the mean.

A 3x2 mixed ANOVA using session as the within-subjects variable and group (memory vs belief vs control) as the between-subjects variable found a significant main effect of session, $F(1, 80) = 23.78$, $p < .001$, $\eta_p^2 = .23$, a significant main effect of group, $F(2, 80) = 5.33$, $p = .007$, $\eta_p^2 = .12$, and a significant Group x Session interaction, $F(2, 80) = 9.54$, $p < .001$, $\eta_p^2 = .19$. Planned comparisons revealed that Session 2 ratings were significantly higher than Session 1 ratings for those with a false memory, $p < .001$, and those with a false belief, $p = .001$, but did not significantly differ for controls ($p = .594$). Ratings for those with a false memory and those with a false belief only did not significantly differ at either Session 1 ($p = .665$) or Session 2 ($p = .639$).

Food Preferences Questionnaire. Mean ratings given for the general preferences questionnaire are displayed in Figure 11. In Session 1, those who would later reported a false memory of the false suggestion event gave a mean rating of 3.89 (*SD* =

2.21), those who would later report a false belief gave a mean rating of 3.56 (*SD* = 2.08) and control participants gave a mean rating of 3.32 (*SD* = 2.24). In Session 2, those who would report a false memory increased their mean rating to 6.37 (*SD* = 1.98), those who reported a false belief increased their rating to 5.56 (*SD* = 2.08) and control participants decreased their mean rating marginally to 3.26 (*SD* = 2.13).

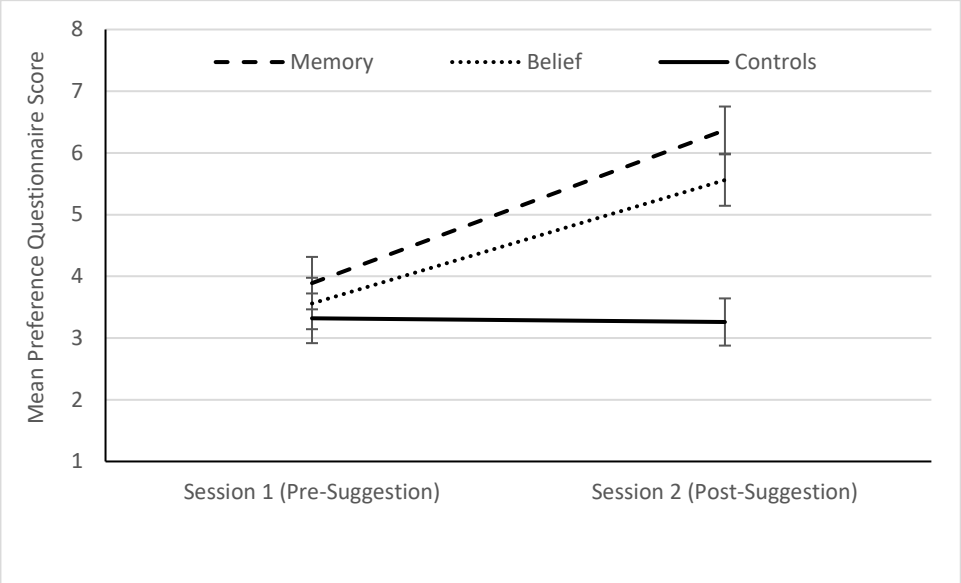

Figure 11. Mean general preference ratings for the critical food items in Session 1 (pre-suggestion) and Session 2 (post-suggestion) given by those who reported a false memory of the false suggestion event, those who reported a false belief of the event only, and control participants. Error bars represent standard error of the mean.

A 3x2 mixed ANOVA with session as the within-subjects factor and group (memories vs beliefs vs controls) as the between-subjects factor found a significant main effect of session on preference ratings, $F(1, 80) = 48.15$, $p < .001$, $\eta_p^2 = .38$, a significant main effect of group, $F(2, 80) = 7.20$, $p = .001$, $\eta_p^2 = .15$, and a significant group x session interaction, $F(2, 80) = 14.44$, $p < .001$, $\eta_p^2 = .27$. As for the Restaurant Questionnaire results, planned comparisons revealed that whilst ratings did not differ significantly between sessions for control participants ($p = .852$), Session 2 ratings were

significantly higher in Session 2 than in Session 1 for those who reported a false memory, $p < .001$, and those who reported a false belief, $p < .001$. One-way ANOVAs revealed that there was no significant effect of group on EAP ratings at Session 1, $F(2, 82) = .486$, $p = .617$, but there was a significant effect of group at Session 2, $F(2, 82) = 17.82$, $p < .001$. Bonferroni-corrected post-hoc tests revealed that at Session 2, both participants who formed a false memory and participants who formed a false belief reported significantly higher EAP ratings than control group participants ($p < .001$ in both cases), but did not significantly differ from each other, $p = 486$.

Food Costs Questionnaire. As in the previous analyses, due to the unequal intervals between the options given, the data were treated as ordinal and the non-parametric Kruskal-Wallis H test was used. In this case, the difference between groups in terms of the amount that participants were willing to pay for their critical item fell short of statistical significance, $\chi^2 = 5.93$, $p = .052$. However, group differences were still in the expected direction with a mean rank of 44.13 for those who formed a false memory, 49.28 for those who formed a false belief, and 34.27 for controls.

5.1.3.5. Implicit Attitudinal Consequences of False Memories and Beliefs (Believers vs Non-Believers vs Controls).

Prior to analyses, reaction time data from the ST-IATs were prepared using the method of Bluemke and Friese (2008), which is itself similar to the *D* algorithm (Greenwald, Nosek, & Banaji, 2003) which is widely used in analyses for the standard IAT. Initially, since the validity of implicit attitude measures relies on participants responding both quickly and accurately in order to facilitate response times via automatic associations, participants with error rates of 20% or more in any block of trials were excluded from analyses (a step which also helps to exclude participants from

analyses who have either failed to engage properly with the task or failed to understand the instructions). Trials in which an error was made were not included in analyses, and latencies above 3000ms and below 300ms were recoded as 3000ms and 300ms respectively. The first trial of each block was considered a "training trial" and dropped from analyses. Each individual latency then underwent z-transformation, by subtracting the individual participant's mean overall response time for all 8 blocks of the ST-IATs (excluding the initial block of training trials) from each latency before dividing it by the individual participant's overall response time standard deviation for all 8 blocks of ST-IATs (again, excluding the initial block of training trials). For each ST-IAT, the measure of a participant's implicit attitude towards the relevant object was calculated by subtracting the mean of transformed latencies in the 'Food + Positive' paired block from the mean of transformed latencies in the 'Food + Negative' paired block. A positive score indicates that participants were quicker in categorising stimuli when the food and positive stimuli were paired together than when the food and negative stimuli were paired together, and thus is representative of a positive implicit attitude towards that item.

ST-IAT results were initially compared between believers, non-believers and controls. Group allocation was based on the same criteria as those used in explicit attitudinal results. After excluding the 16 participants who registered a 20% or higher error rate in one of ST-IAT blocks, as well as additional 5 participants who did not register complete ST-IAT scores due to technical issues during data collection, there were a total of n = 85 participants for these analyses; 42 believers, 18 non-believers, and 25 controls. Believers registered a mean ST-IAT score of -.13 (SD = .34) for their critical item, whilst non-believers had a mean rating of -.36 (SD = .42) and controls had a mean rating of -.22 (SD = .37). These means are displayed in Figure 12.

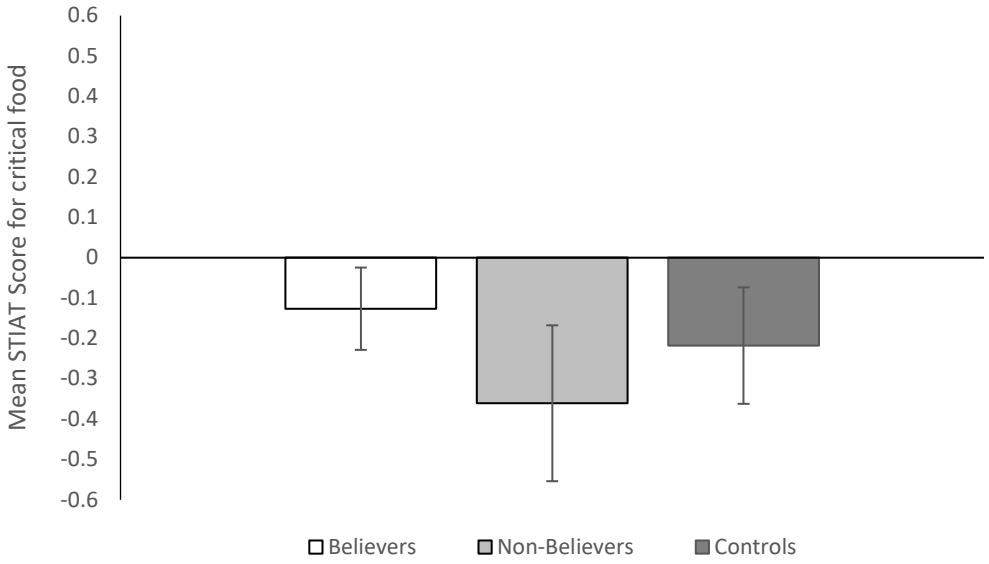

Figure 12. Mean ST-IAT scores for participants' critical foods, split between Believers, Non-Believers and Controls. Error bars represent 95% CIs.

A one-way ANOVA found that ST-IAT scores did not significantly vary as a function of group, $F(2, 82) = 2.63$, $p = .078$.

5.1.3.6. Implicit Attitudinal Consequences of False Memories and Beliefs (Memories vs Beliefs vs Controls).

ST-IAT scores were also compared between the false memory group, the false belief group, and controls. As in the previous analyses, 5 participants were not included due to incomplete ST-IAT data, and 16 were excluded from analyses due to high error rates. Data were compared for 22 participants who reported having a false memory of the suggested event, 20 participants who reported a false belief only, and 25 controls. Participants who reported a false memory had a mean ST-IAT score of -.01 (*SD* = .24), participants who reported a false belief had a mean score of -.26 (*SD* = .39), and controls had a mean score of -.22 (*SD* = .37). These means are displayed in Figure 13.

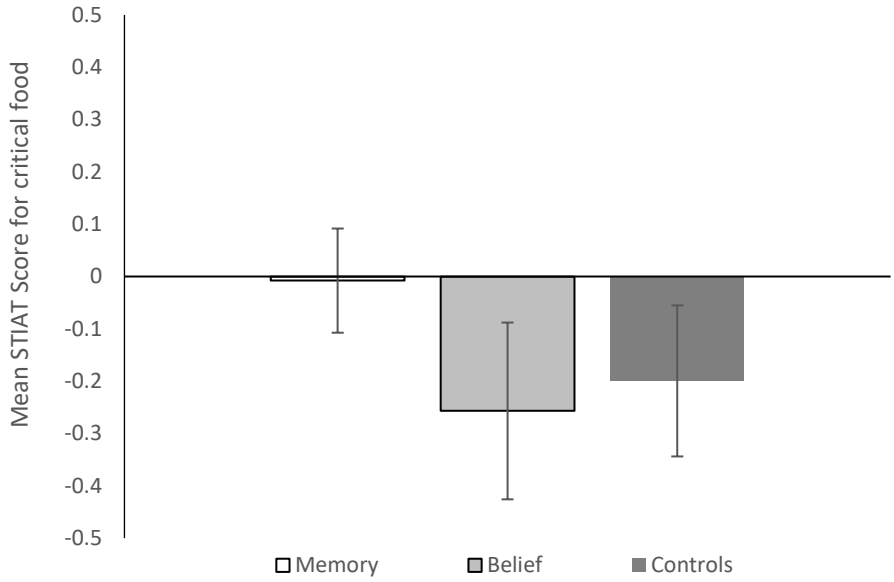

Figure 13. Mean ST-IAT scores for participants' critical foods, split between those who formed a false memory of the false suggestion event, those who formed a false belief only, and controls. Error bars represent 95% CIs.

A one-way ANOVA found that ST-IAT scores varied significantly between those who formed a false memory, those who formed a false belief only and controls, $F(2, 64) = 3.44$, $p = .038$. Planned comparisons revealed that participants who formed a false memory yielded significantly higher ST-IAT scores than those who formed a belief only and controls, $p = .011$. Those with a false belief only and controls did not significantly differ in their ST-IAT scores, $p = .701$.

5.1.3.7. Behavioural Consequences of False Memories and Beliefs (Believers vs Non-Believers vs Controls).

The frequency with which Believers, Non-Believers and controls chose their critical item as a food reward at the end of the study was analysed to assess the

immediate behavioural consequences of false memories and beliefs on related behaviour. Choices of critical food items were rare across all three groups; 2 out of 31 (6.5%) control participants and 8 out of 52 (15.4%) of Believers chose their critical food items. No Non-Believers chose their critical item. Because some of the expected values in the cross-tabulation, Fisher's exact test was used to assess whether likelihood of selecting the critical item as a food reward differed significantly by group (Believers vs Non-Believers vs controls). It was found that this was not the case, $p = .099$.

5.1.3.8. Behavioural Consequences of False Memories and Beliefs (Memories vs Beliefs vs Controls).

The same analysis was carried out comparing the behavioural consequences of those with a false memory of the false suggestion event, those with a false belief in the event only, and controls. As mentioned previously, only 2 of 31 (6.5%) control participants chose their critical food item. The subdivision of the Believers group revealed that 6 out of 21 (22.2%) participants who reported a false memory, and 2 of 25 (8%) of participants who reported a false belief without memory chose their critical item. Again, Fisher's test revealed that frequency of participants choosing their critical item as a food reward did not significantly differ by group, $p = .187$.

5.1.3.9. Was behaviour predicted by explicit and implicit attitude measures?

In order to test whether participant's food choice behaviour was predicted by their explicit and implicit attitudinal measures, a binary logistic regression was conducted for each critical item. Each regression included an initial block of predictors including the appropriate explicit attitude measures from the Restaurant and Food Preferences questionnaires in Session 2 (Session 2 ratings were considered more

appropriate than Session 1 ratings since they were taken in the same experimental session in which the behaviour was measured) for the food item in question, with an additional block adding the predictor of the implicit attitude score for the appropriate item. The DV in the model in each case was whether or not the participant chose the pertinent food item at the end of the study. As for implicit analyses, participants with an error rate of 20% or more in any block of trials in the ST-IAT were excluded from analyses.

Broccoli. A test of the model which included the predictors of ratings from the Restaurant and Food Preferences questionnaires for broccoli was found to be significant against the constant only model, $\chi^2(2, n = 84) = 11.04$, $p = .004$, indicating that participants explicit attitudinal ratings for broccoli significantly predicted whether they would choose it as a food reward. However, neither explicit measure was found to be a significant individual predictor ($p = .104$ for the Restaurant questionnaire, and $p = .751$ for the Food Preferences questionnaire), and the Nagelkerke R^2 value indicated that only 18.7% of the variability in whether or not participants chose broccoli as a food reward was predicted by the explicit attitude ratings. Additionally, although the model predicted 77.4% of cases correctly, its predictive value was limited; whilst 100% of the 65 cases in which broccoli was not chosen were predicted, the model predicted 0% of the 19 cases in which broccoli was chosen. This was the same as the constant only model. The addition of implicit attitudes as a predictor in the next block of the regression analyses marginally improved the predicted variability (Nagelkerke $R^2 = .200$), although was not found to be a significant contributor to the overall model, $\chi^2(1, n = 84) = .76$, $p = .382$.

Green Beans. A test of the model which included the predictors of ratings from the Restaurant and Food Preferences questionnaires for green beans was found to be

significant against the constant only model, $\chi^2(2, n = 84) = 17.31$, $p < .001$, indicating that participants explicit attitudinal ratings for broccoli significantly predicted whether they would choose it as a food reward. However, as was the case for broccoli, neither explicit measure was found to be a significant individual predictor ($p = .109$ for the Restaurant questionnaire, and $p = .132$ for the Food Preferences questionnaire). The Nagelkerke R^2 value indicated that 28.4% of the variability in whether or not participants chose broccoli as a food reward was predicted by the explicit attitude ratings. The model predicted 72.6% of cases correctly, although this was somewhat decreased from the 77.4% predicted by the constant only model. The addition of implicit attitudes as a predictor in the next block of the regression analyses was not found to significantly improve the model, $\chi^2(1, n = 84) = .06$, $p = .811$, and the Nagelkerke R^2 and proportion of correctly predicted cases remained identical.

Cauliflower. The regression model including the two predictors of ratings from the Restaurant and Food Preferences questionnaires for cauliflower did not prove to be significant against the constant only model, $\chi^2(2, n = 84) = 2.53$, $p = .282$. This is potentially due to the very low numbers of participants who chose cauliflower as a food reward (only 2 participants of the 84 included in analyses). The addition of implicit attitude scores for to the model improved the Nagelkerke R^2 from .147 to .284, although was not found to be a significant improvement on the model, $\chi^2(1, n = 84) = 2.42$, $p = .120$. The overall model with all three predictor variables was not significant, $\chi^2(3, n = 84) = 4.95$, $p = .176$.

Carrots. The regression model including the two predictors of ratings form the Restaurant and Food Preferences questionnaires for carrots was not a significant improvement on the constant only model, $\chi^2(2, n = 84) = 3.68$, $p = .159$. Unlike the previously analysed model, this could not be explained by low numbers of participants

who chose carrots as a reward; 24 of the 84 participants in these analyses chose carrots, making it the most frequently selected food reward. The addition of implicit attitude scores did not improve the model significantly, $\chi^2(1, n = 84) = .36$, $p = .546$, and the overall model including all three predictor variables was not significant, $\chi^2(3, n = 84) = 4.04$, $p = .257$.

5.1.4. Discussion

It should firstly be pointed out that this experiment was far more successful at eliciting false memories and beliefs than the previous studies presented in this thesis; or, indeed, the majority of previously published studies using similar experimental designs. A recent review of studies claiming to have elicited false memories and beliefs of childhood events by Brewin and Andrews (2016) analysed data from 15 published experiments using a false-feedback paradigm, and found that the proportion of participants who received the false suggestion and subsequently went on to form a false memory or belief of it ranged from 18% to 53%. In this experiment, the proportion of analysable Suggestion group participants who went on to report a false memory or belief of their event was 70.7%. This would appear to indicate that the changes made with the aim of improving the design efficiency and eliciting more false memories and beliefs (adaptable false suggestions, more in-depth imagination instructions, and truthful filler feedback in Session 2) were moderately successful. No specific hypotheses regarding these changes were formulated, so a statistical analysis of their effects was not performed, but their apparent success in eliciting a high number of false memories and beliefs justifies their use in future experiments.

With regards to the explicit attitudinal effects of false memories and beliefs, these findings replicated those of previous experiments; participants who reported a false memory or belief of loving their critical item the first time they tried it significantly increased their explicit attitudinal ratings for that item post-suggestion. The only set of explicit attitude analyses which failed to find a significant main effect of group was the 'Food Costs' measure when comparing participants with a false memory, participants with a false belief and controls. This measure did yield significant effects when the data of those with false memories and beliefs (the Believers subgroup) were compared against Non-Believers and controls, but when the Believers group was subdivided to separately compare those with a false memory and those with a false belief against controls, the minimal differences between the two contributed to a lessened overall group effect. These results fit with the rest of the explicit analyses which subdivided the Believers subgroup into those with a memory and those with a belief only; although both false memory and false belief groups increased their attitudinal ratings significantly post-suggestion, there were no significant differences between either group either pre-suggestion or post-suggestion.

This pattern is consistent with the current consensus that explicit attitudes are similarly affected by false memories and false beliefs (Bernstein et al., 2015). As Bernstein et al. concluded, the driving factor in explicit attitude change appears to be belief in the occurrence of the false suggestion event; whether or not this belief is accompanied by a memory of the event does not seem to be a critical factor. This also fits within Gawronski and Bodenhausen's (2006) APE framework, which considers explicit attitude judgments to be formed on the basis of syllogistic reasoning involving relevant propositional information. Therefore, it could be argued whether a participant has a false memory of loving a certain food the first time they tried it, or whether they

simply believe that this was the case, the propositional information offered in both circumstances may serve effectively identical purposes in an associated, deliberative explicit attitude judgment.

Perhaps the most novel and interesting finding of this experiment is that participants with false memories of their false suggestion event exhibited significantly more positive implicit attitudes towards their critical item than those with a false belief only or controls. This provides support for the prediction that false memories may be able to affect implicit attitudes, but false beliefs alone may not. Theoretically, this fits with the rationale that, like the guided imagery exercises used in Blair et al. (2001) and Markland et al. (2015), the phenomenological qualities of false memories (sensory details, affective components, autonoetic experience, etc) may result in a change in the underlying associative activations triggered upon presentation of the attitude object which not be possible through a belief in occurrence without recollection. This is consistent with the APE's model of implicit attitude change, and also with the line of evidence regarding the similarities between memory and imagination (Schacter et al., 2012).

The behavioural results are less clear. Unlike in Experiment 1, participants' likelihood of choosing their critical item as a food reward at the end of the study was not found to differ as a function of false memories and beliefs. Both the analyses comparing Believers vs Non-Believers vs Controls and the analyses comparing Memories vs Beliefs vs Controls failed to yield any significant effects. It was also predicted prior to analyses that explicit and implicit attitudes would significantly contribute to the prediction of food choice behaviour. There was limited evidence to support this prediction. Implicit attitude scores were not found to significantly predict food choice in any of the regression models tested. For two of the four foods, the

regression models which included explicit attitude predictors were found to be statistically significant improvements on the constant-only models, but none were found to be significant predictors individually, and data from the classification tables and pseudo-R^2 revealed that the addition of these predictors actually contributed very little to the predictive quality of the models. These results are potentially due to the very low numbers of participants who actually chose their critical food as a reward (regardless of group or subgroup); in each case, the outcomes were always unbalanced to the extent that a constant-only model predicting 100% of cases being a non-critical item already had significant predictive value, and even in the cases where the addition of explicit attitudinal predictors was found to be a statistically significant improvement, the models were consistently limited in their real predictive value.

The fact that both explicit and implicit attitudes appeared to have a very limited role in predicting food choice perhaps indicates that this variable is not the best measure of the behavioural effects of false memories and beliefs. There is evidence to suggest that the explicit and implicit attitudinal measures are reliable and valid; the fact that the explicit attitude measures remain constant for controls across experimental sessions indicates their reliability, and the procedure employed for the ST-IAT has been demonstrated to have strong psychometric performance (Bar-Anan & Nosek, 2014; Bluemke & Friese, 2008). If these measures are considered reliable and valid, they would be expected to have more predictive value of food choice behaviour than was found. Therefore, it seems more likely that the fault is with the behavioural measure, and thus limited conclusions can be drawn from these data. It seems likely that the explicit and implicit attitudinal measures would have more strongly predicted a food-related behaviour which involved actually consuming the critical items, or perhaps even

a behaviour which was more naturalistic (for instance, a free choice of items in a supermarket).

The finding that implicit attitudes may be affected by false memories but not by false beliefs has implications for the dissociation of memories and beliefs in terms of their attitudinal consequences. Studies investigating the attitudinal effects of false memories and beliefs have tended to group data from the two together into 'Believers' (e.g. Bernstein et al., 2005; Laney, Morris, et al., 2008). This has most likely been due to insufficient numbers of memories and beliefs to analyse the two separately, but researchers have also claimed that grouping the two together is not an issue because they do not differ in their attitudinal effects (a claim supported by Bernstein et al., 2015). The explicit attitudinal effects from this experiment also support this, and the conclusion that the critical factor affecting explicit attitudes appears to be belief in the false suggestion. However, the fact that false memories appeared to have an effect on implicit attitudes whilst false beliefs without recollective experience did not perhaps suggests that belief is not a critical factor in implicit attitude change. This is perhaps unsurprising given that the vast majority of theoretical accounts for implicit attitudes assume that implicit attitudes are unaffected by what an individual consciously considers to be true; within Gawronski and Bodenhausen's (2006) APE framework, the associative processes that form the underlying basis of implicit attitudes are considered to be independent of conscious endorsement and are activated whether or not the individual considers them to be "true". Therefore, assuming false memories and able to affect implicit attitudes via the same mechanisms as mental imagery, the individual's belief in the memory should be of little importance. An interesting way to test this idea would be to investigate the implicit and explicit attitudinal effects of non-believed memories; recollections of events which persist even after an individual no longer

believes the event to have occurred (Mazzoni et al., 2010; Otgaar et al., 2014). If belief is considered to be a critical factor in explicit attitude change but not in implicit attitude change, it may be expected that non-believed memories may fail to affect explicit attitudes, but may still be able to affect implicit attitudes.

There are some limitations to the current study which should be noted. The biggest limitation of this study is the lack of a baseline measure of implicit attitudes towards the critical items. This was intentionally omitted due to concern that performing the ST-IATs at the end of the first experimental session would highlight the four critical items as somehow central to the study, and subsequently decrease the credibility of the false suggestions. However, this lack of a baseline measure means it is impossible to determine whether false memories *changed* implicit attitudes. It could be the case that those who went on to form a false memory already had more preferential implicit attitudes towards their critical items pre-suggestion; something which could conceivably have made them more likely to form false memories than controls or those who formed false beliefs only. This is a limitation which was addressed in Experiment 4 by having participants complete the ST-IATs both pre- and post-suggestion.

Another limitation is that it is impossible to determine whether similar implicit attitudinal results could have been observed as a result of detailed imagination of the false suggestion event, without the need for a subsequent false memory. All participants who received the false suggestion were instructed to imagine the event in as much detail as possible, and post-hoc analysis revealed that participants who subsequently formed a false memory of the event reported that they were able to imagine the event significantly more vividly than participants who subsequently formed a false belief only (p = .029). This makes it difficult to disentangle the potential effects of imagination from the potential effects of false memories, and since it has been theorised that mental

imagery and false memories may be able to affect implicit attitudes through the same cognitive mechanisms, this makes it difficult to definitively conclude that the implicit results were caused by false memories. However, those who reported a false belief did report a mean vividness rating above the midpoint in the scale (M = 4.10), with those reporting a false memory reporting a mean of only 1.31 points higher (M = 5.41); therefore, we can assume that participants who formed a false belief still tended to engage in a relatively detailed imagination of the false suggestion event, and whilst the difference in vividness is statistically significant, it is debatable whether the two sub-groups are likely to have differed in their vividness of the false suggestion event to such an extent as to be the sole cause of the implicit attitudinal effects. Again, this is a limitation that Experiment 4 aimed to address through the inclusion of an additional "imagination only" control group, who were instructed to imagine the false suggestion event the same way the Suggestion group were, without it being suggested that the event ever actually happened to them.

This experiment provided additional support for the notion that false memories and beliefs affect explicit attitudes, and that they do so to a similar extent. The experiment was also the first to demonstrate that implicit attitudes may be affected by false memories, but not necessarily by false beliefs. However, because of the limitations listed, these results are in need of replication with some methodological refinements.

5.2. Experiment 4

5.2.1. Introduction

In addition to further replicating the effects concerning the explicit attitudinal consequences of false memories and beliefs, Experiment 3 provided tentative support for the idea that false memories, but not necessarily false beliefs, can affect implicit attitudes. This is a finding that fits well within the APE framework of explicit and implicit attitudes and attitude change (Gawronski & Bodenhausen, 2006), but there were several limitations within the study which justify a replication. Thus, the general aim of Experiment 4 was to determine whether the previously observed implicit attitudinal results could be replicated, with several procedural adjustments which aimed to address the limitations of Experiment 3.

One of the main limitations from Experiment 3 was the lack of a baseline measure of implicit attitudes towards the critical items. This made it difficult to interpret the finding that participants who formed a false memory exhibited significantly more preferable implicit attitudes towards their critical items than participants who formed a false belief only or controls. It may have been the case that this reflected a positive change in implicit attitudes for those who formed a false memory (as theorised). However, an equally plausible explanation could have been that participants who formed a false memory had more preferable implicit attitudes towards their critical item to begin with; despite participants across all groups generally expressing unfavourable explicit attitude judgments towards the critical items, some may still have exhibited more favourable automatic evaluations had their implicit attitudes been measured pre-suggestion.

The latter explanation may fit well with both theoretical considerations and previously-presented data. It has been known for some time that the plausibility of a

false suggestion is a highly important factor in whether or not a false memory of the event is elicited (e.g. Pezdek, Finger, & Hodge, 1997). Whilst it is also the case that increasing the plausibility of suggestions increases the likelihood that a false belief will be elicited, it has also been found that false beliefs can be reliably elicited even for relatively implausible events (Mazzoni, Loftus, & Kirsch, 2001), indicating that plausibility may not be such a critical factor in eliciting false beliefs as it is in eliciting false memories. With regards to the false suggestions used in the experiments presented thus far, it makes sense that a participant's baseline attitudes (either implicit or explicit) towards the critical item would affect the plausibility of positive childhood experience involving that item. This seems to be reflected in the explicit attitudinal data across the previously presented experiments, in that participants who formed false memories or beliefs post-suggestion (Believers) tended to report more preferable baseline explicit attitudes towards the critical item than participants who were not susceptible to the false suggestion (Non-Believers). It is also reflected in some responses on the Memory or Belief questionnaire, with many Non-Believers claiming they were certain the event did not occur on the basis of their baseline explicit attitudinal judgments (e.g. "I don't believe this happened because I don't like broccoli now and I never have").

While there are no data from these experiments reflecting baseline implicit attitudes at this stage, they could theoretically play an important (albeit indirect) role in the plausibility of the false suggestion. As discussed in Section 2.2.2., within the APE framework, whilst implicit attitudes are automatic evaluations which occur independently of what the individual considers to be "true", the system responsible for forming conscious, explicit judgments utilises information from associative activations. Therefore, an initial positive associative response to the critical item could potentially contribute towards a more positive explicit attitudinal judgment, which would in turn

make the false suggestion more plausible, and subsequently increase the likelihood of a false memory being formed. This distinct possibility increases uncertainty as to whether the positive implicit attitudes observed in participants with a false memory were the result of a change, or whether this is simply a reflection of their pre-suggestion state.

Another limitation of Experiment 3 was that it left open the possibility that the implicit attitudinal results observed could have been the result of participants' detailed imagination of the false suggestion events, as opposed to the false memories that may have followed. The rationale behind why false memories may be able to affect implicit attitudes was influenced by studies which have found similar effects through mental imagery exercises (Blair et al., 2001; Markland et al., 2015), and it was theorised that both may be able to affect associative activations through similar cognitive mechanisms. This posed a problem for interpreting the implicit attitudinal results of the study when post-hoc analyses revealed that those who had formed a false memory reported that they were able to imagine the false suggestion event in significantly more detail than those who formed a false belief only (thus opening the possibility that the more preferable implicit attitudes observed in the false memory subgroup may have been the result of merely imagining the event, as opposed to their subsequent false memories). The fact that participants with a false belief did report a mean vividness of imagination rating above the midpoint in the scale (and can therefore be assumed to have imagined the false suggestion with at least moderate detail) may limit this possibility to a certain extent, but it is nonetheless a limitation that needs addressing.

In order to address these problems, a number of methodological changes were applied in Experiment 4. The largest change involved the inclusion of an "Imagination" group, which would allow for the comparison of attitudinal measures for participants who formed a false memory or belief with participants who simply imagined the false

suggestion event. Participants in this group were given feedback in Session 2 similar to that of the Suggestion group, although the feedback simply instructed them to imagine the events occurring without suggesting that the events had occurred to them. This group can effectively be thought of as an additional control group, rather than a new experimental group. It has previously been found that while personalised suggestions (i.e. the suggestion that an event has happened to an individual) can elicit false memories/beliefs and suggestion-consistent attitudes and behaviour, a generalised version of the suggestion which does not imply that the event occurred to the individual elicits false memories and beliefs far less frequently (Scoboria, Mazzoni, Jarry, & Bernstein, 2012). Therefore, it was assumed that participants who simply imagined the feedback events without it being suggested that the events actually occurred to them would tend not to form false memories/beliefs and would not exhibit any changes in attitudinal measures, allowing for an effective dissociation of the effects of imagination only (without accompanying false memories or beliefs).

Another methodological change was that participants now completed the ST-IATs in Session 1, as well as in Session 2, thus allowing for a comparison of pre- and post-suggestion implicit attitudes. The reason that this was not included in Experiment 3 was due to concerns that it would highlight the critical items to the participants as being somehow central to the study, which may have served to decrease the credibility of the false suggestion in Session 2. It was, however, necessary for this experiment to have a baseline measure of implicit attitudes to address the question of whether false memories can *change* implicit attitudes. A subliminal evaluative priming procedure comparable to that used by Greenwald et al. (1996) and Greenwald et al. (1989) was considered as an alternative measure to reduce the risk of demand characteristics, either for the baseline only, or as a complete replacement of the ST-IAT. However, it was decided against

using this as a complete replacement because the psychometric quality of evaluative priming approaches is significantly weaker than the ST-IAT (Bar-Anan & Nosek, 2014), and it was decided against using as a baseline-only measure because there is no evidence that an evaluative priming measure would correlate with the ST-IAT which would be used in Session 2. In addition to this, for ease of comparison with Experiment 3, it was considered important that the measure of implicit attitudes remain consistent. Therefore, it was decided that a baseline ST-IAT measure was the most viable option.

This experiment also switched back to eliciting false memories and beliefs and measuring corresponding attitudes relating to exercise as opposed to food, predominantly in order to determine whether similar implicit attitudinal results could be observed across domains now that the IAT had been changed to the more appropriate ST-IAT. It was predicted that the explicit attitudinal results observed across experiments thus far would be replicated again; that participants who formed a false memory or belief of a positive experience regarding a certain sport/exercise would report significantly more preferable explicit attitudes towards their critical item post-suggestion, but ratings given by other groups would not significantly change between sessions. It was also predicted that explicit attitude ratings would not significantly differ between those with a false memory and those with a false belief. With regards to implicit attitudes, it was predicted that participants who formed a false memory would report significantly more preferable implicit attitudes post-suggestion, but that implicit attitudes would not significantly change between sessions for any other group (including those with a false belief). Because the exercise-relevant behavioural variable used in Experiment 2 had a variety of validity issues, and because behavioural variables which were more valid and realistic could not be practically incorporated into the procedure, behavioural variables were omitted for this study.

5.2.2. Method

5.2.2.1. Participants

A total of 181 participants were recruited, again predominantly consisting of undergraduate Psychology students from University of Hull who participated in return for course credit, as well as a smaller proportion of other students who participated in return for £10. Similar to the previous experiment, participants were assigned randomly to conditions, although at an increased ratio for the Suggestion group; 50% of participants were assigned to the Suggestion group, 25% were assigned to the Imagination group, and 25% were assigned to the control group. After applying the criterion excluding participants who reported high confidence in all possible permutations of the false suggestion, 161 participants remained who were eligible for analyses; 82 Suggestion group participants, 40 Imagination group participants and 39 control participants. Of these remaining participants, there were 130 females and 31 males, with a mean overall age of 21.25 (*SD* = 5.28).

5.2.2.2. Design

The design was largely similar to the design of the previous experiments, although the inclusion of the new Imagination group added an extra level to the factor of ‘group’ in the statistical analyses. Again, session (Session 1/pre-suggestion vs Session 2/post-suggestion) served as the within-subjects factor in the analyses, with group serving as a between-subjects factor. The factor of ‘group’ again varied between sets of analyses; initial analyses compared the main experimental groups (Suggestion vs

Imagination vs controls), whilst later analyses compared various subdivisions of the Suggestion group against the Imagination and control groups.

Because this experiment utilised the methodological changes which worked effectively in Experiment 3, the DVs measured were again the appropriate attitudinal ratings (explicit/implicit) for the participant's selected critical item.

5.2.2.3. Materials

The questionnaires used were largely similar to those used in Experiment 2, with some adaptations to accommodate the methodological changes of Experiment 3, as well as the inclusion of the Imagination group. As in Experiment 2, the 'Exercise History Inventory' (EHI) measured participants' confidence that 24 distinct sport/exercise-related events had occurred to them before the age of 16, and was adapted to include three potential false suggestion items. The inclusion of fewer potential false suggestion items than had been included in Experiment 3 was in order to reduce the number of ST-IATs that participants needed to complete and subsequently contribute towards reducing the overall running time of the experiment; since ST-IATs were now completed in Session 1, and Session 1 contains more questionnaires than Session 2, cutting down to three ST-IATs instead of four was necessary to maintain the running time. Since one of the false suggestion items was the same 'cross-country running' (CCR) suggestion which was used in Experiment 2 and was found to be very rarely endorsed in Session 1, it was decided that this change would be unlikely to have a negative effect on the number of participants eligible for analyses.

Unlike Experiment 3, these false suggestion items were all confined to the original 24-item format of the questionnaire, without including the additional 20 item

section. This was because the nature of the sports/exercise critical items made it more difficult to create a broad template false suggestion which could be used for each item, as had been the case in Experiment 3 ("You loved ___ the first time you tried it"). Instead, it was decided that the wording of each false suggestion would differ between items, although all would describe a broadly similar positive experience which related more specifically to the particular sport/exercise. The four potential false suggestion items were "You really enjoyed cross country running the first time you did it", "You felt excited after scoring a goal in a football match" and "You felt proud after winning a tennis match".

Although this change means that participants who are subsequently grouped together in analyses are given more dissimilar feedback than has previously been the case, it was decided that this would be unlikely to affect the study in any way; the events were all positive events which were considered similar enough that any attitudinal effects that are likely to occur as a result of false memories or beliefs of these events would be comparable between items. To ensure this was the case, preliminary analyses was conducted to ensure that confidence/attitude ratings did not differ significantly between items (in both Session 1 and Session 2).

Session 1 also included the explicit attitude measures from Experiment 2, without any need for modifications (since all critical items were already included). These included the 'Gym' questionnaire (originally adapted from the 'Restaurant' questionnaire) and the 'Exercise Activity Preferences' (EAP) questionnaire. The former again asked participants to imagine they had just joined a gym and rate their likelihood of signing up for a series of 32 sports/exercises (including the critical items of 'cross-country running', 'football' and 'tennis') on a 1-8 scale, whilst the latter asked participants to indicate the extent to which they thought they would enjoy engaging in a

series of 64 different sports/exercises (including the critical items). Session 1 also included several “personality questionnaires”, some of which were individual difference measures analysed in Section 6.2. These included the Need for Cognition scale (Cacioppo et al., 1984), Need to Evaluate scale (Jarvis & Petty, 1996) and the Plymouth Sensory Imagery Questionnaire (Andrade et al., 2014). The Dissociative Experiences Scale (Bernstein & Putnam, 1986) and the revised Self-Consciousness scale (Scheier & Carver, 1985) which had been included as filler material in Experiment 3 were omitted.

The false-feedback questionnaires included in Session 2 were largely the same as they were in Experiment 3; participants were informed that their responses in Session 1 had been analysed, and that a personalised profile of experiences they had indicated they were confident had occurred to them was presented. In reality, the Suggestion group were given three events which they had indicated high confidence in at Session 1, plus the false suggestion item. Control group feedback was the same, except each item was a filler item which they had indicated high baseline confidence in (no false suggestion was included). The Imagination group feedback was slightly different; they were simply given four generalised scenarios adapted from the EHI items (one of which was always the false suggestion event) and were simply told to take a moment to consider each one. At no point was it suggested that these were events which may have occurred to them. In order to increase the similarity of this questionnaire to the Suggestion/control group questionnaires, the events were also ones that the participants had indicated high baseline confidence in during Session 1. The items were also re-worded to make them more general, as opposed to their more specific, personal wording in the EHI (e.g. “Imagine really enjoying cross-country running”, as opposed to “you really enjoyed cross-country running the first time you did it”). All three groups were then given the same imagination instructions as in Experiment 3, with the Suggestion

and Imagination groups always having to imagine the false suggestion item plus one filler item, and the control group always having to imagine two filler items. The filler question of “To what extent do you feel this experience influenced your adult personality?” (which was included to contribute towards disguising the true nature of the study) was changed for the Imagination group to “To what extent do you feel this event could influence one’s personality?”.

The remaining questionnaires in Session 2 were identical for each group. The EHI, Gym and EAP questionnaires were repeated, and the Exercise Intention Questionnaire was included to measure how many times participants intended to engage in the critical items (amongst other filler items) over the next two months. The Memory or Belief questionnaire was again included, presenting the participants with three events (the false suggestion and two filler events) and asking them to indicate whether they had a memory of this event, whether they believed the event occurred but did not have a specific memory of it, or whether they were certain that the event did not happen. The S-MEQ (Luchetti & Sutin, 2015) was again included to measure the phenomenological characteristics of any reported memories.

The ST-IATs used to measure implicit attitudes towards each of the potential critical items were included across both experimental sessions and followed the same procedure as those used in Experiment 3. The valenced evaluative stimuli remained exactly the same, whilst the item-relevant stimuli were replaced with 700x500 resolution pictures displaying people engaging in the relevant sport/exercise. Similar to Experiment 2, male and female versions of the ST-IATs were produced, the only difference being the gender of the individuals engaging in the sport/exercise in the images.

5.2.2.3 Procedure

Session 1. On arrival, participants were falsely informed that they were participating in a study investigating the relationship between exercise-related preferences/activity and personality. They then completed the EHI, Gym and EAP questionnaires and the additional "personality" questionnaires. After these were completed, participants completed the three ST-IATs (one for each critical item). As previously mentioned, the procedure for each ST-IAT was identical to the one used in Experiment 3, except with modified stimuli relating to the relevant critical items.

After Session 1 but prior to Session 2, participants were randomly assigned to the Suggestion group, Imagination group or control group (although at uneven ratios, as previously mentioned). At the same time, participants were allocated a critical false suggestion item based on the same criteria as Experiment 3.

Session 2. Between 5 and 9 days after completing Session 1, participants returned for Session 2. Each group received their relevant feedback questionnaire before completing repeats of the EHI, Gym and EAP questionnaires, as well as the Exercise Intention and Memory or Belief questionnaires. Finally, participants completed the ST-IATs again. After all ST-IATs had been completed, participants were thanked and debriefed.

5.2.3. Results

5.2.3.1. Preliminary analyses of false suggestion items.

To ensure that grouping data from the different false suggestion items was suitable for the main analyses, preliminary analyses were conducted to ensure confidence ratings and attitudinal data did not differ significantly between critical items.

As for all other analyses, participants who indicated high confidence (EHI rating of > 4) were excluded, leaving a functional *N* of 161; 82 Suggestion group participants, 40 Imagination group participants and 39 controls.

As in Experiment 3, the allocation of false suggestion items was analysed to ensure that they were balanced sufficiently across groups. A cross-tabulation displaying the frequencies of false suggestion items allocated to each group can be found in Table 4.

Table 4.
Cross-tabulation of false suggestion items by group allocation.

	False Suggestion Item		
Group	CCR	Tennis	Football
Suggestion	65 (79.3%)	17 (20.7%)	0
Imagination	34 (85%)	6 (15%)	0
Control	28 (71.8%)	8 (20.5%)	3 (7.7%)

Since some expected values fell below 5, a Fisher's Exact test was conducted to ensure that frequencies of false suggestion items did not significantly differ as a function of group. This was found to not reach the threshold for statistical significance, $p = .077$. Whilst the distribution of false suggestion items was highly uneven (with the vast majority of participants being allocated CCR), because the distribution did not differ significantly between experimental groups, this was no considered to be a problem for analyses.

In analysing whether baseline and post-manipulation preferences differed significantly as a function of false suggestion item, the three participants who were allocated Football as their critical item were excluded; whilst allocations of the other two critical items were spread between Suggestion and Imagination groups (and

subsequently, Believer/Non-Believer and Memory/Belief subgroups), all three participants given Football as a critical item were control participants who did not form false memories or beliefs and displayed very minimal changes in attitudinal ratings between sessions. It was therefore decided that comparing data for these three participants against the rest of the sample would not be appropriate for these analyses. A series of independent samples t-tests analysed whether participants who were allocated CCR and participants who were allocated Tennis differed significantly in confidence in the false suggestion (as measured by the EHI), explicit attitudinal ratings (as measured by the Gym and EAP questionnaires) and implicit attitudinal ratings (as measured by the ST-IATs). Ratings for each variable were compared across groups at both Session 1 and Session 2. Although participants who were allocated the false suggestion item of Tennis reported higher mean ratings for all variables across both time points, it was found that ratings did not significantly differ from those who were allocated CCR as a false suggestion item for any variable at either time point (all $p > .05$). It was therefore decided that combining data from these false suggestion items in analyses was appropriate. The three control participants who were allocated Football as a false suggestion item were also included, since their confidence and attitudinal data appeared to be consistent with other control participants within this experiment (and other preceding experiments).

5.2.3.2. Were false memories and beliefs elicited?

As per previous experiments, the EHI and Memory or Belief questionnaires were assessed to determine whether the various false suggestions had been successful at eliciting false memories and beliefs. All three groups gave similar baseline confidence

ratings in their false suggestion items, with Suggestion group participants giving a mean rating of 1.74 (*SD* = 1.03), Imagination group participants giving a mean rating of 1.60 (*SD* = 1.01), and controls giving a mean rating of 1.49 (*SD* = .91). In Session 2, Suggestion group participants increased their mean confidence rating to 4.95 (*SD* = 2.53), Imagination group participants increased their mean rating to 2.40 (*SD* = 1.69) and controls marginally increased their mean rating to 1.54 (*SD* = .82). These means are displayed in Figure 14.

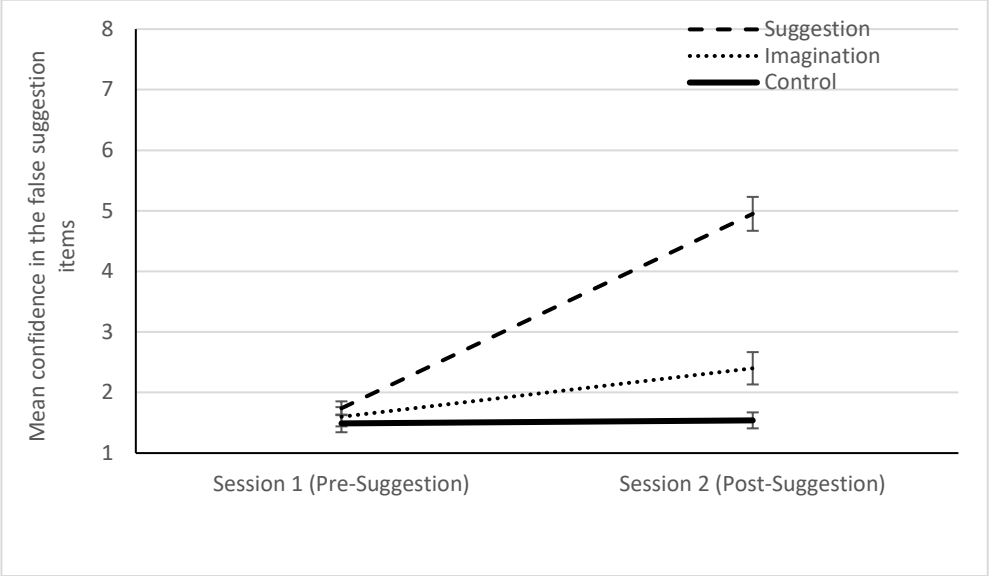

Figure 14. Mean EHI confidence ratings for the critical false suggestions for Suggestion group, Imagination group and control participants across both experimental sessions. Error bars represent standard error of the mean.

A 3x2 mixed-design ANOVA with group (Suggestion vs Imagination vs Control) as the between-subjects factor and session (Session 1 vs Session 2) as the within-subjects factor found a significant main effect of group, $F(2, 158) = 30.82$, $p < .001$, $\eta_p^2 = .26$, a significant main effect of session, $F(1, 158) = 76.73$, $p < .001$, $\eta_p^2 = .35$, and a significant Group x Session interaction, $F(2, 158) = 47.03$, $p < .001$, $\eta_p^2 =$

.36. Planned comparisons found that Session 2 confidence ratings were significant higher than Session 1 confidence ratings for the Suggestion group, $p < .001$, and the Imagination group, $p = .007$, but control ratings did not significant differ between sessions, $p = .863$.

Memory or Belief questionnaire responses were analysed to determine whether the false suggestion efficiently elicited false memories and beliefs of positive exercise-related experiences. Within the Suggestion group, 29 participants (35.4%) reported a false memory, 26 participants (31.7%) reported a false belief, and 27 participants (32.9%) were certain that the event did not occur. Within the Imagination group, 4 participants (10%) reported a false memory, 7 participants (17.5%) reported a false belief, and 29 participants (72.5%) were certain that the event did not occur. Of the control group, no participants reported a false memory, 2 (5.1%) reported a false belief, and 37 (94.9%) were certain the event did not occur. These differences were in the expected direction, and it was found that likelihood of reporting a false memory, false belief or being certain that the event did not occur varied significantly by group, $\chi^2(4) = 47.58$, $p < .001$.

In previous experiments, control group participants who have formed false memories and beliefs have remained in analyses and have been treated as regular control participants. This is partially because very few control participants have reported false memories and beliefs (in Experiment 1, no control participants reported a false memory while 4 reported a false belief; in Experiment 2, one participant reported a memory and 3 reported a belief; in Experiment 3, none reported a false memory and 3 reported a false belief), and so any impact they may have on results would have been very minimal. This was also because they had not received any feedback or other information which could have plausibly elicited a false memory or belief, and so these

few false memories and beliefs reported by control participants seem more likely to be the result of random responses (for instance, a randomised low response on the FHI/EHI questionnaire in Session 1, which could potentially make the reported memories/beliefs true).

However, it was decided that participants who formed false memories and beliefs in the Imagination group should be treated differently. This was partially because there were more reported memories and beliefs within this group than has typically been observed within the standard control group (4 false memories, 7 false beliefs), and so their inclusion in analyses was more likely to have a significant impact on results. Also, since the Imagination group participants did receive feedback instructing them to imagine the false suggestion event (albeit without the suggestion that it actually occurred to them), this could plausibly have led some participants coming to believe/remember this event as one from their personal past. This rationale, combined with the increased frequency of reported false memories and beliefs within this group relative to previous control groups, makes it more likely that these are genuine false memories and beliefs rather than the result of random responses. Therefore, to ensure that any potential attitudinal effects observed in the Imagination group were purely representative of merely *imagining* the false suggestion item (as opposed to believing it occurred or remembering it), these 11 Imagination group participants who reported false memories and beliefs were excluded from analyses. For consistency with previous experiments, the two control participants who reported false beliefs were treated as standard control participants.

5.2.3.3. Explicit attitudinal consequences of false memories and beliefs (Believers and Non-Believers).

Similar to Experiment 3, explicit attitudinal consequences of false memories and beliefs were first compared between Suggestion group participants who formed a false memory or a false belief (Believers), Suggestion group participants who did not form a false memory or belief (Non-Believers), Imagination group participants and control participants. As in previous experiments, Believers were classified as any Suggestion group participants who increased their confidence in the false suggestion item in Session 2, and subsequently reported either a false memory or a false belief of the event (with Non-Believers being classified as Suggestion group participants who did not meet both of these criteria). As mentioned in the preceding section, Imagination group participants who formed false memories and beliefs were excluded from analyses, and the two control participants who formed false beliefs were treated as control participants as opposed to Believers. After these criteria had been applied, the overall *N* was 150; 53 Believers, 29 Non-Believers, 29 Imagination participants and 39 controls.

Gym Questionnaire. The first explicit attitudinal measure to be analysed was the Gym questionnaire, which assessed participants' hypothetical desire to participate in their critical exercise item on a 1-8 scale. At Session 1, participants who would later be classified as Believers gave a mean rating of 3.02 (*SD* = 1.50), participants who would later be classified as Non-Believers gave a mean rating of 1.72 (*SD* = 1.44), Imagination group participants gave a mean rating of 1.69 (*SD* = 1.20), and controls gave a mean rating of 2.15 (*SD* = 1.55). In Session 2, Believers increased their mean rating to 5.25 (*SD* = 1.74), Non-Believers marginally increased their mean rating to 1.86 (*SD* = 1.55), Imagination group participants increased their mean rating to 2.21 (*SD* = 1.52), and

controls slightly decreased their mean rating to 2.08 (*SD* = 1.55). These mean ratings are displayed in Figure 15.

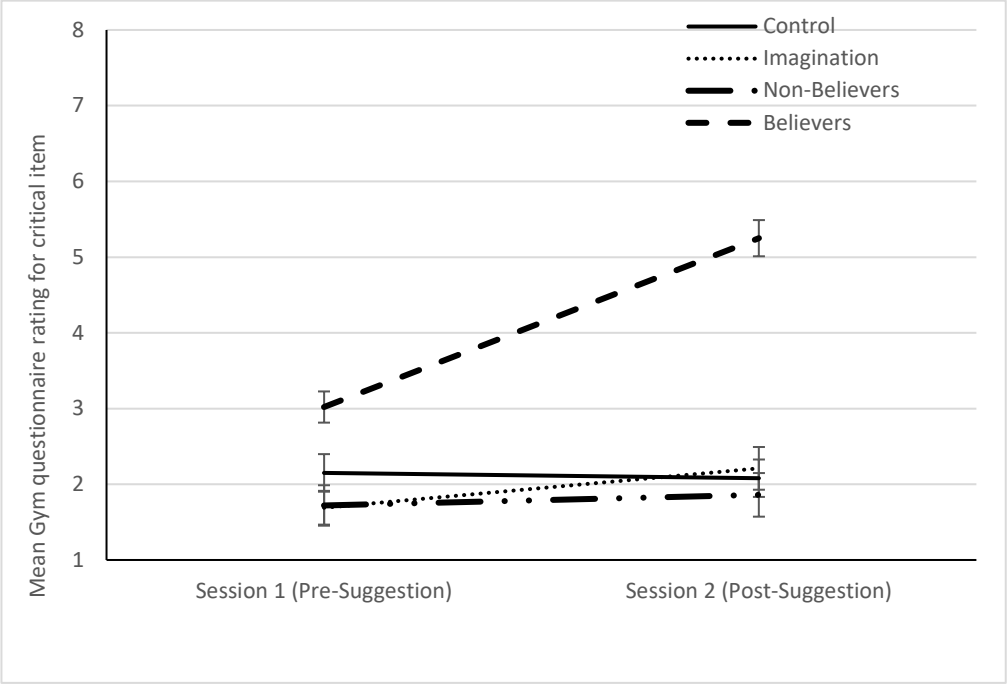

Figure 15. Mean hypothetical likelihood of participating in critical exercise item at a new gym (Gym questionnaire rating) for Believers, Non-Believers, Imagination group and control participants. Error bars represent standard error of the mean.

A 4x2 mixed-design ANOVA with a between-subjects factor of group (Believers vs Non-Believers vs Imagination group vs controls) and a within-subjects factor of session (Session 1 vs Session 2) revealed a significant main effect of group, $F(3, 146) = 27.37$, $p < .001$, $\eta_p^2 = .36$, a significant effect of Session, $F(1, 146) = 45.85$, $p < .001$, $\eta_p^2 = .24$, and a significant Group x Session interaction, $F(3, 146) = 33.41$, $p < .001$, $\eta_p^2 = .41$. Planned comparisons were carried out to determine whether Session 1 and Session 2 ratings differed significantly for each group. It was found that Session 2 ratings were significantly higher for Believers, $p < .001$, and Imagination group participants, $p = .025$. The difference between Session 1 and Session 2 ratings did not

reach the corrected threshold for statistical significance for Non-Believers, $p = .547$, or controls, $p = .697$.

Exercise Activity Preferences Questionnaire. The EAP questionnaire measured the extent to which participants believed they would enjoy participating in their critical exercise item on a 1-8 scale. In Session 1, Believers reported a mean rating of 3.04 (*SD* = 1.55), Non-Believers gave a mean rating of 1.52 (*SD* = 1.55), Imagination group participants gave a mean rating of 1.59 (*SD* = 1.33), and controls gave a mean rating of 2.13 (*SD* = 1.56). In Session 2, Believers mean rating increased to 5.23 (*SD* = 1.64), Non-Believers reported a mean rating of 1.62 (*SD* = 1.18), Imagination group participants reported a mean rating of 2.00 (*SD* = 1.25), and controls gave a mean rating of 1.87 (*SD* = 1.54). These means are displayed in Figure 16.

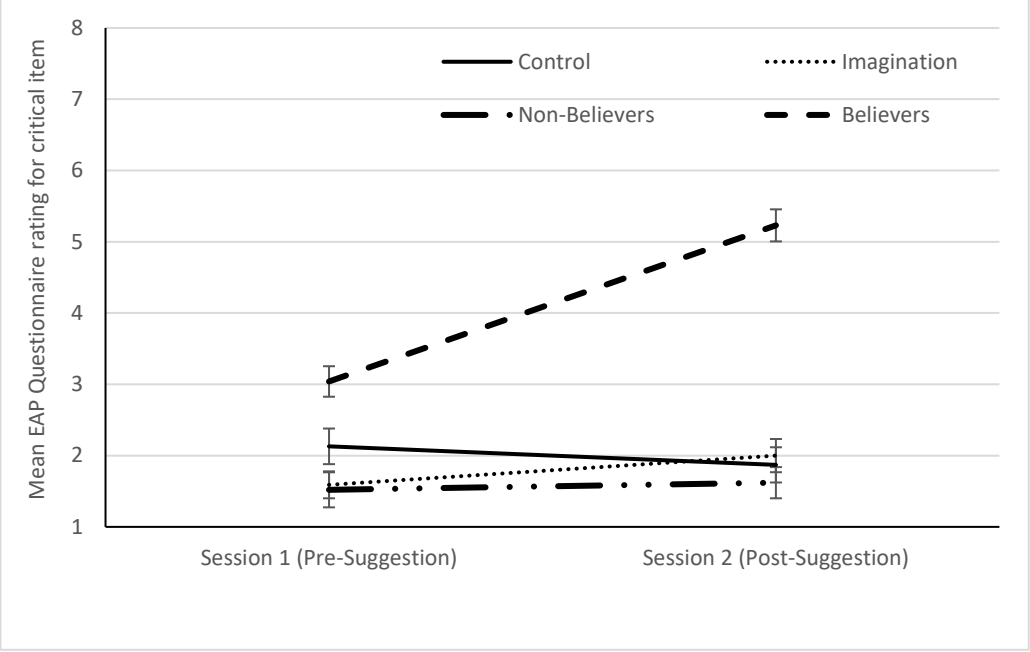

Figure 16. Mean Exercise Activity Preferences (EAP) questionnaire ratings for Believers, Non-Believers, Imagination group and control participants across Session 1 and Session 2. Error bars represent standard error of the mean.

A 4x2 mixed-design ANOVA with group (Believers vs Non-Believers vs Imagination vs controls) as a between-subjects factor and session (Session 1 vs Session 2) as a within-subjects factor found a significant main effect of group, $F(3, 146) = 36.72$, $p < .001$, $\eta_p^2 = .76$, a significant main effect of session, $F(1, 146) = 34.89$, $p < .001$, $\eta_p^2 = .19$, and a significant Group x Session interaction, $F(3, 146) = 36.10$, $p < .001$, $\eta_p^2 = .43$. Planned comparisons were carried out to determine whether Session 1 and Session 2 ratings differed significantly for each group. It was found that ratings were significantly higher in Session 2 than in Session 1 for Believers, $p < .001$, but not for Non-Believers, $p = .652$, Imagination group participants, $p = .072$, or controls, $p = .195$.

Exercise Intention Questionnaire. This questionnaire measured (amongst filler items) how many times participants intended to engage in their critical exercise item over the following two months. Believers indicated that they intended to engage in their critical item a mean of .26 (*SD* = .59) times, while Non-Believers reported a mean of .03 (*SD* = .19) times and control participants reported a mean of .03 (*SD* = .16) times. No Imagination group participants indicated that they intended to engage in their critical item at all. Because the vast majority of participants across all groups indicated that they intended to engage in their critical item 0 times, the data for this variable had a strong positive skew, with significant Shapiro-Wilk values ($p < .001$) indicating that the assumption of normality for parametric analysis was not met. Additionally, Levene's test was revealed to be significant ($p < .001$) indicating a violation of the assumption of homogeneity of variance. Because of these multiple assumption violations, the non-parametric Kruskal-Wallis H test was used in place of a one-way ANOVA. The mean rank for Believers was 83.73, the mean rank for Non-Believers was 72.02, the mean rank for control participants was 71.37, and the mean rank for Imagination group

participants was 69.50. It was found that the number of times participants intended to engage in their critical exercise items over the next two months varied significantly as a function of group, $\chi^2(3) = 13.53$, $p = .004$. Planned pairwise comparisons indicated that Believers intended to engage in their critical exercise item significantly more often than those in the Imagination group, $p = .015$, and controls, $p = .025$, but not significantly more often than Non-Believers, $p = 1.00$.

5.2.3.4. Explicit attitudinal consequences of false memories and beliefs (Memories vs Beliefs)

Explicit attitude measures were analysed again to assess whether false memories and false beliefs had differing effects. The Believers subgroup from the last set of analyses was subdivided into those who formed a false memory of the false suggestion item, and those who formed a false belief of the item but no accompanying memory. Data was again compared with those in the control group, and the Imagination group. For these analyses, there was a total of 121 participants; 29 Believers who reported a false memory, 24 Believers who reported a false belief, 29 Imagination group participants and 39 control group participants.

Gym Questionnaire. In Session 1, participants who later formed false memories of the false suggestion event gave their critical item a mean rating of 3.17 (*SD* = 1.61) and participants who later formed false beliefs of the false suggestion item gave a mean rating of 2.83 (*SD* = 1.37), whilst Imagination group participants gave a mean rating of 1.69 (*SD* = 1.20) and control group participants gave a mean rating of 2.15 (*SD* = 1.55). In Session 2, participants who reported a false memory increased their mean

rating to 5.59 (*SD* = 1.55) and participants who reported a false belief increased their mean rating to 4.83 (*SD* = 1.90), whilst Imagination group participants increased their mean rating to 2.21 (*SD* = 1.52), and control group participants slightly decreased their mean rating to 2.08 (*SD* = 1.55). These means are displayed in Figure 17.

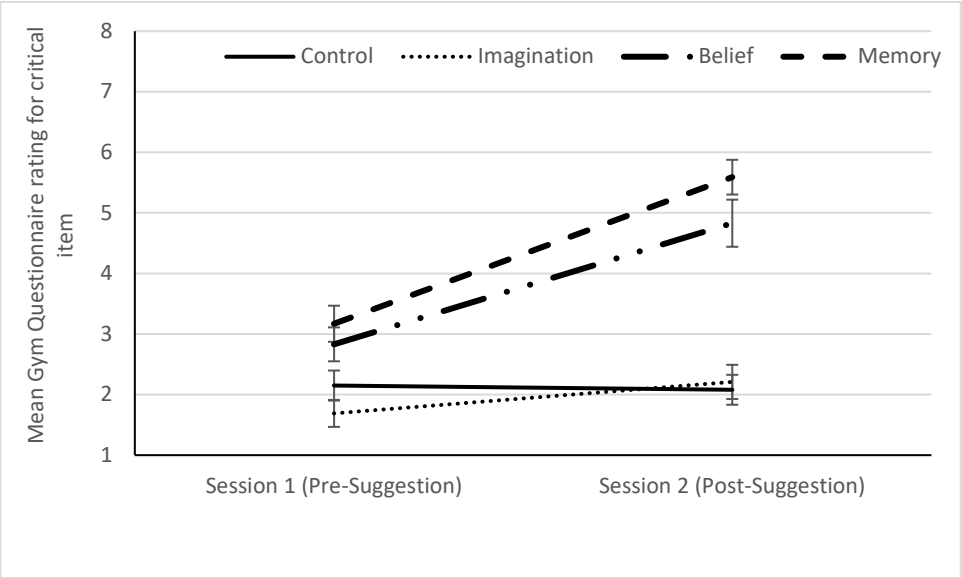

Figure 17. Mean hypothetical likelihood of participating in critical exercise item at a new gym (Gym questionnaire rating) for participants who formed a false memory, participants who formed a false belief only, Imagination group and control participants. Error bars represent standard error of the mean.

A 4x2 mixed-design ANOVA with group (Memories vs Beliefs vs Imagination vs controls) as a between-subjects factor and session (Session 1 vs Session 2) as a within-subjects factor found a significant main effect of group, $F(3, 117) = 22.46$, $p < .001$, $\eta_p^2 = .37$, a significant main effect of session, $F(1, 117) = 116.71$, $p < .001$, $\eta_p^2 = .50$, and a significant Group x Session interaction, $F(3, 117) = 30.04$, $p < .001$, $\eta_p^2 = .44$. Planned comparisons revealed that Session 2 ratings were significantly higher than Session 1 ratings for participants with a false memory, $p < .001$, participants with a false belief, $p < .001$, and Imagination group participants, $p = .025$, but did not significantly

differ for control group participants, $p = .694$. The extent of attitude change (computed as the Gym Questionnaire rating for Session 2 minus the Gym Questionnaire Rating for Session 1) did not significantly differ between those with a false memory and those with a false belief ($p = .981$).

Exercise Activity Preferences Questionnaire. At Session 1, participants who would later form false memories of the false suggestion event gave their critical item a mean EAP questionnaire rating of 3.52 ($SD = 1.46$), participants who would later form a false belief gave a mean rating of 2.46 ($SD = 1.50$), Imagination group participants gave a mean rating of 1.59 ($SD = 1.02$), and control group participants gave a mean rating of 2.13 ($SD = 1.56$). In Session 2, those who formed a false memory increased their mean rating to 5.45 ($SD = 1.48$), those who formed a false belief increased their mean rating to 4.96 ($SD = 1.81$), Imagination group participants increased their mean rating to 2.00 ($SD = 1.25$) and control group participants lowered their mean rating to 1.87 ($SD = 1.54$). These means are displayed in Figure 18.

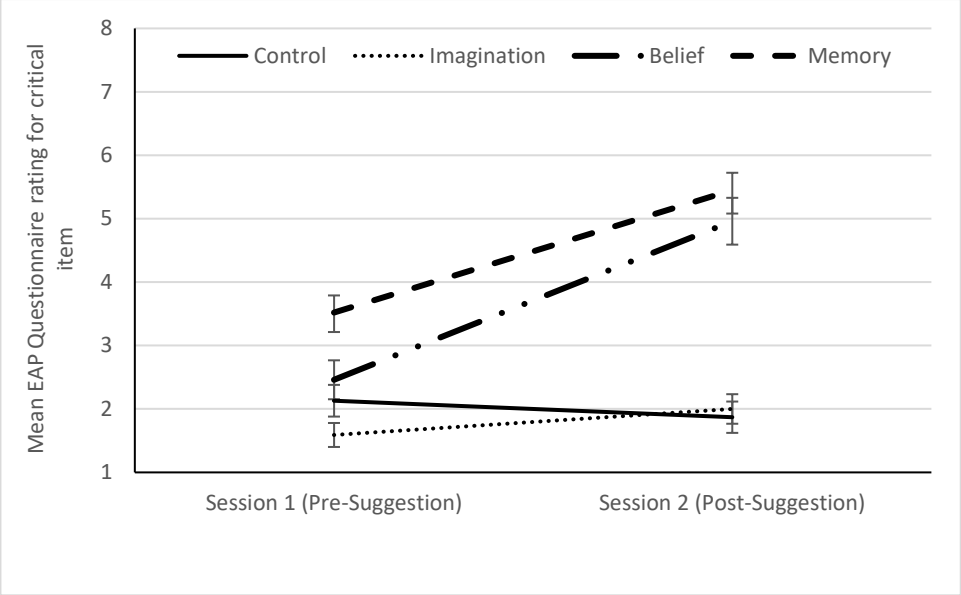

Figure 18. Mean Exercise Activity Preferences (EAP) questionnaire ratings across Session 1 and Session 2 for participants who formed a false memory, participants who formed a false belief, Imagination group participants and control group participants. Error bars represent standard error of the mean.

A 4x2 mixed-design ANOVA with group (Memories vs Beliefs vs Imagination vs controls) as a between-subjects factor and session (Session 1 vs Session 2) as a within-subjects factor found a significant main effect of group found a main effect of group, $F(3, 117) = 29.22$, $p < .001$, $\eta_p^2 = .43$, a significant main effect of session, $F(1, 117) = 102.51$, $p < .001$, $\eta_p^2 = .47$, and a significant Group x Session interaction, $F(3, 117) = 33.31$, $p < .001$, $\eta_p^2 = .46$. Planned comparisons were carried out to assess whether EAP questionnaire ratings for the critical item varied significant across sessions for each group. Session 2 ratings were found to be significantly higher than Session 1 ratings for participants with a false memory, $p < .001$, and participants who formed a false belief only, $p < .001$, but not for Imagination group participants, $p = .072$ or controls, $p = .072$. The extent of attitude change (computed as EAP rating in Session 2 minus EAP rating in Session 1) did not significantly differ between those with a false memory and those with a false belief ($p = .593$).

Exercise Intention Questionnaire. For the same reasons stated in the previous analysis of the Exercise Intention Questionnaire, the non-parametric Kruskal-Wallis H test was used in analysis rather than a one-way ANOVA. This test revealed that the number of times participants intended to engage in their critical exercise item over the next two months varied significant as a function of group, $\chi^2(3) = 13.52$, $p = .004$, with a mean rank of 70.38 for participants who formed a false memory, 62.81 for participants who formed a false belief, 55.50 for Imagination group participants, and 57 for control participants. Planned pairwise comparisons found that participants with a false memory reported that they would engage in their critical item significantly more times than Imagination group, $p = .007$ and controls, $p = .011$, but not than participants who formed a false belief, $p = .701$.

5.2.3.5. Implicit attitudinal consequences of false memories and beliefs (Believers vs Non-Believers vs Controls).

As in Experiment 3, implicit attitudinal data was prepared for analyses using the same procedures as Bluemke and Friese (2008). Participants who had error rates greater than 20% in any block of trials were excluded from analyses. Error trials were also excluded from analyses, and latencies greater than 3000ms and less than 300ms were recoded as 3000ms and 300ms, respectively. The first trial of each block was dropped from analyses, before each remaining latency underwent z-transformation in which the individual's overall mean response time (excluding training trials) was subtracted from each latency before dividing by the overall response time standard deviation across all blocks (again, excluding training trials). ST-IAT scores were computed for each participant's critical item by subtracting the mean of the transformed latencies in the

‘Exercise + Positive’ paired blocks from the mean of transformed latencies in the ‘Exercise + Negative’ paired block. Positive scores were considered to be representative of a positive implicit attitude towards the critical item, whereas negative scores were considered to reflect negative implicit attitudes.

To assess the effects of false memories and beliefs (combined) on implicit attitudes, ST-IAT results were initially compared between Believers, Non-Believers, Imagination group and control group participants. Of the 150 participants included in explicit analyses, 9 were excluded because of technical problems which corrupted at least one of their ST-IATs. Further to this, an additional 13 participants were excluded from analyses because they registered an error rate of greater than 20% on at least one of the ST-IAT blocks (either in Session 1 or Session 2). This meant that the final number of participants included in implicit attitudinal analyses was 128 (47 Believers, 23 Non-Believers, 26 Imagination group and 32 control participants). In Session 1, Believers registered a mean ST-IAT for their critical item of -.02 (*SD* = .32), while Non-Believers registered a mean score of -.02 (*SD* = .45), Imagination group participants registered a mean score of .02 (*SD* = .38) and controls registered a mean score of -.03 (*SD* = .34). In Session 2, Believers mean ST-IAT score increased to .02 (*SD* = .39), while Non-Believers had a mean score of -.02 (*SD* = .33), Imagination group participants had a mean score of .00 (*SD* = .37), and controls had a mean score of -.02 (*SD* = .34). Means are displayed in Figure 19.

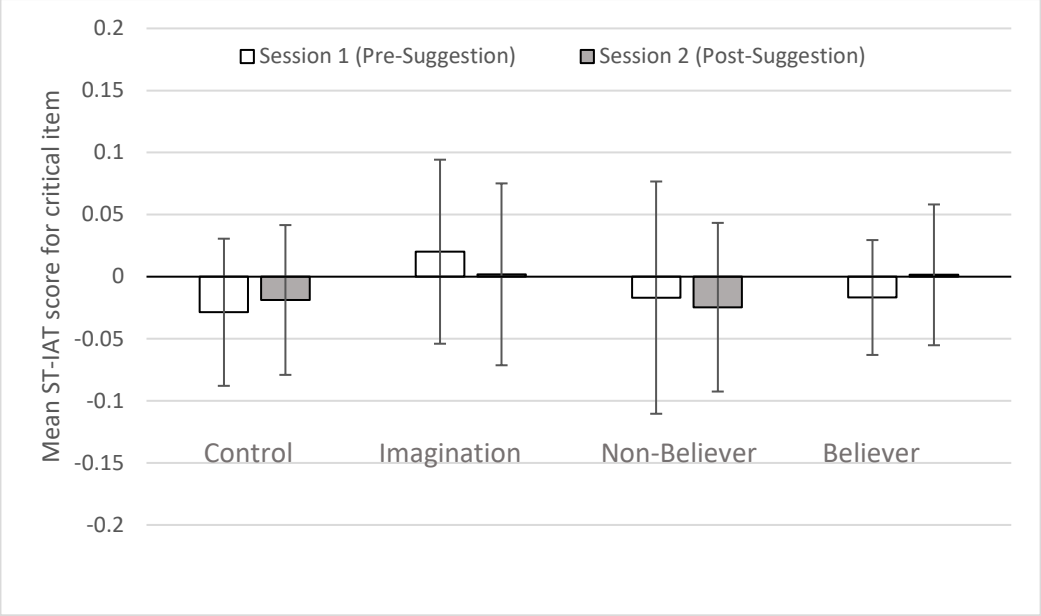

Figure 19. Mean critical item ST-IAT scores for Believers, Non-Believers, Imagination and control group participants. Error bars represent standard error of the mean.

A 4x2 mixed-design ANOVA, with session (Session 1 vs Session 2) as a within-subjects factor and group (Believers vs Non-Believers vs Imagination vs Control) as a between-subjects factor revealed no significant effect of group, $F(3, 124) = .098$, $p = .961$, session, $F(1, 124) = .004$, $p = .952$ on critical ST-IAT scores. Additionally, no significant interaction between group and session was observed, $F(3, 124) = .023$, $p = .995$.

5.2.3.6. Implicit attitudinal consequences of false memories and beliefs (memories vs beliefs vs controls).

To assess whether false memories and false beliefs had differing effects on implicit attitudes, similar analyses were conducted in which the Believers subgroup was

further subdivided into those with a false memory and those with a false belief only (excluding the Non-Believers subgroup). Therefore, implicit attitudinal data was compared for 26 participants who formed a false memory and 21 participants who formed a false belief, as well as the 26 Imagination group and 32 control participants which were included in the previous analyses. In Session 1, participants who would later form a false memory registered a mean critical ST-IAT score of -.02 (*SD* = .31) and participants who would later form a false belief registered a mean score of -.02 (*SD* = .33). In Session 2, participants who formed a false memory increased their mean ST-IAT score to .02 (*SD* = .42), whilst participants who formed a false belief registered a mean score of -.02 (*SD* = .35). These means are displayed in Figure 20.

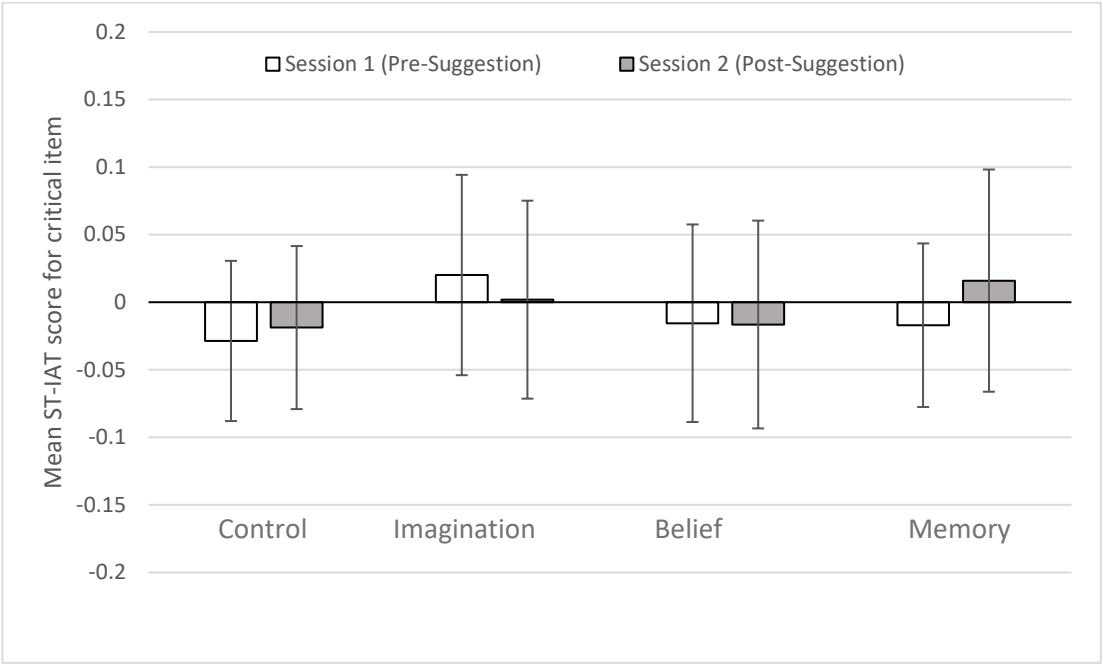

Figure 20. Mean critical ST-IAT scores across Session 1 and Session 2 for participants who formed a false memory, participants who formed a false belief, Imagination group and control group participants. Error bars represent the standard error of the mean.

A 4x2 mixed-design ANOVA, with session (Session 1 vs Session 2) as a within-subjects factor and group (Believers vs Non-Believers vs Imagination vs Control) as a between-subjects factor revealed no significant effect of group, $F(3, 101) = .108$, $p = .955$, or session, $F(1, 101) = .00$, $p = .990$, on critical ST-IAT scores. Additionally, no significant interaction between group and session was observed, $F(3, 101) = .003$, $p = .994$.

5.2.4. Discussion

As was the case in Experiment 3, this experiment was highly successful at eliciting false memories and beliefs in the experimental group; 67.1% of participants eligible for analysis who received the false suggestion went on to report a false memory or a false belief of the event. This further supports the notion that the procedural adaptations applied both here and in Experiment 3 (multiple potential false suggestion items, more detailed imagination instructions, and individually-tailored filler material in the false-feedback questionnaire) were the reason behind this increase in reported false memories and beliefs. Again, since no specific research questions were posed regarding these procedural changes, they have not been subjected to any specific analyses, but their apparent success may support their application in future studies utilising the false-feedback paradigm.

The Imagination group, which effectively acted as an extra control group for the purposes of this experiment, reported a higher rate of false memories and beliefs than that of the regular control group (in this experiment, and across all other reported experiments); 27.5% of participants who imagined the false suggestion event (without it being suggested that it had occurred to them) subsequently reported a false memory or

belief of the event. This was a higher rate than expected, and as was argued in Section 5.2.3.2, it was considered necessary that these participants be excluded from analyses. However, group sizes remained sufficiently large, so this was not overly problematic.

Results regarding the explicit attitudinal effects of false memories and beliefs were largely similar to previous experiments. Suggestion group participants who formed a false memory or belief significantly increased their ratings on both explicit attitude questionnaires (Gym and EAP) post-suggestion, whilst ratings for all other groups did not significantly differ between sessions. Additionally, as in Experiment 3, it was found that Suggestion group participants who formed a false memory and Suggestion group participants who formed a false belief increased their ratings to highly similar extents. This evidence supports the findings of Experiment 3 and those of Bernstein et al. (2015), suggesting that false memories and false beliefs both affect explicit attitudes to highly similar extents. The only salient difference between the explicit attitudinal results of this study and those of the previously reported experiments was the extent to which Believers reported more preferential baseline explicit attitudes relative to other groups. Believers have tended to report more preferential baseline attitudes than the other groups in the previous experiments, but they did so to a greater extent in this study. This isn't necessarily problematic for the core idea that false memories and beliefs can change explicit attitudes, since the explicit attitudinal effects are still highly significant and data of Believers is in fact highly similar to that of other studies; Believers ratings still change from a mean unfavourable rating (below the midline) in Session 1 to a mean preferable rating (above the midline) in Session 2. The scale of the difference in baseline explicit attitudes between Believers and the other groups is primarily because the other groups reported lower baseline attitudes in this experiment than they had done in previous experiments. However, this further emphasises the point made in Section

4.1.4 regarding the application of these findings; if false memories and beliefs are only effective in changing one's attitudes towards attitude objects to which one is originally relatively ambivalent, then there is limited potential in terms of therapeutic intervention.

Explicit attitudinal effects within the novel Imagination group were mixed; while they were not found to significantly increase their explicit attitudinal ratings on the EAP questionnaire, their Session 2 ratings were found to be significantly greater than their Session 1 ratings on the Gym questionnaire. Within the APE framework, it would be predicted that simply imagining the false suggestion without it being implied that it actually occurred would be insufficient to affect one's explicit attitudes; since these are attitude judgments based on propositional reasoning and conscious processes of validation, then assuming that imagination of the event did not result in a false memory or belief (a safe assumption given that Imagination group participants who reported false memories and beliefs were excluded from analyses), the information used to construct this attitude judgment should not have changed between sessions. The mixed results observed here may not necessarily contradict this. Whilst the Gym questionnaire ratings of Imagination group participants were found to significantly increase in Session 2, the magnitude of this increase was drastically smaller than the increase observed in Believers, and their post-Imagination ratings were still unfavourable (a mean rating of 2.21 out of 8). Therefore, whilst there was a significant difference in ratings between sessions on this questionnaire, it is debatable whether the attitudes of the Imagination group actually *changed* (in contrast to those of Believers, whose mean ratings went from below the midline to above; i.e. from unfavourable to favourable). Combined with the non-significant difference between Session 1 and Session 2 EAP questionnaire ratings, the evidence suggests that merely imagining the

false suggestion event (without it being suggested that it actually happened) is insufficient to elicit significant explicit attitudinal effects.

In place of a genuinely behavioural variable, the Exercise Intention Questionnaire was included as a measure of behavioural intention. Whilst the Gym questionnaire can also be considered as a measure of behavioural intention, the Exercise Intention Questionnaire can be considered a more direct measure; while the Gym questionnaire asks participants to imagine how likely they would be to sign up for their critical exercise in an imagined, hypothetical scenario (and as such is probably a better gauge of explicit attitudes as opposed to genuine behavioural intention), the Exercise Intention Questionnaire directly asks how often the participants plan to engage in their critical exercise over the next two months. Evidence for the effects of false memories and beliefs on this variable was not as clear as in the other explicit attitudinal variables. Whilst Believers reported that they would engage in their critical items more often than all other groups, this difference was not significant when compared with the Non-Believers group. In general, the vast majority of participants across all groups indicated that they had no intention of participating in their critical item in the following two months. This would suggest that false memories and beliefs had limited impact on participants' intention to engage in their critical activities, although since this variable is self-reported rather than a genuinely behavioural measure, it may not be possible to conclude anything from this about the behavioural effects of false memories and beliefs.

The main aims of this experiment regarding implicit attitudes were to establish whether the effects observed in Experiment 3 were replicable in another attitudinal domain (exercise as opposed to food), whether similar explicit attitudinal effects could be observed simply through imagining the false suggestion as opposed to forming a false memory or belief of it, and whether implicit attitudes changed between sessions.

The results regarding these predictions are inconclusive, since no significant effects of group or session (or interaction effects) on implicit attitudes were found. The results were in the expected direction with regards to memories and beliefs, with participants who reported a false memory demonstrating both the most preferable implicit attitudes post-suggestion and the biggest difference between Session 1 and Session 2 scores, whilst participants who formed a false belief exhibited highly similar mean scores across both sessions. While it was considered theoretically plausible that merely imagining the false suggestion event without forming a false memory or belief could have led more preferable implicit attitudes, ST-IAT scores for the Imagination group actually decreased in Session 2 (the opposite of what was expected). However, given that none of these differences were significant means that relatively few conclusions can be drawn; the implicit attitudinal results of Experiment 3 were not replicated in a new domain, merely imagining the false suggestion was not sufficient to affect implicit attitudes (but in this case, neither were false memories), and no significant differences were found for any group/subgroup between Session 1 ratings and Session 2 ratings.

Whilst the degree of variability between implicit attitude scores was comparable to Experiment 3, mean ST-IAT scores across all groups and sessions were very close to 0. If it is assumed that the ST-IATs used were valid measures of implicit attitudes towards the critical items, this is indicative of very neutral mean implicit attitudes towards the critical items across all groups. However, it may also be the case that these results were due to some form of methodological flaw which resulted participants registering highly similar times for blocks in which the critical item shared a response key with positive stimuli as blocks when the critical item shared a response key with negative stimuli. Given that the procedure, data preparation and analyses were all identical to those used in Experiment 3 and Bluemke and Friese's (2008) psychometric

evaluation of the technique, any methodological issue which could have affected this would have to involve the stimuli used.

The words used as evaluative stimuli were the same as those used in Experiment 3, so any resulting methodological problems would have to have been caused by the stimuli used to represent the critical exercise items and their subsequent automatic associations with the evaluative stimuli. The evaluative stimuli are all rather general positive or negative words, and there is no reason why they would be more heavily associated with food items than exercise items. The stimuli representing the critical items were not as tightly controlled as in Experiment 3; whereas Experiment 3 used largely very similar pictures of the critical food items presented against white backgrounds, the pictures used in this experiment varied more in what they depicted (for instance, one cross-country running exemplar image involved a group of six people running across a field in the rain, another depicted one person running alone in a wooded area). It may be the case that the differences between these images resulted in inconsistent patterns of associative activation throughout the ST-IAT, whereas the highly similar images of Experiment 3 were consistently able to activate the same patterns of activation. However, it is not uncommon for latency-based measures of implicit attitudes to represent the critical item using a variety of vastly different stimuli; for instance, in measuring implicit attitudes towards political parties, Bluemke and Friese (2008) used pictures of party emblems, pictures of party members, and the names of other party members. Therefore, it seems unlikely that the relatively superficial differences between exemplar images used in the ST-IATs in this experiment could have resulted in them failing to effectively measure implicit attitudes towards the critical items.

One of the main reasons for including a baseline measure of implicit attitudes in this experiment was that not doing so in Experiment 3 left open the possibility that the observed results were due to participants who formed a false memory having had more preferential implicit attitudes than the other subgroups to begin with. This consideration meant that pre-suggestion and post-suggestion implicit attitudes could have been highly similar, and the results of Experiment 3 could not definitively be considered evidence of implicit attitude *change.* In this experiment, participants who reported a false memory exhibited a negative mean ST-IAT score in Session 1, which was highly similar to that of participants who formed a false belief only, Non-Believers, and control group participants. Additionally, those who reported a false memory were the only group/subgroup whose mean ST-IAT scores changed in terms of overall valence (from negative to positive). These results would suggest that those who form a false memory do not necessarily report more preferential baseline implicit attitudes than any other subgroup, and this may make it more likely that the results of Experiment 3 were the result of implicit attitude change in the false memory group. However, given the lack significant effects across the implicit analyses, and given how close ST-IAT scores are to 0 across all groups, relatively little can be definitively concluded from these results.

The results of Experiment 4 regarding the explicit attitudinal effects of false memories and beliefs were largely consistent with those of previous studies. Although the newly-included Imagination group provided some mixed results in explicit attitudinal measures, on the whole they displayed very limited evidence that merely imagining the false suggestion item (without the suggestion that it actually occurred) can affect implicit attitudes. Evidence regarding the behavioural intention variable and implicit attitudes was inconclusive. Whilst participants who formed a false memory or belief reported that they intended to engage in their critical exercise item more often

than other groups, the differences between groups were largely non-significant. The experiment also failed to replicate the implicit attitudinal effects of Experiment 3, with all groups reporting mean ST-IAT scores of close to 0. It is unclear whether this is indicative of very neutral implicit attitudes towards the critical items, or whether it is the result of a methodological problem. The results did not provide any evidence that imagining the false suggestion item alone (without suggestion of its occurrence) was able to elicit implicit attitude change; however, given that implicit attitude change was not observed in any group or subgroup means that this finding is of limited utility. Whilst the results may suggest that participants who form false memories as a result of false feedback do not necessarily have more preferential baseline implicit attitudes than any other subgroup (potentially contradicting a previously-discussed alternative explanation for the results of Experiment 3), the overall nature of the results may make it impractical to generalise this finding.

5.3. Chapter 5 Discussion

Experiments 3 and 4 included a variety of methodological changes which aimed to increase the efficiency of the false-feedback procedure, as well as the number of false memories and beliefs elicited in the Suggestion group. In aiming to reduce the number of participants excluded from analyses on the basis of high baseline confidence in the false suggestion, multiple potential false suggestion items were used, resulting in adaptable suggestions. In aiming to increase the proportion of Suggestion group participants who formed false memories and beliefs, filler items on the feedback questionnaire were adapted to reflect items that participants had (in reality) indicated high confidence of in the first session, and the imagination instructions were adapted to encourage more in-depth, elaborative imagination of the false suggestion item. Whilst

the effects of these changes relative to previous experiments was not subjected to analyses, collectively they appear to have been successful. In Experiment 3, 14 participants (11.67% of the total sample) were excluded from analyses on the basis of high baseline confidence for all possible permutations of the false suggestion. In Experiment 4, 20 participants (11.04% of the total sample) were excluded on this basis. This is a substantial improvement in efficiency relative to Experiments 1 and 2, which excluded 35.16% and 26.05% of participants, respectively.

The changes designed to elicit a greater number of false memories and beliefs also seemed to be effective. In Experiment 1, 54.72% of Suggestion group participants eligible for analyses met the criteria to be classified as “Believers”. In Experiment 2, this proportion was 44.07%. In Experiments 3 and 4, this proportion was increased to 69.33% and 64.63%, respectively. As mentioned in Section 5.1.4., Brewin and Andrews’ (2016) recent review of 15 other studies which utilised the false feedback paradigm to elicit false autobiographical memories of childhood events found that within those studies, the proportion of participants who received a false suggestion and went on to report a memory or belief of it ranged from 18% to 53%. Experiments 3 and 4 exhibited a substantial increase on this proportion. Given that the general false feedback procedure was unchanged from the standard design used in the majority of experiments reviewed by Brewin and Andrews, it is likely that this improvement can be largely attributed to the aforementioned changes. Additionally, whilst participants who met the “Believer” criteria in Experiments 1 and 2 tended to report false beliefs more often than false memories, Experiments 3 and 4 saw an increase in the number of false memories reported, resulting in the number of false memories and false beliefs being far more balanced than in the previous experiments.

Regarding explicit attitude change, Experiments 3 and 4 produced largely consistent results. As in Experiments 1 and 2, it was found that participants who formed false memories and beliefs of a positive experience regarding their critical item reported significantly more preferable attitudes towards that item post-suggestion than they had done pre-suggestion. Additionally, the increased number of false memories and beliefs elicited (and greater balance of these subgroups) allowed for the attitudinal effects of false memories to be compared with those of false beliefs. Consistently across Experiments 3 and 4, false memories and false beliefs were found to affect implicit attitudes to highly comparable extents. These results are consistent with the predictions derived from Gawronski and Bodenhausen's (2006) APE framework; that memories and beliefs both act as largely equivalent pieces of information in propositional explicit attitude judgments; for instance, propositions of "I remember liking broccoli the first time I tried it" and "I believe I liked broccoli the first time I tried it" are likely to be used identically in inferring explicit attitude judgments via syllogistic inference. It is also consistent with the results and conclusion of Bernstein et al.'s (2015) mega-analysis of false-feedback studies investigating the effects of false memories and beliefs on attitude change; false memories and beliefs appear to be indistinguishable in their explicit attitudinal effects, and the critical factor underlying attitude change appears to be belief.

The findings of this chapter relating to implicit attitude change are more mixed. Experiment 3 appeared to solve the methodological problems associated with implicit attitude measurement in Experiment 2 by changing to the single-target method of the IAT, and provided supporting evidence for the prediction that false memories may be able to drive implicit attitude change whilst false beliefs alone may not. However, Experiment 4 was unable to replicate the implicit attitudinal results of Experiment 3,

with participants across all groups and subgroups reporting highly neutral mean implicit attitude scores (close to 0). It is uncertain whether this is due to methodological issues, or whether the ST-IAT scores were a valid representation of largely neutral implicit attitudes. In sum, whilst the evidence presented in this chapter provides some support for the notion that false memories may be sufficient to affect implicit attitudes, further research will be necessary on this matter before definitive conclusions can be made.

Chapter 6. The impact of phenomenological factors and individual differences on attitude change resulting from false memories and beliefs

This chapter aims to establish whether the factors relating to memory phenomenology and individual differences are related to explicit and implicit attitude change resulting from false memories and beliefs. Utilising data which was collected in Experiments 3 and 4 (but not included in the main analyses of those experiments), this will be addressed in two quasi-experiments; Section 6.1. will assess the potential impact of the levels of vividness, accessibility, sensory details, visual perspective and coherence of reported false memories, while Section 6.2. will focus on the individual difference factors of Need for Cognition, Need to Evaluate, and sensory imagery.

6.1. The relationship between phenomenological qualities of reported false memories and explicit and implicit attitude change.

6.1.1. Introduction

As in previous studies which have utilised the false-feedback paradigm, the false memories elicited in Experiments 1-4 have been autobiographical in nature. As discussed in Section 1.2.3., autobiographical memories are memories for personally-relevant events, comprising a complex interplay between episodic and semantic features (Conway, 2005). As highlighted by Tulving (1985), a definitive feature of autobiographical memory is 'autonoetic consciousness'; a detailed recollective experience containing associated sensory re-experiencing. This is sometimes referred to as 'mental time travel' (Suddendorf & Corballis, 1997), and the extent to which an individual engages in mental time travel is essentially determined by a number of different phenomenological characteristics of the pertinent memory (Rubin, Schrauf, & Greenberg, 2003). These characteristics include factors such as vividness, sensory and emotional re-experiencing, coherence and accessibility; all of which contribute towards the experience of mental time travel, and can vary significantly between autobiographical memories (Sutin & Robins, 2007).

Despite the fact that autobiographical memories can vary widely in a range of factors which are central to how they are remembered and experienced, previous research using the false-feedback paradigm has not taken this into account. As in Experiments 1-4, studies utilising the false-feedback paradigm have tended to group memories together for analyses, and compare subsequent attitude change between those who have formed a false memory (or belief, in the majority of analyses) and those who have not. There has been no consideration for the strong probability that phenomenological content of these memories will vary significantly. Consequently, it

has yet to be explored whether the phenomenology of reported false autobiographical memories has any relationship with subsequent explicit or implicit attitude change.

There is reason to believe that certain phenomenological factors may be of importance in attitude change resulting from false memories. Regarding implicit attitude change, they seem to be of particular relevance. As highlighted at various points throughout this thesis, implicit attitude change has been previously found as a result of guided imagination exercises (Blair et al., 2001; Markland et al., 2015), and the underlying phenomenological similarities between imagination/imagery and autobiographical memory have led to the theoretical prediction that false memories may be able to affect implicit attitudes. However, this prediction is dependent on the assumption that reported autobiographical memories engage similar cognitive processes to imagination, and a strong phenomenological similarity in qualities which contribute towards re-experiencing and mental time travel is key to this prediction. The characteristics of vividness, sensory detail and emotional intensity would be of particular relevance here. The quality of vividness is defined as the visual clarity and intensity of the retrieved memory, whilst level of sensory detail and emotional intensity are defined by the extent of sensory/emotional re-experiencing during retrieval (Sutin & Robins, 2007). As previously considered in Section 5.1.1., it is logical within the APE framework (Gawronski & Bodenhausen, 2006) that the underlying associative structures which form the basis of implicit attitudes may adapt to accommodate associative information provided by the sensory/affective details of the memory. It therefore stands to reason that memories which are rich in vividness, sensory detail and emotional intensity would have a greater impact on underlying associative structures than those which are low in these qualities.

Based on the results of Experiments 3 and 4, and their theoretical interpretations, it could be reasoned that phenomenological characteristics of false memories may be of less influence in explicit attitude change relative to implicit attitude change. As found in Experiments 3 and 4, false memories and false beliefs have tended to demonstrate highly comparable explicit attitudinal effects. This finding is consistent with previously published false-feedback studies, as demonstrated in Bernstein et al.'s (2015) mega-analysis, from which it was inferred that the critical factor underlying explicit attitude change is belief in the false suggestion event (a common factor in both memories and beliefs), with it being of little importance whether the event is remembered or merely believed to have occurred. Assuming this is the case, it seems unlikely that the phenomenological characteristics of elicited false memories will be highly influential in the extent of subsequent explicit attitude change. However, because phenomenological factors have never been controlled for in previous false-feedback studies, the possibility remains that they may be influential; considering all memories are grouped together in attitude change analyses, there is a possibility that memories high in phenomenological qualities and memories low in phenomenological qualities average out, resulting in a mean level of attitude change consistent with that of the false belief subgroup. Alternatively, it could also be the case that reported false memories have simply been consistently low in phenomenological qualities. This is highly plausible, considering that phenomenological qualities of false memories tend to be lower than those of true memories (Kealy & Arbuthnott, 2003; Marche, Brainerd, & Reyna, 2010; Ost, Vrij, Costall, & Bull, 2002).

Logically, there is reason to believe that memory phenomenology could hypothetically have some influence on explicit attitude change; for instance, it stands to reason that a participant experiencing a false memory of enjoying broccoli which is

highly vivid and rich in sensory details would be more likely to make a conscious, deliberative decision that they like broccoli than an a participant who has a very vague memory lacking in such qualities. Within the APE framework, it was previously reasoned in Section 5.3 that memories and beliefs may be used as largely equivalent pieces of information in explicit attitude judgments. However, it is equally plausible within this framework that certain aspects of memory phenomenology may be used as additional information in propositional attitude judgments, and their explicit attitudinal impact may be dependent on the attention and deliberation afforded to them by the individual.

Throughout Experiments 3 and 4, a range of phenomenological characteristics of reported false memories were measured (see Section 6.1.2.2 for details). Because of concerns regarding the validity of the implicit attitude data in Experiment 4, the relationship between phenomenological factors and implicit attitudes was only analysed using data from Experiment 3. It was hypothesised that measures of phenomenological factors would positively correlate with implicit attitude scores. Although the theoretical rationale was less clear in predicting whether phenomenological factors would be associated with explicit attitude change, it was tentatively predicted that there would be a positive correlation between the two.

6.1.2. Method

6.1.2.1. Participants

Data from Experiments 3 and 4 were combined to create an overall sample of 301 participants (244 female, 57 male) with a mean age of 21.47 years (*SD* = 5.75). However, analyses were naturally restricted to participants who reported a false memory

(and associated phenomenology ratings). Maintaining consistency with the false-feedback procedure, participants who reported high baseline confidence in the false suggestion item (Session 1 FHI/EHI rating of greater than 4) were excluded from analyses, ensuring that only those with *false* memories were included. After these criteria were applied, a functional sample of $n = 56$ remained (48 females, 8 males), with a mean age of 22.71 ($SD = 6.84$).

6.1.2.2. Materials

Memory phenomenology was measured using questionnaire items taken from the short form version of the Memory Experiences Questionnaire (MEQ-SF) developed by Luchetti and Sutin (2015). This is an adapted version of the Memory Experiences Questionnaire devised by Sutin and Robins (2007). The questionnaire (see Appendix E) was completed in Session 2, and was the final questionnaire participants completed before they undertook the ST-IAT. Memory phenomenology was measured for the three items included in the Memory or Belief questionnaire; two were filler items and one was always the false suggestion. Participants were instructed to only complete the phenomenology questionnaire for items which they had reported a memory of in the Memory or Belief questionnaire. The MEQ-SF measured the following factors associated with participants' false memories (definitions taken from Sutin & Robins, 2007): vividness (measuring visual clarity and intensity of retrieved memories), accessibility (measuring perceived ease of retrieval of the memory), sensory detail (measuring the extent to which sensory details are re-experienced during retrieval), visual perspective (measuring the extent to which the individual perceives the memory from their own point of view), and coherence (measuring the extent to which the memory follows a logical story in a specific time and place). In Experiment 4 only, two

additional factors were included; valence (measuring the extent to which the memory is perceived as being of a positive or negative experience) and distancing (measuring the extent to which the individual psychologically distances themselves from the experience in the memory through comparison of their current selves against themselves in the memory). For each variable, participants indicated the extent to which they agreed with a series of statements (a minimum of 2 and a maximum of 4 per variable) on a scale of 1-5 before their responses were averaged. Higher scores represent greater levels of the pertinent phenomenological factor associated with the reported false memory.

Although the MEQ-SF contains a measure of emotional intensity, and this variable is of relevance to the aforementioned predictions regarding the relationship between memory phenomenology and attitude change, it was decided that this variable would not be measured because the nature of the false suggestion events meant that any associated memories were very unlikely to be associated with strong emotion.

6.1.3. Results

6.1.3.1. The relationship between phenomenological factors of false memories and explicit attitude change.

In order to assess the relationship between phenomenological factors and overall explicit attitude change, a composite explicit attitude change score was computed for each participant; the difference between Session 1 (pre-suggestion) and Session 2 (post-suggestion) ratings for the Restaurant/Gym questionnaire and Food Preferences/Exercise Activity Preferences questionnaire (broadly the same measures of explicit attitudes across both experiments) were computed, and the mean of these two difference scores formed the composite explicit attitude change variable. For the 56

participants across Experiments 3 and 4 who reported a false memory, the composite explicit attitude change variable ranged from -2.50 to 7, with a mean of 2.21 (*SD* = 1.71); the explicit attitude change of those in Experiment 3 (n = 27) ranged from -2.50 to 7 with a mean of 2.26 (*SD* = 2.05) points, whilst the explicit attitude change of those in Experiment 4 (*n* = 29) ranged from .50 to 6 with a mean of 2.17 (*SD* = 1.34) points. Descriptive statistics for each individual phenomenological variable and their correlations with explicit attitude change are displayed in Table 5. It should be noted that statistics for the variables of Vividness, Accessibility, Sensory Detail, Visual Perspective and Coherence were computed for all 56 participants across Experiments 3 and 4 who reported a false memory, whereas the statistics for the variables of Valence and Distancing only represent the *n* = 29 participants who formed a false memory in Experiment 4 (since these variables were not measured in Experiment 3).

Table 5.
Means and standard deviations of individual phenomenological variables of reported false memories in Experiments 3 and 4, and their correlations with explicit attitude change (Note: Sample sizes for Valence and Distancing are smaller as they were only measured in Experiment 4).

			Correlations with explicit attitude change	
	Range	M (SD)	*r*	*p*
Vividness (*n* = 56)	2.00 – 5.00	3.55 (.93)	.282*	.035
Accessibility (*n* = 56)	1.00 – 5.00	3.65 (1.09)	.084	.538
Sensory Detail (*n* = 56)	1.25 – 5.00	3.31 (.88)	.255	.058
Visual Perspective (*n* = 56)	2.00 – 5.00	3.91 (1.00)	.124	.363
Coherence (*n* = 56)	1.00 – 5.00	3.46 (.99)	.098	.475
Valence (*n* = 29)	1.00 – 5.00	4.26 (.99)	.053	.786
Distancing (*n* = 29)	1.00 – 5.00	3.32 (1.30)	-.419*	.024

*Significant at $p < .05$ level.

Explicit attitude change was found to correlate positively with memory Vividness, $r(54) = .282$, $p = .035$, and correlate negatively with Distancing, $r(27) = -.419$, $p = .024$. No other variables were found to have a significant relationship with explicit attitude change.

Two hierarchical linear regressions were carried out to assess the degree to which phenomenological factors predicted explicit attitude change. The first included the variables of Vividness, Accessibility, Sensory Detail, Visual Perspective and Coherence, which were measured for all participants across Experiments 3 and 4 who reported a false memory ($N = 56$). The second included the variables of Valence and Distancing which were only measured for participants in Experiment 4 who formed a false memory ($n = 29$). On the basis of the correlations reported in Table 5., Vividness appeared to have the strongest relationship with explicit attitude change, and was entered as the first block of the regression. The second block consisted of Sensory Details, which had a marginally non-significant relationship with explicit attitude change. Accessibility, Visual Perspective and Coherence all displayed similarly minimal relationships with explicit attitude change, and were all inserted into the third and final block of the regression.

It was first ensured that the assumptions for linear regression were met. Visual examination of residual histogram, P-P and scatter plots revealed that the assumptions of normality, linearity and homoscedasticity were all met. Whilst multiple significant positive correlations between independent variables were found, tolerance and VIF values were within generally accepted limits (Field, 2009), so multicollinearity was not considered a problem. Regression statistics are reported in Table 6.

Table 6.
Hierarchical regression statistics assessing the extent to which phenomenological characteristics of false memories predicted explicit attitude change in Experiments 3 and 4.

		B (*SE* B)	β	*t*	R^2	ΔR^2
Step 1					.080	.080
	Vividness	.52 (.24)	.28	2.16*		
Step 2					.086	.006
	Vividness	.37 (.34)	.20	1.10		
	Sensory Detail	.22 (.36)	.11	0.61		
Step 3					.094	.008
	Vividness	.37 (.38)	.20	.99		
	Sensory Detail	.28 (.39)	.15	.72		
	Accessibility	-.11 (.26)	-.07	-.43		
	Visual Perspective	.11 (.25)	.06	.43		
	Coherence	-.05 (.28)	-.03	-.17		

*Variable significant at $p < .05$.

It was revealed that, at Step 1, the regression model significantly predicted explicit attitude change, $F(1, 55) = 4.67$, $p = .035$, indicating that Vividness alone was a significant predictor of explicit attitude change. At this stage, the variable of Vividness had a regression coefficient of .52 (95% CI [.04 - .99]), indicating that the model would predict an increase of .52 in the composite explicit attitude change variable for every increase of 1 in the Vividness scale. The R^2 value for the initial model of Vividness indicated that only 8% of the variation in explicit attitudes amongst those with a false memory was accounted for by the vividness of the memory. Steps 2 and 3 made very limited additions to the R^2 of the model (.006 and .008, respectively). Additionally, Steps 2 and 3 decreased the predictive value of Vividness to the point that it was no

longer a significant predictor of explicit attitude change, and the overall model was not significant at either step (p = .092 at Step 2, and p = .408 at Step 3).

An additional hierarchical linear regression analysis was performed to assess the extent to which Distancing and Valence predicted explicit attitude change. These were assessed separately to the other phenomenological variables because they were only measured in Experiment 4. Subsequently, only participants from Experiment 4 who reported a false memory (n = 29) were included in the regression model. It was decided that this analysis would only include these two variables in the model, as opposed to creating a model with all of the phenomenological variables which were measured in Experiment 4 (and analysed in the previous regression). This was partly for ease of interpretation of the effects of the other variables, and partially due to the reduced sample size being insufficient for a regression analysis including seven independent variables.

The first step of the regression included Distancing, which demonstrated a strong positive correlation with explicit attitude change (as displayed in Table 7). The second step included Valence. Visual examination of residual histogram, P-P and scatter plots revealed that the assumptions of normality, linearity and homoscedasticity were all met. There was no significant correlation between the two predictor variables, and thus multicollinearity was not a problem. The results of this regression are displayed in Table 7.

Table 7.
Hierarchical regression statistics for assessing the extent to which the phenomenological characteristics of Distancing and Valence (measured for Experiment 4 participants only) predict explicit attitude change.

	B (*SE* B)	β	*t*	R^2	ΔR^2
Step 1				.175	.175
Distancing	-.44 (.18)	-.42	-2.40*		
Step 2				.181	.005
Distancing	-.46 (.19)	-.44	-2.38*		
Valence	-.10 (.25)	-.08	-.41		

*Variable significant predictor at $p < .05$ level.

At Step 1, the model significantly predicted explicit attitude change, $F(1, 28) = 5.74$, $p = .024$, which indicated that Distancing alone was a significant predictor. The R^2 of the model at this stage was .18, indicating that 18% of the variance in explicit attitude change was account for by Distancing. An associated regression coefficient of -.44 (95% CI [-.81, -.06]) indicated that the model predicted a decrease of .44 in explicit attitude change for every increase of 1 in the Distancing scale. The addition of Valence to the model at Step 2 made a very marginal addition the model R^2 (.005), and the overall model was found to not be a significant improvement on the constant-only model at this stage, $F(2, 28) = 2.86$, $p = .075$. However, Distancing remained a significant predictor at Step 2 ($p = .025$).

Due to two sets of regression analyses being performed, a Bonferroni correction was applied to results for both analyses. After the correction had been applied, Vividness was no longer a significant predictor of explicit attitude change at any stage, whilst Distancing remained a significant predictor ($p = .048$) at the first stage of its regression model.

6.1.3.1. The relationship between phenomenological factors of false memories and post-suggestion implicit attitudes.

Correlational and hierarchical regression analyses were also run to evaluate the relationship between phenomenological factors and implicit attitude measures. Because the implicit data obtained in Experiment 4 had characteristics which suggested the test may not have been a valid measure of implicit attitudes towards the critical exercise items (predominantly that the majority of scores obtained were very close to 0), only implicit data from Experiment 3 were included in analyses. Additionally, as in implicit attitudinal analyses in Experiments 3 and 4, participants who had an error rate of 20% or more in any critical block of trials in the ST-IAT were excluded from analyses (because this high an error rate would be likely to skew their overall implicit attitude score and invalidate it). This reduced the number of participants in these analyses to n = 22. Because Distancing and Valence were only measured in Experiment 4, their relationship with implicit attitudes could not be assessed. Only using data from Experiment 3 also meant that the relationship between phenomenological factors and implicit attitude *change* could not be assessed; only the relationship between phenomenological factors and implicit attitudes post-suggestion. The mean ST-IAT score of participants included in these analyses ranged from -.38 to .39, with a mean score of -.01 (SD = .24). Descriptive statistics for each of the phenomenological variables and their correlations with post-suggestion implicit attitudes can be found in Table 8.

Table 8.
Means and standard deviations of individual phenomenological variables of reported false memories for participants in Experiment 3 who registered a valid ST-IAT score, and their associated correlations with post-suggestion implicit attitudes.

			Correlations with implicit attitudes	
	Range	M (SD)	*r*	*p*
Vividness	2.00 – 5.00	3.37 (.86)	.381	.080
Accessibility	1.00 – 4.67	3.29 (1.06)	..279	.208
Sensory Detail	1.50 – 4.25	3.06 (.71)	.453*	.034
Visual Perspective	2.00 – 5.00	3.71 (1.08)	.382	.080
Coherence	1.00 – 4.75	2.95 (.96)	.248	.266

*Significant at $p < .05$ level.

All variables were found correlate positively with implicit attitude scores, although only Sensory Detail was found to correlate significantly, $r(20) = .453$, $p = .034$. A hierarchical linear regression was performed to assess the extent to which the phenomenological variables predicted implicit attitudes. Because of the reduced sample size was insufficient for a regression analyses featuring all five phenomenological factors as predictor variables, only three were included. Step 1 included Sensory Detail as the only predictor, as this had been found to have the strongest association with implicit attitudes. Step 2 added Vividness and Visual Perspective, as these had similarly positive but marginally non-significant relationships with implicit attitudes. Visual inspection of the residuals histogram, P-P and scatter plots revealed that the assumptions of normality, linearity and homoscedasticity were all met. Whilst Vividness and Sensory Detail were significantly correlated ($p = .003$), tolerance and VIF values were again within generally accepted limits (Field, 2009), and so it was

decided that multicollinearity was unlikely to be problematic. Regression statistics are displayed in Table 9.

Table 9.
Hierarchical regression statistics assessing the extent to which the phenomenological characteristics of Sensory Detail, Vividness and Visual Perspective predicted implicit attitudes.

		B (*SE* B)	β	*t*	R^2	ΔR^2
Step 1					.21	.21
	Sensory Detail	.15 (.07)	.45	2.27*		
Step 2					.27	.06
	Sensory Detail	.09 (.09)	.26	.98		
	Vividness	.05 (.07)	.16	.64		
	Visual Perspective	.05 (.05)	.23	1.06		

*Variable significant predictor at $p < .05$ level.

At Step 1, the regression model containing only Sensory Detail was found to significantly predict implicit attitudes, $F(1, 21) = 5.17$, $p = .034$, indicating Sensory Detail to be a significant predictor of implicit attitudes. The R^2 of the model at this stage was .21, indicating that 21% of the variance in implicit attitudes was accounted for by Sensory Detail. When Vividness and Visual Perspective were added to the model at Step 2, R^2 was increased slightly to .27, although this increase was non-significant ($p = .471$). At this stage, none of the variables were found to be significant predictors of implicit attitudes, and the overall model was not found to be a significant improvement on the constant only model ($p = .122$).

6.1.4. Discussion

It was predicted that the measured phenomenological factors of reported false memories would have a significant relationship with explicit and implicit attitude change. The results were generally mixed with regards to these predictions, but provided some tentative evidence that certain phenomenological factors may play a role in attitude change. With regards to explicit attitudes, the measures most strongly associated with attitude change were Distancing and Vividness. Implicit attitudes were found to be most strongly associated with Sensory Detail. These associations have sound logic behind them and fit well within the APE theoretical framework, but there are numerous issues which limit the extent to which generalisations can be made from these data.

The fact that Distancing was found to negatively correlate with explicit attitude change is unsurprising. The higher participants scored on the Distancing measure, the greater the level of detachment they felt from themselves in the memory; as one of the questionnaire items states, they "feel like the person in the memory is a different person than who [they] are today". It is logical that this would have an impact on the extent to which they changed their explicit attitudes; if a participant forms a positive memory of a disliked item, but no longer consider the representation of themselves in the memory to be a representation of their current self, this memory is less likely to have a strong effect on their current conscious, deliberative attitude judgments. On the other hand, if a participant forms a positive memory of a previously disliked item, and considers their current self and themselves in the memory to be much the same, then their current explicit attitude judgment will be more likely to take into account the positive attitude represented in the memory. This was the only variable in any of the regression models which was found to be a significant predictor at multiple steps. However, since this

variable was only measured in Experiment 4, the model was based on a reduced sample size, which necessitated a smaller regression model with only two variables (reported in Table 7). Therefore, it is uncertain whether Distancing would have uniquely accounted for as much of the variation in explicit attitude change had it been included in a regression model containing the other predictor variables included in the model reported in Table 6. Because regression models with fewer than 10 participants per predictor variable tend to be unreliable (Field, 2009), this cannot be reliably determined with the currently available data.

The other phenomenological variable found to be associated with explicit attitude change was Vividness. Although the relationship was weaker than that of Distancing, Vividness was still found to have a significant positive correlation with explicit attitude change, as well as being found to be a significant predictor of it in the first step of the regression model presented in Table 6. This finding makes sense within the theoretical framework of the APE. Despite previous evidence suggesting that participants use memories and beliefs as broadly similar pieces of information in establishing explicit attitudinal judgments, it is plausible that certain phenomenological characteristics of memories may be used in propositional processing. This is likely to be dependent on the extent to which participants attend to or ruminate on aspects of their memories; the greater the degree of conscious attention they give to their memories, the more likely they are to use aspects of them in the construction of explicit attitude judgments. It makes sense that participants who report their memories as being more "vivid" and "detailed" (both gauged in the items which measure overall Vividness) have attended more to various details within their memory (or simply thought about the experience which the memory describes in greater detail). Therefore, whilst the APE framework would predict that more specific aspects of memory phenomenology should

have limited or no relationship with explicit attitude change, it is plausible that the quality of Vividness may have some effect. This is a prediction which is generally supported by the presented data. It should be noted, however, that Vividness was no longer a significant predictor of explicit attitude change after applying the Bonferroni-correction for multiple comparisons, or once the regression model accounted for Sensory Detail. The significant positive correlation between Vividness and Sensory Detail suggests that there may be overlap in the explicit attitude change variance which they explain. Although tolerance and VIF statistics were within generally acceptable limits, it may have been the case that the multicollinearity of these variables was an issue in this model. In addition to this, Vividness was only found to explain 8% of the variance in explicit attitudinal change; therefore, although it was found to be a statistically significant predictor, it is unlikely that Vividness (or any of the other phenomenological variables in this regression model) play a significant role in explicit attitude change.

The theoretical rationale for predicting that phenomenological characteristics of false memories would play an important role in affecting implicit attitudes was clearer than for the predictions regarding explicit attitudes. The results of Experiment 3 supported the notion that false memories may be able to affect implicit attitudes, but false beliefs alone may not; a finding which memory phenomenology was central to the prediction and explanation of. Various methodological restrictions meant that the regression model assessing the relationship between phenomenology and implicit attitudes had several limitations. Being unable to use implicit data from Experiment 4 meant that the sample size was heavily restricted. It also meant that the variables of Distancing and Valence were not included in analyses, and that analyses were restricted to assessing the association between phenomenological variables and post-suggestion

implicit attitudes alone rather than implicit attitude *change*. This presented the same problem of interpretation encountered in Experiment 3; that the formation of memories rich in sensory detail may have been the result of pre-existing positive implicit attitudes towards the critical item, as opposed to increased sensory detail influencing implicit attitudes.

Within this restricted regression analyses, only Sensory Detail was found to significantly correlate with implicit attitudes, as well as being found to be a significant predictor in the first step of the model. Sensory Detail was also found to predict 21% of the variance in implicit attitude scores; this was higher than the proportion of variance explained in explicit attitude change by any phenomenological variable. These findings fit well with the theoretical predictions; sensory details are a major phenomenological similarity between autobiographical memories and mental imagery (which has previously been found to affect implicit attitudes), and it is likely to be through aspects such as sensory details that underlying automatic associative processes are modified. However, similarly to the effects of Vividness in the first explicit attitudinal regression model, once extra phenomenological variables were included in the second step, Sensory Detail was no longer found to be a significant predictor. Again, this is likely to be due to the multicollinearity between Vividness and Sensory Detail resulting in a large amount of overlap between the two in explained variance of implicit attitude scores. Like the first explicit attitudinal regression, tolerance and VIF statistics suggested that the model should be robust to the effects of multicollinearity, but this may not have been the case. The potential vulnerability of the model to multicollinearity may be due to the small sample size.

The results presented here provide an indication that certain phenomenological factors of false memories may play a role in the extent of subsequent attitude change.

Findings suggested that explicit attitude change may be influenced by the extent to which participants consider their current selves to be similar to themselves in the memory. A potential role for memory vividness in explicit attitude change was also highlighted, although this variable was limited in its predictive power, and was not found to remain a significant factor when its contribution was considered alongside those of other phenomenological variables. A positive relationship was found between implicit attitude scores and levels of sensory detail in false memories; a factor which was found to have greater predictive power than that of any phenomenological variables in predicting explicit attitude change. These findings fit well with the theoretical rationale that memory phenomenology is more likely to affect implicit attitudes than explicit attitudes. However, a number of limitations mean that these results would benefit from future replication. Perhaps most crucially, it must be determined whether phenomenology has a relationship with implicit attitude change, as opposed to simply with post-suggestion measures. Future studies would also benefit from greater sample sizes and addressing issues of collinearity between certain predictor variables in order to obtain more powerful regression models.

6.2. The relationship between individual difference measures, false memory and belief formation, and subsequent explicit and implicit attitude change.

6.2.1. Introduction

In addition to phenomenological characteristics of false memories, there are likely to be other factors which are influential in the extent to which explicit and implicit attitudes are changed as a result of false memories and beliefs, and which have not been controlled for in previous studies utilising the false feedback paradigm. Some of these factors are likely to fall under the category of individual differences. Attitude change resulting from a range of persuasive techniques has been found to be associated with a variety of individual difference measures (for a review, see Briñol & Petty, 2005), and certain individual difference measures have also been found to be influential in the formation of false autobiographical childhood memories (Hyman & Billings, 1998; Zhu, Chen, Loftus, Lin, He, Chen, Li, Moyzis, et al., 2010; Zhu, Chen, Loftus, Lin, He, Chen, Li, Xue, et al., 2010). However, despite the fact that many self-reported measures of individual differences can be very easily accommodated within the standard false-feedback paradigm, very limited individual differences data are available from previously published false-feedback studies.

As noted by Bernstein et al. (2011), some past false-feedback studies have included individual difference measures within their questionnaires, although they have not typically been found to be associated with false memory or belief formation, or subsequent attitude change. Additionally, since individual differences data in false-feedback studies has tended to be supplementary and not directly related to the primary research questions, these non-significant relationships have not tended to be reported. However, these have typically been individual difference measures which various false-

feedback studies suggest were primarily measured in order to rule out demand characteristics and other alternative explanations for attitudinal effects; for instance, Laney, Morris, et al. (2008) compared participants' scores on Crowne & Marlowe's (1960) social desirability scale to ensure that the Believers subgroup did not significantly differ from Non-Believers and controls, thereby ruling out the possibility that reports of false memories and beliefs were simply socially desirable answers. Individual difference measures included for this kind of purpose have not been chosen based on strong theoretical rationale that they should be influential in false memory/belief formation or attitude change. Therefore, it is perhaps unsurprising that no significant relationships have been found.

There are numerous individual difference measures for which there is reason to believe that they may be influential in false memory/belief formation and attitudinal change within the false-feedback paradigm. One such measure is Need for Cognition (NFC); defined as "an individual's tendency to engage in and enjoy effortful cognitive endeavours" (Cacioppo et al., 1984). Individuals who are high in NFC tend to be highly attentive to their current tasks and engage in deeper processing of task-relevant information (Briñol & Petty, 2005). In relation to explicit attitude change, it has been found that individuals high in NFC tend to engage in deeper processing and greater elaboration of persuasive information, forming attitude judgments based on comprehensive analysis of a wide range of available information, whilst individuals low in NFC tend to form attitude judgments based more on information which is reliant on more peripheral cues in the persuasive context (Cacioppo, Petty, Feinstein, & Jarvis, 1996; Cacioppo, Petty, & Morris, 1983). Assuming that false memories and beliefs are the driving factor of explicit attitude change in the false-feedback paradigm, this would suggest that Believers who are also high in NFC may be more likely to elaborate on

their false memories and beliefs. It is plausible that this would result in them giving their false memories and beliefs greater consideration in forming their explicit attitudinal judgments. Given that Experiment 3 provided some tentative evidence that explicit attitude change was associated with memory vividness, this may make NFC a potentially influential variable in explicit attitude change.

With regards to implicit attitude change, it is a common assumption of many theoretical frameworks that elaboration is a key process in implicit attitudes and attitude change. As mentioned at various times throughout this thesis, Gawronski and Bodenhausen's (2006) APE framework suggests that implicit attitudes are modifiable through changing the underlying automatic associations activated on presentation of the attitude object; therefore, the greater the degree of elaboration within a counter-attitudinal argument (or false memory), the greater the potential for implicit attitude change. Other theoretical frameworks such as the MCM (Petty et al., 2007) also account for the effect of elaboration on implicit attitude change by stating that elaboration strengthens object-evaluation associations in their accessibility; greater elaboration thereby increases the accessibility of counter-attitudinal object-evaluation associations, increasing the likelihood of implicit attitude change. This assumption that elaboration is an important factor in implicit attitude change is generally well supported in social cognition research (see Briñol & Petty, 2015 for a review). Therefore, as discussed in relation to explicit attitude change, it seems likely that individuals who form a false memory and are also high on NFC may be more likely to go into greater elaborative detail in their recollections, thus increasing the likelihood of implicit attitude change. Individuals high in NFC have also been found to be more susceptible to false memories (Graham, 2007; Leding, 2013), potentially due to increased elaboration of information resulting in greater degree of associative activation during encoding. However, this

research has measured false memories for semantic associates using the Deese-Roediger-McDermott (DRM) paradigm (Deese, 1959; Roediger & McDermott, 1995), and therefore it is uncertain whether this will generalise over to greater susceptibility for false autobiographical memories in the false-feedback paradigm.

Another individual difference factor which may be associated with false memory/belief formation and subsequent attitude change is Need to Evaluate (NTE), which refers to an individual's tendency to engage in evaluative thought processes and form opinions on a wide range of objects/topics (Jarvis & Petty, 1996). Because individuals who are high in NTE tend to engage in evaluative thought more frequently than those low in NTE, their attitudes tend to be stronger and more stable and consistent across contexts, whilst those low in NTE tend rely more on salient information in their immediate environment (Briñol & Petty, 2005). Therefore, individuals high in NTE will be more likely to use information from their past explicit attitude judgments to inform their current explicit attitude judgments, while those low in NTE will be more likely to use information relating to their current situation. Because of this, it seems likely that individuals who score highly on NTE and go on to form false memories/beliefs in the false-feedback paradigm may be more resistant to associated explicit attitude change. With regards to implicit attitudes, it has been found that high NTE individuals have more extreme implicit attitudes towards a range of objects/topics, whilst low NTE individuals tend to have more neutral implicit attitudes (Hermans, De Houwer, & Eelen, 2001). This is most likely because individuals high in NTE access their attitudes more regularly, thereby strengthening underlying associative processes. This may potentially mean that individuals high in NTE are less susceptible to implicit attitudinal change resulting from false memories. Additionally, because those high in NTE are likely to

have stronger explicit attitudes towards the critical item, this may make them less likely to form a false memory or belief of a positive event involving that item.

It is also highly plausible that individual differences in mental imagery ability may be a factor in the false-feedback paradigm, particularly in false memory/belief formation. Mental imagery is related to the vividness with which an individual can vividly bring to mind a range of sensory experiences, and is highly comparable to the concept of mental time travel; i.e. the ability to mentally project oneself into the past or future (Andrade et al., 2014; Schacter, Addis, & Buckner, 2007). Individuals who score highly in measures of mental imagery would be more likely to engage in these processes during the imagination exercise during the false-feedback, and therefore could reasonably be expected to be more likely to form false memories and beliefs (i.e. imagination inflation). Additionally, as mental imagery exercises have been previously found to affect implicit attitudes (Blair et al., 2001; Markland et al., 2015), it makes sense that mental imagery ability may be positively associated with implicit attitudinal processes. The potential influence of mental imagery ability in explicit attitude change is likely to be more indirect. In Experiment 4, the vividness with which participants claimed that they imagined the false suggestion item was virtually identical for participants in Imagination only group who did not form false memories or beliefs (M = 5.20, SD = 1.86) and participants in the false suggestion group who did subsequently form false memories or beliefs (M = 5.30, SD = 1.87). However, it was only the Believers in the Suggestion group who went on to exhibit significant explicit attitude change, while the explicit attitudes of the Imagination only group remained virtually identical across sessions. This suggests that vividness of imagination alone is unlikely to be influential in explicit attitude change. However, Section 6.1 found tentative evidence that memory vividness may be a factor in explicit attitude change, and it would be

expected that a higher mental imagery ability may be linked to more vivid false memories. Therefore, there may be an indirect relationship between mental imagery ability and explicit attitude change (potentially moderated via the vividness of false memories).

It was predicted that susceptibility to the false suggestion (i.e. formation of a false memory or belief) would be positively associated with NFC and mental imagery, and negatively associated with NTE. In analysing the associations between individual difference factors and explicit attitude change, separate analyses were conducted for those who formed a false memory, those who formed a false belief and the Believers subgroup as a whole (i.e. those who formed a false memory or a false belief). Since these analyses are only interested in analysing the relationship between individual difference factors and attitudinal effects resulting from false memories and beliefs, and the only available evidence regarding implicit attitudinal effects of false memories and beliefs suggests that false memories may be sufficient to influence implicit attitudinal processes whilst false beliefs alone are not, the relationship between individual difference factors and implicit attitudes was only investigated for those who formed a false memory. It was predicted in all cases that explicit attitude change would be positively associated with NFC and mental imagery, and negatively associated with NTE. With regards to implicit attitudes, the aforementioned theoretical rationale is predominantly related to implicit attitude *change*. However, because of the problematic implicit attitude data in Experiment 4, only post-suggestion implicit attitude data from Experiment 3 could be used. Subsequently, it is tentatively predicted that post-suggestion implicit attitudes of participants who formed a false memory would be positively associated with NFC and mental imagery and negatively associated with NTE. For analyses of the false memory subgroup, the interaction between individual

difference variables and phenomenological factors found to be associated with attitude change in Section 6.1 were also investigated.

6.2.2. Method

6.2.2.1. Participants

Data from Experiments 3 and 4 were combined for analyses of individual difference factors. In analysing the relationship between individual difference factors and formation of false memories and beliefs, analyses were restricted to Suggestion group participants. The overall sample size for these analyses was N = 157; 105 participants who classified as Believers, and 52 participants who classified as Non-Believers. Within this overall sample, there were 129 females and 28 males, with a mean age of 22.04 (SD = 6.37).

In analyses relating to the association between individual difference factors and attitude change resulting from false memories and beliefs, analyses were restricted to Believers only, n = 105 (85 females and 20 males), with a mean age of 22.43 (SD = 6.94). Within this sample, there were 56 participants who reported a false memory and 49 participants who reported a false belief. When split by experiment, there were 27 false memories and 25 false beliefs from Experiment 3, and 29 false memories and 24 false beliefs from Experiment 4.

Sample sizes varied slightly in certain subsets of analyses due to missing or incomplete data. Any variations from the sample sizes reported here is reported in the corresponding analysis.

6.2.2.2. Materials

The individual difference measures of interest were included in Experiments 3 and 4, being presented as general “personality questionnaires”. In both experiments, these were interspersed throughout the relevant attitudinal measures obtained in Session 1, in place of the extraneous filler questionnaires which were included in Experiments 1 and 2.

NFC was measured with the 18-item scale utilised in Cacioppo et al. (1984). Participants rated the extent to which they agreed with a series of statements on a 1-5 scale. Items included statements such as “I would prefer complex to simple problems” and “I find satisfaction in deliberating hard and for long hours”. A participant’s NFC score was computed as the sum of all items (after reverse scoring appropriate items).

NTE was measured using the 16-item scale utilised by Jarvis and Petty (1984). Again, this required participants to rate the extent to which they agreed with a series of statements on a 1-5 scale. Items included statements such as “I form opinions about everything” and “I enjoy strongly liking and disliking new things”. Total NTE score was computed as the sum of items (after reverse scoring where appropriate).

Mental imagery ability was measured using the 21-item scale constructed by Andrade et al. (2014). Each item described an item or scenario which participants were instructed to “take a moment to imagine and try to form mental images” of. Participants then rated the vividness with which they were able to imagine the item/scenario on a scale of 1-10. The scale measured vividness in relation to seven distinct sensory modalities (with three items per modality). These modalities included visual (“Imagine the appearance of…”), auditory (“Imagine the sound of…”), and emotional (“Imagine

feeling…"), as well as smell, taste, touch and bodily sensation. The sum of all sensory modality subsets formed an overall mental imagery score.

6.2.3. Results

6.2.3.1. The relationship between individual difference factors and susceptibility to false memories and beliefs.

In order to assess whether individual difference factors were associated with false memory or belief formation, an initial series of independent samples t-tests were conducted to determine whether mean NTE, NFC and mental imagery scores differed significantly between participants in the Suggestion group who formed a false memory or a false belief (Believers, n = 105) and participants in the Suggestion group who did not form a false memory or belief (Non-Believers, n = 50). No significant differences were found between Believers and Non-Believers in any of the individual difference measures.

To account for the possibility of differences in scores between those who formed a false memory and those who formed a false belief, a series of one-way ANOVAs were conducted to determine whether mean NFC, NTE or mental imagery scores varied significantly between participants who formed a false memory, participants who formed a false belief and Non-Believers. There are minor differences between these sample sizes (reported below) and those reported in Section 6.2.2.1 as a result of missing or incomplete data. In the NFC scale, participants who formed false memories (n = 56) had a mean score of 64.50 (SD = 10.07), those who formed a false belief (n = 49) had a mean score of 60.92 (SD = 10.04) and Non-Believers (n = 50) had a mean score of 61.40 (SD = 10.58). In the NTE scale, participants who formed false memories (n = 56)

had a mean score of 55.50 (*SD* = 10.02), those who formed a false belief (*n* = 47) had a mean score of 50.11 (*SD* = 9.15) and Non-Believers (*n* = 50) had a mean score of 51.98 (*SD* = 11.62). In the mental imagery scale, participants who formed false memories (*n* = 56) had a mean score of 7.68 (*SD* = 1.37), those who formed a false belief (*n* = 49) had a mean score of 7.37 (*SD* = 1.50) and Non-Believers (*n* = 49) had a mean score of 7.06 (*SD* = 1.67).

Only NTE scores were found to differ significantly as a function of whether participants formed a false memory, a false belief, or were classified as Non-Believers, $F(2, 154) = 3.67$, $p = .028$. Bonferroni-corrected post-hoc tests revealed that participants who formed false memories had significantly higher NTE scores than those who formed a false belief, $p = .027$, but did not significantly differ from Non-Believers, $p = .097$.

6.2.3.2. The relationship between individual difference factors and explicit attitude change resulting from false memories and beliefs.

6.2.3.2.1. Believers. Initial analyses examining the relationship between individual difference factors and explicit attitude change resulting from false memories and beliefs focused on the Believers subgroup as a whole (*N* = 105). An overall explicit attitude change variable was computed using the same method described in Section 6.1.3.1. Bivariate correlations between NFC, NTE, mental imagery and explicit attitude change were examined, and are presented in Table 10.

Table 10.

Bivariate correlations between explicit attitude change, NFC, NTE, and mental imagery scores for participants who formed a false memory or belief in Experiments 3 and 4.

	Explicit attitude change	NFC	NTE	Mental Imagery
Explicit attitude change	-			
NFC	.043	-		
NTE	-.007	.395**	-	
Mental Imagery	.152	.063	.104	-

Note: n = 103 for NTE correlations due to missing/incomplete data.

**Correlation significant at $p < .001$.

Explicit attitude change was found to have weak positive correlations with NFC and mental imagery and a very weak negative correlation with NTE, but none of these were significant. A linear regression model with mental imagery entered at the first step was found to predict only 2.5% of the variance in explicit attitude change, and was not found to be a significant improvement on the constant only model, $F(1, 102) = 2.63$, $p = .108$. Adding NFC and NTE as predictors at the second step of the model increased the variance accounted for by the model to 3.1%, but this was not a significant improvement ($p = .762$) and the overall model was still found to be non-significant, $F(3, 102) = 1.05$, $p = .376$.

6.2.3.2.2. False beliefs. The relationship between explicit attitude change and individual difference factors was analysed for participants who reported a false belief in the occurrence of the false suggestion event, without accompanying recollective experience (n = 49). This subgroup had a mean overall explicit attitude change of 1.97

(*SD* = 1.74), and a mean NFC score of 60.92 (*SD* = 10.04), a mean NTE score of 50.11 (*SD* = 9.15) and a mean mental imagery score of 7.37 (*SD* = 1.50). Bivariate correlations between explicit attitude change, NFC, NTE and mental imagery are presented in Table 11.

Table 11.

Bivariate correlations between explicit attitude change, NFC, NTE, and mental imagery scores for participants who formed a false belief in Experiments 3 and 4.

	Explicit attitude change	NFC	NTE	Mental Imagery
Explicit attitude change	-			
NFC	-.020	-		
NTE	-.226	.357*	-	
Mental Imagery	.229	.009	-.044	-

Note: $n = 47$ for NTE correlations due to missing/incomplete data.
*Correlation significant at $p < .05$.

Explicit attitude change in participants with a false belief only was found to have a very weak negative correlation with NFC and a stronger (but still non-significant) negative correlation with NTE. Mental imagery positively correlated with explicit attitude change, but this was also non-significant. A linear regression model with mental imagery included as a sole predictor in the first step was found to account for 6.7% of the variance in explicit attitude change, and was found to be a non-significant model overall, $F(1, 46) = 3.23$, $p = .079$. The addition of NFC and NTE to the model increased the explained variance to 12.6%, but this was not found to be a significant change in R^2 ($p = .242$), and the overall model remained non-significant, $F(3, 46) = 2.08$, $p = .118$.

6.2.3.2.3. False memories. The relationship between explicit attitude change and individual difference factors was analysed for participants who formed a false memory of the false suggestion item (n = 56). This subgroup had a mean explicit attitude change of 2.21 (SD = 1.71), and had a mean NFC rating of 64.50 (SD = 10.07), a mean NTE rating of 55.50 (SD = 10.02), and a mean mental imagery rating of 7.68 (SD = 1.37). Bivariate correlations between explicit attitude change, NFC, NTE and mental imagery are presented in Table 12.

Table 12.

Bivariate correlations between explicit attitude change, NFC, NTE, and mental imagery scores for participants who formed a false belief in Experiments 3 and 4.

	Explicit attitude change	NFC	NTE	Mental Imagery
Explicit attitude change	-			
NFC	.077	-		
NTE	.138	.369**	-	
Mental Imagery	.063	.079	.178	-

** Correlation significant at $p < .001$.

Explicit attitude change was found to have weak positive correlations with all three variables, but none were significant. In constructing a hierarchical linear regression model, there was consideration of potential interaction effects between individual difference factors and phenomenological factors of false memories which were previously found to be associated with explicit attitude change. Section 6.1 found that Vividness and Distancing were two phenomenological factors potentially associated with explicit attitude change. Since Distancing was only measured in

Experiment 4 and subsequently would have reduced the number of participants in the regression analyses to an insufficient number for the amount of predictor variables included, interaction effects between individual difference variables and Distancing were not included in the model. NFC was the only individual difference factor found to significantly correlate with Vividness (r = .244, p = .035), and so this was the only interaction included in the regression model. The first step of the model included Vividness, while the second step added the individual difference variables of NFC, NTE and mental imagery. The interaction variable of NFC and Vividness was included in the third and final step, computed after each variable had been centred on the mean in order to reduce the impact of multicollinearity. The results of this regression model are presented in Table 13.

Table 13.

Hierarchical regression statistics assessing the extent to which memory vividness, NFC, NTE, mental imagery and the interaction of Vividness and NFC predicted explicit attitude change

		B (*SE* B)	β	*t*	R^2	ΔR^2
Step 1					.080	.080
	Vividness	.52 (.24)	.28	2.16*		
Step 2					.111	.031
	Vividness	.58 (.26)	.32	2.26*		
	NFC	-.01 (.03)	-.07	-.48		
	NTE	.03 (.03)	.19	1.31		
	Mental imagery	.00 (.17)	.00	.02		
Step 3					.159	.049
	Vividness	.69 (.26)	.376	2.65*		
	NFC	-.03 (.03)	-.16	-1.03		
	NTE	.04 (.03)	.225	1.54		
	Mental imagery	-.09 (.17)	-.07	-.52		
	Vividness*NFC	-.05 (.03)	-.25	-1.70		

*Variable significant at $p < .05$

At Step 1, when only memory vividness was included as a predictor in the regression model, the overall model was statistically significant, $F(1, 55) = 4.67$, $p = .035$, despite the model only accounting for 8% of the variation in explicit attitude change. After the addition of the individual difference factors at Step 2, the proportion of variance increased by a non-significant degree to 11.1%, and the overall model no longer significantly predicted explicit attitude change, $F(4, 55) = 1.59$, $p = .192$. However, Vividness remained a significant predictor ($p = .028$), and its predictive value was also marginally increased. No other predictors were found to be significant at this stage.

At Step 3, after the addition of the interaction between Vividness and NFC, the proportion of variance in explicit attitude change accounted for by the model increased to 15.9%, although this increase was found to be non-significant ($p = .095$). The overall model was also not found to significantly predict explicit attitude change at this stage, $F(5, 55) = 1.90$, $p = .112$. However, Vividness remained a significant predictor ($p = .011$) and its predictive value was further increased. Again, none of the individual difference factors were found to be significant predictors of explicit attitude change at this stage. The interaction between NFC and Vividness was also found to be non-significant ($p = .095$).

6.2.3.3. The relationship between individual difference factors and post-suggestion implicit attitudes of participants who formed a false memory.

Because these analyses are predominantly interested in the association between individual difference factors and attitudinal effects resulting from false memories and

beliefs, and because available data suggests that false beliefs are unlikely to have implicit attitudinal effects, the following analyses were restricted to participants who formed a false memory. Similarly to analyses relating to implicit attitudes in Section 6.1, the potential validity issues of implicit measures in Experiment 4 meant that only implicit data from Experiment 3 was utilised. Because of this, analyses could only focus on the relationship between individual difference factors and implicit attitudes post-suggestion, as opposed to implicit attitude change. Additionally, as for other implicit analyses throughout the thesis, participants who had a greater than 20% error rate in any critical block of trials during the ST-IAT were excluded from analyses. This restricted analyses to n = 22 participants. ST-IAT scores for this subset of participants ranged from -.38 to .39, with a mean score of -.01 (SD = .24). These participants had a mean NFC score of 62.64 (SD = 11.56), a mean NTE score of 54.32 (SD = 8.60) and a mean mental imagery score of .76 (SD = 1.18). Bivariate correlations between ST-IAT scores, NFC, NTE and mental imagery are presented in Table 14.

Table 14.

Bivariate correlations between implicit attitude scores, NFC, NTE and mental imagery for participants who formed a false memory in Experiments 3 or 4.

	ST-IAT score	NFC	NTE	Mental Imagery
ST-IAT score	-			
NFC	.168	-		
NTE	.148	.426*	-	
Mental Imagery	.088	.042	.372	-

*Correlation significant at $p < .05$

NFC, NTE and mental imagery were all found to have weak positive correlations with ST-IAT scores, although none were significant. Regression analyses did not include a consideration of interaction effects between individual difference factors and the phenomenological variable of Sensory Detail (the only phenomenological variable found to be associated with implicit attitudes), partially because none of the individual difference factors were found to correlate with Sensory Detail, and partially because including more than 1 predictor per 10 participants in regression models tends to affect the reliability of the model (Field, 2009). A regression model including NFC, NTE and mental imagery as predictors of ST-IAT scores was not a significant improvement to the constant only model, $F(3, 21) = .24$, $p = .868$. None of the individual difference factors were found to be significant.

6.2.4. Discussion

Analyses of the associations between individual difference factors and false memory and belief formation revealed mostly non-significant results. Mental imagery scores were found to be in the expected direction (those who formed false memories and beliefs reported higher mental imagery scores than Non-Believers), although these differences were not significant. Mean NFC scores were highest for participants who formed a false memory, whilst those who formed a false belief and Non-Believers had very similar mean scores. However, these differences were also non-significant. The NTE scores of participants who formed a false memory were significantly higher than those of participants who formed a false belief, but did not significantly differ from Non-Believers. This difference was in an unexpected direction; it had been hypothesised that NTE would be negatively associated with susceptibility to the false suggestion, although this was primarily due to the assumption that those high in NTE would tend to

have stronger negative baseline attitudes towards the critical item. Post-hoc analyses indicated that this was not the case; NTE was not found to correlate with baseline ratings on either the Restaurant/Gym questionnaire (r = -.08, p = .355) or the Food Preferences/Exercise Activity Preferences questionnaire (r = .00, p = .973). It may be the case that because explicit attitude ratings did not tend to be lower for those high in NTE, the increased accessibility of positive attitudes triggered by the false suggestion increased the likelihood of participants forming a false memory. However, it is somewhat unclear as to why this would not have had a similar effect with regards to false belief formation. Also, since the NTE ratings of those who formed a false memory did not significantly differ from Non-Believers, the extent to which NTE can be considered to be associated with susceptibility to the false suggestion is highly limited.

With regards to the relationship between individual difference factors and explicit attitude change, the results provided very little support for the hypotheses. When analysing this relationship for participants who formed a false belief only and the Believers subgroup as a whole, none of the individual difference variables significantly correlated with explicit attitude change, and were not found to account for a significant proportion of the variance in explicit attitude change in regression analyses. This was also the case for participants who formed a false memory, although there was some evidence to suggest that the interaction between NFC and the vividness of reported false memories may have some predictive value in explicit attitude change. None of the individual difference variables (or the interaction between NFC and Vividness) were found to significantly predict explicit attitude change, or significantly increased the amount of variance in explicit attitude change predicted by the model. However, once the individual difference factors had been added to the model, the predictive value of Vividness was increased, and then further increased in the third step after the interaction

between NFC and Vividness had been added. This suggests that there may be a minor interaction effect between Vividness and NFC which may play a role in explicit attitude change. Theoretically, this interaction would make sense; those who are high in NFC are more likely to engage in more effortful cognition and consider a wider range of information in constructing explicit attitude judgments than those who are low in NFC. Therefore, it stands to reason that those who are high in NFC and also report vivid false memories may be more likely to incorporate the numerous details of their false memory into their explicit attitude judgments. This fits well with the rationale discussed in Section 6.1 that the extent to which the vividness of false memories affects explicit attitude judgments is likely to be affected by the degree of conscious attention and deliberation the individual gives to their memory. However, the interaction effect itself is non-significant, as is the amount of variance in explicit attitude change predicted by the regression model once individual difference variables and the interaction have been added, and so it is impossible to reach a definitive conclusion regarding this potential interaction.

As in Section 6.1, analyses relating to implicit attitudes were adversely affected by a number of issues. The most significant issue was that despite the theoretical rationale and predictions being relevant to implicit attitude *change*, the exclusion of implicit data from Experiment 4 meant that analyses were restricted to post-suggestion implicit attitude data from Experiment 3. Additionally, this exclusion meant that the sample size was restricted to just 22 participants, meaning that the regression model could not take into account any interactions as predictor variables. Post-suggestion implicit attitudes were not found to be correlated with NFC, NTE or mental imagery, nor was a regression model consisting of these three variables found to predict implicit attitudes. The predictions regarding the association between NFC and mental imagery

and implicit attitudinal processes were largely dependent on an interaction effect with phenomenological qualities of false memories. Although the regression model had an insufficient sample size to take these interactions into account, the fact that none of the individual difference variables correlated in any way with phenomenological factors previously found to be associated with post-suggestion implicit attitudes suggests any interaction effects may have been highly limited (particularly within such a small sample).

The overall evidence presented provides very little support for the theoretical predictions regarding the association between the considered individual difference variables and both false memory and belief formation in the false-feedback paradigm, and associated explicit attitude change or implicit attitudinal processes. Results suggested that there may be a potential interaction effect of memory vividness and NFC in explicit attitude change, although this evidence was far from conclusive. In general, results suggested that NFC, NTE and mental imagery appear to be generally unrelated to false autobiographical memory/belief formation, and any potential association they have with explicit attitude change is likely by way of interaction with phenomenological qualities of false memories. Analyses of these interactions would benefit from greater sample sizes which allow for more complex and comprehensive regression models. Predictions regarding the association between individual difference variables and implicit attitudinal processes were not supported, although ultimately the available data was unable to account for implicit attitudinal change (as well as being heavily restricted in its sample size). It would be beneficial for these predictions to be revisited with both pre- and post-suggestion measures of implicit attitudes as well as a markedly increased sample size.

Chapter 7. General Discussion

7.1. Overview

The first two experiments presented in the thesis (Chapter 4) primarily aimed to provide evidence that the attitudinal effects of false autobiographical memories and beliefs found in a variety of studies (reviewed by Bernstein et al., 2015) could be replicated, transfer over to a new attitudinal domain (exercise-based attitudes as well as to food-based), generalise to other related items/general concepts, and extend to implicit as well as explicit attitudes. Experiments 1 and 2 provided evidence that participants who formed false memories and beliefs of a positive experience regarding a previously disliked item reliably reported significant preferential explicit attitude change, whilst the explicit attitudes of participants who were not susceptible to the false suggestion and control participants did not significantly differ between sessions. Experiment 2 provided evidence that these effects are generalisable to new domains other than food/drink (as had been the sole focus of previously published experiments). Experiments 1 and 2 both found that these effects were specific to the critical item central to the false suggestion ('broccoli' in Experiment 1 and 'cross-country running' in Experiment 2); no evidence was found that explicit attitudinal effects of false memories and beliefs generalised over to related items (e.g. 'green beans' or 'asparagus' in Experiment 1) or general concepts (e.g. general attitudes to exercise in Experiment 2).

Experiment 2 also attempted to establish whether false memories and beliefs would affect participants' implicit attitudes towards exercise. To address this question, general implicit attitudes towards exercise were measured using the Implicit Association Test (IAT, Greenwald et al., 1998). Analyses did not find any significant

effect of false memories and beliefs on implicit attitudes, although on reflection, there were problems with the rationale behind these predictions and with the type of implicit measure utilised.

Experiments 3 and 4 (presented in Chapter 5) made several procedural changes to the standard false-feedback paradigm in order to increase the efficiency of the method in terms of minimising excluded data, and potentially increasing the number of false memories and beliefs elicited. These changes (discussed in greater detail in Section 7.2.2) generally appeared to be successful, with Experiments 3 and 4 excluding less data and having a higher false memory and belief rate than Experiments 1 and 2. Experiments 3 and 4 provided further evidence of the explicit attitudinal effects of false memories and beliefs, and due to an increased number of false memories and beliefs, were able to analyse the attitudinal effects of the two separately. Both experiments found that the explicit attitudes of participants who formed a false memory and participants who formed a false belief changed to highly similar extents.

Experiments 3 and 4 also attempted to establish whether false memories affected implicit attitudes towards the critical item, after it was reasoned that analyses should be restricted to the critical item specifically, and that false beliefs without accompanying recollective experience may be insufficient to affect implicit attitudinal processes. In doing this, these experiments utilised the “single-target” equivalent of the Implicit Association Test (ST-IAT, Bluemke & Friese, 2008) as opposed to the regular IAT used in Experiment 2. Experiment 3 found that implicit attitudes towards the critical item were significantly more preferable for participants who formed a false memory than for those who formed a false belief or controls, supporting the prediction that false memories may be sufficient to affect implicit attitudes, but false beliefs alone may not. Experiment 4 aimed to replicate this finding, whilst also providing a baseline measure

of implicit attitudes (to determine whether change had occurred between sessions) and an additional control group who imaged the false suggestion without it being suggested that it occurred to them (in order to rule out the possibility that implicit effects in Experiment 3 were the result of merely imagining the false suggestion, not necessarily forming a false memory of it). Experiment 4 did not replicate the implicit effects found in Experiment 3, although the nature of the implicit attitude data suggested that the ST-IAT may not have worked effectively.

Experiments 1-4 also investigated whether the elicited false memories and beliefs had behavioural consequences as well as attitudinal. These analyses produced mixed results. In Experiment 1, it was found that participants who formed a false memory or belief (Believers) were more likely to choose the critical item (broccoli) as a "food reward" than controls or participants who did not form a false memory or belief of the false suggestion (Non-Believers). However, when this behavioural measure was repeated in Experiment 3, Believers were not significantly more likely to choose their critical item as a food reward than Non-Believers or controls. In Experiment 2, the behavioural measure involved assessing whether Believers were more likely to sign up to a future study which would require them to run on a treadmill. This was not found to be the case, due to the fact that very few people signed up for the study at all (regardless of experimental group/subgroup). Retrospectively, this was not considered a valid behavioural measure, and was subsequently not repeated in Experiment 4 (which also focused on exercise-related false memories and attitudes). As a substitute for a genuine behavioural measure in Experiment 4, participants were asked how many times in the next two months they would engage in their critical exercise item. It was found that Believers reported that they would engage in their critical exercise item more frequently than other groups, but this difference was only significant when compared with the

Imagination group (not Non-Believers or controls). In general, very few participants across all groups indicated that they would engage in their critical item at all. Overall, the presented research presents little evidence that false memories and beliefs can influence suggestion-relevant behaviour.

Chapter 6 investigated whether individual difference measures and phenomenological qualities of the false memories measured over Experiments 3 and 4 were associated with explicit and implicit attitudinal effects of false memories. Section 6.1 presented some evidence that the vividness and level of distancing associated with false memories may have some influence on associated explicit attitude change, while the level of sensory detail in false memories may be associated with implicit attitudinal processes. While these results were theoretically supported, there were various issues within the analyses which limit the strength of this evidence. Section 6.2 found no evidence for associations between individual difference factors (NFC, NTE and mental imagery) and either false memory or belief formation, or attitudinal effects of false memories and beliefs (including several interactions with phenomenological variables). Results hinted at a potential interaction effect between memory vividness and NFC in explicit attitude change, but this too was non-significant.

7.2. Implications

7.2.1. Theoretical implications

Experiments 1-4 provided consistent evidence that false memories and beliefs of a positive experience involving an attitude object result in positive explicit attitude change towards that attitude object. This replicated the results of previous false-feedback studies (e.g. Bernstein et al., 2005b; Clifasefi et al., 2013; Laney, Morris et al.,

2008), whilst also demonstrating that these effects transfer across multiple critical items (including attitude domains separate from food and drink). Experiments 3 and 4 were also able to analyse the explicit attitudinal effects of false memories and beliefs separately, something which has only previously been done in Bernstein et al.'s (2015) mega-analysis. These analyses produced similar results to those of Bernstein et al. in that false memories and false beliefs were found to affect explicit attitudes to highly similar extents. Bernstein et al.'s interpretation of this was that belief in the false suggestion item was the critical factor in explicit attitude change, with it making little difference whether this belief was accompanied by recollective experience. The results of Experiments 3 and 4 support this interpretation, although if one truly wanted to test this idea, it would be beneficial to analyse the explicit attitudinal effects of 'non-believed memories'; memories of events which persist even after the individual no longer believes the event occurred (Mazzoni et al., 2010; Otgaar et al., 2014). If belief in the occurrence of the false suggestion event is considered critical to explicit attitude change, it would be expected that a participant who forms a false memory of the false suggestion item but then goes on to withdraw their belief in this event would report similar explicit attitudes towards the critical item to their pre-suggestion measures. The conclusion that belief in the false suggestion event is necessary to elicit explicit attitude change appears rational given the data presented here (and in Bernstein et al., 2015), but measuring the explicit attitudinal effects of non-believed memories would be a more direct way of testing this.

The results presented in this thesis have also been interpreted in relation to models of social cognition, predominantly Gawronski and Bodenhausen's (2006) Associative-Propositional Evaluation (APE) model. It was theorised that within this theoretical framework, false memories and false beliefs would be likely to act via highly

similar propositional processes in explicit attitude judgments. For instance, in constructing an explicit attitude judgment, a participant who forms a false memory of a positive experience involving an attitude object (X) would be likely to create the proposition of "I remember enjoying X", while a participant who forms a false belief would create the proposition of "I believe I enjoyed X". In subsequent syllogistic inferences which form the basis of explicit attitudes, these two propositions would be likely to have largely similar contributions. This is consistent with the evidence of Experiments 3 and 4, and consistent with Bernstein et al.'s (2015) interpretation that belief in the occurrence of the false suggestion is the key factor in explicit attitude change.

However, the results of Section 6.1 suggested that the phenomenological factor of memory vividness significantly predicted explicit attitude change (despite accounting for only a small percentage of the variance), suggesting that certain aspects of memory phenomenology may be involved in propositional processes. This would appear to contradict the interpretation that memories and beliefs are treated much the same within the propositional system. However, it does seem plausible within the APE framework that a particularly vivid false memory which is likely to be highly detailed (one of the three questionnaire items assessing vividness assessed the level of detail in the memory) would produce more information with which relevant propositions could be constructed. For instance, a participant with a vivid false memory of loving a certain food might also remember liking the smell or the appearance of the food; this would provide extra information with which new, accompanying propositions could be formed, which would ultimately contribute towards a more favourable overall explicit attitude judgment.

However, whether the extra information provided by a vivid, detailed memory relative to a dim, vague memory is actually used in propositional reasoning is likely to

be dependent on the level of attention afforded to it by the individual; a participant may form a vivid, detailed memory, but unless they fully attend to the details of the memory, it is unlikely to contribute strongly towards their explicit attitude judgment. This interpretation may explain why memory vividness was found to significantly predict explicit attitude change, despite accounting for a low proportion of the associated variance. It may also be supported by the potential interaction between vividness and Need for Cognition (NFC), as found in Section 6.2. Whilst this interaction between NFC and vividness was found to be a marginally non-significant predictor of explicit attitude change, its addition to the regression model did increase the predictive value of the Vividness variable. Individuals high in NFC tend to engage in tasks with a higher degree of cognitive effort, and consider a wider range of available information in constructing their explicit attitude judgments than individuals low in NFC (Bohner & Dickel, 2011; Cacioppo et al., 1996). Therefore this potential interaction effect in predicting explicit attitude change may be the result of high NFC participants' greater consideration of their detailed memories in constructing their deliberative evaluations. Because this interaction effect was non-significant, it should not be considered strong evidence of this, but it does provide tentative support for the theoretical interpretation of memory vividness' association with explicit attitude change.

With regards to implicit attitudinal effects, the theoretical rationale of the APE was key in forming the prediction that false memories may be sufficient to elicit implicit attitude change via phenomenological processes which affect the underlying associations triggered in response to the presentation of the attitude object. The results presented in this thesis concerning implicit attitudes produced mixed results. Experiment 3 provided evidence that participants with a false memory had significantly more preferable implicit attitudes towards their critical items than participants who

formed a false belief or controls, providing some support for the theoretical prediction. However, the conclusions that can be drawn from this are limited by the fact that the data only represented implicit attitudes post-suggestion, with no comparison baseline measure. Therefore, Experiment 3 cannot be said to produce evidence regarding implicit attitude *change*; the results may simply have been a reflection of the participants' pre-suggestion implicit attitudes, or the results could have been explained by participants who formed a false memory simply imagining the false suggestion more vividly than controls or those who formed false beliefs. This has heavily restricted the theoretical conclusions that can be drawn from these data.

Experiment 4 attempted to address the problems of Experiment 3, but found that implicit attitude data were very similar for all groups across both sessions (having a mean very close to 0 in every instance). If it is assumed that Experiment 4's implicit data are valid, it indicates highly neutral implicit attitudes towards the critical items. It would also indicate that the baseline implicit attitudes of participants who formed false memories are not necessarily any more preferable than those of those who form false beliefs or controls, which would contradict one of the alternative explanations for the results of Experiment 3. However, it is more likely that the implicit data of Experiment 4 are not valid. The variability of the implicit attitude data was comparable to that of Experiment 3, but the mean was very close to 0 for all groups. This indicates that the majority of participants had very little difference in reaction times between blocks which paired the critical item and positive words and blocks which paired the critical item and negative words. Essentially, the facilitation effect which forms the basis of reaction time-based implicit attitude measures was not elicited. Therefore, no conclusions were ultimately drawn from the implicit data in Experiment 4.

The problems with implicit data in Experiment 4 also created problems in analyses in Chapter 6 relating to individual differences and phenomenological factors of false memories, since any analyses in this chapter relevant to implicit attitudes could only utilise data from Experiment 3 (see Section 7.3 for more detail). Nonetheless, Section 6.1 found that the level of sensory detail of reported false memories significantly predicted post-suggestion implicit attitudes. While this provides no information relating to implicit attitude change, the finding does fit well with the theoretical predictions, which viewed sensory detail as a key phenomenological aspect in affecting associative processes. Within the APE framework, any sensory details generated in false memories could theoretically create new, positively-valenced automatic associations with the attitude object which may be triggered upon presentation of the attitude object. However, the evidence presented in Section 6.1 should be treated as tentative support for this prediction, since it only relates to post-suggestion implicit attitudes as opposed to implicit attitude change, and was ultimately based on a small sample size which limited the predictive power of the regression model.

7.2.2. Methodological implications

In response to certain methodological issues encountered while using the standard false-feedback paradigm in Chapter 4, Chapter 5 saw the introduction of various procedural changes which aimed to improve the efficiency of the design in terms of decreasing the number of participants excluded due to high baseline explicit attitudes towards the false suggestion item, as well as aiming to increase the number of false memories and beliefs elicited in the Suggestion group. In an attempt to improve the efficiency of the design, Experiments 4 and 5 introduced multiple potential critical

items within the false suggestions, which were tailored individually to participants. This meant that for participants to be excluded on the basis of high baseline confidence in the false suggestion, they had to indicate high baseline confidence in all four possible permutations of the false suggestion. In aiming to increase the rate of false memories and beliefs elicited, two changes were made to the false-feedback questionnaire; filler event items in the questionnaire represented events which participants had genuinely indicated high confidence in in Session 1 (with the aim of increasing the credibility of the questionnaire), and modifying the instructions regarding imagination of the false suggestion in an attempt to encourage deeper and more elaborative imagination.

It appears that these modifications to the procedure worked effectively. In Experiment 1, 35.16% of participants tested were excluded because they indicated high baseline confidence in the false suggestion. In Experiment 2, this figure was 26.05%. These rates were comparable with those of previous false-feedback studies (e.g. Laney, Morris et al., 2008) The proportion of participants excluded based on this criterion in Experiment 3 dropped to 11.67%, while in Experiment 4, the proportion was 11.04%. The false memory and belief rate was also noticeably increased. In Experiment 1, 54.72% of Suggestion group participants eligible for analyses formed a false memory or belief, while in Experiment 2, this figure was only 44.07%. In Experiment 3, 69.33% of the eligible Suggestion group formed a false memory or belief. In Experiment 4, this figure was 64.63%. As well as being an improvement on Experiments 1 and 2, the proportion of false memories and beliefs elicited in Experiments 3 and 4 is also an improvement on those achieved in previously published false-feedback studies. Brewin and Andrews (2016) provided a recent review of 15 published experiments using a false-feedback paradigm, finding that within these studies, the proportion of participants who received the false suggestion and went on to report false memories or beliefs

ranged from 18% to 53%. While the impact of the changes introduced in Chapter 5 was not analysed statistically, they appear to have made a substantial improvement to the efficiency of the procedure, and would be most likely be beneficial additions to any future applications of this paradigm.

Potentially increasing the number of usable participants and false memory and belief rate through these procedural changes could have additional benefits for the false-feedback paradigm, aside from simply an improved efficiency in terms of the number of overall participants needed to elicit a sufficient number of false memories and beliefs for analyses. One current limitation of the false-feedback procedure is the relatively liberal criterion of excluding participants who demonstrate high baseline confidence in the false suggestion. The typical procedure at the moment is to exclude participants who give a confidence rating of above 4 (the midline of the scale) in the critical false suggestion item. This allows for a certain number of people included in analyses whose rating of 3 or 4 would indicate that they are simply unsure whether the event happened to them or not, meaning that any subsequent memories or beliefs reported may not necessarily be false. This is not ideal, but the size of the subgroups in later analyses is generally relatively small, and applying a stricter criterion regarding baseline confidence in the false suggestion would exacerbate this problem. However, if having multiple potential false suggestion items increases the number of participants eligible for analyses after applying the baseline confidence criterion, studies with large numbers of participants may find themselves in a position to make this criterion more conservative.

7.2.3. Applied Implications

As discussed in Section 1.2.4, various researchers have raised the possibility that findings related to the attitudinal effects of false memories could be applied in a therapeutic context (Bernstein et al., 2005b; Bernstein, Pernat, & Loftus, 2011; Clifasefi et al., 2013; Geraerts et al., 2008). The central idea behind this would be eliciting false memories and beliefs in people with the aim of establishing healthier attitudes and behaviours. This has obvious problems ethically speaking, since individuals involved in this 'therapy' would need to be naïve to the procedure. Whether or not this could ever be justifiable is a topic which appears to strongly divide public opinion (Nash et al., 2016). Obviously, the overall effectiveness of the technique would be central to any debate on whether this is potentially viable; in order for the ends to justify the means, false memories and beliefs would have to be highly reliable in producing substantial attitudinal and behavioural effects. With regards to behavioural and implicit attitudinal effects, the evidence presented in this thesis is not nearly substantial enough to suggest application could be justified. The evidence regarding explicit attitudes is much more consistent, but there is a common feature of the explicit results across Experiments 1-4 which highly restricts the potential for application. It was consistently the case that participants who went on to form false memories or beliefs tended to have mean baseline explicit attitude ratings of approximately 3-4 (around the midline) for the critical item, while the baseline ratings of Non-Believers were typically much lower. This is not uncommon in false-feedback studies; for instance, Laney, Morris et al. (2008) and Bernstein et al. (2005a) both found that participants who formed false memories and beliefs reported a mean baseline preferences for the critical item around the midline before increasing them post-suggestion, whilst Non-Believers had significantly lower baseline preferences which remained consistent. This suggests that,

to an extent, participants' baseline implicit attitudes towards the critical item affect their susceptibility to the false suggestion. While explicit attitude ratings were consistently found to significantly increase post-suggestion, the fact that the baseline attitudes of those who formed false memories and beliefs around the midline of the scale suggests that they had relatively ambivalent attitudes towards the items in the first place. Any potential application of these findings would be aimed at changing attitudes which the individual has strong initial attitudes towards (presumably either a strong preference for something unhealthy, or a strong aversion to something healthy); however, it seems likely that the elicitation of counter-attitudinal false memories and beliefs may be impaired by these strong pre-existing attitudes.

This type of problem can be found in pre-existing false-feedback studies which have suggested the potential application of false memories and beliefs to changing unhealthy behaviours. For instance, Geraerts et al. (2008) suggested to participants that they had become ill after eating an egg salad, and found that participants who formed false memories and beliefs of this were then less likely to consume egg salad sandwiches than controls and Non-Believers when given the opportunity four months post-suggestion. It was interpreted that the false memories and beliefs had resulted in lasting behavioural change. However, it could have been the case that participants the participants who ate less of the egg salad sandwiches may have been those who were less inclined to do so in the first place (which may have been a factor in increasing the plausibility of the false suggestion). The baseline preferences of the subgroups are not reported in this study, so this remains a distinct possibility.

Another limitation of applying this type of evidence is that there is currently no evidence to support the notion that attitudinal effects of false memories and beliefs would persist after participants have been debriefed. Given the prevailing view that

belief in the occurrence of the false suggestion is what drives explicit attitude change (Bernstein et al., 2015), it seems likely that after being debriefed (and presumably withdrawing belief in the false suggestion), that explicit attitudes would revert back to their pre-suggestion state (theoretical predictions regarding implicit attitudes would be slightly different in a scenario like this; this is discussed in further detail in Section 7.4). Without evidence that attitudinal and behavioural effects persist after debriefing, any therapeutic application of false memories and beliefs would either have to risk reversing the beneficial effects of the therapy, or ensure that the individuals are never made aware of the process. Both of these scenarios are difficult to justify. On the balance of the evidence presented in this thesis, and by other previously published false-feedback studies, there is little evidence overall to suggest that false memories and beliefs would be sufficiently beneficial to warrant the highly unethical techniques posited by previous researchers.

7.3. Limitations

One of the key general limitations of the research presented in this thesis is that it provides limited information with regards to the behavioural consequences of false memories and beliefs, as well as providing no longitudinal data on whether the observed attitudinal effects are long-lasting. Ultimately, these measures are necessary to establish whether these attitudinal effects are meaningful, as opposed to simply transient artefacts resulting from the experimental manipulation. The existing literature provides some evidence to suggest that false memories and beliefs and their explicit attitudinal effects are persistent over time (Laney, Fowler, et al., 2008), and that there may be long-term as well as immediate behavioural consequences (Geraerts et al., 2008), but more is required.

Behavioural variables were measured in Experiments 1-3, but these measures were somewhat problematic. Experiment 1 found some evidence that participants who formed false memories and beliefs were more likely than Non-Believers and controls to choose the critical item as a 'food reward', but Experiment 3 was unable to replicate this finding. Additionally, a forced choice of one of four food items is a rather unrealistic measure of behaviour; this was considered a practical and convenient measure of behaviour immediately post-suggestion, but a more naturalistic measure of behaviour may have been a better reflection of participants' attitudes towards the critical item. The behavioural variable of Experiment 2 was also highly flawed; in retrospect, this may have been too remote a measure of behaviour, given its rather tenuous relevance to the false suggestion. Across all three experiments which included behavioural measures, participants' behaviour had very weak or near non-existent correlations with their explicit and implicit attitude measures; had these behavioural measures been more valid, it would have been expected that explicit and implicit attitude measures would have been more predictive of behaviour.

While the results regarding explicit attitudinal effects of false memories and beliefs provided consistent results, which were theoretically supported and consistent with the existing literature, there were a number of significant limitations regarding implicit attitudinal results which prevented definitive conclusions from being drawn. The initial attempt to measure implicit attitudes in Experiment 2 was flawed in several regards; retrospectively, the decision to measure whether false memories and beliefs affected implicit attitudes towards exercise in general (and subsequent use of the standard IAT) was theoretically flawed. The approach of Experiments 3 and 4 to measuring implicit attitudes was much more theoretically sound, but whilst Experiment 3 provided some tentative supporting evidence for the implicit predictions, Experiment

4's implicit data indicated that the measure may have been ineffective. This is unlikely to be an issue with the ST-IAT as a measure in general, as this has been consistently found to be a reliable and valid measure of implicit attitudes towards individual items to a much greater degree than other approaches to implicit attitude measurement like evaluative priming (Bar-Anan & Nosek, 2014; Bluemke & Friese, 2008). For lack of a more plausible alternative, it would seem that there may simply have been an issue with the stimuli in Experiment 4 which resulted in a failure to elicit sufficiently strong automatic associations. Whatever the cause of this problem, it has significantly affected this thesis' ability to draw any strong conclusions on the implicit attitudinal effects of false memories and beliefs, since the only valid available data comes from a single, post-suggestion measure. A pre-suggestion measure of implicit attitudes was left out of Experiment 3 out of concern that it would highlight the four potential critical items as central to the study, thus decreasing the credibility of the false suggestion and increasing the potential for demand characteristics. In retrospect, this would have been an acceptable risk to take, given how useful pre-suggestion implicit data would have been. Although the results of Experiment 3 offered some support for the predictions regarding implicit attitudinal effects, the fact that there are numerous alternative explanations for this finding limits the conclusions which can be drawn from it.

In regards to the findings of Chapter 6, many analyses were restricted by small sample sizes. This was particularly true of Section 6.2, in which the relationship between the attitudinal effects of false memories and beliefs and individual difference variables was analysed separately for participants who formed a false memory and participants who formed a false belief. This was also true of all phenomenological and individual difference analyses relating to implicit attitudes, which only considered participants from Experiment 3 who had formed a false memory and who had also not

made too many errors in one of the critical ST-IAT blocks. A generally accepted rule of thumb regarding sample size in multiple regression analyses is ten participants per predictor variable (Field, 2009); the majority of regression analyses conducted in Chapter 6 had either just enough participants to meet this recommended minimum, while some were just under it. Ideally, more participants would have been included in these analyses, which would likely have produced clearer results, but the nature of the false-feedback paradigm meant that sample sizes were dependent on the rate of false memory and belief formation (and additionally dependent on error rates in the ST-IATs for implicit analyses).

The argument that explicit attitudinal effects of false memories and beliefs may be due to demand characteristics is a frequent criticism of studies which use the false-feedback paradigm (Bernstein et al., 2011). The central argument for demand characteristics in this context would be that participants have come to understand the true nature of the study whilst actively participating, and altered their answers in accordance with the aims of the study (i.e. reporting that they have a false memory when they don't, and changing their explicit attitude responses to fit). In general, the paradigm takes aims to avoid this by including a fake rationale for the experiment; that the focus is on the relationships between food/exercise attitudes and personality. In previous studies, researchers have taken steps such as conducting in-depth interviews with participants after the study to gain insight into their interpretations (Laney, Kaasa, et al., 2008), or simply quickly asking what participants believed the study was about immediately prior to debrief (Bernstein et al., 2011). The former was impractical for Experiments 1-4 given constraints on time and resources, and the latter was considered to have issues with validity; the act of asking participants at the end of the study what they thought the study was about immediately suggests to them that the true nature of

the study is in fact different to what they have been told throughout (i.e. the cover story regarding food/exercise attitudes and personality). Therefore, even if a participant has believed the fake rationale they were given at the beginning throughout the entirety of the experiment up until that point, they will suddenly be motivated to think of alternative explanations. Therefore, any measure of how participants interpreted the experiment which is taken at the end of the study will always be unreliable to a certain extent.

However, some informal data was collected in Experiment 4 which investigated participants' perceptions of the study immediately prior to debrief. In the initial stages of data collection during Experiment 4, after participants had completed all questionnaires and ST-IATs, they were informed that they would be debriefed via email later on that day. However, prior to being sent a debrief form, they were sent an email asking what they believed the study had been about (with a further note stating that if they did not reply within 24 hours, they would be emailed a debrief sheet regardless). The data collected from participant responses to this question was not mentioned in the results of Experiment 4 because of a very low response rate (only 8 responses were collected), and this approach was abandoned in favour of immediate debriefing midway through data collection for methodological convenience (as well as due to the aforementioned methodological concerns regarding the validity of this data). Of the 8 responses received, 3 were from Suggestion group participants, 4 were from control group participants and 1 was from an Imagination group participant. These responses are reported in Appendix F.

Of the 8 responses obtained, 6 highlighted memories as being central to the focus of the study. However, no responses indicated that the participants believed that the study was interested in *false* memories. Two responses suggested that the study was

interested in how childhood memories affected current attitudes. Another two responses indicated that they believed the study was interested in the consistency of attitude judgments over time (i.e. between Session 1 and Session 2). The responses in general were quite consistent with those reported by Laney, Kaasa, et al. (2008), who found that while many participants highlighted that memories were of central importance to the study, very few (8% of the total sample) reported that they believed the study was aiming to elicit *false* memories. Additionally, Laney, Kaasa, et al. reported that many participants believed that the study was interested in the consistency of attitudes over time. It should be noted that if participants believed the study was relating to the stability of attitudes over time, any effects of demand characteristics on their results would result in more consistent attitudes across sessions and thus work *against* the hypotheses of the study. An additional finding of Laney, Kaasa, et al. was that Suggestion group participants who *did* identify the true nature of the study were not more likely to report false memories or attitude change. Although the demand check data obtained in Experiment 4 is not substantial enough to draw conclusions from, when taken into consideration alongside the findings of Laney, Kaasa, et al., it suggests that demand characteristics are unlikely to be a major contributing factor to the results reported in Experiments 1-4.

7.4. Future Research

The predominant aim of future research in this area should be to gain further evidence regarding the implicit attitudinal effects of false memories and/or beliefs. Future studies will need to decide upon a measure of implicit attitudes which is valid, reliable, and can be easily incorporated into the false-feedback procedure. Despite the problematic results of Experiment 4, the ST-IAT is still most likely to be the best choice

for this, but there are other potential methods (such as evaluative priming). Future studies will also need to include both pre- and post-suggestion measures so that it can reliably be established whether false memories and/or beliefs can result in implicit attitude change. A future study with the time and resources to test a large number of participants may also collect sufficient data to provide a stronger analysis of the association between phenomenological factors/individual difference measures and explicit/implicit attitude change. Applying the methodological changes discussed in Section 7.2.2 may assist future studies in minimising excluded participant data, and enhancing the rate of false memories and beliefs elicited.

It would also be theoretically beneficial to test whether belief in the false suggestion event is necessary to elicit attitudinal change via non-believed memories. Within the APE framework, it would be predicted that withdrawal of belief in the false suggestion would be likely to reverse any explicit attitudinal changes, since propositional processes can be consciously assessed for validity, and if this event was no longer believed to have occurred, any associated propositions could be discarded. However, with regards to implicit attitudes, should it be confirmed that false memories can affect automatic associative activations, these effects (which are outside of any conscious control) may be expected to remain if the memory persists even after belief in the occurrence of the event has been withdrawn. However, testing these predictions through non-believed memories may be difficult in practice, since such studies can typically only generate non-believed memories in a small proportion of participants (Clark, Nash, Fincham, & Mazzoni, 2012; Mazzoni et al., 2010). Within the false-feedback paradigm, the overall number of participants would need to be very large to generate sufficient participants for statistical analyses who initially reported a false memory and then withdrew belief in it.

Future research should also aim to include longitudinal measures of attitudes, as well better measures of suggestion-relevant behaviour. This is ultimately necessary for establishing whether attitudinal effects are truly meaningful. While there is some evidence to suggest that elicited false memories and beliefs and their attitudinal effects can persist over time (Geraerts et al., 2008; Laney, Fowler, et al., 2008), more is needed, particularly with regards to implicit attitudes. If a false memory is able to persist over time, the APE framework would predict that any resulting change in underlying associative structure which accompanies this false memory would strengthen upon repeated retrieval of this memory. Therefore, whilst long-lasting implicit attitude change as a result of false memories may be theoretically plausible, it may be dependent on how much the participant has considered this memory since the initial feedback session. Future studies investigating lasting implicit attitude change as a result of false memories may need to take this into account.

Additionally, it would be beneficial for future studies to attempt further integration of the literature on attitude change and the literature on false memories. As discussed in Section 1.2.4, the persuasion/attitude change literature and the false memory literature have stayed largely disassociated, despite a number of underlying theoretical similarities; for instance, the debate around whether attitudes are stored or constructed anew each time based on a combination of stored and current contextual information (see Bohner & Dickel, 2011, for a discussion) closely mirrors the debate between reconstruction and copy theories of memory (see Williams, Conway, & Cohen, 2008 for a discussion). Certain authors have made an effort in recent years to integrate the social psychology-focused domain of attitudes and the cognitive psychology-focused domain of false memory (Blank, 2009; Nash et al., 2015), but this is something which could be developed further in future research. The experiments presented in this

thesis have attempted an integration of the two literatures through using a paradigm predominantly used by cognitive psychologists to elicit false memories and beliefs and measure their effects, whilst using the APE framework of social cognition/attitude change to form theoretical predictions and interpret results. Further integration of the two literatures in the future may lead to new predictions and insights into false memory and attitude change phenomena that may have otherwise been overlooked.

7.5. Concluding remarks

The research presented in this thesis adds to the body evidence which demonstrates that false autobiographical memories and beliefs can influence current explicit attitude judgments. This thesis also presents the first investigation of whether false memories and beliefs can affect implicit attitudes, as well as explicit. Theoretical insights from the attitude change and social cognition literature provided rationale that false memories may be sufficient to do so, but false beliefs alone may not. Some results showed tentative support for this prediction, as well as highlighting a potential role for certain phenomenological factors of false memories. However, numerous limitations mean that this will need to be revisited in future research.

Future studies should also consider whether any explicit and implicit attitudinal effects are long-lasting, and whether they impact upon measures of behaviour which are more directly relevant to the false memory/belief than those considered in Experiments 1-3. Future studies may also wish to further investigate the role of individual difference factors in attitude change resulting from false memories and beliefs; while this research found little evidence to support any associations, this may be worth revisiting with greater sample sizes. While this may be difficult to achieve given the somewhat

inefficient nature of the false-feedback procedure, a series of methodological changes were presented which may enhance the amount of usable participant data, as well as the number of false memories and beliefs elicited in future applications of the paradigm. Future research in this area may also benefit from further integration of the attitude change/social cognition and false memory literatures.

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Appendices

Appendix A – Food History Inventory (FHI), as used in Experiment 1

Food History Questionnaire

Below is a list of events that may or may not have happened to you before you were 12 years old. Please read each event and rate on an 8-point scale how certain you are that the event (or a very similar event) did or did not happen to you by circling one of the numbers to the right of the item. Circle the '1' only if you are completely confident that the event **did not** happen to you before you were 12 years old. Circle the '8' if you are completely confident that the event **did** happen to you before you were 12 years old. And, if you are not completely confident choose one of the middle numbers.

	Definitely did not happen							Definitely did happen
1. Ate two scoops of ice cream on a cone	1	2	3	4	5	6	7	8
2. Sold chocolate bars for a school fundraiser	1	2	3	4	5	6	7	8
3. Ate chocolate cake at a friend's birthday party	1	2	3	4	5	6	7	8
4. Felt uncomfortably full after eating Christmas dinner	1	2	3	4	5	6	7	8
5. Ate too much ice cream	1	2	3	4	5	6	7	8
6. Helped someone peel potatoes	1	2	3	4	5	6	7	8
7. Baked a birthday cake	1	2	3	4	5	6	7	8
8. Ate dinner at a very fancy restaurant	1	2	3	4	5	6	7	8
9. Felt ill after eating cake	1	2	3	4	5	6	7	8
10. Spilled a glass of wine at a wedding	1	2	3	4	5	6	7	8
11. Slipped on a banana peel and fell down	1	2	3	4	5	6	7	8
12. Made orange squash for yourself	1	2	3	4	5	6	7	8
13. Bought school lunch	1	2	3	4	5	6	7	8
14. Ate a hotdog with onions and sauerkraut	1	2	3	4	5	6	7	8
15. Ate candyfloss at a fair	1	2	3	4	5	6	7	8
16. Loved broccoli the first time you tried it	1	2	3	4	5	6	7	8
17. Had a cheese pizza delivered	1	2	3	4	5	6	7	8
18. Ate freshly picked vegetables	1	2	3	4	5	6	7	8
19. Baked a pie with your mother	1	2	3	4	5	6	7	8
20. Were forced to go on a diet	1	2	3	4	5	6	7	8
21. Ate aeroplane food	1	2	3	4	5	6	7	8
22. Were sick after eating too many crisps	1	2	3	4	5	6	7	8
23. Had a burger at a football match	1	2	3	4	5	6	7	8
24. Ate breakfast in bed with your parents	1	2	3	4	5	6	7	8

Appendix B – Exercise History Inventory (EHI), as used in Experiment 2.

Exercise History Questionnaire

Below is a list of sport/exercise-related events that may or may not have happened to you before the age of 15. Please read each event and rate on an 8-point scale how certain you are that the event (or a very similar event) did or did not happen to you by circling one of the numbers to the right of the item. Circle the '1' only if you are completely confident that the event **did not** happen to you before the age of 15. Circle the '8' if you are completely confident that the event **did** happen to you before the age of 15. And, if you are not completely confident choose one of the middle numbers.

	Definitely did not happen							Definitely did happen
1. Scored a goal in a football match.	1	2	3	4	5	6	7	8
2. Lost a game of tennis.	1	2	3	4	5	6	7	8
3. Went on a bike ride for 15 miles or more.	1	2	3	4	5	6	7	8
4. Were picked last for a sports team.	1	2	3	4	5	6	7	8
5. Did more than 20 push-ups in a row.	1	2	3	4	5	6	7	8
6. Climbed a rope.	1	2	3	4	5	6	7	8
7. Were badly injured during sport/exercise.	1	2	3	4	5	6	7	8
8. Went on a long hike (roughly 8+ miles).	1	2	3	4	5	6	7	8
9. Enjoyed playing rugby (touch or contact).	1	2	3	4	5	6	7	8
10. Felt sick after pushing yourself too hard.	1	2	3	4	5	6	7	8
11. Represented your school in a sports or athletics competition.	1	2	3	4	5	6	7	8
12. Pretended to be ill to get out of sports or P.E.	1	2	3	4	5	6	7	8
13. Did aerobics at school.	1	2	3	4	5	6	7	8
14. Regularly exercised in your journey to/from school (e.g. walking, cycling).	1	2	3	4	5	6	7	8
15. Felt depressed after losing a sports game.	1	2	3	4	5	6	7	8
16. Loved cross country running at school.	1	2	3	4	5	6	7	8
17. Felt pressured into sports by your parents.	1	2	3	4	5	6	7	8
18. Wanted to be a professional sportsperson / athlete when you were older.	1	2	3	4	5	6	7	8
19. Felt excited after winning a sports game.	1	2	3	4	5	6	7	8
20. Chose to do P.E. as a GCSE level (or equivalent) qualification.	1	2	3	4	5	6	7	8
21. Won a sporting-related award.	1	2	3	4	5	6	7	8

22. Went to the gym 3 or more times a week over at least a 6 month period.	1	2	3	4	5	6	7	8
23. Did regular exercise with your friends.	1	2	3	4	5	6	7	8
24. Found learning to swim difficult.	1	2	3	4	5	6	7	8

Appendix C – Modified FHI, as used in Experiment 3.

Food Experiences Questionnaire

Below is a list of food-related events that may or may not have happened to you during your childhood. Please read each event and rate on an 8-point scale how certain you are that the event (or a very similar event) did or did not happen to you before the age of 12 by circling one of the numbers to the right of the item. Circle the '1' if you are completely confident that the event **did not** happen to you before you were 12 years old. Circle the '8' if you are completely confident that the event **did** happen to you before you were 12 years old. And, if you are not completely confident choose one of the middle numbers.

	Definitely did not happen							Definitely did happen
1. Ate ice cream at the seaside.	1	2	3	4	5	6	7	8
2. Sold cakes at a fundraiser/charity event.	1	2	3	4	5	6	7	8
3. Ate chocolate cake at a friend's birthday party	1	2	3	4	5	6	7	8
4. Felt uncomfortably full after eating Christmas dinner.	1	2	3	4	5	6	7	8
5. Ate popcorn at the movies.	1	2	3	4	5	6	7	8
6. Helped your parents prepare a meal.	1	2	3	4	5	6	7	8
7. Cooked a ready meal in a microwave.	1	2	3	4	5	6	7	8
8. Ate dinner at a very fancy restaurant.	1	2	3	4	5	6	7	8
9. Felt ill after eating food that had gone-off.	1	2	3	4	5	6	7	8
10. Spilled a glass of wine at a wedding.	1	2	3	4	5	6	7	8
11. Ate at a restaurant in a foreign country.	1	2	3	4	5	6	7	8
12. Picked strawberries in a field.	1	2	3	4	5	6	7	8
13. Felt happy after eating fast food.	1	2	3	4	5	6	7	8
14. Ate a hotdog with onions.	1	2	3	4	5	6	7	8
15. Ate candyfloss at a fair.	1	2	3	4	5	6	7	8
16. Ate brussel sprouts.	1	2	3	4	5	6	7	8
17. Had a pizza delivered to your home.	1	2	3	4	5	6	7	8
18. Felt happy when a friend gave you sweets.	1	2	3	4	5	6	7	8
19. Ate a meal in McDonalds.	1	2	3	4	5	6	7	8
20. Went on a diet.	1	2	3	4	5	6	7	8
21. Ate a meal on an aeroplane.	1	2	3	4	5	6	7	8
22. Felt sick after eating too many crisps	1	2	3	4	5	6	7	8
23. Had a burger or pie at a football match	1	2	3	4	5	6	7	8
24. Ate breakfast in bed	1	2	3	4	5	6	7	8

Food Experiences Questionnaire (continued)

Again, these questions are concerned with your childhood food-related experiences (before the age of 12).

For each of the following foods, please rate how confident you are that you ***loved the food the first time you tried it***. If you do not believe you tried a certain food before the age of 12, please leave that item blank.

	Definitely **did not** love first time I tried it							Definitely **did** love *first time I tried it*
1. Pizza	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
2. Broccoli	1	2	3	4	5	6	7	8
3. Chips	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
4. Ham	1	2	3	4	5	6	7	8
5. Green Beans	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
6. Cabbage	1	2	3	4	5	6	7	8
7. Apples	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
8. Cauliflower	1	2	3	4	5	6	7	8
9. Grapes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
10. Aubergine	1	2	3	4	5	6	7	8
11. Bananas	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
12. Oranges	1	2	3	4	5	6	7	8
13. Chocolate-Chip Cookies	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
14. Doughnuts	1	2	3	4	5	6	7	8
15. Pears	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
16. Carrots	1	2	3	4	5	6	7	8
17. Cheddar Cheese	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
18. Sausages	1	2	3	4	5	6	7	8
19. Spinach	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
20. Chicken	1	2	3	4	5	6	7	8

Appendix D – Format of false-feedback questionnaire utilised for Suggestion and control groups in Experiments 3 and 4

Subject Name: **[PARTICIPANT NAME HERE]**

This section concerns some of your childhood food [/exercise] -related experiences. After you left the lab last week, we analysed your responses to the food [/exercise] events questionnaire and used this information to generate a personalised profile of some childhood experiences that you indicated you were confident had happened to you (before the age of 12 [/15]). From the data you provided, the following profile was generated. As a child:

1) **[FILLER EVENT 1]**

2) **[FILLER EVENT 2]**

3) **[FALSE SUGGESTION (SUGGESTION GROUP) / FILLER ITEM 3 (CONTROL GROUP)**

4) **[FILLER EVENT 3 (SUGGESTION GROUP) / FILLER EVENT 4 (CONTROL GROUP)**

When you have finished reading the items, please continue to the questions on the next page.

Two of these experiences have been randomly selected for you to give some elaborative details on. For each item, please read the following questions, and indicate your answer by circling the appropriate response or by writing in the blank space provided.

[FILLER ITEM 1]

1. Take a moment to imagine you are currently at the scene in which this experience might have occurred. Imagine with as much detail as possible. In the space below, please list any information on sensory details (sights, sounds, etc), thoughts or feelings associated with this event (please try to list around 3 or 4 details).

2. On the scale below, please rate how vividly you were able to imagine this event.

Not at all vivid		Somewhat vivid				Very vivid	
1	2	3	4	5	6	7	8

3. To what extent do you feel this experience influenced your adult personality?

Not at all			Somewhat				Very much
1	2	3	4	5	6	7	8

(Continued on next page…)

[FALSE SUGGESTION (SUGGESTION GROUP) / FILLER ITEM 2 (CONTROL GROUP)]

1. Take a moment to imagine you are currently at the scene in which this experience might have occurred. Imagine with as much detail as possible. In the space below, please list any information on sensory details (sights, sounds, etc), thoughts or feelings associated with this event (please try and list around 3 or 4 details).

2. On the scale below, please rate how vividly you were able to imagine this event.

Not at all vivid		Somewhat vivid				Very vivid	
1	2	3	4	5	6	7	8

3. To what extent do you feel this experience influenced your adult personality?

Not at all		Somewhat				Very much	
1	2	3	4	5	6	7	8

Appendix E – Memory Phenomenology Questionnaire as administered in Experiment 4 (analysed in Section 6.1).

Memory Experiences Questionnaire

As a final step, we'd like a few further details regarding any memories you may have just described. **For each of the items you indicated you had a specific memory of,** please read each of the following statements and circle on the scale the extent to which you agree/disagree with each statement (1 = *strongly disagree*, 5 = *strongly agree*). If you indicated that you *did not have a specific memory of the item* (you chose B or P for that item in the previous Memory or Belief? questionnaire), please leave the ratings for that item blank.

1. [Event 1]

My memory for this event is very vivid.	1	2	3	4	5
My memory for this event is very detailed.	1	2	3	4	5
My memory for this event is dim.	1	2	3	4	5
This memory was easy for me to recall.	1	2	3	4	5
It was difficult for me to think of this memory.	1	2	3	4	5
I had to think for a while before I could recall this event.	1	2	3	4	5
As I remember the event, I can hear it in my mind.	1	2	3	4	5
When I recall this event, I think the same things I thought when the event originally happened.	1	2	3	4	5
My memory for this event does **not** involve a lot of sensory information (sounds, smells, tastes, etc).	1	2	3	4	5
As I remember the event, I have a difficult time recalling the particular physical reactions and sensations I had during the experience.	1	2	3	4	5
In this memory, I see this experience through my own eyes.	1	2	3	4	5
I view this memory as if I was an observer to the experience.	1	2	3	4	5
As I remember this event, I feel like an observer watching myself.	1	2	3	4	5
The order of events in the memory is clear.	1	2	3	4	5
This memory is of an event that occurred once at a particular time and place, not a summary or merging of many similar or related events.	1	2	3	4	5
This memory comes back to me in bits and pieces, not as a logical, coherent story.	1	2	3	4	5
This memory is a blending of many similar, related events, rather than a specific memory about a particular event.	1	2	3	4	5
When I recall this memory, I think "that's not me anymore".	1	2	3	4	5
I feel like I am the same person in the memory as I am today.	1	2	3	4	5

Appendix F – Demand check responses obtained in Experiment 4.

Response 1 (Suggestion group) "The study might have been to do with how consistent with each other our memories and attitudes are, like whether having a good memory about something that happened ages ago means you like that thing now."

Response 2 (Suggestion group)– "I think that the study may have been more interested in memories than personality, specifically what impact childhood memories have on our current attitudes. I think the questionnaires were done over two sessions to see how reliable attitudes are."

Response 3 (Imagination group) – "There was quite a lot of components to the study, reaction time, types of exercise you take part in, attitudes towards exercise, Memory recall of past exercise -based events. So, I didn't try to figure out the aim of the study because it was so vast and in depth too. I look forward to hearing what the aim of your study is, particularly since it was the only study I can say I enjoyed taking part in."

Response 4 (Control group) – "I'm guessing the study might have been about investigating whether certain personality types are more inclined to exercise or not. I'm not sure how associating pictures of sporting related events with negative or positive words fits into that though. Would love to know what it was about!"

Response 5 (Control group) – "The bit at the start where we were imagining exercise I think was about seeing if the imagining made us rate things higher than we did before."

Response 6 (Suggestion group) – "Was the study looking at how memories affect attitudes, and how consistent attitudes are week to week? I don't have any idea what the computer task was about".

Response 7 (Control group) – "I got the impression that the experiment was about the effect of experiences and memories of sports/exercise from a long time ago impact our current attitudes and personality".

Response 8 (Control group) – "I think the study measured our attitudes twice to see if they were consistent across sessions. Also the questions about memories made me think that you were interested in how those memories might affect our exercise attitudes/how much we exercise now. I think the computer bit might have been about conditioning to like exercise or something?"

Appendix G – Memory or Belief questionnaire

Memory or Belief?

We'd like to get a few more details about your sport/exercise history.

Take a moment to consider each of the following exercise-related events.

Then for each item:

- If you have a specific memory (from before the age of 16) pertaining to the item, write 'M' in the box, and give *as many details as possible* about the memory.
- If you believe that the event happened to you before you were 16, but do not have a specific memory, write 'B' in the box, and explain why you think the event happened to you.
- If you are positive that the event did not happen to you before you were 16, write 'P' in the box, and explain how you are so sure that the event didn't happen.

1. [Filler item]

☐

2. [False Suggestion]

☐

3. [Filler item]

☐

Appendix H – Words used in ST-IAT tasks.

Positive words

Glorious

Good

Triumphant

Wonderful

Peace

Paradise

Joy

Happy

Miracle

Lovely

Negative words

Cruel

Lonely

Anguish

Cancer

Torture

Awful

Evil

Failure

Hurt

Horrible