False Memories of UFO Encounters: An fMRI Investigation

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ABSTRACT

False Memories of UFO Encounters: An fMRI Investigation

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The idea of 'false memories' for traumatic events has powered numerous controversies. For this reason, the present study was designed as an attempt to resolve this debate with the use of neuroscience by alleviating two major limitations that have hindered progress in the field: namely, a more specific and restricted definition of what constitutes a false memory; and alleviating concerns surrounding the lack of ecological validity of simulated cases by testing individuals claiming to have been abducted by space aliens.

Our objective was to determine whether fMRI could distinguish between a false and a real memory and to identify the neural processes associated with these memories. Personality traits and/or cognitive abilities related to incidences of false memory were investigated, as well as, brain activation during 4 memory recall conditions: 1) self false memory; 2) self real memory; 3) other false memory; and 4) other real memory. A sample of 12 men and women who identified themselves as UFO abductees were used in the fMRI part of this experiment with their UFO abduction memory as the 'self false memory' condition. Results revealed higher scores on all cognitive and personality measures for the UFO group. We found evidence that the processing of real and false memories is correlated with different patterns of brain activity. In addition, main effects of self-referential processing and memory type (unusual content versus usual) were also tested. The results indicated that self-referential responding was mainly associated to

prefrontal and limbic activations whereas the successful retrieval of unusual content was associated to multiple regions of the brain including but not limited to bilateral prefrontal and occipital activations, and right anterior cingulate. Significant interactions were also observed in four right hemispheric regions: the lateral globus pallidus; the superior frontal gyrus; the parietal supramarginal gyrus; and the limbic lobe with increased activation specifically linked to the condition “self false memory”. Our findings extended the line of false memory research to unusual false memories and revealed additional activations associated specifically to this type of memory.

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Introduction

In the last four decades, the idea of 'false memories' for traumatic events has fueled numerous controversies. Some of these debates have been examined in the laboratories whereas others have been carried out in private practices and most importantly in the legal arena. This contentious topic has made many famous for their in depth thinking and high quality research and has left others feeling depressed and awaiting trial for an act they claim was never committed. Thus far, has research accomplished its goals and put our minds to rest when we speak of false memories? The answer is yes and no. More work is clearly needed if researchers and clinicians are still divided in relation to whether or not narratives of traumatic events are like any other types of memories, malleable.

Why is the false memory debate such a dividing topic? Some researchers may support the thought that clinicians are uninformed by choice and are more accepting of theories that have no scientific bases (Dawes, 1994). Clinicians on the other hand, may propose that researchers are too stringent in their experimental designs and that their experiments do not accurately depict the real world (Brown, Hammond & Schefflin, 1998). This discrepancy means that we have yet to design an experiment that permits both sides to agree on an eventual common goal. This experiment focused on merging the needs of clinicians and researchers regarding the authenticity of false memories for traumatic events and attempted to design a study that hopefully met researchers standards and clinicians needs for real life experiments. For this reason, the present study was designed as an attempt to resolve this debate with the use of neuroscience, by alleviating two major limitations that have hindered progress in the field. The first major limitation

pertains to the diverse use of a false memory definition. By designing an experiment that defines a false memory as one that is acceptable by all standards, the inconsistent findings surrounding this issue would be eliminated. The second major limitation concerns the lack of ecological validity of simulated cases. Testing individuals claiming to have been abducted by space aliens would enable us to accurately assess a false memory and how it pertains to the recovered memory debate without the ecological validity argument. The following section reviews false memory research and related topics in light of past and current evidence from behavioral and neuroimaging studies to give the reader a better understanding of the reasons why this topic has led to such controversy.

What is a False Memory?

Words, titles, even sentences have different meanings depending on the context they belong too. The false memory phenomenon is no exception. Thus, how should we define a false memory? Do we consider a false memory to be one that has *partial new* incorrect events, one that has changed details, or one that is entirely fabricated? It depends on the implication the memory will bring about. If we are simply recalling a pleasant childhood memory, does it really matter if the memory has changed details or is partially or entirely incorrect? If however, our recollection results in more severe consequences (e.g. suddenly remembering being sexual abused) then we clearly have a problem if the memory is indeed incorrect. This latter type of false memory is in fact the most problematic and is at the heart of the recovered memory debate.

If the implications were not detrimental, false memories could be defined on a continuum. That is, the definition could apply to some insignificant change in detail, to

something significant as a completely new incorrect memory. However, the problem that arises when defining a false memory on a continuum is when an attempt is made to generalize laboratory findings to the real world. Specifically, is it acceptable for studies focusing on 'changed details' to draw similar conclusions as studies that define a false memory as one that has been entirely created? One can argue that it would depend on the conclusion being drawn. If these studies were drawing conclusions in regards to the malleability of memory, then it would not matter whether we would be changing a detail, or creating an entirely new memory. In fact, it would be more fruitful to reach similar outcomes by employing variations of a false memory in order to add strength to our conclusions. However, if the studies' conclusions are not merely on the malleability of memory, but make direct generalizations to the recovered memory phenomenon that centers on the creation of an entirely new memory, then, it would matter to a great extent. Clinicians would then be keen on rejecting laboratory findings given that their methods do not depict the real world. Pezdek and Lam (2007), addressed this issue in a review article investigating the contributing factors leading to inconclusive results in relation to false memory research.

Pezdek and Lam's review was written to help us understand the reasons why false memory research often leads to questionable evidence and why it is at the center of such a heated debate. The authors conducted a search of all the empirical publications they could find under the heading "false memories" in order to investigate their methodologies and evaluate the similarities and discrepancies between them with the intent of uncovering some answers. This study reviewed 198 empirical studies and classified them in six different categories. These categories were organized according to the research task

that was used in defining a false memory. The investigators were primarily interested in placing in the first category the studies that used the planting of *entirely new events* in memory as a false memory. The authors' keen interest in this category stemmed from the notion that the planting of entirely new events was the main task used in the earliest false memory studies, and, in fact, was when the term was first coined and applied as the defining feature of the recovered memory debate. The second category included all the articles that employed tasks involving suggestion or misinformation and resulted in *some* new or *changed* details (not a memory for entirely new events). These new or changed details were labeled as a false memory. The third category included the studies that employed the Deese, Roediger, and McDermott (DRM) technique (Deese, 1959; Roediger & McDermott, 1995), a procedure that exposes participants to a list of semantically related words (e.g., bed, rest, and awake) in which one highly associated word (e.g., sleep) is excluded. This results in participants producing high rates of false alarms to the highly associated word. Therefore, the false memory in this case is the incorrect recollection of the highly associative word. The fourth category included all the articles that used "general recognition memory" tasks. These studies examined false memories for various stimuli (e.g., objects, faces, narratives, and other stimuli). The fifth category included the studies that focused on a "source monitoring" task, a task in which participants must determine the origin (or source) of their memories. The failure to accurately recollect the source of the memory is considered to be a false memory. The sixth and final category was labeled "other" and included articles using different tasks resulting in false memories (e.g. changing social beliefs tasks).

Comparing these studies permitted the authors to locate the catalyst leading to inconclusive results. Their analysis revealed that the key contributor leading to inconsistent findings is due to the different 'false memory' definitions employed by different researchers. They argued that this variation in definition has not allowed false memory research to excel and therefore remains in its infancy. Although the authors were criticized (Wade et al., 2006) for their rigid conclusions, our interest lies in the important issue that was raised. Namely, they argued that a standard definition should be implemented if we are to resolve the recovered memory debate. After all, it is this debate that initiated false memory research.

Provided that the central point of the recovered memory debate is to suddenly remember a repressed memory, a false memory could not be defined as one with changed details or a memory that is partially untrue. Otherwise it would not be considered a "recovered memory" given that the individual would have had partial recollection. Therefore, we agree with Pezdek and Lam and support the idea that researchers should strictly employ the creation of an entirely new memory as the "standard" and "sole" definition for a false memory if the recovered memory debate is to be resolved.

The Recovered Memory Debate

Over the last two decades, there has been considerable debate over the veracity of reports of childhood sexual abuse (CSA) derived from "recovered memories". In essence, the controversy is whether CSA occurring at an earlier age can be forgotten for long periods and then retrieved, or recovered, later in therapy or in response to cues or triggers from the environment.

This phenomenon began with the writings of Sigmund Freud with the presentation of a paper to the Society for Psychiatry and Neurology in Vienna, entitled "*The Aetiology of Hysteria".* In this paper, he proposed that repressed memories of childhood sexual abuse represent the primary etiological factor in the development of hysteria as well as certain other forms of neurosis. Freud soon began to doubt its validity and recanted this theory within a year of first proposing it. The grounds for this abandonment involved the realization that the use of highly suggestive procedures could lead to the creation of memories and concluded that without corroboration the memories cannot be validated (Freud, 1914). Nevertheless, many present day authors have argued in favor of the validity of recovered memories by presenting much of the same type of theoretical evidence that Freud once did (Gelinas, 1983; Gleaves, Smith, Butler, Spiegel & Kihlstrom, 2010; Herman & Schatzow, 1987; Terr, 1991).

Sexual abuse is a bona fide problem and researchers do not question its general historical veracity if the memories have always been continuous (Berliner & Loftus, 1992, p.572). Instead, the debate is over memories that have been *entirely* lost and *later* recalled. That is, the memory is entirely new and not one that has changed details. Unfortunately, these recovered memories are always traumatic and consequential. Imagine being accused of something you have never done? Or imagine remembering something traumatic that will change your life entirely? Given the severity of this issue, an understanding of how people remember trauma is needed and therefore a brief review of memory research is warranted.

Memory Research

Memory could mean many things. For example, it could mean remembering

factual information like the capital city of France (also known as semantic memory), and it could also mean remembering personal experiences like a Christmas party we have attended (also known as episodic memory). A personal or autobiographical memory is the combination of episodic and semantic memory. Thus, remembering a play we participated in requires autobiographical episodic memory, and remembering our stage name requires autobiographical semantic memory. There are other types of memory, however, our focus is on how people remember trauma and therefore we are mainly interested in autobiographical memory.

The idea that memory works like a tape recorder, encoding events exactly as they occur, has long been refuted (Bartlett, 1932). Moreover, researchers and clinicians (Brainerd & Reyna, 2005; Brewer, 1986; Kihlstrom, 1993; Loftus & Ketcham, 1994; McNally, 2003) affirm that memory is a blend of fact and fiction. Studies consistently reveal that every time something is remembered it is reconstructed (Brewer, 1986; Kihlstrom, 1993; Loftus & Ketcham, 1994). In other words, each successive recall may preserve the gist of the memory but some portion of the details will inevitably be different on each occasion (for example, Brainerd & Reyna, 2005; McNally, 2003).

Many of us fail to accept this fact given the vividness of our memory and therefore in genuine belief claim to remember everything. However, remembering an event from our past is not similar to remembering a phone number or a prayer, material memorized by rote. In fact Neisser (1981) coined the term 'repisodic memory' to explain that when there is a repetition of the same type of memory, it makes it more difficult to distinguish among the different experiences. However, not only does repetition make it harder to retrieve a single experience, it strengthens overall memory for the entire class of

experience. For example, a hockey player who has played many games in his life time will tend to blend together most details and have a difficult time remembering information in regards to a single game unless something unusual occurred, while a person who has played hockey only once in his life would retain a substantial amount of information. Likewise, a person exposed to many physically abusive incidents as a child, would have difficulty recollecting the specifics of every horrific encounter, yet will never forget what it was like to be physically abused as a whole.

Given what we know about how repetition affects memory, it is baffling to discover writings on repetitive childhood trauma reporting an opposite view. Specifically, the writings in regards to children having an increased likelihood to experience full amnesia for repeated traumas than for a single trauma (Terr, 1991). According to some theorists (Gelinas, 1983; Terr, 1991), children may endure chronic sexual abuse by developing this 'avoidant encoding style' that enables them to disengage attention from disturbing happenings and direct it elsewhere. The ability to focus on doorknobs, wallpaper patterns, and so forth may attenuate the emotional impact of otherwise overwhelmingly upsetting episodes of abuse (Herman & Schatzow, 1987). Impaired encoding of these and other aversive episodes of an unhappy childhood may result in the impoverished autobiographical memory reportedly characteristic of CSA survivors (Harvey & Herman, 1994). Conversely, researchers have tested the 'avoidant encoding style' and have not supported the theorists' assumptions (McNally, Metzger, Lasko, Clancy & Pitman, 1998). To further understand the recovered memory debate, familiarity with the underpinnings of how adults remember their early years and how children remember trauma is warranted.

Infantile Amnesia

According to the British Psychological Society (1995), "nothing can be recalled accurately from before the first birthday, little from before the second, and poor memory before the fourth birthday is normal" (p.29). Memory researchers have robustly found that few people seem able to remember events that took place before the age of three years for the reason that there is a delayed maturation of the brain (Campbell & Spear, 1972; Campbell, Misanin, White et al., 1974; Coulter, Collier & Campbell, 1976). Episodic memory does not develop until after age four and most people have limited memories prior to five or six years of age (Hudson & Nelson, 1986). Consequently many of the memories before age five are reconstructed or created by external influences like family stories and pictures (Lindsay & Johnson, 1987; Spiegel, 1995).

To further corroborate the notion that early memories cannot be recalled later in adulthood, memory studies conducted with preschoolers are worth mentioning. These studies assessed young children's memories regarding salient events. Depending on the age of the child, young children tend to remember earlier memories (Hammond & Fivush, 1991). However, as they grow older, the memories fade to the point of nil autobiographical recollection, yet semantic memory is established and retained (Newcombe, Drummey, Fox, Lie & Ottinger-Alberts, 2000).

In support of early memories, some investigators report that early recollections are retained, however, not in a verbal format (Smith, Ratner & Hobart, 1987). That is, memory may be adequately reflected in nondeclarative measures (i.e. memory expressed in behavior than in language) than declarative ones (i.e. episodic and semantic memory). Smith et al. (1987) had kindergarten students follow a step-by-step recipe for making

clay. The children were tested two weeks later in the presence of all the ingredients and utensils. They found that the children were able to verbalize about 20% of the steps necessary to complete the recipe yet were able to reenact about 80% of the steps to make the clay. Other studies have revealed similar impressive nondeclarative memory abilities in children as young as 14 months and as old as 4 or 5 years of age, however, few episodic memories from those years persist into later childhood. For these reasons, the extent to which a therapist can help the client retrieve memories of early childhood is baffling to many researchers and clinicians.

Nonetheless, advocates like van der Kolk and Kadish (1987) believe that traumatic memories of CSA are laid down in the brain through a unique process that does not apply to normal memory, only in cases of extreme stress. However, the results of laboratory simulation studies, flashbulb memory studies, and nonexperimental field studies of trauma suggest that traumatic memory is similar to normal memory.

Trauma Related Studies

For several decades, laboratory simulation studies have centered their experimental designs on employing shocking stimuli to assess whether participants remember more than neutral stimuli. For example, Loftus and Burns (1982) exposed their participants to either a violent or a nonviolent videotape of a simulated bank robbery and then gave them a memory test about aspects of the film. Christianson (1984) exposed participants to a slide show forming a traumatic story depicting a boy being struck by a car. These participants were also provided a memory test two weeks later. Gary et al. (1981) exposed their participants to a staged theft whereby their task was to identify the culprit in a photolineup.

These studies show that exposure to a shocking event does not produce "amnesia" for the event itself. In fact, simulated traumatic events themselves are easily remembered. So much so, that participants fail to encode and remember any neutral information provided at the same time as the shocking stimuli.

Other studies focused on real life emotional events to determine whether amnesia occurs under these circumstances. One type of real life studies is the phenomenon entitled "flashbulb memories". Flashbulb memories are recollections of the circumstances when one *first received news* of an emotionally shocking event. These shocking events range from a president's assassination (Brown & Kulik, 1977), to recalling what participants were doing when they heard momentous news (e.g. death of a loved one) (Rubin & Kozin, 1984). These studies have shown that months and years after the flashbulb event, participants can often provide with great confidence detailed accounts of where they were and what they were doing when they heard the emotional news. The central point of these results is the notion that people continue to remember instead of them forgetting. However, it should be noted that the longer the time lapse between the original assessment and the second assessment, consistencies in the details provided decrease and inconsistencies increase every bit as much as with a regular everyday memory, but confidence and vividness remain high only on the flashbulb memories (Talarica & Rubin, 2003, 2007).

Another type of non-simulated real life traumatic studies is 'field studies'. These studies mainly assess individuals whom have witnessed real crimes (e.g. fatal shootings, bank robberies, earthquake survivors, etc.) (Christianson & Hubinette 1993, Neisser et al., 1996). Results reveal that recall of a memory for a directly experienced emotional

event is extremely high during initial recall. When assessed a few months later, confidence in recall remains high even when details begin to change slightly. In addition, when researchers compared field studies to flashbulb memory studies, memory recall for a directly experienced emotional and shocking event is found to be more consistent than a flashbulb memory over time (Pillemer, 2009 pp, 125-140).

This line of research provides further evidence that people retain vivid memories of shocking events they have directly witnessed, and due to the real nature of the event, it strengthens their conclusions. Although there is mounting evidence showing that emotional memories are very well remembered, many continue to believe that memory for sexual abuse operates with different guidelines. In fact, these advocates believe that suggestive techniques like hypnosis, guided imagery and dream analysis can be employed to retrieve memories in the manner they were encoded (for a review see Brown, Scheflin & Hammond, 1998).

Suggestive Techniques as the Road to False Memories

Can suggestive techniques help us recover real memories? Researchers claim that a large and growing number of therapists have helped their adult clients remember memories of childhood sexual abuse by suggestive methods like hypnosis and guided imagery (Lindsay & Read, 1994; Ofshe, 1992; Ofshe & Watter, 1994). However, are these recovered memories real or false?

The creation of false memories is one of the most robust findings in memory research. Laurence and Perry (1983) pioneered this line of research when they implanted a false memory about an incorrect event in their participants by hypnosis, which the participants came to accept as their own memory with a high rate of confidence.

Following and modifying Laurence and Perry's experimental methodology, others have consistently found that memory influenced by hypnosis and other suggestive techniques to be unreliable and extremely misleading (Ceci & Loftus, 1994; Laurence, Nadon, Nogrady & Perry, 1986; Laurence and Perry, 1988; Lindsay & Read, 1994). Although the hypnotic implantation method is ideal for determining whether we can create false memories, it does have a drawback. Namely, it is a lengthy process in terms of implementation and in finding highly hypnotic susceptible individuals. Given the laborious nature of the implantation method, countless studies have strayed from hypnotic implantation yet show that memory for an event can be altered through other experimental methods. For example, Loftus and Pickell (1995) sent 24 adult participants a booklet describing four of their own childhood events as reported from their older relatives. Three out of the four events had really happened and the fourth had not. Two interviews later, six participants remembered the false event. Interestingly, when participants were told that one of the events was false, some suspected real memories as being the impostor. That is, they believed in the reality of the false memory even more than in the reality of a real memory.

More recently, misinformation studies and DRM studies have dominated false memory research. DRM studies however will not be discussed in this section due to their lack of ecological validity to real life events. However, these studies merit attention and are discussed further when addressing abduction by aliens, and the neurobiology of false memories.

Misinformation studies were designed to show how readily memory could become skewed when people are fed false information. The procedure consists of

presenting participants visual representation of a complex event (e.g. automobile accident). Half of the participants receive misleading information (e.g. telling the participants the road sign was a yield sign when in fact it was a stop sign) and the other half do not. Participants are tested on their memory of the original event (see Loftus 1979). Countless similar studies show that misinformation can easily change an individual's recollection (for example, Van Bergen, Horselenberg, Merckelbach & Jelicic, 2010; Zhu et al., 2010).

Misinformation can also be transmitted with the use of guided imagery. Hyman and Pentland (1996) tested this method by asking participants to imagine themselves engaged in several true and false events. Over the course of several interviews, 37% of the guided imagery group and 12% of the control group created a false memory (e.g. spilling a punch bowl at a party). Thus, successive imaginations can result in the creation of false memories and increased confidence that the memories actually happened. This increased confidence has been termed 'imagination inflation' by Garry, Manning, Loftus and Sherman (1996). Consistent with Garry et al.'s findings is a review by Talalaric and Rubin (2007) discussing how vividness of mental imagery plays a key role in a person's belief in the reality of the memory.

Others have examined whether a dream interpretation provided by a clinician will enhance confidence that such an event had actually happened (Mazzoni, Lombardo, Malvagia & Loftus, 1999). Indeed, it did. Others have shown similar high confidence ratings when using authority as their main source of misinformation (Spanos, Burgess, Burgess, Samules & Blois, 1999). These studies show that an authority figure that provides convincing information can create false memories about these events. Other

studies focus on forcing an individual to respond to events that have never happened. Their results also reveal that witnesses later came to misremember as real the confabulated details (Zaragoza, Payment, Ackil, Drivdahl & Beck, 2001).

In general, providing misinformation or using other suggestive methods are not specific to laboratory experiments. They also occur in everyone's day-to-day life and generally go unnoticed. Misinformation is transmitted when we talk to someone, when we are interrogated in a suggestive manner, or when we are exposed to media coverage on an event we have experienced ourselves. The slight change in information might lead us to adopt the new information as our own recollection. For all these reasons, the APA Working Group of Investigation of Memories of Childhood Abuse stated: "It is possible to construct convincing pseudo-memories for events that never occurred" (1996, p.1). The British Psychological Society (1995, p.25) and the Australian Psychological Society (1994, p.3) stated comparable views.

Clinicians agree that memory for ordinary events may fade over time and flashbulb, field, and misinformation studies provide great evidence for the malleability of memory for *normal* emotional events. However, they remain firm on the idea that the mechanism for *traumatic* memories (e.g. CSA) follows different rules (Brown, Scheflin & Hammond, 1998). Therefore, the use of repeated suggestions, confrontations, or highly suggestive techniques are often necessary tools to employ in order to recover memories. Brown, Scheflin and Hammond (1998) quote: "Because some victims of sexual abuse will repress their memories by dissociating them from consciousness, hypnosis can be very valuable in retrieving these memories. Indeed for some victims, hypnosis may provide the only avenue to the repressed memories" (p. 647). However, the robust

findings that hypnotherapy, guided imagery, or simple suggestions can create or change a memory, is adequate in proving a case against the use of suggestive techniques for retrieval of a memory. Nevertheless, clinicians continue to claim that memories of abuse operate under different rules than other emotional memories.

Retrospective and Prospective Studies

For this reason, researchers have attempted to investigate repression and recovery of memories directly by retrospectively assessing adult individuals with a history of childhood sexual abuse. One of the most commonly cited retrospective study of trauma and memory was based on 468 adults who reported having a history of childhood sexual abuse (Briere & Conte, 1993). These individuals, who were mostly women, were recruited by their therapists and asked to complete a survey, on which the following question appeared: “During the period of time between the first forced sexual experience happened and your eighteenth birthday, was there ever a time when you could not remember the forced sexual experience?” Slightly more than half reported having had a period of time prior to age 18 when they had no memory for the abuse. This "forgetting" was more likely for those who reported having been abused at a younger age, more frequently, and/or more violently, which is contrary to laboratory findings (McNally, Clancy & Schacter, 2001; McNally, Metzer, Lasko, Clancy & Pitman, 1998).

In 1994, Feldman-Summers and Pope found 40% of those who reported a history of childhood abuse also reported a period of time in which they had no or only partial memory for the abuse. The reported forgetting was related to the severity of the abuse.

In 1997, Melchert and Parker studied 290 students with a history of sexual, physical, and emotional abuse. When they were asked if there was a time where they

could not remember the abuse, 16% of the participants reported no recollection of the event at some point in their lives.

These studies appear to give credence to the authenticity of recovered memories. However, when observing their methodologies they all have inherent common flaws that render their findings uninterpretable (Kihlstrom, 1998; McNally, 2003). Firstly, the most fundamental flaw is not assessing how the memory was recovered. In some studies, the use of hypnosis or guided imagery was the method employed which tells us that those particular results should have been excluded. In addition, accepting the participant's memory as valid without corroboration is taking a big risk. Furthermore, these studies assumed that forgetting the memory for a period of time automatically results in having experienced repression. People forget for many reasons. For instance, forgetting could occur if one did not initially process the experience as traumatic. In addition, others may interpret forgetting as not thinking about it for a period of time. Should not thinking about it automatically mean repression? Therefore, corroboration, accurately assessing forgetting, and the assessment of the various methods of recovery used, are imperative in retrospective studies if we are to accept their results as valid.

To avoid these methodological problems, others have developed an interest in a prospective method of assessing memories of CSA (Pope, Hudson, Bodkin & Oliva, 1998). A prospective study "follows-up victims of a known past traumatic event, and then assesses their memories at the time of evaluation" (Pope, 1998 p. 172). This methodology eliminates non-corroborative recall and gives investigators an opportunity to accurately assess forgetting and method of recovery. Prospective studies of recovered memories have not been limited to CSA. Many investigators have examined this

phenomenon with various types of traumas and found that people remembered their trauma (Peterson & Bell, 1996; Malt, 1988; Terr, 1979, 1983, 1991; Wagenaar & Groeneweg, 1990).

Interestingly, however, some studies on recovered memories of child sexual abuse paint a different picture in that they do report some repression. For example, in 1990, Femina, Yeager and Lewis were the first to conduct a prospective study assessing recovered memory of CSA in 69 participants. When participants were interviewed nine years after initial assessment, 26% (18 individuals) of the participants did not remember the abuse. At this point, they had the opportunity to conclude that repression had occurred. Instead, they attempted to track the 18 participants that could not remember the abuse and re-interview them. They managed to locate 8 of the participants and asked them about the inconsistency between their reports of not remembering and the documented event. All of the participants reported that they had remembered the event but preferred not to disclose the abuse given that they were not asked directly.

Linda Meyers Williams (1994) conducted a similar study. This longitudinal study consisted of 129 women whom had been treated for sexual abuse ranging from fondling (no physical trauma present) to sexual intercourse, and were then re-interviewed as adults 17 years later. A small minority (12%) of the women failed to report that they had ever been abused in childhood. Williams and other professionals have claimed that the study supports 'repression' as a valid construct.

In 1995, Burgess, Hartman and Baker decided to conduct a follow-up interview on 20 children who were sexually abused 5 to 10 years earlier in a day care center. They

decided to ask the participants directly about the abuse. They reported that 3 participants did not remember the event despite the fact that they were asked about it directly.

In 2003, Goodman et al. interviewed 175 young men (34) and women (141) who 13 years ago were involved in criminal prosecutions as victims of CSA. Their findings revealed that 5% of their participants did not remember the abuse.

When assessing these studies further, 'non-disclosure' and 'infantile amnesia' were the two main explanations for the lack of remembering. Non-disclosure is a phenomenon that has been well substantiated in non-traumatic populations (National Center for Health Statistics, 1965) and is revealing to be true in the traumatic populations as well. Numerous studies assessing populations with histories of abuse, psychiatric conditions, and crime victims have also revealed that interviewees deliberately withhold information unless they are specifically asked or disclose the events on a later interview. When questioned about the reason for not disclosing the event in the initial interview, embarrassment or not wanting to accuse the perpetrator was given as responses (Femina et al. 1990; see Pope et al. 1998 for review).

If non-disclosure was not the reason for not reporting the abuse, infantile amnesia was. For instance, in the Burgess study (1995), the participants who did not remember the abuse were approximately three years of age when the abuse occurred. Therefore, as with non-disclosure, we saw earlier that infantile amnesia cannot be offered as an explanation for temporary forgetting.

Abduction by Aliens & Personality Correlates

Some investigators decided to investigate false memories by studying people who claim to have been abducted by space aliens. Abduction memories are considered false

given the lack of scientific validity substantiating organized alien presence on earth, and the lack of corroboration. Various methods have been employed to assess susceptibility to false memories including abduction memories, with the DRM paradigm most commonly used.

The DRM paradigm examines false recall and false recognition of semantically associated words. It consists of presenting a series of word lists that are associated with a single non-presented theme word. For instance, one list can consist of words associated with 'sweet' (e.g. sour, candy, sugar, bitter). The word 'sweet' in this case is the non-presented theme word. Following the list presentation, participants perform a recall test, and then perform a recognition test composed of studied words, non-studied theme words (e.g. sweet), and other non-studied words. False recall occurs when participants incorrectly recall a non-studied theme word (e.g. sweet), and false recognition occurs when participants incorrectly claim to have studied a non-presented theme word.

Using a variant of the DRM paradigm, Clancy, Schacter, McNally and Pitman (2000) conducted a false recognition study in a group of women reporting recovered memories of CSA, a group of women who were abused and never forgot the event (i.e. continuous memory), women who believed they were abused as a child but cannot recall this abuse (repressed group), and a control group consisting of women that never experienced childhood sexual abuse. Their results revealed that women who reported recovered memories of CSA were more prone than the other participants to exhibit false recognition. Given that corroboration of the CSA was not acquired, this study was faced with similar criticism as anecdotal cases, namely, the lack of verifiable evidence for the

abuse. Therefore, the investigators were not able to conclude that the memory distortion was a function of cognitive impairments related to the abusive event.

To rectify this problem, this group of investigators conducted a similar experiment whereby the traumatic event was not CSA, rather, it was abduction by space aliens (Clancy, McNally, Schacter, Lenzenweger & Pitman (2002). Given that this type of memory is presumed to be false, it eliminates the criticism related to ascertaining accuracy of the memory. Their study included three groups: a recovered memory group (people reporting recovered memories of alien abduction); a repressed group (people who believe they have been abducted by aliens but have no memories); and a control group (people who deny having been abducted by aliens). Using the DRM paradigm, their results revealed higher rates of false recognition and recall for the recovered memory and repressed memory groups when compared to the control group. In addition, those reporting recovered and repressed memories of alien abduction scored higher than controls on measures of hypnotic suggestibility and depressive symptoms. Given that the memory was indeed false and the findings could not be attributed to the event itself, these results are consistent with robust laboratory findings concluding that memory creation can occur in susceptible participants (Ceci & Loftus, 1994; Laurence, Nadon, Nogrady & Perry, 1986; Laurence and Perry, 1983,1988; Lindsay & Read, 1994). Specifically, participants who claim abduction by space aliens are susceptible to memory creation. With this said, the familiarity of the personality correlates associated with alleged alien abduction is warranted to better identify individuals whom are susceptible to false memory creation.

To the best of our knowledge, no one has ever been abducted by space aliens, or

at the very least, there is no scientific evidence substantiating this phenomenon. Increase in scientific information and in people's educational level was long considered to lead to the triumph of rationality over superstition and the paranormal (Frazer, 1922/1963; Mauss, 1950/1972). Yet, beliefs in paranormal phenomena are widely held in the general population (e.g. Clark 1991). According to a poll by Yankelovich (1996), 34 percent of Americans believe that space aliens have landed on earth and 17 percent believe that medical experimentation with humans has occurred. Others have found that more than a third of Americans still believe in psychic powers, extrasensory perception and extraterrestrial visitations (Rice, 2003; The National Science Foundation, 2002). In spite of the prevalence of such beliefs, there is no consensus about the reasons for the popularity of the beliefs. A discussion on these potential reasons is beyond the scope of this thesis and therefore will not be discussed further. However, what is of interest are the personality correlates associated with individuals claiming to have been in contact with space aliens.

The first study to assess this phenomenon, investigated schizophrenia related personality correlates associated to alien abductees. This study was carried out by Windholz and Diamant (1974) and found that students' scores on a measure of extraordinary phenomena beliefs were associated with scores on the schizophrenia scale of the Minnesota Multiphasic Personality Inventory (Hathaway & McKinley, 1983). Based on the Diagnostic and Statistical Manual –IV (DSM-IV) schizotypal personality is based on some of the following signs and symptoms: ideas of reference, odd beliefs, unusual perceptual experiences, suspiciousness, etc. (American Psychological Association, 1994).

Thalbourne (1994) has replicated this finding and extended the investigation to the association between paranormal beliefs and some aspects of schizotypal personality. Thalbourne (1994) found that stronger beliefs in the paranormal were associated with high scores on the magical ideation scale (Eckland & Chapman, 1983). Magical ideation includes belief in a number of magical influences. The items on this scale inquire mainly about the participant's interpretation of his or her own personal experiences rather than belief in the theoretical possibility of magical forms of causation.

In 1997, Spanos et al. developed an 8-item scale to assess belief in extraterrestrial life and UFO-related beliefs. They compared those who reported intense UFO experiences (e.g. contact with aliens) with those who reported non-intense experiences (e.g. seeing an unexplained light in the sky). Cross sectional data were reported on 276 young adults who completed the 8-item scale along with several measures of schizotypal personality based on the Multidimensional Schizotypal Traits Questionnaire (MSTQ) (Rawlings & MacFarlane, 1994). The data provided evidence that UFO-related beliefs were associated with higher schizotypy scores, but that the belief in extraterrestrial life ***per se*** did not. In 2005, Genovese used the he Schizotypal Personality Questionnaire (SPQ) developed by Raine (1991) to investigate the correlation between schizotypy and paranormal beliefs and found a correlation with paranormal beliefs in normal participants. Moreover, Clancy et al. (2000) employed the DRM method and schizotypy measures to assess whether there is a correlation between abductees and schizotypal measures, and to ascertain whether these participants are more susceptible to false memories. Their results revealed that proneness to magical thinking and schizotypy are characteristics that would indeed lead to heightened susceptibility to false memories.

Furthermore, there is now some evidence that disturbances in attentional processes are present in individuals scoring high on schizotypal measures (Barch et al. 2004; Kieffer et al. 2006). The attentional disturbance is generally characterized in terms of having difficulty inhibiting or ignoring irrelevant stimuli while attempting to selectively attend to relevant stimuli (e.g., Garmezy, 1977); taking the form of having difficulty with controlled attention (e.g., Cohen & Servan-Scheiber, 1992); or having difficulty with sustained attention (Bergida & Lenzenweger, 2006). Generally, schizotypy groups like schizophrenic groups show significantly longer reaction times and make significantly more errors than control groups on the Stroop task (Barch et al. 2004; Kieffer et al. 2006). The color–word Stroop task, referred to as the "gold standard" for the measurement of selective attention (MacLeod, 1992), has been used to demonstrate this impairment in these populations (e.g., Barch, et al.,2001; Giraldez et al, 2000; Moritz et al, 1999). Therefore, it is possible that the Stroop task may also reveal selective attention deficits in participants claiming to be in contact with space aliens.

Neuroscience Perspective

Clearly, the recovered memory debate is a complex one. Although to date false memory research has broadened and honed our knowledge on this topic, the controversy still remains. Since cognitive neuroscience approaches have begun to disentangle central psychological and neurological aspects of memory, perhaps this research can also help to establish a foundation for basic understanding that may someday shed light on the real-world cases of recovered memories. In light of the fact that neuroscience in this area is at the embryonic stage, several different yet related phenomena provide important insights concerning possible neural bases of false memories. This includes neurocorrelates of:

autobiographical memory; trauma memory; the DRM paradigm; the misinformation effect; confabulation; and deception. Scientists have used positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) to identify regions of the brain showing heightened activity when asked to perform a task.

Autobiographical memory neurocorrelates and their role.

The number of functional neuroimaging studies that investigate autobiographical memory (AM) has increased rapidly in recent years. Neuroimaging research on AM has focused on three main processes: retrieval; monitoring; and self-referential processes. *Retrieval processes* involve control operations interacting with different forms of memory. For example, try to remember the last time you had Italian food. Unless this event occurred recently, recovering this memory would involve semantic knowledge, inferential processes, emotions, and visual images. If some part of the memory does not fit, *monitoring processes* would also be involved to detect errors. Given that the final point of AM construction is a personal memory, it is dependent on *self-referential processing*. Neuroimaging studies have associated these processes with different prefrontal cortex (PFC) regions. More specifically, memory search and controlled retrieval processes involve left lateral PFC (Conway et al, 1999, Conway & Fthenaki, 2003; Svoboda et al, 2006), monitoring processes involve ventromedial PFC (Gilboa, 2004), and self-referential processes involve medial PFC (Cabeza et al, 2004; Maguire et al, 2001). These constructive processes eventually lead to remembering a specific event. When adding emotion and visual imagery to an AM, a different pattern of neural correlates emerges.

Studies investigating emotion in AMs, have found that in contrast to the typical left PFC activation found for neutral AMs, emotional AMs tend to elicit right or bilateral PFC activations, as well as the medial temporal lobe (MTL), the amygdala, the hippocampus, parahippocampal regions and activation in visuospatial imagery such as cuneus/precuneus (Denkova et al, 2006; Dolcos et al, 2005; Gardini et al, 2006; Greenberg et al, 2005; Vandekerckhove et al, 2005;). In summary, the prefrontal cortex and structures in the medial temporal lobe are critical regions associated with autobiographical memory.

Neurocorrelates associated with trauma.

Scientists have also developed methods to understand the neuroanatomical circuits that mediate recollection of trauma. Predictions generally lie within structures of the limbic system as the likely regions associated with traumatic memories given their emotional nature. Audiotaped scripts narrating the individual's trauma (a.k.a. script-driven imagery) is usually the method employed in neuroimaging studies to identify brain regions associated with their trauma.

Applying the script-driven imagery paradigm, several research groups have used PET to determine which brain regions show heightened activity when PTSD patients are visualizing their trauma. Rauch and his colleagues (1996) tested 8 PTSD participants with diverse traumas and found heightened activation in the medial orbitofrontal cortex, the insular cortex, the anterior temporal pole, the medial temporal cortex, and the secondary visual cortex. In addition, they found increased activity in the amygdala and ACC, regions associated with emotional experiences. Unfortunately, this study did not use any controls, therefore, it is difficult to assess whether these activations reflect

traumatic memories or whether normal control participants would exhibit similar activations when listening to these horrific accounts.

Shin et al. (1999) designed a similar experiment, however, their participants consisted of 16 women reporting CSA, 8 of who had PTSD and 8 of whom did not. Their study differed from Rauch's study in that their participants were not only exposed to audiotaped trauma scripts, but neutral scripts as well. The results were similar to those of Rauch et al., however, the amygdala did not show heightened activation. Other more recent studies investigating the neurocorrelates of trauma using variations of the script driven paradigm also showed no detectable activation of the amygdala during processing of trauma scripts (Bremner et al, 1999, Lanius et al, 2001).

Patterns in brain activation in PTSD patients have been strikingly inconsistent across studies. Researchers sometimes noted activation in certain limbic structures, whereas other studies revealed activation in other limbic structures (Francati, Vermetten & Bremner, 2007). At this time, it is difficult to pinpoint the reasons for this diverse pattern of findings.

False Recognition studies

A handful of recent studies have examined false recognition. The use of the DRM procedure has been used to investigate this concept. In a PET study, Schacter, Currant, Galluccio, Milberg and Baltes (1996) examined brain activity of healthy young individuals during true versus false recognition. Compared with a control condition in which participants fixated on a crosshair, significant increased blood flow for both true and false recognition was associated with the anterior prefrontal cortex, medial parietal cortex, left middle temporal gyrus, cerebellum and left parahippocampal gyrus. Others

have investigated false recall using the DRM method in patients with lesions restricted to lateral frontal regions (i.e. not causing amnesia), and other patients with damage to both frontal (i.e. ventromedial) and medial temporal lobes (i.e. causing amnesia) (Melo et al, 1999). They concluded that the lateral regions of the frontal lobe play a unique role in the production of false memories and are critical to the strategic processes that allow an individual to avoid or to make false recognition errors when overall memories are intact.

A major limitation in applying the DRM method to assess the neurobiology of false memory is that most of what we learn is specifically on the neurocorrelates of true and false memories of words not actual autobiographical memories.

Neural basis of the misinformation effect.

Okada and Stark (2005) investigated the neural basis of the misinformation effect using fMRI. The study consisted of two phases: The original event phase and the misinformation phase. Both phases took place in the scanner. The original event phase consisted of exposing their participants to eight unique vignettes consisting of 50 color digital slide images. During the misinformation phase, the same vignettes were shown, however, for every vignette 12 of the 50 slides contained an item that was changed. Participants were told that the purpose of the study was to assess whether memory is better for one or two presentations of an event. Participants were also tested two days later outside of the scanner to assess whether the misinformation effect induced false memories. The participants' responses were then used to assess which neuronal activations correspond with true or false memories. They found that the MTL and PFC are critical regions for encoding processes for true and false memory creation. However,

during the original event phase, actvity was greater for true than false memories, whereas during the misinformation phase, activity was greater for false rather than true memories.

As mentioned previously, the misinformation paradigm is based on exposing a person to misinformation about a crime or an event they have witnessed. The nature of this paradigm is to expose the participant, therefore, it focuses on how people encode rather than retrieve information. Although we might expect the neural mechanism in encoding and retrieval to overlap considerably in that the cognitive operations performed during retrieval reinstate those performed during encoding, differences still remain and no single study can definitively answer the question of how encoding and retrieval relate neurally (Prince, Takashi & Cabeza, 2007). However, findings generated from the misinformation paradigm remain interesting and relevant even if this method of study is not synonymous to real life cases of recovered CSA memories or other AMs, which center on retrieval processes alone. Nevertheless, their findings are useful as a basic understanding of the underlying mechanisms leading to memory creation and are helpful in predicting activation in false memory retrieval given the overlapping nature of encoding and retrieval processes.

Confabulation.

Confabulation is a symptom that occurs in a variety of neurological and psychiatric syndromes. Confabulation is best described as "honest lying". That is, patients believe what they are saying even though it is demonstrably false (Johnson & Raye, 1998). In addition, confabulation is linked to episodic memory rather than semantic memory. Although confabulation is a term for the clinical population, it is quite comparable to a false memory in that people with false memories generally believe their

memory is real. Therefore, understanding which brain processes are indicative of confabulation may shed light on the biology of false memories. In cases of brain damage, confabulation is often observed in connection with lesions to ventromedial aspects of the frontal lobes (Johnson, 1991). However, ventromedial frontal lesions are not sufficient for confabulation, basal forebrain damage must be present for long lasting confabulation in the clinical population (Deluca, 1993; Fischer, Alexander, D'Esposito & Otto, 1995). Studies of false recognition in patients with brain lesions due to an aneurysm or other conditions, indicate increased susceptibility to false recognition and reveal atrophy in ventromedial and posterior frontal lobe, bilateral areas in the medial aspects of the frontal lobes, right temporal lobe, parahippocampal gyri, and basal forebrain (Delbecq-Derouesne, Beauvois, & Shallice 1990; Moscovitch & Melo, 1997; Parkin, Leng, Stanhope & Smith, 1996). Damage limited to dorsolateral frontal regions does not appear to produce confabulation.

Lying and imagined/rehearsed.

Some light has been shed on the brain mechanisms involved in deception. More specifically, Spence et al. (2004) designed a study in which participants withheld truthful responses and answered with their opposites (e.g. yes for no) to questions developed on their recent daily behaviors. They found that it took longer for participants to respond to a lie than to the truth. In addition, using fMRI, they found greater activity in bilateral ventrolateral prefrontal cortices suggesting that these regions are associated with withholding the truth and engaging in lies. Other neuroimaging studies support these findings (Kozal et al, 2004b ; Lee et al, 2002).

In a recent event-related potential (ERP) study, Johnson, Barnhardt, and Zhu (2004) argued that the anterior cingulate cortex (ACC) plays a key role in deceptive responses. ACC activation has been consistently reported during tasks associated with the inhibition of a pre-potent response or monitoring of cognitive conflict (Botvinick, Nystrom, Fissell, Carter & Cohen, 1999; Carter et al, 1998). In addition, the lateral prefrontal cortex has also been observed in deception studies (Courtney, Petit, Maisog, Ungerleider & Haxby, 1998; Smith & Jonides, 1999). In 2008, Abe et al. attempted to identify the roles of these two structures. They found that activity of the dorsolateral, ventrolateral and medial prefrontal cortices were commonly associated with two types of deception: pretending to know (i.e. deceptive responses to new targets), and pretending not to know (i.e. deceptive responses to true targets). However, activation of the ACC was positively correlated with that of the dorsolateral prefrontal cortex only during pretending not to know. Overall, lateral and medial prefrontal cortices have general roles in deception, whereas the ACC contributes specifically to pretending not to know.

Imagined events, like AM and deception, also depicted frontal regions. In 2003, Conway, Pleydell-Pearce, Whitecross and Sharpe conducted a study assessing neuroanatomical differences between experienced autobiographical events and imagined events using electroencephalograpy (EEG). This method of study differs from PET and fMRI methods, in that it identifies more precisely *when* specific brain structures become active due to high temporal resolution as opposed to *which* structures are activated due to very low spatial resolution. Both kinds of memory led to increased activation of the left frontal regions reflecting the operation of control process in accessing and evaluating

knowledge in memory. However, memories for experienced events contain sensory-perceptual episodic knowledge found in the occipital regions, whereas memories for imagined events contain generic imagery generated from frontal regions. Although, contrary to most AM, confabulation, deception and trauma related studies whereby a right brain or bilateral PFC activations are found, imagined events most often activate left regions.

Self Reference Effect (SRE).

Whether we are assessing real versus imagined events, truth versus deception, or straightforward episodic memory, the aforementioned studies have one main component in common, the self. The phenomenon labeled the "Self Reference Effect (SRE)" (Symons & Johnson, 1997) was developed to assess differences between the "self and other processes. This phenomenon simply suggests that words processed with reference to the self are generally better remembered than material processed in semantic terms (Rogers, Kuiper & Kirker, 1977). Recent studies support the notion that a sense of self is associated with the prefrontal cortex (Frith & Frith, 2003; Gallagher, 2000; Gusnard, Akbudak, Shulman & Raichle, 2001; Meares, 1999). In particular, activation in the right medial prefrontal-cortex during self-referential *encoding* in normal participants has been a reliable finding (Craik et al., 1999; Kelley, Lloyd, Nurmikko & Roberts, 2002). When adding emotions as a component of the self, results are not solely specific to the right medial prefrontal cortex. In studies focusing on the explicit *retrieval* of emotional stimuli, brain activation is found in regions associated with episodic memory and brain structures associated specifically to emotion such as the amygdala, insula, basal ganglia and ventral

prefrontal cortex (Dolan, Lane, Chua & Fletcher, 2000; Maratos, Dolan, Morris, Henson & Rugg, 2001).

Others have evaluated the role of emotion during retrieval when encoding occurred in a self-referential mode (Fossati et al., 2004). Their findings suggest that recognition of self encoded positive and negative words when compared to other non self encoded words, are associated with the right medial prefrontal cortex during self encoding as well as a set of brain areas comprising lateral prefrontal regions, premotor cortex, parietal and occipital cortex, caudate and cerebellum. Within these brain regions, the recognition of negative self encoded words involved greater activity in the right hemisphere regions than positive words.

All in all, the interpretation of neuroimaging results is not an easy task given that studies vary in their methods and in their participants. Although we have reached a point where the ability to correctly identify broad areas of activation is possible, pinpointing exact structures at this time would be premature.

Current Study

In summary, if we are to resolve the recovered memory debate, a false memory should be defined as the creation of an entirely new memory, and this definition should be the standard and sole definition across false memory studies. Clearly, having false memories may not necessarily be detrimental to ones mental state. However, in the context of recovered memories of childhood sexual abuse, having a false memory could lead to horrific consequences. Laboratory research has affirmed that memory is a blend of fact and fiction and therefore malleable. For this reason, corroboration is essential for confirmation of authenticity. Moreover, susceptibility to memory change does not only

apply to normal memories but to emotional/traumatic memories as well. Change in memory occurs in many ways with leading or suggestive techniques being the most problematic. The use of these methods almost always leads to change in memory and therefore must not be employed in memory retrieval. Although to date false memory research has broadened and honed our knowledge on this topic, the controversy still remains. Therefore, some have turned to cognitive neuroscience for a different perspective. This method of study has begun to elucidate key psychological and neurological aspects of memory. However, little to nothing has been accomplished when we speak of a false memory that would directly address the recovered memory debate. That is, an entirely new and created autobiographical memory.

For this reason, the present study was designed as an initial attempt to resolve this debate by alleviating two major concerns and limitations that have hindered progress in the field. Specifically, the first limitation is the diverse use of a false memory definition, and the second limitation is the lack of ecological validity of simulated cases. Therefore, the use of individuals claiming to have been abducted by space aliens was imperative to enable us to study autobiographical memories that have been entirely created, and address clinicians' needs for real life experiments therefore alleviating the two aforementioned limitations. Specifically, the use of these participants' memories rather than the use of simulated ones had the advantage of the experimental conditions being real life cases.

The purpose of this study was two-fold: 1) to determine whether fMRI could distinguish between a false and a real memory while considering and eliminating the major concerns that plague false memory research; and 2) to identify the neural processes

associated with these memories. To achieve these objectives, we investigated activity during 4 memory recall conditions: 1) self false memory; 2) self real memory; 3) other false memory; and 4) other real memory. The *self false memory* (FM) condition consisted of the participant's memory regarding their encounter with space aliens. This condition could also be viewed as honest lying given the assumption that it never really happened, but that the participant honestly believes it did.

The *self real memory* (RM) condition consisted of a normal emotional memory provided by the participant. The *other false memory* (OFM) condition and *other real memory* (ORM) condition consisted of the participant learning another participant's memories regarding an encounter with space aliens and a normal emotional memory. These two conditions also served as a comparison baseline to the FM and RM conditions.

Every participant provided their *own* space alien encounter memory and their *own* normal emotional memory. In addition, *every* participant was provided with the *same written script* of the 'other' false and 'other' real memory to learn and respond to questions in the scanner. A participant who did not participate in the study provided these scripted memories. However, the questions in the scanner regarding these two memories (OFM and ORM) were structured in a manner that forced the participant to respond as if these memories were in fact their own. Specifically, the participant was asked to *pretend* to have experienced these memories by lying in the scanner. Therefore, conditions OFM and ORM were also viewed as intentional lying.

The rationale for utilizing conditions 3 and 4 in such a study, stems from the notion that false memories are in fact not real, thus, similar to lying, and studies using fMRI have revealed clear differences between responding truthfully and responding with

a lie (Jou et al., 2004; Spence et al., 2001; Ganis, Kosslyn, Stose, Thompson & Yurgelun-Todd, 2003). Therefore, it would be interesting to assess whether conditions OFM and ORM reveal the same or a different pattern of activation as the FM condition. If the results did reveal the same pattern of activation, then fMRI would not be a good measure in distinguishing between intentional lying and honest lying.

In this exploratory analysis, our hypotheses were the following:

1) If personality traits and/or cognitive abilities were related to incidences of false memory of alien encounters, then we would expect a significant difference between participants who reported having had an alien encounter compared to normal controls on questionnaires assessing schizotypy and on the Stroop task.

2) If lying has a longer response time, then the RM condition would have a faster response time than all other conditions because this condition includes only real memories and all other conditions are a variation of lying.

3) If real and false memories were associated with different brain processes, then real and false memories contrasted with their baseline would be discriminated with reasonable and quantifiable accuracy by correlating with different patterns of brain activity.

4) If the FM condition is in fact an instance of "honest lying" or confabulation, then the intentional lying conditions (conditions OFM & ORM) contrasted with truth conditions (conditions FM and RM) would

reveal a pattern of activation seen in self-referential processing studies, and in deception findings when reverse contrasts are made.

5) If the two distinct types of memories are treated differently according to the normalcy of their content, then when combining condition FM and OFM (unusual memories) and condition RM and ORM (usual memories), we would expect to see a distinguishable difference in the brain activity patterns between these types of memories.

Methods

Participants

Twenty (5 females and 15 males) right-handed English-speaking volunteers, aged between 21 and 54 years old, were recruited from ads in local newspapers and local university campuses. The ads stated: "We are looking for right-handed volunteers, age range 18 to 50 years, who believe they have had an encounter with extraterrestrial life to participate in a study of memories and brain imaging. Specifically, a task will be performed during MRI (magnetic resonance imaging) scanning" (see Appendix A). These participants constituted of the ET group.

All 20 participants joined in session 1 (filling out questionnaires and performing the Stroop task). Twelve of the 20 participants (3 females and 9 males) completed the fMRI part of the experiment. All 12 participants reported a memory of having had an encounter with extraterrestrial life. Participants were screened and excluded if they exhibited: 1) current or past psychiatric impairments; 2) current or past neurological impairments; and 3) had a history of alcohol or drug abuse; 4) or regularly take psychotropic drugs or anti-depressants (see psychosis screener Appendix B and fMRI screener Appendix C). In addition, they were required to conform to standard health and safety regulations regarding the use of MRI (e.g., no metallic implants in their bodies, etc) (Appendix D).

Twenty additional participants (8 females and 12 males) were recruited to participate in session 1. These participants did not have a memory of an encounter with extraterrestrial life and were excluded from all fMRI related tasks. These participants constituted the control group and their data were used for comparison purposes to the

schizotypal measures (see below for a description of these measures) and the Stroop task. The study was approved by the Research Ethics Board of the Montreal Neurological Institute and by the Concordia University Ethics Board (see Approval Appendix E), and written informed consent was obtained from all participants (see consent form Appendix F).

Materials and Tasks

Beck depression inventory-II (BDI-II; Beck et al., 1996): The BDI-II is a 21 item self-report measure of depressive symptoms over the past two weeks. Each item is rated on a 4-point Likert scale (0–3). The absence of depressive symptoms is defined below a score of 12 points, a moderate depression between 12 and 17 points and a clinically relevant depression at 18 points or above. Total scores of 30 points or above are rated as severe depression (see Appendix G).

Schizotypal personality questionnaire (SPQ, Raine, 1991): The SPQ is a 74 item true/false self report instrument designed to cover all nine criteria (ideas of reference, social anxiety, magical thinking, unusual perceptions, odd behavior, lack of close friends, odd speech, restricted affect, and suspiciousness) of schizotypal personality disorder defined by the third edition, revised, of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IH-R;* American Psychiatric Association, 1987). It was designed for research on the correlates of schizotypal features in the normal population. This instrument contains three scales; Cognitive Perceptual, Interpersonal, and Disorganized. Some examples of scale items are: (1) Cognitive Perceptual: ”Have you ever had the sense that some person or force is around you, even though you cannot see anyone?” (2) Interpersonal: “People sometimes find me aloof and distant’’; (3) Disorganized: “People

sometimes comment on my unusual mannerisms and habits". The range of possible scores on the SPQ is 0 to 74 (see Appendix H).

Magical ideation scale (MIS, Eckblad & Chapman, 1983): The MIS is a 30-item true/false inventory. It is a measure of magical ideation. That is, this scale taps uncommon experiences and deviations in information processing and logic reasoning. Higher scores on the MIS are associated with greater magical ideation. The range of possible scores on the full MIS is 0 to 30. Some examples of this scale are: "I have felt that there were messages for me in the way things were arranged, like in a store window"; or "I have sometimes been fearful of stepping on sidewalk cracks" (see Appendix I).

Multidimensional schizotypal traits questionnaire (MSTQ, Rawlings and McFarlane, 1994): The MSTQ is a 74-item yes/no questionnaire. This inventory measures three subscales of schizotypy: 1) *Positive schizotypy*, which refers to characteristics of reality distortion, such as magical ideas, unusual perceptions and referential ideas; 2) *Negative schizotypy,* referring to patterns of social isolation, anhedonia and restricted affect; and 3) *Impulsive* nonconformity, referring to characteristics of impulsive-type personality, social anxiety and maladjustment behaviors. The range of possible scores on the MSTQ is 0 to 74 (see Appendix J).

Stroop neuropsychological screening test (SNST Trennery et al. 1989): The Stroop task is administered in two conditions, Color and Color–Word: *The Color condition* consists of a sheet of 112 printed color names (red, green, blue, tan) arranged in four columns of 28 names. The names are printed in one of four different colors of ink (red, green, blue, tan), but no name is printed in a matching color (e.g. the name RED is

never printed in red ink). The participant is required to read the words aloud as quickly as possible (irrespective of the color ink in which they are printed), and is allowed up to 120s to read the words. *The Color–Word condition* is the same as the Color condition sheet, except for the order of the color names. In this condition the participant is required to name aloud, as quickly as possible, the color of the ink in which the word is printed. The participant is allowed up to 120s in which to name the colors. For each condition, five variables were measured: (1) the number of items completed in 2 min; (2) the number of errors; (3) the total score, calculated by subtracting the number of errors from the number completed; (4) the error rate, calculated by dividing the number of errors by the total number completed; and (5) the time to complete all 112 items. To assess whether the color-word condition created any interference, three variables were measured: (1) the total interference score, calculated by subtracting the total correct score of the color-word condition by the total correct score of the color condition; (2) the interference error rate, calculated by subtracting the error rate of the color-word condition by the error rate of the color condition; (3) the interference time to complete all 112 items, calculated by subtracting the total time of the color-word condition by the total time of color condition.

Tasks completed by the ET group.

The extraterrestrial interview: This interview consisted of gathering detailed accounts of the participants' extraterrestrial memory (i.e. FM) (see Appendix K). From the participants' detailed transcription of their memory (see Appendix L for a sample of a participant's memory), Thirty questions were formulated to be used in the fMRI scanning session (see sample of questions Appendix M).

The emotional memory interview: This interview consisted of gathering detailed accounts of the participants' real emotional memory (i.e. RM) (see Appendix N). From the participants' detailed transcription of their memory (see Appendix O for a sample of a participant's memory), thirty questions were again formulated (see sample of questions Appendix P).

The participants were given two stories and were instructed to learn these stories very well and pretend that these memories were their own. The two stories included an alien encounter story (i.e. OFM) and an emotional story (i.e. ORM) (Appendix Q). Thirty questions were formulated for each story (Appendix R). These stories were actual memories of one of the participants not used in the scanning session. The same two stories were given to everyone in the ET group.

Of the initial 20 participants, 4 did not want to participate in the scanning session and another 4 were discarded due to data corruption [e.g. too many artifacts, head movement, etc.]. Twelve ET participants remained and were scanned using fMRI at the Montreal Neurological Institute.

Experimental design/procedure for the ET group.

The experiment was divided in three parts: Pre-session, Session 1, and Session 2 (scanning session).

Pre-session: The pre-session consisted of a telephone interview. During this interview, the participant was informed about the nature of the study (see purpose of study Appendix S) and that it would involve fMRI. If the participant agreed to collaborate further, he/she was briefly screened for psychopathology and fMRI exclusions [e.g. any metallic objects in the body (see telephone screener Appendix T)]. If

the participant met criteria for this study, a brief summary of session 1 (see session 1) was provided. In addition, the participant was asked to think about a personally significant emotional memory and to be prepared to provide this memory to the investigator. An appointment was then scheduled.

Session 1 (Two weeks prior to the scanning session): The participant met with the principal investigator and signed the consent form. Following obtained consent, the participant was interviewed to rule out psychopathology. Further, the he/she participated in the extraterrestrial interview and the emotional memory interview. Both these memories were audio recorded and transcribed. Following these interviews, the participant was asked to fill out the schizotypy questionnaires and to perform the Stroop task. The participant was then provided with the two stories (i.e. OFM and ORM) and was instructed to read and learn them very well. They were informed that in the scanner, he/she would be required to respond to questions referring to these two stories as if they were their own personal memory (i.e. intentional lying). For example, if the question asked: Where were you when the alien appeared? The response required would be the one in the story. Finally, the participant was told that 30 questions would be developed and presented in the scanner for each memory (i.e. FM, RM, OFM, ORM), for a total of 120 questions. Their task was to respond truthfully to all memories keeping in mind that they needed to pretend that the OFM and the ORM were also their own memories. The data provided information that targeted the 4 conditions mentioned in the section entitled "current study".

Session 2 (scanning session): The participant met with the principal investigator at the MNI. Consent for fMRI was obtained (see fMRI consent form Appendix U) and

scanning instructions were verbally provided. The participant met with the technician, changed into scanning clothing and got into the scanner for testing. A total of 120 questions/responses and 60 baseline questions/responses (a series of XxX's forming a question/answer) were administered in counterbalanced and pseudo-random sequence in two computer administered experimental runs of 20 minutes of duration and were then followed by a T1 anatomical scan (approximately 15 minutes). The inclusion of 60 baseline questions/answers was to obtain a good estimate of baseline activity.

The experiment began with a 0.5s fixation cross (e.g. +), followed by a 1s *cue* word to orient the participant's mind towards the memory that was asked next. The cue words were the following: "ET1" for their own extraterrestrial memory; "Event 1" for their own emotional memory; "ET2" for the 'other' extraterrestrial memory; and "Event 2" for the 'other' emotional memory). Following the cue word, a question was presented at the top center of the screen for 11s. After 6s into the question, two responses appeared at the bottom of the screen (one response on the right and the other on the left) for 5s. The responses included a correct response and an incorrect response. The participant was instructed to respond accurately/honestly at all times by using a designated two-button (right and left) keypad. The participant was compensated 50$ for their participation in the fMRI task (see reimbursement form Appendix V).

Experimental design/procedure for the control group.

The experiment was divided in two parts: Pre-session, and Session 1.

Pre-session: The pre-session consisted of a telephone interview. During this interview, the participant was informed about the nature of the study (see purpose of study Appendix W) and that it would involve participation in filling out schizotypy

questionnaires and performing the Stroop task. If the participant agreed to participate further, he/she was briefly screened for psychopathology. If the participant did not meet the criteria for psychosis, an appointment was then scheduled.

Session 1: The participant met with the principal investigator and signed the consent form. Following obtained consent, the participant was interviewed to rule out psychopathology (See psychosis screener), filled out the questionnaires and performed the Stroop task.

Data Acquisition

FMRI and structural data were acquired at the Montreal Neurological Institute on a 1.5 T Siemens Sonata scanner (Siemens, Germany). A vacuum cushion was used to stabilize the participant's head within the head coil. The stimuli text were generated by an IBM PC laptop computer running E-PRIME (Psychology Software Tools, Pittsburgh, PA) and presented via a LCD projector and a mirror system attached to the participant head coil. A mouse connected to the laptop computer was used to record the participant's responses. Functional T2*-weighted images were acquired with blood oxygenation level-dependent (BOLD) contrast (477 volumes per run, TR=2500ms, TE=50ms, flip angle =90°, FOV= 256mm, matrix=64 x 64), covering the entire brain (25 interleaved slices parallel to the anterior-posterior commissural plane; in-plane resolution 4 x 4; 5mm thickness). Following the functional session, a high-resolution T1-weighted anatomical volume was acquired using a gradient echo pulse sequence (TR=22ms, TE=9.2ms, flip angle=30°, voxel size 1 x 1 x 1mm^3). The entire experiment consisted of two fMRI runs and a structural run and lasted approximately an hour.

Data Analysis

FMRI data was processed and analyzed using the Statistical Parametric Mapping (SPM2) software package (Wellcome Department of Cognitive Neurology, London, UK) modified for fMRI (Friston et al., 1995) and implemented in Matlab (Mathworks Inc., Sherborn, Mass., USA). Image preprocessing was performed following a standard procedure (Ashburner & Friston, 1997). The first 8 volumes of each run were discarded because of spin saturation effect. The remaining T_{2*} volumes were time-corrected to account for differences in sampling times for different slices, realigned to the first image in their respective run, normalized into standard MNI space (Talairach & Tournoux, 1998), and spatially smoothed with a 10 mm (FWHM) isotropic Gaussian kernel.

A two-step mixed-effect general linear model was used for further analysis. The stimulus onsets for each event type, synchronized with the acquisition of the middle slice were modeled using a 6s long boxcar function convolved with the canonical hemodynamic response function (HRF). The 6s boxcar consisted of the onset of the question to the moment just before the responses appeared. This boxcar represented the best opportunity to assess memory recall for that particular memory without the contamination of the responses.

Four event types were modeled: 1) FM; 2) RM; 3) OFM; 4) ORM. These estimates for each participant were entered into a second level random effects model. This analysis allowed us to compare the brain activity associated with the evaluative processing when comparing each event with the other. However, the analysis included HRF for only accurate responses. The analyses were conducted using a threshold of 0.001, uncorrected for multiple comparisons, including simple comparisons, main effects

and interactions. Following the simple comparisons, a 2 X 2 repeated measures analysis of variance (ANOVA) was conducted for each main effect (self-referential processing and type of memory). The dependent variables consisted of the areas determined by the main effects and interaction.

Results

Questionnaire Analysis

Out of 40 participants who completed the questionnaires, 20 reported having an alien encounter (ET group) whereas the remaining 20 did not have such an experience (control group). Ages of the participants ranged from 21 to 54 with a mean age of 31 for the ET group and 33 for the control group. According to scores on the BDI-II, there was an absence of depressive symptoms in both groups ($M = 7.45$ for the ET group, $M = 1.75$ for the control group) even though the ET group endorsed a significantly higher number of depressive symptoms than the control group ($t(38) = 5.211$, $p < 0.001$).

To assess our first hypothesis, we compared the performance obtained on schizotypy measures and on the Stroop task between the two groups. If the ET group would score significantly higher on schizotypy measures and would show more interference on the Stroop task when compared to the control group, then previous studies would be corroborated.

Independent sample t-tests revealed significantly higher scores for the ET group compared to the control group on the MIS, SPQ and MSTQ [$t(38) = 6.89$, $p < 0.01$; $t(38) = 5.842$, $p < 0.01$; $t(38) = 6.96$, $p < 0.01$, respectively]. For the SPQ and MSTQ subscales, independent sample t-tests revealed significant differences between the two groups on several subscales. The ET group depicted significantly higher scores on the following SPQ subscales: ideas of reference; excessive social anxiety; odd belief or magical thinking; unusual perceptual experiences; and odd and eccentric behavior. In addition, the ET group revealed significantly higher scores on several MSTQ subscales: perceptual aberration; magical ideation; cognitive disorganization; physical anhedonia;

and impulsive nonconformity. Results of the scales and subscales are presented in Table 1.

Table 1

Means, Standard Deviations, and T-values for all Questionnaires

	ET Group		Control Group		
Scale (full score)	M	SD	M	SD	(t values)
BDI (30)	7.45	4.59	1.75	1.71	5.21**
MIS (30)	10.95	3.53	3.80	3.00	6.90**
SPQ total score (74)	13.70	4.88	6.25	2.95	5.84**
Ideas of reference (9)	1.85	1.60	.70	.92	2.79**
Excessive social anxiety (8)	1.45	.76	.50	.69	4.15**
Odd belief or magical thinking (7)	2.30	1.03	.95	.95	4.32**
Unusual perceptual experiences (9)	1.65	.93	.55	.69	4.25**
Odd or eccentric behavior (7)	1.20	1.01	.35	.49	3.40**
No close friends (9)	1.55	1.64	.95	1.28	1.29
Odd speech (9)	1.30	1.03	.85	.88	1.49
Constricted affect (8)	1.10	.79	.90	.72	.84
Suspiciousness/paranoia (8)	1.20	1.47	.50	.78	1.89
MSTQ total score (74)	19.15	4.85	9.15	4.21	6.97**
Perceptual aberration (13)	2.80	1.36	1.10	1.21	4.18**
Magical ideation (13)	6.05	1.79	1.60	1.90	7.62**
Cognitive disorganization (7)	2.80	1.19	1.25	1.25	4.01**
Paranoid ideation (6)	.95	1.19	1.40	1.05	-1.29
Physical anhedonia (14)	2.45	1.54	1.45	1.36	2.18*
Social anhedonia (8)	1.70	1.53	.95	.89	2.01
Impulsive nonconformity (13)	2.35	1.35	1.40	1.60	2.03*

Note. n = 20 for ET group; n = 20 for Control group. * $p < 05$. ** $p < .001$ for the test of the ET group versus the Control Group

Stroop Task

The Stroop task revealed a similar pattern of results. Average number of errors, average reaction times (RTs) and error rates were calculated for each condition and displayed in Table 2.

Table 2

Average Number of Errors and Response Times, and Error Rates of the Color, Color-Word, and Interference Conditions in the ET and Control Group

Group	Color			Color-word			Interference		
	NC	RT	ER	NC	RT	ER	NC	RT	ER
ET group	110.40	62.58	0.52	96.50	117.41	2.20	1.3	54.79	1.69
Control Group	111.85	61.01	0.05	109.40	103.82	1.80	1.0	42.74	1.76

Note. NE = number of correct responses; RT = reaction times (measured in seconds); ER = error rates in percentage

When we compared the total score difference between the color condition and the color-word condition to determine the error mean between the two groups, the ET group exhibited a mean of 13.90 errors whereas the control group exhibited an average of 2.45 errors. Therefore, the results revealed that in the color-word condition, the number of errors were significantly higher for the ET group than the control group [$t(38) = 5.994$, $p < 0.01$]. However, the interference error rate between the two groups failed to reach significance [$t(38) = 0.36$, $p = 0.71$] suggesting that the interference error rate within

each group was similar. We were also interested in between-group comparisons of reaction time interference. The results depicted that the ET group took significantly longer than the control group to perform the color-word condition than the color condition ([$t(38) = 2.72$, $p < 0.01$]).

fMRI Results

Behavioral fMRI results.

Participants were generally accurate in selecting truthful responses across the four conditions. The mean proportion for accurate responses for each condition ranged from 87% to 93% with the ORM condition revealing the lowest accuracy rating, the OFM and RM conditions scoring 93% and the FM condition scoring 91%. Only truthful response data were considered in the analysis process. See Table 3 for a detailed description of accurate response ratings across participants.

Table 3

Accuracy ratings of all 12 participants

Participants	FM	RM	OFM	ORM	SELF (FM + RM)	OTHER (OFM +ORM)
1	97	77	75	78	86	77
2	77	81	90	66	83	73
3	87	96	100	83	93	90
4	93	100	87	97	90	98
5	87	96	93	90	90	93
6	93	82	97	95	95	89
7	93	97	93	96	93	97
8	96	97	93	100	95	98
9	87	93	86	77	86	85
10	93	100	97	93	95	97
11	97	100	100	87	98	93
12	93	100	100	87	97	93

Note. Scores are in percentages. FM = false memories; RM = real memories; OFM = other false memories; ORM = other real memories; SELF = their own personal memories; OTHER = other person's memories.

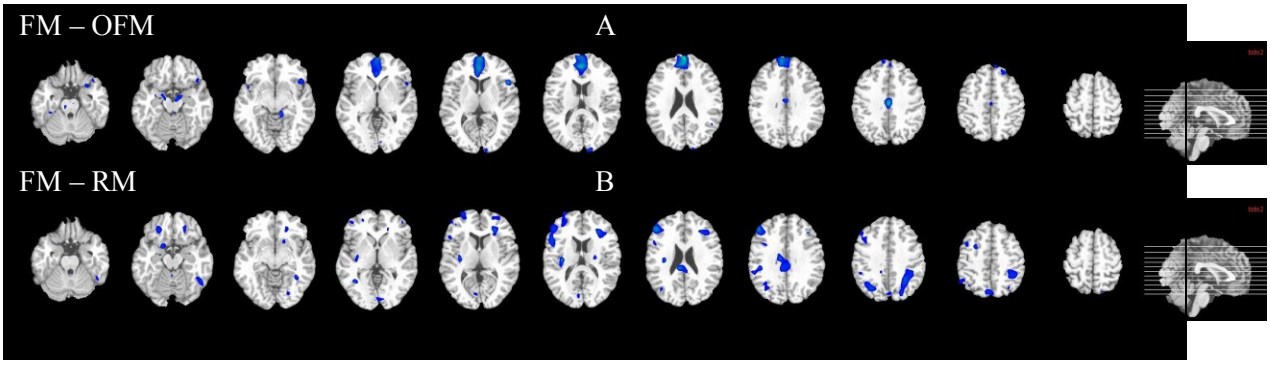
Reaction time data.

To assess our second hypothesis, mean reaction time was analyzed to investigate whether truthful responding had a faster reaction time than non-truthful responding. The mean reaction times were: FM = 2.537s; OFM 2 = 2.313s; RM = 2.327s; ORM = 2.226s. The data were analyzed using a one-way repeated measures ANOVA. A significant difference in response time ($F(3,11) = 5.49$, $p. < 0.01$) was observed among the four

memory tasks. Post hoc tests using a Bonferroni correction revealed that responses to the FM condition were significantly slower when compared only to the ORM condition ($p. < 0.03$). In addition, a two-way repeated measures ANOVA with the participants' response time to their own memories (FM, RM) and other memories (OFM, ORM) as factors, revealed significant main effects for both factors [i.e. own memories: $F(1,11) = 6.925$, $p. < 0.023$; other memories: $F(1,11) = 6.429$, $p. < 0.028$]. No interaction was found ($F(1,11) = 1.677$, $p. = 0.222$).

fMRI group results.

Group analyses were initially conducted to assess changes in blood oxygenation levels among all four conditions when contrasting one with the other. Twelve contrasts were conducted (i.e. FM-OFM; OFM-FM; FM-RM; RM-FM; FM-ORM; ORM-FM; OFM-RM; RM-OFM; OFM-OFM; OFM-ORM; RM-ORM; ORM-RM). Out of the 12 contrasts, two (OFM-FM and ORM-FM) did not reveal any changes in blood oxygenation levels. Specifically, both "other" memories did not contribute any additional activation when contrasted from the participant's own false memory. The remaining 10 contrasts revealed increased blood flow in several regions (Figure 1).



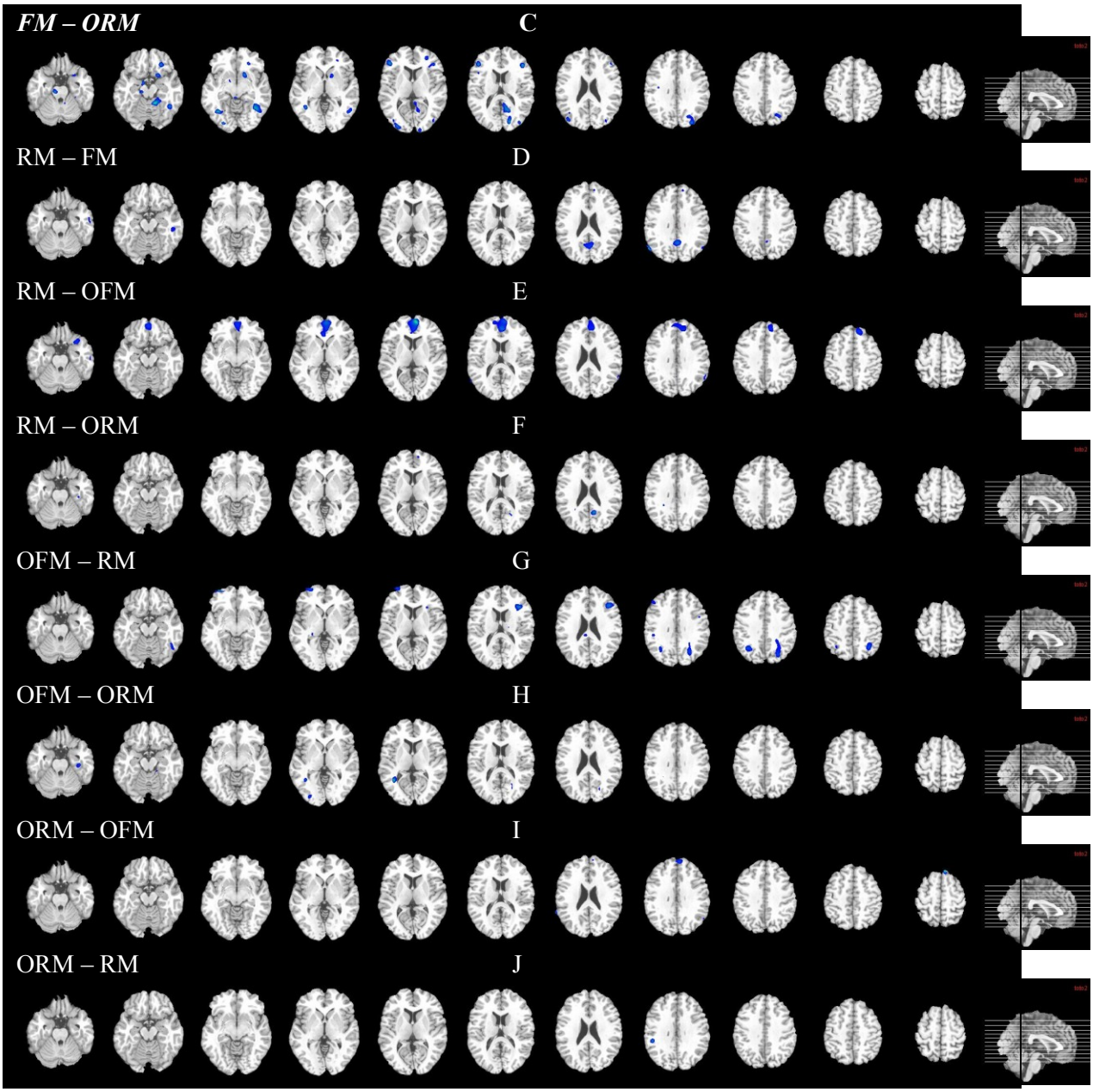


Figure 1. Group analysis (n = 12) showing significant differences in brain activation when comparing all possible contrasts between the four conditions. 10 contrasts revealed significant brain activation. Images are displayed over a Talairach-normalized template in radiological convention. Significant thresholds for all contrasts were set at $p < .0001$.

In general, the FM condition seemed to be the only one that resulted in little to no brain activation when reverse contrasts were conducted with the exception of activity in the right temporal angular gyrus during the RM minus FM contrast (Figure 1D).

Analyses related to our third hypothesis investigated whether real and false memories can be discriminated if they are associated with different brain processes when contrasted with the control conditions. Comparisons of blood oxygen levels in the true and false conditions to the control conditions (ORM & OFM respectively) revealed that the FM condition was characterized by a different pattern of brain activation when compared to the RM condition (Figure 1 A & F and Table 4 & 5). Therefore, based on these two contrasts our hypothesis was supported and provided evidence that the processing of real memories and false memories is correlated with different patterns of brain activity.

Table 4

Location of Bold signal change for FM – OFM (False memory – control)

Region	BA	MNI Coordinates x	y	z	p value	T score
		Right-brain activations				
Parahippocampal Gyrus		16	-2	-12	0.000	6.89
Pons		8	-26	-22	0.000	5.08
Cerebellar Tonsil		-12	-46	-36	0.000	4.92
Culmen		34	-34	-26	0.000	4.65
Superior Temporal Gyrus	38	44	10	-12	0.000	4.57
Inferior Semi-Lunar Lobule		50	-72	-36	0.001	4.16
Temporal Lobe, Sub-Gyral		48	-12	-14	0.001	4.15
Amygdala		28	-4	-16	0.001	4.09
		Left-brain activations				
Anterior Cingulate Gyrus	32	-2	18	42	0.000	7.40
Inferior Frontal Gyrus	45	-52	20	10	0.000	7.05
Occipital Lingual Gyrus		-10	-84	-2	0.000	5.82
Culmen		-14	-38	-8	0.000	5.64
Pons		-10	-12	-18	0.000	5.52
Frontal Sub-Gyral		-24	-6	-40	0.000	5.20
Inferior Frontal Gyrus	47	-30	14	-22	0.000	4.82
Uncus		-20	4	-30	0.000	4.51
Temporal Supramarginal Gyrus		-50	-54	26	0.001	4.33
Inferior Parietal Lobule	40	-64	-40	28	0.001	4.05
Parietal Supramarginal Gyrus	39	-58	-62	34	0.00	4.04

Note. Estimated Brodmann's areas and coordinates are from Talairach and Tournoux (1988). All activations greater than $p \leq 0.001$ are reported.

Table 5

Location of BOLD signal change for RM – ORM (Real Memory minus Control)

Region	BA	MNI Coordinates x	y	z	p value	T score
		Right brain activations				
Parietal, Sub-gyral		26	-42	30	0.000	6.47
		Left brain activations				
Limbic precuneus	31	-14	-56	26	0.000	5.85
Parahippocampal gyrus		-40	-26	-22	0.000	4.66
Medial Frontal Gyrus		-14	56	12	0.001	4.39

Note. Estimated Brodmann's areas and coordinates are from Talairach and Tournoux (1988). All activations greater than $p \leq 0.001$ are reported.

Further, when the conditions are compared to each other (i.e. FM minus RM), a number of regions are activated (Figure 1B, Table 6). The FM condition reveals an additional pattern of brain activation not found in the RM condition. These additional regions may be linked to unusual or false extraterrestrial memories.

Table 6

Location of BOLD signal change for FM – RM (False Memory minus Real Memory)

Region	BA	MNI Coordinates ***x***	***y***	***z***	p value	T score
		Right brain activations				
Insula		32	-20	20	0.000	10.41
Posterior Cingulate Gyrus		6	-32	26	0.000	8.41
Middle Frontal Gyrus		46	36	28	0.000	7.87
Parietal Precuneus		28	-68	38	0.000	6.31
Frontal Sub-Gyral		22	26	-12	0.000	6.04
Superior Frontal Gyrus		26	8	54	0.000	5.86
Inferior Parietal Lobule		44	-32	32	0.000	5.66
Superior Frontal Gyrus	10	26	66	10	0.000	5.59
Middle Frontal Gyrus		14	8	-18	0.000	5.26
Middle Frontal Gyrus	46	50	50	6	0.000	4.53
Occipital Cuneus	17	4	-78	12	0.001	4.28
Occipital Lingual Gyrus		20	-78	4	0.001	4.18
Anterior Cingulate Gyrus		6	30	28	0.001	4.15
Parietal Angular Gyrus		46	-58	34	0.001	4.13
Superior Parietal Lobule	5	22	-40	62	0.001	4.10
		Left brain activations				
Limbic Uncus	20	-28	-2	-40	0.000	7.26
Frontal Sub-Gyral		-30	36	10	0.000	7.23
Parietal Sub-Gyral		-30	-56	42	0.000	6.27
Temporal Sub-Gyral		-40	-48	-6	0.000	5.82
Inferior Semi-Lunar Lobule		-42	-64	-38	0.000	4.87
Hippocampus		-26	-14	16	0.000	4.87
Inferior Frontal Gyrus	10	-48	50	2	0.000	4.83
Occipital Lingual Gyrus		-8	-88	-2	0.000	4.75

Occipital Lingual Gyrus	-26	-76	-8	0.000	4.71
Middle Frontal Gyrus	-24	58	6	0.000	4.68
Lentiform Nucleus, Putamen	-18	14	-6	0.000	4.49
Middle Frontal Gyrus	-24	6	46	0.001	4.35
Pons	-12	-40	-32	0.001	4.29
Frontal Sub-Gyral	-32	14	14	0.001	4.05

Note. Estimated Brodmann's areas and coordinates from Talairach and Tournoux (1988). All activations greater than $p \leq 0.001$ are reported.

Parameter estimates of the Blood Oxygenation Level-Dependent signal (BOLD).

To assess our fourth and fifth hypotheses, the specificity of several main regions for the successful retrieval of truthful/self-referential content and content related to unusual type memories was also tested. This procedure was accomplished by calculating the parameter estimates of the BOLD activation observed in the peak voxel of each of these main regions. Repeated measure ANOVA's were conducted to determine these main effects.

More specifically, for our fourth hypothesis, we pooled the participants' responses of their "own" memories (FM & RM) and compared the data to the participants' responses to the "other" memories (OFM & ORM) to identify brain regions specifically associated to the successful retrieval of truthful responding compared to intentional lying. The results of this contrast were not only informative in confirming or disconfirming previous deception findings when reverse contrasts are made, but they added credence to studies assessing 'self-referential' responding.

The results revealed mainly prefrontal and limbic activations associated with truthful or self-referential responding when contrasted from intentional lying [Figure 2 (truth/self (FM + RM) – lie/other (OFM + ORM), table 7]. When the reverse contrast was conducted, the intentional lying condition showed brain activation only in the left superior parietal lobule.

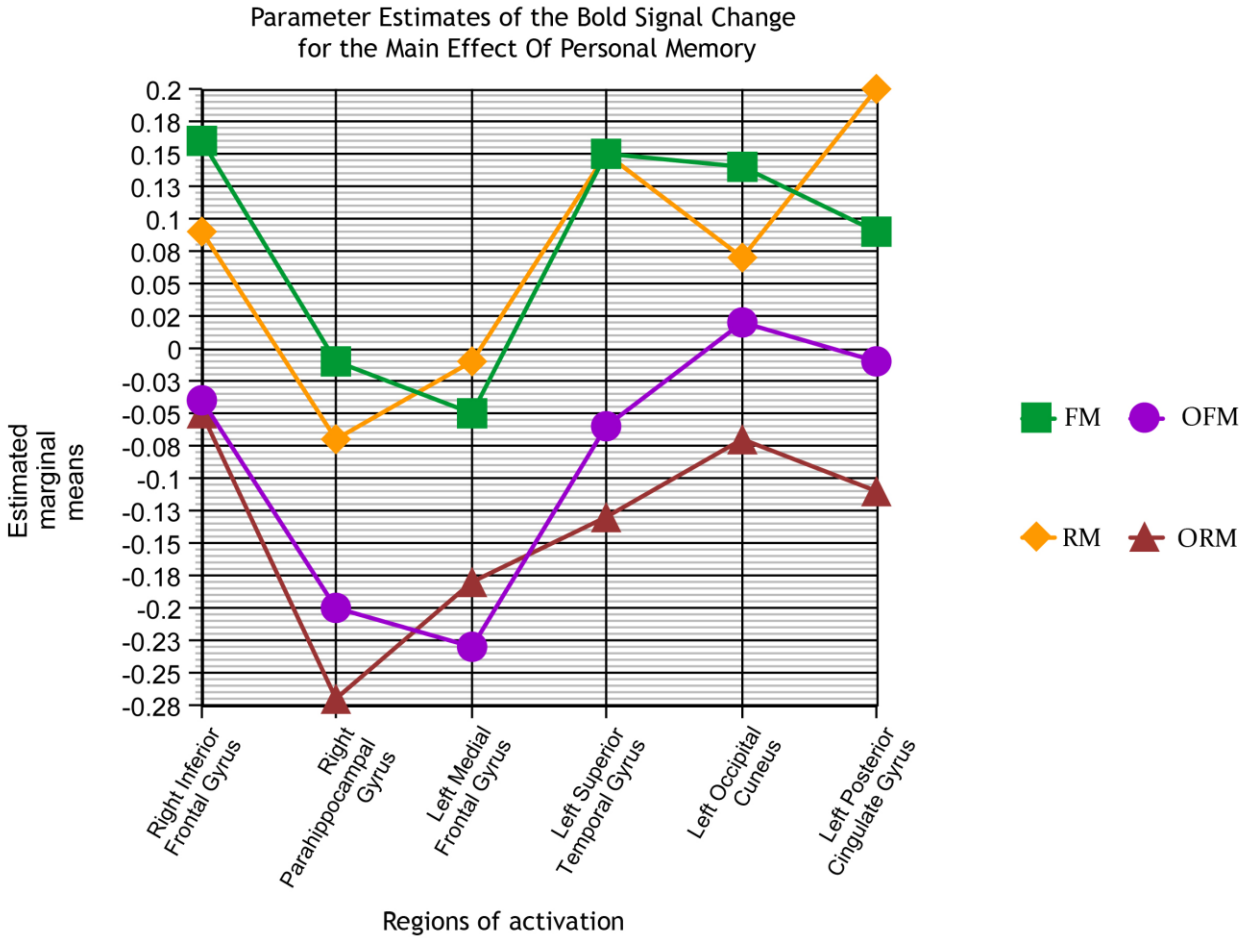


Figure 2. Group analysis (n = 12) brain activation for the main effect of Personal Memory: Truthful/Self – Lie/Other (FM + RM minus OFM + ORM).

Table 7

Parameter estimates of the BOLD signal in the peak voxel of the main target regions specific to the successful retrieval of truthful/self content (contrast: [FM & RM] minus lie/other content [OFM & ORM])

Truthful content regions	R/L	BA	Peak voxel			*F* value	Effect Size
			X	Y	Z		
Inferior Frontal Gyrus	R		48	30	0	176.95	.94
Parahippocampal Gyrus	R		24	-12	-20	69.77	.86
Medial Frontal Gyrus	L		-10	44	18	332.51	.97
Superior Temporal Gyrus	L	38	-38	16	-32	15.63	.59
Occipital Cuneus	L		-16	-84	8	188.57	.95
Posterior Cingulate Gyrus	L		-8	-56	22	121.89	.92

Note. Estimated Brodmann's areas and coordinates from Talairach and Tournoux (1988). All activations greater than $p \leq 0.001$ are reported.

For our fifth hypothesis, we pooled the participants' responses of "unusual" memories (FM & OFM) and compared the data to the participants' responses to "usual" memories (RM & ORM) to identify brain regions specifically associated to the successful retrieval of unusual content compared to usual content. The results revealed activation in multiple regions of the brain including but not limited to bilateral prefrontal activations, bilateral occipital lingual gyrus and right anterior cingulate [Figure 3 (unusual (FM + OFM) – usual (RM + ORM), table 8]. When the reverse contrast was conducted, retrieval of usual content showed brain activation only in the right superior temporal gyrus and left superior frontal gyrus.

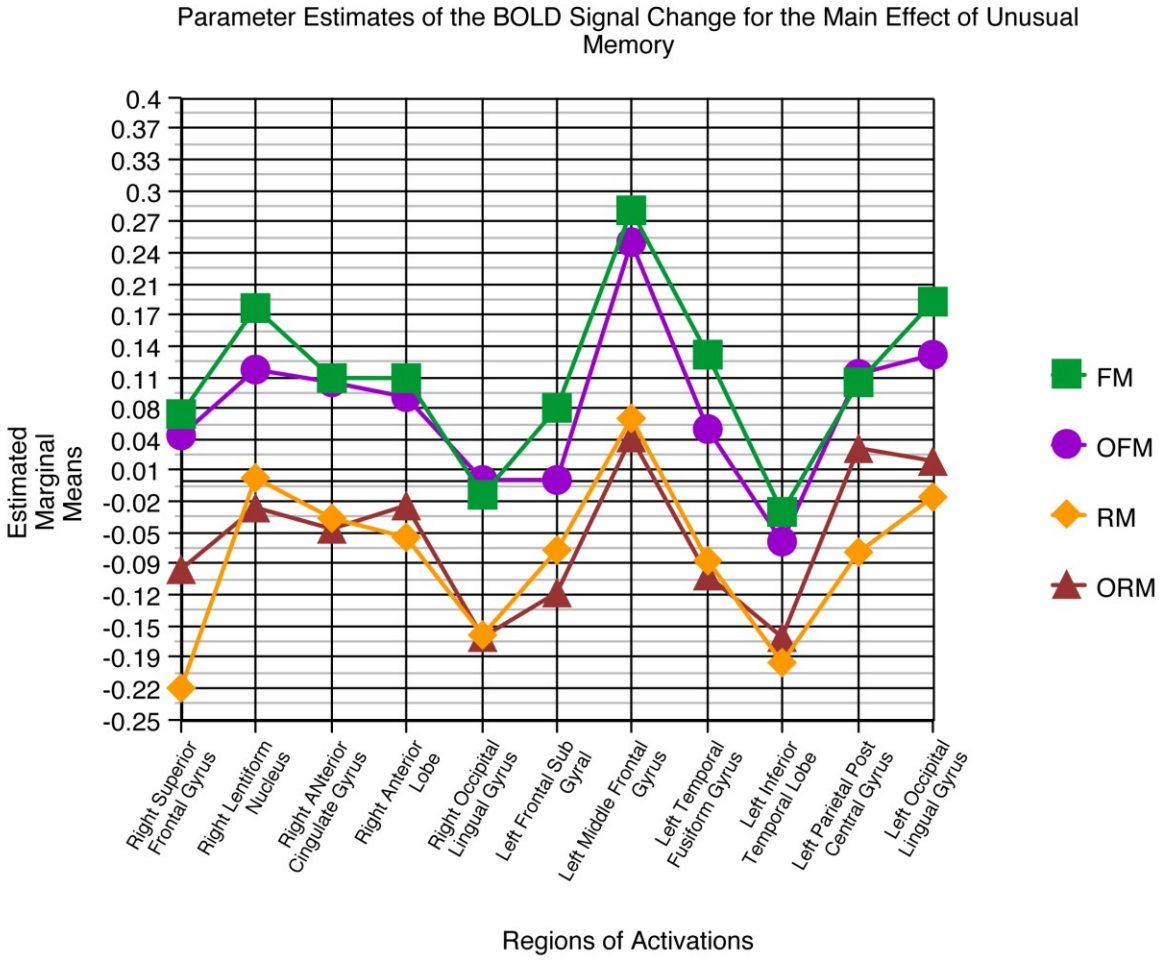


Figure 3. Group analysis (n = 12) brain activation for the main effect of Unusual Memory: Unusual – Usual (FM + OFM minus RM + ORM).

Table 8

Parameter estimates of the BOLD signal in the peak voxel of the main target regions specific to the successful retrieval of unusual content (contrast: [FM & OFM] minus usual content [RM & ORM])

FM/unusual content regions	R/L	BA	Peak voxel			*F* value	Effect Size
			X	Y	Z		
Superior frontal gyrus	R	9	46	38	32	61.90	.85
Lentiform Nucleus Putamen	R		18	6	-4	43.11	.80
Anterior Cingulate	R		10	12	22	44.14	.80
Anterior Lobe	R		14	-58	-24	33.58	.75
Occipital Lingual Gyrus	R	19	26	-60	0	63.84	.85
Frontal Sub-Gyral	L		-24	12	-14	68.57	.86
Middle Frontal Gyrus	L		-46	30	22	125.95	.92
Temporal Fusiform Gyrus	L		-46	-52	-16	124.11	.92
Inferior Temporal Gyrus	L		-36	-4	-36	10.82	.50
Parietal Postcentral Gyrus	L		-36	-32	52	46.68	.81
Occipital Lingual Gyrus	L		-26	-78	-8	74.76	.87

Note. Estimated Brodmann's areas and coordinates from Talairach and Tournoux (1988). All activations greater than $p \leq 0.001$ are reported.

The regions depicted in tables 7 and 8 yielded significant main effects of personalization of memory (self – other) and type of memory (unusual – usual) respectively.

Significant interactions were also observed in four right hemispheric regions (see figure 4). Repeated measure ANOVA's yielded significant interactions of the lateral

globus pallidus ($F(1,11) = 17.18$, $p = .002$), the superior frontal gyrus ($F(1,11) = 29.29$, $p < 0.001$), the parietal supramarginal gyrus ($F(1,11) = 38.79$, $p < 0.001$) and the limbic lobe ($F(1,11) = 26.55$, $p < 0.001$). These four regions showed greater BOLD signal and increased activation specifically to the condition "False Memory" when compared to all other conditions.

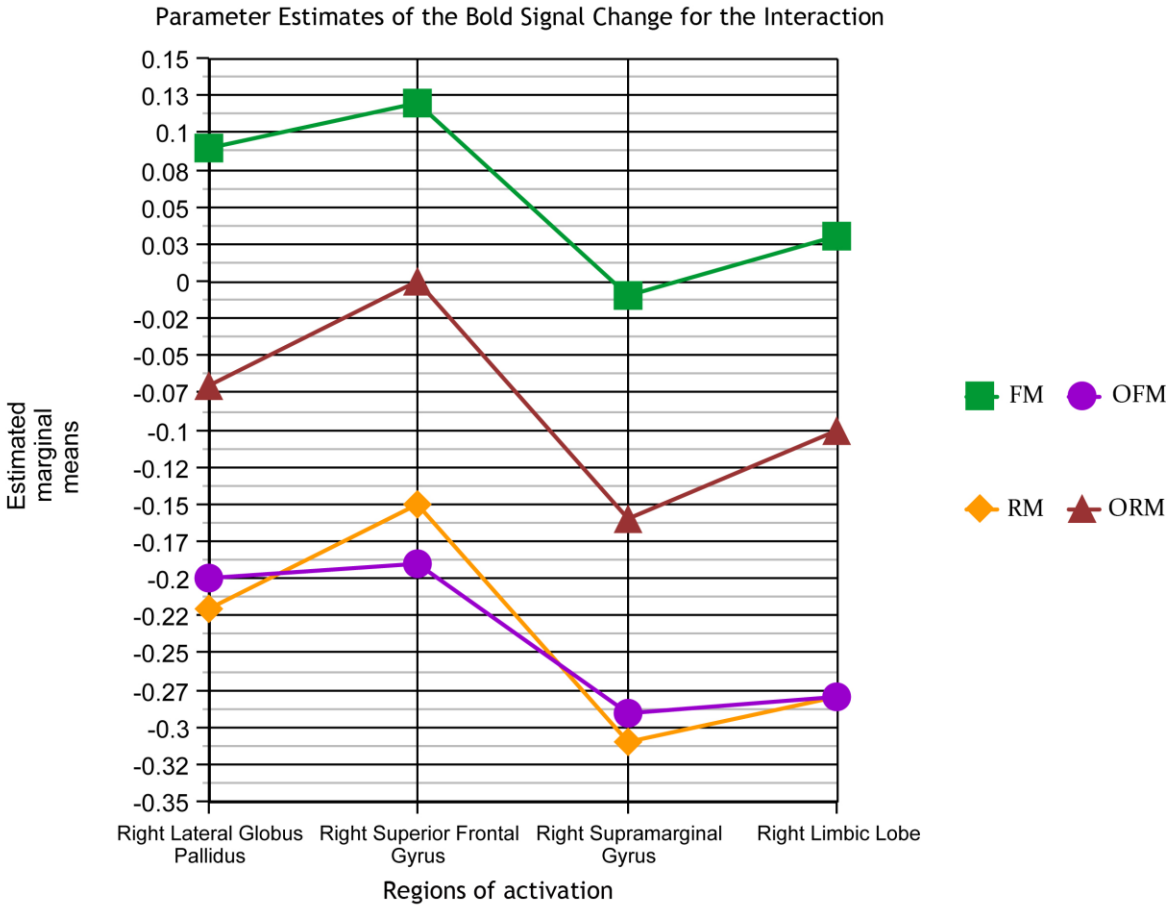


Figure 4. Parameter estimates of the BOLD signal observed in the peak voxel of the right lateral globus pallidus (26 –10 -4), the right superior frontal gyrus (22 38 -20), the right supramarginal gyrus (64 –48 34) and the right limibic lobe (26 0 -42) for four conditions of interest (FM, OFM, RM, and ORM). Peak voxel was obtained from the contrast [(FM + OFM) minus (RM + ORM)] minus [(FM + RM) minus (OFM + ORM)]

Discussion

Alien Abduction Correlates

Many have focused on personality correlates to give some indication of susceptibility to the development of alien abduction and other false memories. The literature often finds high scores on schizophrenia and schizotypy related measures as a distinguishing feature within the population of alien abductees. However, scoring high on these measures does not imply they are mentally ill (Bloecher, Clamar & Hopkins, 1985; Mack, 1994; Parnell & Sprinkle, 1990). In fact, it is possible that there is overlap between the alien abduction experience and items on these instruments that might result in higher scores on schizotypy measures.

To assess whether our participants were actually experiencing a false memory and were not merely suffering from a mental illness, we interviewed every participant and our results confirmed previous findings that people who claim to have been abducted by aliens are free from mental disease. These findings have been supported throughout the last two decades. In one of the earliest studies, Spanos, Cross, Dickson and DuBreuil, (1993) compared differences in psychopathology among three groups: people who had reported intense UFO-related experiences (communicating with aliens); those who had reported non-intense experiences (e.g. seeing unidentified lights in the sky); and people with no such experiences. This study differed from our study in that we did not have a group with non-intense related experiences; nevertheless, our results are similar in that psychopathology was not found.

Since mental illness does not account for these false memories we investigated whether certain personality correlates do. The literature mainly has focused on schizotypy

and magical thinking as two main correlates associated with alien abduction, therefore, replicating previous findings was imperative to add credence to linking such specific personality correlates to this population (Eckland & Chapman, 1983; Rawlings & MacFarlane, 1994; Thalbourne, 1994). Our results revealed higher scores on schizotypy and magical thinking for the ET group compared to the control group. This suggests that individuals with paranormal experiences can be differentiated from people without such experiences by revealing higher scores on the measures employed in this study. Furthermore, it could be argued that scoring high on schizotypy and magical thinking, one is more prone to creating false memories. This line of thinking is consistent with Bell's et al. (1997) research stating that high scores on magical thinking provide a better chance of creating an effective and imaginative framework to account for odd experiences.

Moreover, Clancy et al. (2002) employed the DRM method in addition to schizotypy related measures and magical thinking scales, to ascertain that abductees are more susceptible to false memories. Their results confirmed our findings and strongly suggested that proneness to magical thinking and schizotypy are characteristics that would indeed correlate with heightened susceptibility to false memories. However, the investigation looking precisely at what dimensions/factors of schizotypy correlate with false memory is warranted to ascertain that the measured items are not just overlapping with a UFO experience. It should be noted however that the conclusions drawn from our findings are limited to individuals reporting extraterrestrial contact and not for belief in extraterrestrial life.

Furthermore, there is now some evidence that disturbances in attentional processes are present in individuals scoring high on schizotypal measures. This evidence could help in understanding the mechanisms involved in the creation of a false memory by understanding the connection between an alien encounter false memory and schizotypy. The attentional disturbance is generally characterized in terms of having difficulty inhibiting or ignoring irrelevant stimuli while attempting to selectively attend to relevant stimuli (e.g., Garmezy, 1977); taking the form of having difficulty with controlled attention (e.g., Cohen & Servan-Scheiber, 1992); or having difficulty with sustained attention (Bergida & Lenzenweger, 2006).

Generally, schizotypy groups like schizophrenia groups show significantly longer reaction times and make significantly more errors than control groups on the Stroop task (Barch, Carter & Cohen, 2004; Kieffer et al. 2006). Our findings partially supported these studies. Our ET group did indeed make more errors than our control group, however, the error rate between these two groups was similar. However, the response time of the ET group was significantly slower than the control group.

Based on these findings, our groups were not significantly dissimilar. Therefore, slower response times and a higher amount of errors made by the ET group would not necessarily point to dysfunctional attention, it could merely suggest that the control group was faster and more careful than the ET group at mentally processing information because of secondary (e.g. motivation) rather than primary effects. Therefore, the attentional differences as revealed in the ET group are not necessarily due to deficits in selective attention, but rather suggest a generalized difficulty in both the color and color-word condition. All in all, these results only partially confirm the idea that high

schizotypy leads to disturbances in attentional processes. In other words they are consistent with this proposition, but can also be explained by other factors for instance, differential reactivity: the ET group may feel especially pressured by the tests or may feel especially "under the microscope".

Reaction Time Data/Behavioral Data

The present study examined behavioral and functional anatomical responses associated with the four memory tasks. The participants performed the memory tasks with high accuracy, with the lowest accuracy rating (87%.) belonging to the OFM task. All other memories received accuracy ratings of 91% and above. Reaction times showed a significant main effect of 'personal' memories and of 'other' memories with the FM condition responding slower then the RM condition, and the OFM condition responding slower than the ORM condition. The FM condition received the slowest reaction time compared to the other three conditions.

Studies supporting our findings have reported latency data in the DRM procedure, arguing that latencies may be more sensitive to false recognition items. Jou et al. (2004) found that false recall RTs were consistently slower than true recall RTs and this is consistent with other studies latency data in the DRM procedure (Brown, Buchanan & Cabeza, 2000; Fabiani, Stadler & Wessels, 2000). Interestingly however, our study contributes to the literature on false memory RT data by employing a different technique than the DRM method. Adding data from a real world false memory perspective and not a simulated one only adds credence to RT data by solidifying the notion that false memory recall leads to slowed RT regardless of the technique employed.

To some extent, this trend of results replicates those found in previous neuroimaging studies on deception (Spence et al., 2001; Ganis et al., 2003). These studies generally deal with two types of deception: overt deception (intentional lying) and concealed deception (unintentional lying). In these studies, concealed deception revealed longer reaction times than overt deception suggesting that the cognitive processes associated with concealed deception are more complex than those associated with overt deception or truth telling for that matter. Therefore, our study is comparable to deception studies seeing as our 'overt' deception conditions was our OFM and ORM conditions, and our 'concealed' deception was the FM condition. However, more research on how overt and covert deception differs is warranted to understand the underlying mechanism of such a complex cognitive process.

Despite the aforementioned analysis, longer RT for the FM condition might instead be explained by differential reactivity in that the participants' eagerness to join in a study related to their paranormal belief system, may have led them to focus more intensely to the FM related questions then the questions of the other conditions. Overall, RT data is another measure employed to differentiate between true and false memories, however results should be interpreted with caution given that this measure alone is insufficient to draw definite conclusions. Additional evidence stemming from diverse methods is needed to generate a comprehensive understanding of the nature of false memories.

FMRI Discussion

Whereas many studies have examined neural correlates of successful memory retrieval, our study added the examination of brain activity associated with the retrieval

of 'false' memories. This study was exploratory in nature, and aimed at differentiating false memories from all other types of memories, and assessed whether or not a false memory reveals the same pattern of brain activation as remembering a real memory or a deception.

False memory versus baseline.

With event-related fMRI, we succeeded in observing neural correlates associated with false memories. To ascertain false memory activation, we compared the FM condition with the control condition (OFM) in order to eliminate the unusual aspect or ET part of the memory and remain true to activations associated with a personal false memory retrieval only. Our prediction was that real and false memories when contrasted with their baseline could be discriminated with reasonable and quantifiable accuracy.

Although false and real memory retrieval did show some similar activation, the FM condition depicted additional activity in different areas. Indeed, there was greater activation in the left ACC, left ventrolateral prefrontal regions and subcortical regions such as the right amygdala and parahippocampal regions and visual areas in occipito-parietal regions for false memory retrieval. Whereas, mainly left MTL regions (i.e. limbic precuneus, parahippocampal gyrus) and medial frontal gyrus and visual-spatial regions were associated with real memory retrieval. Clearly, there is a distinguishable difference between these two conditions. However, the activated regions found in both false and real memory retrieval have been reported in typical autobiographical memory studies with some variations depending on the research design and whether they included emotional and/or neutral memories (Denkova et al, 2006; Dolcos et al, 2005; Gardini et al, 2006; Greenberg et al, 2005; Vandekerckhove et al, 2005). This suggests that both false and

real memories included in this study are autobiographical in nature. Therefore, a false memory is as personal as a real memory.

Although early neuroimaging studies revealed little to no difference between true and false memory retrieval, our results support more recent studies that found a distinguishable pattern between true and false recognition (for review, see Schacter and Slotnick 2004). It is noteworthy to mention that these studies are specifically looking at a sensory signature differentiating true from false recognition which suggests that true memory, more than false memory, is preferentially associated with the reactivation of sensory/perceptual processing that occurred during an encoding phase. A direct comparison of our results to the ones found in evidence supporting the sensory signature theory is futile at this time given that our methodological design does not permit for such comparisons given that our study was only retrieval based without an encoding phase.

It is worth mentioning, that previous fMRI studies that found differences between true and false memories, whether attempting to confirm a sensory signature or not, revealed more activation for the true condition rather than the false condition (Slotnick & Sachter, 2004; Kim & Cabeza, 2007). We on the other hand found the opposite effect. A possible explanation to account for this difference is the methodology employed to assess a false memory. These studies used a variation of the misinformation paradigm and created false memories of words or objects, or used the DRM method, whereas we employed a real false memory. Differences in the results could be due to such methodological variations. For example, in DRM studies, the false memory construct may be contaminated with "guessing". A lack of concrete memory, supplemented with a

strong enough feeling of familiarity could lead them to guess that something was seen, when in fact it was not, confounding the data altogether. In our study, this is not an issue.

Interestingly, the pattern of activation revealed by our false memory condition is similar to the results found by Rauch et al. (1996) PET study that exposed 8 PTSD to audiotaped scripts narrating the individual's trauma (also known as script-driven imagery). The similarities in our results suggested that our ET group might have experienced their encounters as very emotional and potentially traumatic.

However, a major limitation of Rauch's study was the lack of a control group making it difficult to assess whether a non-traumatized individual would exhibit a similar pattern of activation. In an attempt to replicate Rauch et al. findings and add credence to their results, Shin et al. (1999) included a control group and found similar results as Rauch et al. without activation in the amygdala. The lack of amygdala activity is also reported in other trauma related studies using variations of the script driven paradigm (Bremner et al, 1999, Lanius et al, 2001).

Nevertheless, our results did detect activation in the amygdala during false memory retrieval. The amygdala is usually associated with emotional experiences, and when a study does not include a control group it is difficult to decipher whether amygdala activation is indeed associated with traumatic experiences or whether the addition of a non-traumatized group exposed to trauma related information would eliminate this finding. Although our study confirmed Rauch's results possibly because we also used a within group design, we also tried to account for this problem by employing the 'other' emotional memories (OFM and ORM) as our control conditions in order to maintain equality in memory type.

False memory versus real memory.

To further assess the nature of the false memory condition, a look at our FM-RM contrast was warranted to evaluate whether the data resembled the findings of false memory research or deception research. This contrast eliminated all activations associated with retrieval of a personal memory in order to specifically assess its "false" aspect. The contrast revealed right ACC, right posterior cingulate, right dorsolateral, right cuneus and precuneus activations, bilateral occipital lingual activations, bilateral orbital frontal regions, and parietal regions with more activation on the right hemisphere, left inferior parietal lobe, limbic uncus, hippocampus and putamen. These results coincide with those found in autobiographical and deception studies (Abe et al., 2008; Cabeza & St Jacques, 2007; Gilboa, 2004; Kozel et al, 2004b; Lee et al, 2002; Spencer et al., 2004) and therefore imply that these regions are important in false memory (honest lying) retrieval. Despite the diversity of paradigms and scanning parameters used to date, most studies have found activation in the ACC and the prefrontal cortex, as areas involved in deceptive responding (Abe et al., 2008; Kozel et al, 2004b; Lee et al, 2002; Spencer et al., 2004).

Furthermore, most deception studies show activations mediated via the right hemisphere, which support our results as well. Stuss, Gallup and Alexander (2001) found a significant correlation between damage to the right medial frontal areas, the right anterior cingulate, and the number of errors made when committing deceit. This evidence suggests that the right hemisphere plays an important role in deception detection; however, neuroimaging evidence has not consistently confirmed these findings (Ganis et

al, 2003; Lo, Choong & Tan, 2003). Therefore, it is possible that fMRI may be detecting tan unconscious deceptive or false aspect of the alien encounter memory.

There is also evidence of a right hemisphere predominance when processing emotions (Stirling et al., 2001). In this case, our FM findings could not only be interpreted as deception but as the processing of the statement's emotionality as well. There is strong evidence that processing of negative emotions is lateralized to the right hemisphere (Davidson, 1992; Bellamy & Shilcock, 2007). Marchewka et al. (2008) investigated whether the left and right hemisphere are differentially activated in false recognition when negative emotional stimuli is presented. They found that false recognition occurred significantly more often when emotionally negative pictures were used compared to emotionally neutral stimuli, and that the right hemisphere PFC is more involved in these memory distortions. This is in line with our right hemisphere PFC findings suggesting that the emotionality of our FM condition may have significantly increased the probability that they will be falsely interpreted as a real memory. However, this interpretation is based on the assumption that the participants processed their alleged alien encounter as a negative experience. Although an alien encounter might appear frightful to most individuals, a future study ascertaining the participants' emotional state for their encountered experience is warranted. Altogether, these results suggest that exposure to negative emotional content may facilitate the formation of false memories and may strengthen the involvement of the right PFC.

When we speak of negative emotional stimuli, previous studies have reported an association between negative emotional stimuli and activation of the ACC. Kelly, Loyd, Nurmikko & Roberts (2007) assessed whether the retrieval of autobiographical memories

triggered by pain related words activated the ACC and found significantly greater activation of the ACC, more than memories triggered by non-pain words. This again is also in line with our ACC activation, however, we are now faced with a conundrum. Is our ACC activation related to emotionality (assuming negative emotionality as mentioned above), or deceit, or both? Given the potential combination of both the emotional and the deceptive nature of the FM condition, it is difficult to draw conclusions about the role of the ACC due to the alternate viewpoints that could potentially explain its role. A study exploring these alternatives is warranted.

Main effects.

In an attempt to potentially clarify and solidify a little further the role of our FM condition. The analyses of two main effects were conducted. The first main effect enabled us to clarify and strengthen which brain activations are associated with self-referential retrieval/truth telling and deception. Whereas the second main effect allowed us to verify which brain activations are associated with the psi/paranormal phenomenon and assess whether it differs from normal/usual type memories.

We predicted that the first main effect would confirm activations seen in self-referential studies and in deception studies. The neural correlates of self-referential retrieval found in other studies are activations in the ventral and dorsal prefrontal regions, posterior cingulate, medial and lateral parietal cortex, and the parahippocampus. In addition, Marchewka et al. (2008) have suggested that episodic retrieval necessarily involves the concept of self and reported that this involvement is signaled by enhanced activity in the medial prefrontal cortex. Indeed, our study confirms this finding as well, and found activations (contrast: [FM & RM] minus [OFM & ORM]) in the left medial

frontal gyrus, and in regions such as the right inferior frontal gyrus, right parahippocampal gyrus, left superior temporal gyrus, left posterior cingulate gyrus, and the left occipital cuneus. Interestingly, Kelley et al. (2002) and Fossati et al. (2003; 2004) also found activations in the mPFC and posterior cingulate, however, the condition was a self-encoding condition where the participant made a judgment on whether or not the presented words (trait adjectives) described them. Although our study only assessed retrieval processes and not encoding ones, our activations are similar to those found in encoding of self-referential conditions as well. In fact, our retrieval activations might reflect the reactivation of self/true and other/lie memory traces formed during encoding. Although our data may provide direct support for retrieval reactivation for self/true memories, a study assessing both encoding and retrieval properties is needed.

Activation of these medial prefrontal and posterior regions is also consistent with previous studies of self-referential personality processing (Craik et al., 1999; D'Argembeau et al., 2005; Fossati et al., 2003; Heatherton et al., 2006; Kelley et al., 2002; Kjaer, Nowak & Lou, 2002; Schmitz, Kawahara-Baccus & Johnson, 2004) and confirms that these regions are important for representing self-knowledge.

The representation of self-knowledge in these studies is usually established by the use of a SRE (Self Referential Effect) paradigm. Various aspects of the self-referential paradigm involve the recognition of one's own physical appearance, awareness of one's own actions, and knowledge of one's own personality traits and abilities. As was mentioned in the introduction, this phenomenon simply suggests that words processed with reference to the self are generally better remembered than material processed in semantic terms (Rogers et al., 1977). Given the association to the mPFC, many have

concluded that a sense of self is dependent upon the integrity of the prefrontal cortex (Frith & Frith, 2003; Gallagher, 2000; Meares, 1999). If this conclusion is accurate, than it is reasonable for us to have similar activations given the "sense of self" aspect of our study even if our design is retrieval based only. Interestingly however, encoding and retrieval processes are strongly interdependent (Tulving & Thomson, 1973) and as mentioned earlier the neural mechanism in encoding and retrieval overlap considerably in that the cognitive operations performed during retrieval reinstate those performed during encoding (Prince, Tsukiura, Takashi & Cabeza, 1999).

Although the main regions associated with self-encoding or self-retrieval are areas in the medial PFC, our findings depicted more areas than the medial PFC. In fact, activation of the cuneus and parahippocampal gyrus revealed that visuospatial imagery played a key role in these memories as well. Personal memories are usually richer in sensory details than laboratory memories and therefore explained these activations found in our 'self' conditions and not in our 'other' conditions. Interestingly however, areas related specifically to emotion such (e.g. amygdala) were not specifically activated in our contrast [FM & RM] minus [OFM & ORM]), even though our study called for emotional memories. This also suggests that the comparison conditions (OFM & ORM) were also equally emotional to the participant even though the comparison memories were not personalized. Nonetheless, the lack of emotional activations for personal memories remains an enigma given that it would be expected for personal memories to be slightly more emotional than non-personal emotional memories. Conversely, it could be that the memory had extinguished the emotionality of its content given that the task called for more detail-oriented facts to be remembered than emotions or feelings which also could

explain the lack of current ACC activation in comparison to previously found activation in relation to negative emotional content.

Interestingly, our second main effect analysis (contrast [FM & OFM] minus [RM & ORM]) investigating the psi/paranormal phenomenon did activate the ACC. Additional activations associated with memories of paranormal content were found in bilateral PFC and lingual gyrus, right lentiform nucleus and in the left temporal and fusiform gyrus.

Moulton and Kosslyn (2008) directly investigated differences in activation between psi and non-psi stimuli. Their design consisted of scanning twins that played one of two roles: "sender" or "receiver"; in order to assess telepathy, clairvoyance and precognition. There results revealed no difference between psi and non-psi stimuli. Their results evoked widespread but indistinguishable neuronal responses with the exception of one participant that revealed increase activity in the superior temporal gyrus with the most activity occurring in the left hemisphere. Pizzagalli et al. (2000) investigated differences between belief and disbelief in paranormal phenomena using electroencephalography (EEG). They pre-screened their participants and divided them in two groups: believers and non-believers of paranormal phenomenon and assessed brain electrical activity during resting with open or closed eyes. They found a pattern of increased brain electrical activity in the right hemisphere for believers. Our results contradicted both of these studies. Our psi/paranormal condition combined personal and non-personal paranormal memories and revealed, distinguishable differences and activations in both hemispheres with the majority of the activations in the left hemisphere when compared to usual/normal type memories.

The inconsistent differences between their findings and our study may be related to two main reasons. Firstly, there is a limited amount of neuroimaging studies assessing paranormal phenomena, therefore, the conclusions drawn are developing and tentative. Secondly, the methodologies used to investigate this phenomenon are diverse and often encompass different objectives. As a result, it is difficult to draw confirmatory or convincing conclusions when the foundation of this topic is just beginning to form.

Nevertheless, an important finding emerged from the analysis of these two main effects. Namely, the role of the ACC and other deception (BA 9) related activations. Although it was expected for the deception activations to emerge in the 'other minus self' main effect, given that the 'other' conditions involved only deception, such findings did not materialize. Luckily, the emergence of deception related activations were found in the psi/paranormal conditions suggesting that these activations may be linked to paranormal phenomena whether it is a 'believed' real memory (FM) or an overt lie (OFM). However, the involvement of the ACC does not necessarily mean that deception is taking place, it could likely be that the participant is always monitoring the information or content of the memories. With normal type memories, the monitoring process seems to be low key, whereas when there is abnormal information this process seems to be more active. Furthermore, seeing as deception related activations did not surface in the self-referential analysis, suggests that the "personal" or "self reference" aspect was taking precedence over the distinct type of memory (usual vs. unusual type), therefore, deception correlates did not materialize. Based on these findings, one can conclude that the FM condition is associated with a manifestation of deception and not overt deception. We cannot conclude that the participants were aware that the memory was a lie given that deception

correlates did not materialize during the self/other main effect analysis that included the FM condition. It is probable that in the FM condition, the participant was responding in an honest manner even though the recollection of the event was false. Thus, we could tentatively conclude that the FM condition is related to honest lying and fMRI can possibly detect it.

The interaction analysis revealed activation of four main regions located in the right hemisphere specifically linked to the FM condition: the superior frontal gyrus; the lateral globus pallidus; the supramarginal gyrus; and the limbic lobe. The FM condition revealed increased activation in these four areas when compared to the other three conditions. The same pattern of activation occurred regardless of whether we were comparing type of memories (unusual/usual) or when comparing personalization of memories (self/other). We could theorize that these four regions are specific to the FM condition in that these regions are linked to *personal paranormal* type memories and could be argued that this is a signature for false memories.

Asymmetric activations in the right hemisphere seem to be a general finding in our study. As mentioned earlier, there is a right hemisphere predominance when reporting retrieval of emotional autobiographical memories (Cabeza & St Jacques, 2007; Gilboa, 2004). It appears as though our FM condition has been internally processed in the same manner as a real emotional autobiographical memory. As for the four regions of activation, at first glance, these activations appear both confusing and conventional. Based on our findings, two of these four regions were expected to some degree, namely the limbic lobe and the superior frontal gyrus. However, the addition of the lateral globus pallidus and supramarginal gyrus posed an interpretation problem. Upon further

investigation, the amalgamation of these four regions as neural correlates of our false memory condition proved to be an ideal union. For example: the limbic lobe (inferior temporal gyrus) is a structure related to emotional memory; the lateral globus pallidus is associated with confabulation, that is, the false part of the memory; the superior frontal gyrus is linked to self awareness which explains the personal aspect of the memory; and the supramarginal gyrus is connected to dreaming and schizophrenia which is associated with the paranormal nature of the memory (Bellamy & Shillcock, 2007; Boisgueheneuc et al., 2006; Cunha et al., 2009; Frey & Ptrides, 1999; Goldenberg, Schuri, Dromminger & Arnaold, 2009; Grindrod, Bilenko, Myers & Nlumstein, 2008; Kessels, Kortrijk, Wester & Nys, 2008; Lavoie, Willoughby & Faulkner, 2006; Mamah et al., 2007; Markowitsch et al., 2000; Niznikiewicz et al., 2000; Repetto et al., 2007; Torrey, 2007; Schider, 2001, 2003; Schnider, Treyer & Buck, 2000; Wang et al., 2008; Witte, Engelborghs, Verhoeven, Deyn & Marien, 2008). These four regions were significantly more active in the FM condition than the other three conditions suggesting that the FM condition was significantly more emotional, personal, false, and schizotypy related. Taken together, it can be theorized that the union of these four regions are directly linked to a paranormal false memory. However, this theory requires further testing and corroboration mainly because this type of false memory has never been investigated.

The inferior temporal gyrus (limbic lobe) has been associated with depression, pain, disgust, and PTSD (Bremner et al., 2003; Hamame et al, 2011; Surguladze, El-Hage, Radua, Gohier & Phillips, 2010; van Heeringen et al. 2010), however, it has also been associated with schizophrenia (Berges et al., 2011; Benes, 2004; Levitt, Bobrow, Lucia & Srinivasan, 2010; Meisenzahl et al. 2008). Specifically, Berge et al. 2011

showed a reduction in Gray Matter (GM) volume in the inferior temporal gyrus. This study compared structural MRI scans and clinical assessment of twenty-one drug naive first-episode subjects and 20 controls to determine brain areas reduced in first episode of psychotic subjects and its association with lack of insight and negative symptoms. Optimized voxel-based-morphometry analysis (VBM) was implemented to find between-group differences and correlations between GM volumes. Patients showed GM reduction in prefrontal and inferior temporal areas. Other studies have supported these findings (Benes, 2004; Levitt, Bobrow, Lucia & Srinivasan, 2010; Meisenzahl et al. 2008).

Although the lateral globus pallidus is typically associated with Alzheimer's disease, increased arousal and/or movement related disorders, and the supramarignal gyrus contributes preferentially to phonological and semantic aspects of word processing (Stoeckel, Gough, Watkins & Devlin, 2009), both these regions have also been associated to schizophrenia (Spence et al., 21997; Torrey, 2007). This suggests that the subjects might have experienced their alien encounter as a delusion.

Research on the supramarginal gyrus as being linked to schizophrenia has received relatively little attention until the last two decades when compared to the prefrontal cortex, hippocampus and cingulate cortex. More specifically, the inferior parietal lobule, consisting of both the supramarginal gyrus and angular gyrus, is the region more often reported, with less attention to the supramarginal gyrus alone. If this line of research reveals that the inferior parietal lobule (IPL) is connected to the delusional aspect of schizophrenia, then our theory regarding the supramarginal gyrus as a key structure involved in false memories (paranormal type) would begin to achieve plausibility. Torrey (2007) reviewed the medical literature for links between

schizophrenia and the inferior parietal lobule. This review partially supported our right hemisphere findings by reporting four studies examining asymmetry of the IPL in normal individuals compared to individuals with schizophrenia. Their studies revealed the right side to be larger anatomically for individuals with schizophrenia whereas the asymmetry was reversed for normal individuals.

Several studies have linked delusions of passivity ("one's thoughts or actions are being influenced or replaced by those of an external agent") to the IPL. One study in particular compared seven individuals with schizophrenia with passivity delusions, six without such delusions, and six normal controls and found the passivity delusions were associated with hyperactivation of the right supramarginal gyrus (Spence et al.,1997). This study supports our theory of the supramarginal association to false memories given that delusional passivity applies to the false memory condition since the external agent controlling the participants' thoughts and experiences could have been the aliens. Although these findings are a breakthrough in regards to how it applies to our false memory condition, the literature in this area specifically is sparse therefore conclusions cannot be drawn at this point. Nonetheless, these findings inspire further research on the supramarginal gyrus as a direct link to delusions as applied to false memories.

The globus pallidus like the supramarginal gyrus has also been linked to schizophrenia. The globus pallidus is one out of a collection of nuclei that make up the basal ganglia. Unfortunately, to date, the globus pallidus alone has not been reported as a main structure in schizophrenia studies. Instead, research has focused on the basal ganglia as a whole with some mention of the specific nuclei including the globus pallidus. Given that the association between the basal ganglia and schizophrenia is fairly new, it is

conceivable to expect more specific results in the future that may include a bigger role of the globus pallidus in schizophrenia. Research on the basal ganglia with respect to schizophrenia has mainly focused on total volume differences between a brain with schizophrenia and healthy controls. One study did analyze the relationship between individual basal ganglia structures and selected clinical and cognitive features associated with schizophrenia and found significant group volume differences of the right globus pallidus (Mamah et al., 2007). This study was exploratory in nature, nevertheless, the result are consistent with our right hemisphere asymmetry and globus pallidus findings. However, the direct association of their findings to ours is less clear given that their results do not speak directly to the delusional aspect of schizophrenia, hence, more research is clearly warranted.

Moreover, other studies found contradictory results. For example, Wang and et al. (2008) investigated the pattern of progressive changes in cortical gray matter volume over an extended period of time in the deep brain nuclei formation or deformation in schizophrenia and control participants. They hypothesized that structures with direct excitatory connections with the cortex (thalamus, striatum, hippocampus, and amygdala) would show changes over time (follow-up compared to baseline), whereas structures with indirect inhibitory connections with the cortex like the globus pallidus would not show any changes over time. Their results supported their hypothesis, which is in not line with our theoretical hypothesis in regards to the association between the globus pallidus and schizophrenia. Nevertheless, the relationship between neurotoxicity and gray matter volumetric reductions is unclear, because possibilities other than neuronal loss, including neuropil, water content, and synaptic pruning, may also account for reductions in gray

matter volume as detected by imaging studies. Taken together, the delusional aspect of schizophrenia has not been directly correlated to the globus pallidus even though some evidence suggests a promising future.

Confabulation research also describes the role of the basal ganglia. As was mentioned in the introduction, confabulation occurs when there is an organic problem, such as chronic infections, brain injuries, tumors, and other diseases. In a review by Schnider (2000) lesion sites could vary, but the common feature is that they either involve the posterior orbitofrontal cortex (OFC) itself or anterior limbic structures directly connected with it. The most common lesion site was the posterior OFC together with the basal forebrain. Our results did show activation of BA 11 supporting the OFC contribution to confabulation in addition to the globus pallidus. Recent studies have also supported these anatomical regions to be associated with confabulations (Glowinski, Payman & Frencham, 2008; Gilboa et al., 2006; Kessels et al., 2008). With this being said, although our OFC finding is consistent with other confabulation studies, our theory regarding the globus pallidus cannot be supported at this time given that a direct link to confabulation has yet to be discovered. A speculative false memory framework can however be entertained in regards to the globus pallidus as a relevant nucleus in our false memory condition. Seeing as research on the basal forebrain has revealed direct association to schizophrenia and confabulation, honing in on the sub-structures would be a necessity to confirm our theory.

All in all, the four regions found in our interaction are directly and indirectly linked to confabulation suggesting that our false memory condition may be more likely

associated with confabulation then false memory. All things considered, our interaction findings suggest that there is a close relationship to confabulatory memories.

Summary

Our results provide a clear demonstration that false memory retrieval can be differentiated from other types of autobiographical memories. Whereas prior neuroscience of false memory research has emphasized verbal associative paradigms (Okada & Stark, 2007; Roediger & McDermott, 2000), our findings add a new dimension to this research. Specifically, this study was the first to explore the underlying mechanisms of a non-simulated and non-created false memory retrieval based study with neuroimaging techniques.

This experiment focused on the neurobiology of false memories in the context of alien abduction, therefore, our conclusions only apply to false memories of this nature. Although we expected our false memory condition to resemble either a true memory given its personal nature or deceptive memory given its false nature, fMRI methods superseded our expectation and cautiously revealed an ability to detect 'honest lying'. More importantly, it was the only condition that led to almost no brain activation when reverse contrasts were made solidifying the notion that this condition could be autobiographical and/or deceptive. Furthermore, the pattern of activation of our FM condition revealed that the participants' memories were emotional, traumatic, autobiographical, deceptive, and have a right asymmetry advantage. Moreover, our interaction allowed us to begin building a neurobiological foundation of a paranormal false memory, by giving us an opportunity to further investigate the pattern of activation consisting of four main regions: the superior frontal gyrus; the supramarginal gyrus; the

lateral globus pallidus; and the limbic lobe. These regions are theorized to be the main areas associated to our paranormal false memories. A paranormal false memory in this instance resembles confabulation, deception, and emotional trauma. Nevertheless, this was an exploratory study and more studies are clearly needed. This experiment was an initial step in associating neurocorrelates to false autobiographical paranormal type memory and will likely be improved with additional advances in imaging and statistical analysis.

Critical issues remain concerning the use of fMRI in false memory detection. First, the pattern of activation reported in our experiment was similar to ones observed in studies of trauma related memory, lie detection, and autobiographical memories (Hester, Fassbender & Garavan 2004; Huetted & McCarthy, 2004; Zarahn, Rakitin, B, Abela, Flynn & Stern, 2004). These similarities need to be scrutinized to hone in on the neurocorrelates specific to false memory only. Second, inference in the General Linear Model (GLM) analysis of BOLD fMRI is based on a contrast of conditions, making the choice of a control condition critical. We chose to control our experimental conditions by controlling the type of memory, not by using a new group of participants. Thus, the use of a separate control group may have yielded different results. However, it would be extremely difficult to produce a meaningful control group given that real abductees would be our only option. Therefore, we used a within-participant design to control for individual differences and maintain the best internal validity. Finally the sensitivity and specificity with which an experiment can discriminate lie from truth from honest lying in the individual participant or single event level is unknown at this time, thus, making it difficult to make definitive conclusions. This study adds to the growing literature

showing that a complete understanding of false memory requires the consideration of real life cases and not only simulated laboratory designs. Moreover, while we only focused on retrieval processes, a complete understanding of the nature of false memory may be best served by studying the role of both encoding and retrieval processes that play in the production of false memories.

In summary, our results complemented previous work illustrating right brain asymmetry and prefrontal cortices activations. More importantly, our findings extended this line of research to paranormal false memories and revealed additional activations associated specifically to this type of memory. The results indicated that specific brain regions that are not commonly found in other false memory studies mediate paranormal false memories.

It is important to note that this study was exploratory in nature and that the analysis was looking at the whole brain and not specific regions of interest. The reason for this analysis was to observe the outcome of a study design that represented real life in order to draw conclusions. We did not focus on dissociation between several MTL regions or PFC regions as a function of the type of information recovered. For example, whereas some studies depict different regions for episodic information and others for semantic information, we did not. The main reason for this lack of analysis was that we tried to keep the memories as real as possible. If we asked the participants to report an equal amount of semantic vs. episodic memories, the quality of the memory would be jeopardized and therefore become another laboratory experiment with little ecological validity. With this being said, we hope that we have started to address researchers' and

clinicians' concerns in an attempt to design a study that merges quality research and clinicians need for real life experiments.

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Appendix A

Alien Encounters

Have you ever been in contact with extraterrestrial life?

We are looking for right-handed volunteers, age range 18 to 50 years, who believe they have had an encounter with extraterrestrial life to participate in a study of memories and brain imaging. Specifically, a task will be performed during MRI (magnetic resonance imaging) scanning. The project is directed by Dr. Martin Lepage from the Douglas Hospital Research Centre, McGill University and from Dr. Jean-Roch Laurence from Concordia University.

The study will last for about 2 hours and volunteers will be reimbursed $50 for their time and inconvenience.

For more information, contact:
Angela Lambrinos (Ph.D. student in Laurence's laboratory)
at (514) 848-2424 ext. 2213
(laurencelab@yahoo.ca)

Appendix B

Psychosis Screener

Symptoms

Hallucinations	Catatonic behaviour
Delusions	negative symptoms (affective flattening, alogia, avolition)
Disorganized speech	

- *Social occupational dysfunction*
- *Persistence of signs for 6 months and at least one month of symptoms*
- *Only one criteria required if delusions or hallucinations*

Questions

Auditory Hallucinations

In the last month, have you ever heard a voice or other sounds (clicking, banging, hissing, etc.) when no one else was around, or that no one else seemed to hear?

If yes*:* when you heard this were you fully awake?

If yes: What have you seen?

Has this happened more than once?

If yes to all these questions:

What did you hear? *Ask for details*

If subject hears voices exclude from study

Visual Hallucinations

In the last month, have you ever seen anything when you were fully awake, that no one else seemed to see, or when no one else was around?

If yes: Has this happened more than once?

If yes, What have you seen? *Ask for details*

How often has this happened?

If subject has visual hallucinations exclude from study

Delusions

(If yes to any of the following questions as "in the last month")

1. Have you ever spent a lot of time thinking or believing that other people are thinking or talking about you?

   If yes*: Never Rarely Sometimes Often Always*

2. Have you felt that many people have spied into your private life for years?

   If yes*: Never Rarely Sometimes Often Always*

3. Have people ever tried to make you believe that you are crazy?
   ***If yes**: Never Rarely Sometimes Often Always*
4. Have you ever felt that you were being plotted against?
   ***If yes**: Never Rarely Sometimes Often Always*
5. Have you ever felt that someone has been trying to control your mind?
   ***If yes**: Never Rarely Sometimes Often Always*
6. Since you were a child, have you always needed to watch out for people who were trying to cheat you or hurt you?
   ***If yes**: Never Rarely Sometimes Often Always*
7. Have you ever felt like the people on TV or the radio were talking directly to you?
   ***If yes**: Never Rarely Sometimes Often Always*

If no hallucinations or delusions stop here

Negative symptoms

1. In the last month, does your strength seem to be draining out of you even in the morning?
2. In the last month, do you feel terribly sad and depressed for much of the time?
3. In the last month, have you lost your appetite and have trouble sleeping?
4. In the last month, do you feel deeply depressed for no reason?
5. Have you ever thought about committing suicide?

Appendix C

SCREENING:

ASSO-ITEM RECOGNITION PROJECT

Completed by: _____ Date: _____

A. Demographic information :

Name: _____ Sex: _____ Age: _____ DOB: _____
Address:

_____

Tel at home: _____ Tel at work: _____

Email address: _____

Race: a) Caucasian b) Asian c) Black d) Other:

_____

Primary language : a) English c) French c) Other : _____

Highest level of education:

_____

Current main occupation and for how long:

_____

Previous main occupation and for how long:

_____

Father's highest level of education: _____ Occupation : _____

Mother's highest level of education : _____ Occupation :

_____

Do you need glasses or contact lenses to see from far?

_____

* Explain it is important for MRI scanning.

B. Exclusion criteria :

I am going to ask you some questions to answer by yes or no, and then we will go through some of those questions in more details:

	Yes	**No**
1) Are you right handed?		
2) Do you fear of closed spaces (or think you are claustrophobic)?		
3) Do you currently see a doctor for any medical problem?		
4) Do you take prescription drugs?		
5) Do you take recreational drugs?		
6) Do you have family history of neurological/ psychiatric disorders?		
7) Did you have neurological or psychiatric problems in the past?		
8) Do you have any metal or metallic fragments in any part of the body?		
9) Are you pregnant? (ask only if a women!!!)		

C. Handedness

1. With which hand do you normally write?	Left [1] Either [2] Right [3]
2. With which hand do you draw?	Left [1] Either [2] Right [3]
3. Which hand would you use to throw a ball to hit a target?	Left [1] Either [2] Right [3]

4. Which hand do you use your racquet for tennis, squash etc.?	Left [1] Either [2] Right [3]
5. Which hand do you use your toothbrush?	Left [1] Either [2] Right [3]
6. With which hand you hold a knife when you are cutting things? (Not with a fork)	Left [1] Either [2] Right [3]
7. Which hand holds the hammer when you are driving a nail?	Left [1] Either [2] Right [3]
8. When you strike a match, which hand holds the match?	Left [1] Either [2] Right [3]
9. In which hand would you use an eraser on paper?	Left [1] Either [2] Right [3]
10. Which hand removes the top card when you are dealing from a deck?(i.e., when you are the dealer of a Blackjack game, which hand to you use to distribute the cards that is placed on the table?)	Left [1] Either [2] Right [3]
11. Which hand holds the thread when you are threading a needle?	Left [1] Either [2] Right [3]
12. In which hand would you hold a fly swatter (the 'weapon' you use to kill a fly)?	Left [1] Either [2] Right [3]

D. Claustrophobia

1) Have you ever felt uncomfortable in a close area/enclosed space?

_____

2) Have you ever felt uncomfortable in a crowded space?

_____

3) Have you ever been in a MRI scanner before?

_____

---

* Explain to the subject that the MRI scanner is a very enclosed setting.

E. Medical condition and prescription drugs

1) If currently taking any prescription drugs:

a) Can you tell me what medication you take, how much, how often and duration?

_____

_____

2) If currently seeing a doctor for medical condition:

b) Why and duration?

_____

---

3) In the past, did you take any medication regularly for any medical problem? If yes, list and duration and dosage?

_____

_____

_____

4) Have you ever been hospitalized? If yes, when and why?

_____
_____
_____

F. Recreational drugs and alcohol

1) If have used recreational drugs:

a) What drugs?

_____

b) How often?

_____

c) How much have you been drinking or taking recreational drugs in the last 2 weeks?

_____

___

d) Did you take some in the last year?

_____

G. Neurological, psychological and psychiatric history

1) Did you ever have seizures/fits/epilepsy? If yes, when, how many, any medication, for how long?

_____

_____

_____

2) Have you ever had serious head injury that resulted in a loss of consciousness or hospital visit? If yes, when, how long LOC, what investigations, what outcome?

_____
_____
_____

3) Have you ever sought counseling for any psychological help? I yes, under what circumstances?

_____
_____
_____

H. Metal or metallic parts in the body

Do you have any of the following?

	Yes	**No**
a) Cardiac pacemaker		
b) Surgical clip on an aneurysm or other vessel		
c) Surgical clip or valve on the heart		
d) Prosthesis (please specify type and location):		
e) Metal or metallic fragments in any parts of the body (please specify):		

I. Observations of the interviewer

_____
_____
_____
_____
_____
_____
_____
_____
_____

_____

J. Subject's participation in our studies

Study	Date	Subject no.
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Appendix D

Memory for usual and unusual events: an fMRI study

Magnetic Resonance Imaging
QUESTIONNAIRE

McConnell Brain Imaging Centre

It is of the **ultimate importance** for the participant that this questionnaire be completed by the **participant and investigator**.

1. Previous surgery (type and date)

_____

_____.

2. Does the subject have any of the following?	**YES**	**NO**
Cardiac pacemaker	____	____
Surgical clip on an aneurysm or other vessel	____	____
Surgical clip or valve on the heart	____	____
Prostheses (please specify type and location) _____	____	____
Implants (please specify type and location) _____	____	____
Metal or metallic fragments in any part of the body (please specify) _____	____	____
3. Is the subject pregnant?	**____**	**____**

All of my questions regarding this exam have been satisfactorily answered.

SIGNATURE _____ _____ _____
SUBJECT *DATE* *CONTACT NO.*

SIGNATURE _____ _____ _____
INVESTIGATOR *DATE* *CONTACT NO.*

Appendix E

Centre universitaire de santé McGill
McGill University Health Centre

June 17, 2005

Martin Lepage, PhD
Brain Imaging Group
Douglas Hospital Research Centre
6875 LaSalle Blvd
MONTREAL H4H 1R3

Re: 7.a. NEU-04-011
Memory for Usual and Unusual Events: An fMRI Study
PI: Dr. Martin Lepage
- Submission letter
  Letter from the REB dated April 26, 2005
  Corrected Application for Initial Review version 2002.10.31;
  Corrected English Consent Form version 2004.04.21;
  English Certification of Ethical acceptability for research involving human subjects from Concordia University dated July 5, 2002

Dear Dr. Lepage,

Thank you for submitting your Application for Initial Review for the above-cited research protocol.

The above submission, reviewed by the full REB at the April 25, 2005 meeting, was found to be acceptable for continuation at the McGill University Health Centre (MUHC). This was entered accordingly into the minutes of the REB meeting.

The approval of the study is valid until June 17, 2006.

All research involving human subjects requires review at recurring intervals. To comply with the regulation for continuing review of "at least once per year," it is the responsibility of the investigator to submit an Application for Continuing Review to the REB prior to expiry. However, should the research conclude for any reason prior to approval expiry, you are required to submit a Termination Report to the board once the data analysis is complete to give an account of the study findings and publication status.

The Research Ethics Boards (REBs) of the McGill University Health Centre are registered REBs working under the published guidelines of the Tri-Council Policy Statement, in compliance with the "Plan d'action ministériel en éthique de la recherche et en intégrité scientifique" (MSSS, 1998) and the Food and Drugs Act (2001.06.07), acting in conformity with standards set forth in the (US) Code of Federal Regulations governing human subjects research and functioning in a manner consistent with internationally accepted principles of good clinical practice.

Should any revision to the study or other development occur prior to the next required review, you must advise the REB without delay. Regulation does not permit initiation of a proposed study modification prior to REB approval of the amendment.

We trust this will prove satisfactory to you. Thank you for your consideration in this matter.

Yours very truly,

Eugene Bereza, MD CM, CCFP,
Chair, MNH/I Research Ethics Board
EB/lz

* Meeting of April 25, 2005

Appendix F

CONSENT FORM TO PARTICIPATE IN RESEARCH
Doctoral Thesis Research Project
Memory Laboratory, Department of Psychology, Concordia University

This experiment will involve your participation in a research project that is concerned with understanding more about the nature of memory. The success of this research strongly depends upon the assistance of volunteers like yourself and we are grateful for your participation. The experiment is supervised by Dr. Jean-Roch Laurence who is a member of the Psychology Department.

Today is the *first* of two parts of the experiment and will be conducted in the Memory Laboratory at Concordia University. This part will involve the administration of questionnaires concerning experiences you may have had, the administration of an attentional task, and an interview regarding autobiographical memories. In addition, several questions will be asked by the experimenter in order to determine your eligibility to participate in the *second* part of the project.

I understand that today's experiment will last approximately 1 hour 30 minutes (90 minutes).

I understand that I may ask questions about the experiment prior to signing this consent form and that I am free to withdraw my consent and discontinue my participation at anytime without negative consequences.

I understand that this experiment is part of a larger project and that I may be asked to participate in a future session involving memory with the use of a neuroimaging procedure. I understand that my participation in this study will remain confidential even though the data from this study may be published.

I have carefully studied the above and understand this agreement. I freely consent and voluntarily agree to participate in the present experiment conducted by Angela Lambrinos, M.Sc.

NAME (please print)_____

SIGNATURE _____

WITNESS SIGNATURE _____

DATE _____

Appendix G

Beck Depression Inventory

Choose one statement from among the group of four statements in each question that best describes how you have been feeling during the **past few days**. Circle the number beside your choice.

1	**0** I do not feel sad. **1** I feel sad. **2** I am sad all the time and I can't snap out of it. **3** I am so sad or unhappy that I can't stand it.	8	**0** I don't feel I am any worse than anybody else. **1** I am critical of myself for my weaknesses or mistakes. **2** I blame myself all the time for my faults. **3** I blame myself for everything bad that happens.
2	**0** I am not particularly discouraged about the future. **1** I feel discouraged about the future. **2** I feel I have nothing to look forward to. **3** I feel that the future is hopeless and that things cannot improve.	9	**0** I don't have any thoughts of killing myself. **1** I have thoughts of killing myself, but I would not carry them out. **2** I would like to kill myself. **3** I would kill myself if I had the chance.
3	**0** I do not feel like a failure. **1** I feel I have failed more than the average person. **2** As I look back on my life, all I can see is a lot of failure. **3** I feel I am a complete failure as a person.	10	**0** I don't cry any more than usual. **1** I cry more now than I used to. **2** I cry all the time now. **3** I used to be able to cry, but now I can't cry even though I want to.
4	**0** I get as much satisfaction out of things as I used to. **1** I don't enjoy things the way I used to. **2** I don't get any real satisfaction out of anything anymore. **3** I am dissatisfied or bored with everything.	11	**0** I am no more irritated by things than I ever am. **1** I am slightly more irritated now than usual. **2** I am quite annoyed or irritated a good deal of the time. **3** I feel irritated all the time now.
5	**0** I don't feel particularly guilty. **1** I feel guilty a good part of the time. **2** I feel quite guilty most of the time. **3** I feel guilty all of the time.	12	**0** I have not lost interest in other people. **1** I am less interested in other people than I used to be. **2** I have lost most of my interest in other people. **3** I have lost all of my interest in other people.
6	**0** I don't feel I am being punished. **1** I feel I may be punished. **2** I expect to be punished. **3** I feel I am being punished.	13	**0** I make decisions about as well as I ever could. **1** I put off making decisions more than I used to. **2** I have greater difficulty in making decisions than before. **3** I can't make decisions at all anymore.
7	**0** I don't feel disappointed in myself. **1** I am disappointed in myself. **2** I am disgusted with myself. **3** I hate myself.	14	**0** I don't feel that I look any worse than I used to. **1** I am worried that I am looking old or unattractive. **2** I feel that there are permanent changes in my appearance that make me look unattractive. **3** I believe that I look ugly.

15	**0** I can work about as well as before. **1** It takes an extra effort to get started at doing something. **2** I have to push myself very hard to do anything. **3** I can't do any work at all.	19	**0** I haven't lost much weight, if any, lately. **1** I have lost more than five pounds. **2** I have lost more than ten pounds. **3** I have lost more than fifteen pounds. (Score 0 if you have been purposely trying to lose weight.)
16	**0** I can sleep as well as usual. **1** I don't sleep as well as I used to. **2** I wake up 1-2 hours earlier than usual and find it hard to get back to sleep. **3** I wake up several hours earlier than I used to and cannot get back to sleep.	20	**0** I am no more worried about my health than usual. **1** I am owrried about physical problems such as aches and pains, or upset stomach, or constipation. **2** I am very worried about physical problems, and it's hard to think of much else. **3** I am so worried about my physical problems that I cannot think about anything else.
17	**0** I don't get more tired than usual. **1** I get tired more easily than I used to. **2** I get tired from doing almost anything. **3** I am too tired to do anything.	21	**0** I have not noticed any recent change in my interest in sex. **1** I am less interested in sex than I used to be. **2** I am much less interested in sex now. **3** I have lost interested in sex completely.
18	**0** My appetite is no worse than usual. **1** My appetite is not as good as it used to be. **2** My appetite is much worse now. **3** I have no appetite at all anymore.		

SCORING

1 – 10: These ups and downs are considered normal.
11 – 16: Mild mood disturbance
17 – 20: Borderline clinical depression
21 – 30: Moderate depression
31 – 40: Severe depression
over 40: Extreme depression

Appendix H

SPQ-A

NAME : _____

MALE FEMALE (CIRCLE ONE)

DATE OF BIRTH(MM/DD/YY) ___/___/___

PLACE OF BIRTH_____

ETHNICITY_____

Please answer each item by putting a circle around **Y** (Yes) or **N** (No). Answer all items even if unsure of your answer.

1. Do you sometimes feel that things you see on the TV or read in the newspaper have a special meaning for you? **Y N**

2. I sometimes avoid going to places where there will be many people because I will get anxious.
Y N

3. Have you had experiences with the supernatural? **Y N**

4. Have you often mistaken objects or shadows for people, or noises for voices? **Y N**

5. Other people see me as slightly eccentric (odd). **Y N**

6. I have little interest in getting to know other people. **Y N**

7. People sometimes find it hard to understand what I am saying. **Y N**

8. People sometimes find me aloof and distant. **Y N**

9. I am sure I am being talked about behind my back. **Y N**

10. I am aware that people notice me when I go out for a meal or to see a film. **Y N**

11. I get very nervous when I have to make polite conversation. **Y N**

12. Do you believe in telepathy (mind-reading)? **Y N**

13. Have you ever had the sense that some person or force is around you, even though you cannot see anyone? **Y N**

14. People sometimes comment on my unusual mannerisms and habits. **Y N**

15. I prefer to keep to myself. **Y N**

16. I sometimes jump quickly from one topic to another when speaking. **Y N**

17. I am poor at expressing my true feelings by the way I talk and look. **Y N**

18. Do you often feel that other people have got it in for you? **Y N**

19. Do some people drop hints about you or say things with a double meaning? **Y N**

20. Do you ever get nervous when someone is walking behind you? **Y N**

21. Are you sometimes sure that other people can tell what you are thinking? **Y N**

22. When you look at a person, or yourself in a mirror, have you ever seen the face change right before your eyes? **Y N**

23. Sometimes other people think that I am a little strange. **Y N**

24. I am mostly quiet when with other people. **Y N**

25. I sometimes forget what I am trying to say. **Y N**

26. I rarely laugh and smile. **Y N**

27. Do you sometimes get concerned that friends or co-workers are not really loyal or trustworthy? **Y N**

28. Have you ever noticed a common event or object that seemed to be a special sign for you?
Y N

29. I get anxious when meeting people for the first time. **Y N**

30. Do you believe in clairvoyancy (psychic forces, fortune telling)? **Y N**

31. I often hear a voice speaking my thoughts aloud. **Y N**

32. Some people think that I am a very bizarre person. **Y N**

33. I find it hard to be emotionally close to other people. **Y N**

34. I often ramble on too much when speaking. **Y N**

35. My "non-verbal" communication (smiling and nodding during a Y N conversation) is poor. **Y N**

36. I feel I have to be on my guard even with friends. **Y N**

37. Do you sometimes see special meanings in advertisements, shop windows, or in the way things are arranged around you? **Y N**

38. Do you often feel nervous when you are in a group of unfamiliar people? **Y N**

39. Can other people feel your feelings when they are not there? **Y N**

40. Have you ever seen things invisible to other people? **Y N**

41. Do you feel that there is no-one you are really close to outside of your immediate family, or people you can confide in or talk to about personal problems ? **Y N**

42. Some people find me a bit vague and elusive during a conversation. **Y N**

43. I am poor at returning social courtesies and gestures. **Y N**

44. Do you often pick up hidden threats or put-downs from what people say or do? **Y N**

45. When shopping do you get the feeling that other people are taking notice of you? **Y N**

46. I feel very uncomfortable in social situations involving unfamiliar people. **Y N**

47. Have you had experiences with astrology, seeing the future, UFOs, ESP or a sixth sense? **Y N**

48. Do everyday things seem unusually large or small? **Y N**

49. Writing letters to friends is more trouble than it is worth. **Y N**

50. I sometimes use words in unusual ways. **Y N**

51. I tend to avoid eye contact when conversing with others. **Y N**

52. Have you found that it is best not to let other people know too much about you? **Y N**

53. When you see people talking to each other, do you often wonder if they are talking about you? **Y N**

54. I would feel very anxious if I had to give a speech in front of a large group of people. **Y N**

55. Have you ever felt that you are communicating with another person telepathically (by mind-reading)? **Y N**

56. Does your sense of smell sometimes become unusually strong? **Y N**

57. I tend to keep in the background on social occasions. **Y N**

58. Do you tend to wander off the topic when having a conversation. **Y N**

59. I often feel that others have it in for me. **Y N**

60. Do you sometimes feel that other people are watching you? **Y N**

61. Do you ever suddenly feel distracted by distant sounds that you are not normally aware of? **Y N**

62. I attach little importance to having close friends. **Y N**

63. Do you sometimes feel that people are talking about you? **Y N**

64. Are your thoughts sometimes so strong that you can almost hear them? **Y N**

65. Do you often have to keep an eye out to stop people from taking advantage of you? **Y N**

66. Do you feel that you are unable to get "close" to people? **Y N**

67. I am an odd, unusual person. **Y N**

68. I do not have an expressive and lively way of speaking. **Y N**

69. I find it hard to communicate clearly what I want to say to people. **Y N**

70. I have some eccentric (odd) habits. **Y N**

71. I feel very uneasy talking to people I do not know well. **Y N**

72. People occasionally comment that my conversation is confusing. **Y N**

73. I tend to keep my feelings to myself. **Y N**

74. People sometimes stare at me because of my odd appearance. **Y N**

Appendix I

MIS

Name_____ Date_____ ID_____

Please respond by putting a circle around **True** or **False**

1. Some people can make me aware of them just by thinking of me **True** **False**
2. I have had the momentary feeling that I might not be human **True** **False**
3. I have sometimes been fearful on stepping on sidewalk cracks **True** **False**
4. I think I could learn to read other's minds if I wanted too **True** **False**
5. Horoscopes are right too often for it to be a coincidence **True** **False**
6. Things sometimes seem to be in different places when I get home, even though no one has been there **True** **False**
7. Numbers like 13 and 7 have no special powers **True** **False**
8. I have occasionally had the silly feeling that a TV or radio broadcaster knew I was listening to him **True** **False**
9. I have worried that people on other planets may be influencing what happens on earth **True** **False**
10. The government refuses to tell us the truth about flying saucers **True** **False**
11. I have felt that there was messages for me in the way things were arranged, like in a store window **True** **False**
12. I have never doubted that my dreams are the products of my own mind **True** **False**
13. Good luck charms don't work **True** **False**
14. I have noticed sounds on my records that are not there at other times **True** **False**
15. The hand motions that strangers make seem to influence me at times **True** **False**
16. I almost never dream of things before they happen **True** **False**

17. I have had the momentary feeling that someone's place has been taken by a look-alike **True False**

18. It is not possible to harm others merely by thinking bad thoughts about them **True False**

19. I have sometimes sensed an evil presence around me although I could not see it **True False**

20. I sometimes have a feeling of gaining or losing energy when certain people look at me or touch me **True False**

21. I have sometimes had the passing thought that strangers are in love with me **True False**

22. I have never had the feeling that certain thoughts of mine really belonged to someone else **True False**

23. When introduced to strangers, I rarely wonder whether I have known them before **True False**

24. If reincarnation were true, it would explain some unusual experiences I have had **True False**

25. People often behave so strongly that one wonders if they are part of an experiment **True False**

26. At times I perform certain little rituals to ward off negative influences **True False**

27. I have felt that I might cause something to happen just by thinking too much about it **True False**

28. I have wondered whether the spirits of the dead can influence the living **True False**

29. At times I have felt that a professor's lecture was meant especially for me **True False**

30. I have sometimes felt that strangers were reading my mind **True False**

Appendix J

MSTQ

Name_____ Date_____ ID_____

Please respond by providing a check mark **(√)** to either **"yes"** or **"no"**

	Yes	**No**
1. Do you like talking to a good friend even when you have other things to do?		
2. Do dreams often wake you up at night?		
3. Do you get easily confused if many things happen at once?		
4. Do you ever know something is going to happen before it actually does?		
5. Do you think thunderstorms are exciting?		
6. If you think too carefully about something you would like to do, does it take all the fun out of it?		
7. Do your friends ever start looking like strangers?		
8. Do you have any really close friends at school?		
9. Is it a little bit silly to believe aliens might be controlling things here on earth?		
10. Do you often feel that others have it in for you?		
11. Can you always tell the difference between your body and the other things around you?		
12. Do you think that the sounds of a parade are rather boring?		
13. Do you break rules just for the fun of it?		
14. Have you ever had the feeling that a TV or radio person knew you were listening to him/her?		
15. Do you find it pretty boring to stand on a high place and look out over the view?		
16. Do ordinary things like tables and chairs ever look strange?		

17. Do you sometimes eat too much and then later wonder why?		
18. Do good luck charms work?		
19. Does it take too much time and effort to make new friends?		
20. Do you sometimes do dangerous things just for fun?		
21. Do ordinary things sometimes seem too big or small?		
22. Do you like to hug your friends when you are very happy?		
23. Is it true that you could never learn to read another person's mind?		
24. Do you sometimes feel that other people are talking about you?		
25. Do you sometimes feel like everything around you is tipping over?		
26. Does it make you feel really good just being with friends?		
27. Do you usually stop and look carefully before you cross the road?		
28. Is it true that a stranger can know what you are thinking?		
29. Do you try to eat your favorite foods slowly to make them last longer?		
30. Have you felt that a part of your body no longer belonged to you?		
31. Do you often find it hard to concentrate because little things attract your attention away?		
32. Do you sometimes stop to smell flowers when walking past them?		
33. Would it worry you if you didn't pay back money to someone?		
34. When you meet new people do you sometimes have the feeling that you already know them?		

35. Does a quick walk make you feel good?		
36. Does your face always seem the same shape when you look in the mirror?		
37. Is it hard for you to make good friends?		
38. Do you like looking at beautiful scenery?		
39. Are people often too polite?		
40. Is it silly to believe in ghosts?		
41. Is it sometimes hard to understand what you say because your words get all mixed up?		
42. When your best friend gets upset does it make you feel sad too?		
43. Do you often leave things unfinished so you can start something new?		
44. Do ordinary colors sometimes seem much too bright?		
45. Do you feel you can trust most People?		
46. Do you feel good when someone you care about holds your hand?		
47. Do you often find it hard to control yourself when you get into an argument?		
48. Have you ever felt that your thoughts belonged to someone else?		
49. Do crowded rooms confuse you?		
50. Have vou ever felt like taking your shoes off and walking through a pouddle with bare feet?		
51. Is it hard to wait for something you really want?		
52. Have you ever felt that your body was not there?		
53. Have you ever felt that there were bad things around you which you couldn't see?		

54. Is it tiring to have long conversations with others?		
55. If you burped loudly at a friend's dinner table would you be embarrassed?		
56. Do you think that a person can hurt their friends by thinking bad thoughts about them?		
57. When you are washing yourself, does it feel good to make yourself really soapy?		
58. Are indoor lights often so bright that they hurt your eyes?		
59. Do you often just sit alone, thinking or dreaming?		
60. Do you think a person can make something happen just by thinking about it?		
61. When you hear a good song, does it make you want to sing along?		
62. Do you like to do unusual things just to be different from other children?		
63. Do things you touch sometimes seem like they are joined to you?		
64. Do you feel very close to your friends?		
65. Do you often dream about things before they happen?		
66. Do you think it is hard for other children to get to know you?		
67. Have you sometimes found that ordinary sounds are so loud they hurt your ears?		
68. Do you enjoy looking into the flames in a fireplace?		
69. Do you always think carefully about what you are about to do?		
70. Do you like talking to your friends on the telephone?		
71. Do you often feel lonely, even when you are with other people?		

72. Are you sometimes a little bit frightened of stepping on cracks in the footpath?		
73. Have you ever stolen things?		
74. Do you ever dance with yourself just to feel your body move with the music?		

Appendix K

Extraterrestrial life Experience Interview

Tell me about your experience with extraterrestrial life from the very beginning. Please include all the details no matter how insignificant some may seem.

Appendix L

It was October 6th 2003. I was in bed with my boyfriend in the Dominican Republic, in a small house on top of a mountain. This house did not have any electricity or running water and my boyfriend did not want us to sleep with the windows open because there is a lot of robberies and he was scared that maybe some robbers would come in and rob us during our sleep or even kill us because we were very far away from the city. There was not a lot of people around. There was a house with elderly people, and another house with a small family. But they were on the other side of the street. It is a very small street where we would come by with a motorcycle. The house was very small. It consisted of a kitchen and a bedroom and the living room were all in the same place. I remember my boyfriend went to sleep before me and I was in bed just thinking how lucky I was living in the Dominican Republic. I remember feeling very good and I remember feeling like it was an extraordinary moment in my life. It was a sacred moment. And I just thanked God or life for that moment, I felt very peaceful and I fell asleep at that point.

I was sleeping on my belly and I never sleep on my belly. I don't know how I fell asleep that way. During the night it got a bit uncomfortable and I remember thinking that the window was open. I sat up, and because my hair was long and in my face I pushed them away from my face. While I was doing that, I was looking at the window which was just at my right and very very close to the bed. I then saw a being doing the same thing I was doing. Like imitating me. But it did not have any hair and it was a small being like maybe a 7 or 8 year old child. The first thing about this being that I remember is that it was flesh and bone. It was very real and I could look at it like it's eyes…it had wider eyes then we do but not like very big animal eyes and it had a retina and color. It did not have any hair or body hair, it had features and the head was bigger like a bigger brain inside the head. It was like a grayish color. The color of its skin was not the skin color that we have, it was not green or grey or brown or pink….It was all of it together with a different color that I can't describe. It was all color together as one color. It had a bigger head then we have but not like those that we see in the movies. It was small but was not skinny. Not like with fat but like strong…small but strong. It had hands but the fingers were smaller and fatter. I remember that it was looking at like we look at animals. Like with this fascination…I remember feeling that it looked at me like I was this beautiful being like we look at Bambi for example. It was not male or female and it wasn't young, it looked young but it was old. It looked like a 10 thousand year old child. But very mature and intelligent. Like more intelligent then we are. Much more intelligent then we are. I remember that it seemed not to have the same kind of love that we have. It had love through conscience and through intelligence but not through the heart. It was very fascinated that we could love through our hearts and with emotion. I felt this telepathically. I could feel telepathically that it was not allowed to come into the house so it had to look at me from the other side of the window. I did not see its legs but part of the wall under the window was covering them.

It was looking at me like I was very innocent. It was surprised that I could see it and quite amused by it. Kind've like a cosmic joke. It was looking at me like "oh she could see me so I must disappear". Like doing the movement that I was doing like moving its hair out

of its face…hair it did not have…it then disappeared. It lasted about 2-3 seconds but fet like a lot more then that. Like time stopped. When it started to disappear, it started to become less and less flesh and bone and more transparent. At first I did not feel scared, but my brain stopped working for a moment…it was something that my mind could not believe, so I just stopped thinking and moving. I remember thinking just breathe and don't be scared and allow yourself to experience this moment.

After it disappeared, I stood there for 5 minutes because I had to focus on the fact tht I was awake and that this was not a hallucination and that I was not crazy and just gathering my thoughts and trying to remember as much as possible.

The amazing thing and feeling for that moment is that I was so innocent for that being. And that it was so much more intelligent then I was. I believe that it was curiosity that brought it close. After I stood there and gathered my thoughts, I tried to wake up my boyfriend because I needed to talk to someone to make sure that I was not going crazy,. I think I just needed someone to validate that I was awake. So I tried to wake him up but he was not waking up. He was in a deep profound sleep it took me a long time to wake him up and shake him up and say "wake up" many times. When he woke up he noticed that the windows were opened. I asked him "do you believe in aliens?" He said why are you asking me that, I said "because I saw one" and for a moment he did not say anything and then he said I told you to shut the windows before going to bed and went right back to sleep. SO I kind of stood there for a couple more minutes, then shut the window and went to sleep. The next day he told me not to say anything to anyone….I told all my friends, I sent emails, and wrote a letter to my friend. During the next morning I thought about asking it for more information knowing that it can hear me…but because I did not feel love from the heart and because I don't know what they want from us I got a bit…not scared but I thought about the fact that it may be back just to laugh at me so I decided not to call it back and for sure my boyfriend did not want the windows to be open anymore. I remember also thinking, how do they get here. I thought about a space ship, but I don't know, maybe that is my own thought and it was not coming from them.

Appendix M

Extraterrestrial memory

In which month did it happen?
In which country were you in when it happened?
Why did your boyfriend want the windows to be closed?
In which position where you sleeping when you woke up?
The "being" imitated which gesture that you did?
How was the "beings' " hair?
How was the "beings' " eyes compared to ours?
How was the "beings' " head size compared to ours?
How was the "being" looking at you?
How old did you feel the "being" was?
How did you know that the "being" was not allowed to come into the house?
How much time did the whole experience last?
What did you say to yourself when the "being" disappeared?
What is the first thing you did after gathering your thoughts when the being disappeared?
The next morning, what did you wish you had asked the "being" during the encounter?
In which year did it happen?
Where was the small house you lived in situated?
On that night, How did you feel before falling asleep?
What was the first thing you thought about when you woke up?
What was the "being" doing when you first saw it?
The "being" was tall like a child of what age?
What color was the "beings' " skin?
How were the "beings' " fingers compared to ours?
Compared to us, how intelligent did you feel the "being" was?
Where did you feel the "beings' " love came from?
How did the "being" feel when he realized you could see him?
How did the "being" disappear?
What did you think brought the "being" to come this close?
What did you ask your boyfriend when you woke him up?

Appendix N

Emotional Experience Interview

Tell me about an emotional experience you have encountered from the very beginning. Please include all the details no matter how insignificant some may seem.

Appendix O

It was spring of last year. My friend Norman invited me to lunch. And usually we go on Mont royale street but he wanted us to go to another restaurant on Laurier street. He parked his car somewhere but could not remember exactly were the restaurant was. So we had to walk a bit and we went eastward and crossed st urbain street because there was construction, so we crossed the street because of road work, then we crossed the street again towards southbound and he could still not remember where it was. So he said I am going to ask that man. My first reaction was "no no don't ask this man" I did not know why I felt that. My friend however ask him anyway.

He said "excuse me do you know where the restaurant is" I looked at that man and realized it was the doctor who had operated on me 20 years ago. He had amputated my leg. It was quite a shock because before we left to go to the restaurant I was telling Norman how today is the 20th anniversary of my this surgery and that it had saved my life. I had gangrene.

So I looked at that man and his name is Dr. Laurando. And I said "Dr. Laurando it is me Karene" and he looked at me and for a while it seemed like he was searching his memory about who I was. When he got it he was happy to see me. But I saw that he was happy but it also looked like it was quite a shock for him to see me. He ask me how am I and what I was doing. So I told him I was working with conjugal violence and that I was living with my best friend. And everything was quite good for me. And we started walking with him towards st urbain and my friend

Norman crossed the street before us. And I went to cross the street but I stopped and turned around to see if Dr. Lorando was following me. But he stopped. At that point, I realized that he was so much older then I remember. And that I survived and that I will out live this man. For me this was a shock and quite a surprise to realize that because this man as I remember him was very strong and he was the strong Dr and I was the weak and very sick little girl.

And so I went back to walk with him and felt a little ashamed that I did not realize before hand. So we crossed the street together, very slowly. Then he said to my friend Norman that I was quite a courageous little girl and it shocked me. I was kind've mad. I wanted to tell him that survival has nothing to do with courage. And that I had no way out. I had no choice but to go through with it in order to survive. It has nothing to do with courage. But I did not say it because I did not want to make him feel bad because I thought he was trying to say something good about me.

We walked more and I had the chance to tell him that everything in my life so far has been ok and if I had to do it again I would go through it the same way even though I nearly died because I was amputated three times and it was quite painful but I would do it again the same way because it has made me who I am now. He then looked at me and I saw that we both felt that this was like a full circle. We then hugged and he said our goodbyes. And then we went into the restaurant.

Appendix P

Emotional memory

In which season did it happen?
What kind of meal did Norman invite you too?
On which street was the place you were going with Norman too?
Why did you and Norman have to walk a bit?
At first, why did you have to cross St-Urbain street with Norman?
Who was the man that Norman asked for directions?
For which disease did you have to be operated?
How did Dr. Laurendo feel when he remembered you?
When you first looked at the man that Norman asked for information, what did you realize about him?
How did you feel when you realized that you would out-live Dr. Laurendo?
When you turned around to see if Dr. Laurendo was following you, what did you suddenly realize?
What did Dr. Laurendo tell your friend Norman about you?
What did you want to tell Dr. Laurendo after he spoke to Norman about your courage?
What did you have the chance to tell Dr. Laurendo when you were walking with him?
If you could go back to the time you were operated, why would you do it the same way?
On which street do you usually go on when you go out with Norman?
Where were you and Norman going on the day of the event?
What did your friend ask the man on the street?
What was your first reaction when Norman wanted to ask a man for directions?
On the day of the event, it was the 20th anniversary of what?
What is the first thing you said to Dr. Laurendo?
What population did you tell Dr. Laurendo that you were working with?
Which one of the three of you crossed St-Urbain's street first?
How did you once remember Dr. Laurendo as a person?
At which pace did you cross the street with Dr. Laurendo?
How did you feel about what Dr. Laurendo told Norman about your courage?
Why did you not say what you wanted to tell Dr. Laurendo after he spoke to Norman about your courage?
How many times did you get amputated?
Just before hugging and parting with Dr. Laurendo, you looked at each other and felt that this was like what?

Appendix Q

(OFM)

I use to live up north on the weekends on my grandfathers farm given that my parents would work in the city. My grandfather and I would always take care of the animals and the fields. I would often sleep outside on the balcony even though on some nights it was too cold. During the nights, I would always look at the sky filled with stars. Winter was almost over and spring was on its way. Sometimes I would notice a bat fly by or would hear the owls. It would bring a little fear within me and I would hide under the covers but not completely because I did not want my grandfather to find out I was scared. As I was staring up in the sky, I noticed one star brighter and bigger then the others. It looked like it was only 3 inches away from the moon. It was one of the brightest that night. So I found myself always staring at it as it remained still, just like all the others. So I gazed elsewhere. Then, I noticed a falling star and started making wishes. I then turned my head to look at the big star and realized that it had moved 3 additional inches. It left me wondering how come it moved. I tried to rationalize. So again, I started gazing elsewhere but I still had my eye on the other big one. Then, all of a sudden, I noticed that this bigger star released a brighter light from within it. At first I thought it was my imagination due to the fact that I was looking at so many stars. Then I decided to focus on it to decipher whether it was real or not. As I was staring at the sky many thoughts were running through my head, "could it be?" I wondered. So I was determined to spend a whole night looking at the star to figure it out. Two hours pass and shortly after, that star made a swirl motion around itself almost like forming three rings around it, and then took off so fast that I could not keep up by just looking at it. It appeared as if it went behind the moon. I said to myself "I can't believe this". As excited as I was, I was just as frightened. I started freaking out, and every time after that event, I would sleep outside with a weapon of some sort just in case. I thought if they thought I saw them they would want to take me out so there won't be any witnesses. Months went by and I never saw it again. So I started to question if I really saw it. Maybe it was a shooting star. So a year had past and never saw anything else. Until my15th birthday… I was staying in the city with my mom. When we went to bed everything was normal as usual. At around 4:30 in the morning, I had the need to go to the bathroom. I should mention that the way we would sleep was my mom in the middle, I was on the left side and my brother on the right. So I got up and my feet were cold because the floors were marble. To go to the bathroom you must go towards the hallway, which has three doors. The first leads to the kitchen, the second to my parents' bedroom, and the third to the bathroom. As I was headed to the bathroom, I stopped. There were four men sitting in my kitchen. Three of them were around the table, and one was standing over the sink watching the water flow out. I could not see faces, they were dressed in dark clothing, almost like robes. I thought I was dreaming, but I knew I was not because I felt the cold floor. I must have frozen for a couple of seconds as I was just staring at them without them noticing me. I could not move from my fear. I thought they would see me, "run, run" I said to myself. As I was about to back up, the one that was standing over the sink and turned head towards my direction. "Shit" I screamed out. His eyes locked with mine. I could not see his face but I could see those white piercing eyes looking at me." He had transparent-like eyes, and they were bigger then humans. At first I thought they came for me, they figured out it was me a year ago

that saw them. At that moment, I had forgotten about wanting to go to the bathroom, and ran as fast as I could back to my room. I jumped in my bed, and this time, instead of sleeping at the edge, I went in the middle, took the blankets and covered myself completely. I was saying to myself, it's a dream they don't exist. As I was saying that, I woke up. I must have passed out. So I was wondering did it actually happened. I know it was real because I felt the cold floor. So I asked my mom if she had people over the night before. She said no. I told her what happened and she said it was a dream. But I felt the cold floor. Slowly I began to believe it was a dream. But if it was a dream why did I wake up in the middle of the bed and why did my hand look bruised. Days went by and I would always wonder whether it really happened or not. I was almost 100% sure it did because of the bruise on my hand. The bruise was shaped as three long lines with a round suction-like dot beneath every line.

A couple of months later it was Easter and we were all going to the farm to celebrate. I always enjoyed going to the farm to see the animals and to be in the presence of another man due to the fact that my father was always out of town. So like all the other times, I slept outside gazing up at the sky, and trying to see if I would see the star that changed my life. But this time I had people with me. I had my four cousins and my brother that were sleeping outside. We all eventually passed out. I thought it was a regular night until I found out in the morning what had happened. My grandfather had woken up at 5:30am to find me standing at the edge of the balcony, on the railings, which were made out of brick. I was standing at the top of the bricks, at edge of the balcony, still as a statue. He took me and brought me back to bed. Later that morning, he asked me if I remember what happened the night before, I said no why, are you sure he asked, no why I replied, because you were standing on the edge on top of the railings and you were not able to move, you were almost frozen he said. So I did not really believe him, I thought he was joking but I saw the seriousness in his face. So I started to question what must have happened. Especially given that I am afraid of heights and the brick railings were only a few inches thick. The next morning, my mom was trying to wake me up at 6 am. I asked what is going on, she said what is going on with you. I started becoming scared. She told me that my grandfather saw me running on the brick railings. I was terrified. I could not understand it. So the following night I was determined I would not sleep…I asked my brother not to let me sleep. So I was lying down again, and that is the moment when it happened. Only this time the bright light was coming from the back of the house. I started freaking out again. I screamed" "what do you want", and I walked myself towards the bright light, as I walked that way, the last thing I remember was waking up on the balcony, so I thought it was dream again. Did you see anything I asked my brother. He said, no I did not see anything, so as I got up, I questioned it again…however, I saw again those three bruises but this time they were on my chest. In panic mode, I showed the bruises to my grandparents and they thought they were a result of an animal scratch or bruises from playing with my cousins. I was still afraid so my grandmother said she would watch me sleep that evening. So I went to bed knowing that someone is watching me, I felt secure and protected, I went to sleep, As I was about to doze off, I felt the light. So I stood up and asked my grandmother if she could see it? She started to scream "stay away, leave my grandson alone". I don't remember anything after that except finding my grandmother dead. They said she was drowned. The doctors could not explain it given

that she did not die in water, but they found water in her lungs. I never saw the bright light after that day.

(ORM)
I was 16 years-old and was in grade 10, it was November 1983, my parents were very strict about my school grades. To them, if you had anything less then an 80% you were not doing well in school. My marks were pretty good, my lowest mark was in the 70s, and my average was around 82%, but that was not good enough for them. So report card day cam along. I knew I was not going to have 80% and above on all my subjects. Also, given the fact that I had skipped 5 days of school, I started becoming very nervous about what would happen when they pick up my report card. I was picturing the scenario, my parents coming back home, taking the report card, throwing it in my face, telling me "what kind of grades are these, calling me names, your stupid, I work so hard so you can have a better life and this is what you do with your time, not only do you have a 75% in math and a 72% in History, but you skipped school as well". So I can picture my dad pulling out the belt and start to hit mw with it. I was not afraid of the pain, I was able to take the punishment, it is just the whole situation that will occur before the beating, that is, the mood swings that would remain for a couple of weeks until my grades start to increase again. To avoid all that, I started coming up with my own scenarios. I started thinking about how I can make this not be about my marks. I thought to myself "maybe I can somehow manage to hurt myself so they can shift their attention to my well being instead of my grades". I was thinking, "should I jump in front of a slow moving vehicle enough to hurt myself mildly but maybe it would damage me completely leaving me crippled and then I am screwed". After all, I did not want to hurt myself that bad, I just wanted to get out of the situation. Then I started looking at my balcony and looking downwards...I lived on the 10th floor. If I jump and hold my body straight and land on my feet maybe I would only bust my legs and maybe that will work. But given the fact that I knew a little bit about physics, my weight and the wind would play a big factor in this jump. So I knew for a fact I would not land on my legs. So scratch that idea out. Then I thought, maybe I will go to the kitchen and grab a knife and stab myself at a certain spot, enough for me to bleed but not cause serious damage. But again, I had the fear "what if I miss, what if they take long to come and I bleed to death". As I am working all of this out in my head, I peak outside the window and saw my parents coming around the corner. My dad had an angry face, my mom too. Shit, they are almost here. I will not be able to avoid it any longer. So they walked in, and like I predicted they started with the name-calling, the yelling the screaming, the slaps across the head. It was the first time I actually backed away and yelled back at them. What I said really surprised me. Rather then saying "what is a matter with you, I have a good enough average and you are treating me like this", I said, " I shamed you, I am not worth it to be your son anymore, I understand your pain, so I will take it away". So I ran away towards the balcony and climbed up on the railings. It was the first time I saw my dad go on his knees and beg for me to get down. I never really attempted to jump it was a scare tactic that came to me at the last minute to avoid all this confrontation. It worked because my parents never bothered me again for my marks.

Appendix R

Extraterrestrial (other) memory

Where did this event occur the first time?
Where were you sleeping the first time this event occurred?
The first time it happened, when looking at a star, how was the star different from the others?
The first time it happened, when looking at the star, how far from the moon did it initially appear?
The first time it happened, when you were looking at the star, you gazed elsewhere and what did you see?
The first time it happened, when you turned your head towards the big star what did you realize?
What did the star release from within it?
Before the star took off and disappeared, what did it create during the swirl motion?
How did you feel after your first experience?
At what age did you have your second experience?
Where were you going when you had your second experience?
How many men did you see in the kitchen during your second experience?
During your second experience, what was the standing man doing?
Where did this event occur the second time?
What color were the men's eyes?
What did the men's clothing look like during your second experience?
During your second experience, what made you think the event occurred?
During your second experience, where on the bed did you sleep after seeing the men?
What were you telling yourself when you went to bed after seeing the men?
During your second experience, when you woke up, where did you notice a bruise?
During your second experience, what did the dots underneath the lines forming the bruise look like?
During your last experience, where did you celebrate Easter?
During Easter weekend, where did your grandfather find you at 5:30am?
During Easter weekend, where did you see the bright light?
During Easter weekend, what did you say when you saw the bright light?
During Easter weekend, where on your body did you see the bruise?
According to your grandparents, what is one of the causes of your bruise?
How did you feel when you went to bed knowing your grandmother was watching you?
What did your grandmother scream during your last experience?
What did you say to yourself when you saw the man during your second experience?

Emotional (other) memory

What year did this event take place?
During which month did this event take place?
How old were you during this event?
What grade were you in during this event?
What was your parents` attitude concerning school grades?
What grade was satisfactory for your parents?
What was your lowest mark?
What was your grade average?
How many days had you skipped school?
How were you feeling when your parents went to pick up your report card?
What did you imagine your parents were going to do after picking up your report card?
What did you imagine your dad would do when he came home from picking up your report card?
After the physical punishment, what were you not looking forward to?
To avoid punishment from your parents what did you do?
Why were you thinking of hurting yourself so your parents would notice?
When you thought about jumping in front of a slow moving vehicle, what were you most afraid of?
What floor did you live on during this event?
When you thought of a scenario to avoid punishment, what did you want to grab from the kitchen?
When you went on your balcony and looked downward, what were you thinking of doing?
When you thought of hurting yourself with something from the kitchen to avoid punishment, what were you thinking?
For which courses were your parents upset with the grades?
As you were thinking up different scenarios in your head, what did you do?
What did you notice about your parents when they were turning the corner to come home?
What did your parents do when they first walked in?
How did you feel about your reaction to your parents after they walked in the house?
What did you do once you saw your parents' reaction after they walked into the house?
What did you tell your parents instead of "I have a good enough average and you treat me like this"?
Why did you come up with your last minute scare tactic?
What did your dad do when you climbed on the railings of the balcony?
How did you know that your scare tactic worked?

Appendix S

Purpose of study

Experimental group

The purpose of this study is to investigate extraterrestrial memories and see how they compare to usual type memories. Our primary mode of assessing such differences is by gathering a detailed account of your extraterrestrial encounter and another emotionally significant memory in order to compare the two memories. To look at these differences we use fMRI to look for patterns of brain activation for each memory. However, to have more conclusive results we will also assess patterns of brain activation of two similar type of memories (ET and emotionally significant memories) however these other memories are someone else's experiences that you will read and learn and act as if they are your memories in the scanner. The reason for adding these memories is to assess whether fMRI can in fact differentiate brain activation of our own usual and unusual memories when compared to somebody else's memories when we are the ones remembering them. Therefore our objectives are twofold: 1) to look at differences between usual and unusual memories, 2) and assess whether fMRI can detect differences between truth and lie.

The experiment consists of two sessions:

In the first session we will meet and you will fill out several questionnaires and you will give me a detailed account of the two memories I just mentioned. In addition, I will give you the two other memories you will need to read over and learn very well. This part will take approximately 1 hour and a half.

The second session will occur two weeks later whereby you will be meeting me at the MNI in order to complete the fMRI portion of the experiment. This will consist of you answering truthfully to all the questions presented in the scanner. The questions that will be asked are formulated based on your two stories and the two other stories that I will give you. A question will be presented followed by two answers: A correct one and an incorrect one. Your task is to always answer truthfully. !30 questions and answers will be presented and the fMRI experiment will take approximately 1 hour.

Appendix T

I am going to ask you some questions to answer by yes or no, and then we will go through some of those questions in more details:

	Yes	**No**
10) Are you right handed?		
11) Do you fear of closed spaces (or think you are claustrophobic)?		
12) Do you currently see a doctor for any medical problem?		
13) Do you take prescription drugs?		
14) Do you take recreational drugs?		
15) Do you have family history of neurological/ psychiatric disorders?		
16) Did you have neurological or psychiatric problems in the past?		
17) Do you have any metal or metallic fragments in any part of the body?		
18) Are you pregnant? (ask only if a women!!!)		

Appendix U

CONSENT FORM
MONTREAL NEUROLOGICAL INSTITUTE AND HOSPITAL
McConnell Brain Imaging Centre

1. **TITLE OF PROJECT:** Memory for usual and unusual events: An fMRI study

   INVESTIGATORS: Angela Lambrinos, M.Sc., Martin Lepage, Ph.D., Jean-Roch Laurence, Ph.D., Jorge Armony, Ph.D., Bruce Pike, Ph.D.

2. **REASON FOR THE STUDY**
   The purpose of this session is to identify brain regions that are related to different memories by using a Magnetic Resonance Imaging (fMRI) technique.

3. **PROCEDURES**
   Your participation in this session will last about an hour and a half. During this session, you will undergo structural (MRI) and functional Magnetic Resonance Imaging (fMRI). They are non-invasive techniques that use a magnetic field and radiofrequency waves to visualize brain tissues (MRI) and to identify regions involved in performing a task (fMRI).
   For the functional part, you will have to respond by clicking on a mouse with your right hand to questions regarding the stories you provided in session 1. You will be instructed to respond accurately. During the structural run, you will be asked to close your eyes, stay as still as possible and be relaxed. This run will last for about 15 minutes. The functional part will be repeated. The fMRI machine will be quite noisy. To reduce the noise, you will be given earplugs. You will be asked to remain absolutely still during the examination, and your head will be held in place with restraints that can be disengaged at any time. You will be in constant communication with the operator throughout the experiment.

4. **CONTRAINDICATIONS**
   The following are contraindications for a magnetic resonance study:
   - Pacemaker
   - Aneurysm Clip
   - Heart/Vascular Clip
   - Prosthetic Valve
   - Metal Prosthesis
   - Pregnancy
   - Claustrophobia
   - Metal fragments in body

5. ADVANTAGES OF THE PROPOSED STUDY

Functional Magnetic Resonance Imaging (fMRI) is a test, not a treatment. It is hoped that the information obtained in this study will help to clarify what happens in the brain during memory processing and recognition.

6. DISADVANTAGES OF THE PROPOSED STUDY

During this study, you will be exposed to a strong magnetic field and radio waves. However, no long-term negative side effects have been observed from this type of examination. As mentioned above, the MR machine is very noisy and you will be given earplugs to reduce this effect. Metallic objects can be attracted with great force by the magnetic field. You will be asked to remove all such objects from your person and clothing prior to the test.

7. EFFECTS OF PARTICIPATION IN THIS STUDY

Magnetic Resonance Imaging does not interfere with any treatment or other diagnostic tests.

8. CONFIDENTIAL NATURE OF THIS STUDY

The results of the testing will be kept confidential. No personal information will be released to third parties without your written approval. The only individuals who will have access to the data are the investigators and the Research ethics board or Quality Assurance Officers and authorized by it.

9. INCIDENTAL FINDINGS

Research scans are not subject to clinical review. However, any incidental finding regarding your health will be communicated to you and, upon your request, to your physician.

10. DISCONTINUATION OF THE STUDY BY THE INVESTIGATOR

At any time during the testing, the investigators have the right to terminate the study for any reason.

11. SUBJECT'S WITHDRAWAL FROM THE STUDY

Your participation in this research study is voluntary and you may withdraw at any time, including during the procedure.

12. COMPENSATION FOR PARTICIPATION IN THE STUDY

Upon completion of the study, you will receive $50 as compensation for your time and inconvenience.

13. CONTACT INFORMATION

If you would like additional information you can contact by telephone Dr. Martin Lepage at McGill University (514 761-6131 ext. 4393) and/or the MNH Patient's Committee, Room 354, tel. 514 398-5358 (a group established to protect the rights of patients, who are deemed to include research subjects).

Memory for usual and unusual events: an fMRI study

DECLARATION OF CONSENT
Montreal Neurological Institute

I, _____, have reviewed the project with one of the investigators, _____.

I fully understand the procedures, advantages and disadvantages of the study which have been explained to me. I freely and voluntarily consent to participate in this study.

Further, I understand that I may seek information about each test either before or after it is given, that I am free to withdraw from the testing at any time if I desire, and that my personal information will be kept confidential.

SIGNATURE _____ _____ _____

SUBJECT ***DATE*** ***CONTACT NO.***

SIGNATURE _____ _____ _____

INVESTIGATOR ***DATE*** ***CONTACT NO.***

Appendix V

REIMBURSMENT FORM

I, _____, acknowledge receiving $_____, for the participation in a two session study entitled “Memory for usual and unusual events: An fMRI study”.

_____ _____

Signature Date

Appendix W

Purpose of study

Control group

The purpose of this study is to investigate extraterrestrial memories and see how they compare to usual type memories. You will be a control subject. That is, a person who has not had an extraterrestrial encounter. Therefore, your task will be to fill out questionnaires and perform an attention task. Your results will be compared to the experimental group. The experiment will take approximately one hour.