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Alien abduction experiences: Some clues from neuropsychology and neuropsychiatry

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Introduction. Many thousands of people around the world firmly believe that they have been abducted by alien beings and taken on board spaceships where they have been subjected to painful medical examination.
Method. Given that such accounts are almost certainly untrue, four areas of neuroscience are considered with respect to possible clues that may lead towards a fuller understanding of the alien abduction experience.
Results. First, it is argued that sleep paralysis may be implicated in many such claims. Second, research into false memories is considered. It is argued that abductees may be more prone to false memories than the general population. Third, evidence is considered relating to the mental health of abductees. It is concluded that there is currently no convincing evidence for higher rates of serious psychopathology amongst abductees compared to the general population. However, abductees do seem to show higher levels on some potentially relevant measures (e.g., tendency to dissociate). Finally, claims that alien abduction experiences may be linked to abnormal activity in the temporal lobes is considered.
Conclusion. Although the neurosciences provide many clues to the nature of this bizarre experience, further research is required before a full understanding will be attained.

This special issue of *Cognitive Neuropsychiatry* is devoted to ''the neuropsychiatry of the body in space.'' Readers might be forgiven for assuming that the word ''space'' is being used here in a general sense and not in the sense of *Star Trek*'s ''space ... the final frontier''. In the case of the current article, however, such an assumption may be mistaken.

A universally accepted definition of the alien abduction experience (AAE) is not possible, as different commentators have emphasised different features. However, according to Bullard (1987), common features include capture by the aliens and subsequent examination (physical, mental, and/or spiritual). The experience may also include communication with the aliens (often

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telepathically), a guided tour of the UFO, trips to other worlds, the receipt of important messages for humanity, being returned (usually to the point of initial abduction), and various post-abduction effects. According to Jacobs (1992, 1998), various reproductive procedures are also a common feature of such experiences (e.g., collection of sperm or ova, implantation of alien-human hybrid embryos, removal of foetuses, sexual activity, and presentation of hybrid babies). Other attempts to characterise the alien abduction experience are summarised in Table 1. As Appelle, Lynn, and Newman (2000) comment, ''If nothing else, these descriptions illustrate that the AAE is a dynamic, elaborate, and involved experience, rich in contextual detail, with considerable perceptual, psychological, cognitive, and physical concomitants'' (p. 255).

TABLE 1
Summary of typical characteristics of alien abduction experiences

Gitlib, Appelle, Rodeghier, and Flamburis' (1994) characteristic features:
- Recall of an abduction or encounter with apparently nonhuman entities.
- Missing time related to recall of unidentified lights, objects, or apparently nonhuman entities.
- Unusually realistic and emotionally intense dreams or dream-like experiences of UFOs or apparently nonhuman entities.

Hopkins, Jacobs, and Westrum's (1992) ''indicator experiences'':
- Waking up paralysed with a sense of a strange figure or figures present.
- Missing time.
- The feeling of actually flying.
- Seeing balls of light in one's room.
- The presence of puzzling scars on one's body.

Rodeghier's (1994) ''selection criteria'' for abductees:
A person must be taken:
- against his or her will,
- from terrestrial surroundings,
- by nonhuman beings.

The beings must take the person to:
- an enclosed place,
- not terrestrial in appearance,
- assumed or known to be spacecraft by the witness.

In this place the person must either:
- be subjected to an examination,
- engage in communication (verbal or telepathic),
- or both.

These experiences may be remembered:
- Consciously,
- or through methods of focused concentration (e.g. hypnosis).

It is also evident from the literature that there is no consensus regarding just how many people believe themselves to be the victims of alien abduction. Bullard (1994) surveyed just 13 UFO investigators and found that between them they had details of around 1700 cases. Strieber (1998) claims to have received almost a quarter of a million letters from individuals claiming alien contact. Jacobs (1992) has suggested that as many as 15 million Americans may have been abducted and according to Mack (1992, p. 7), ''Hundreds of thousands, if not millions, of American men, women and children may have experienced UFO abductions, or abduction-related phenomena''. As Stacy (1992) points out, the logistics of such a level of invasion by aliens defy common sense and simply fail to compute. Although the number of people with conscious memories of alien abduction experiences is orders of magnitude lower than most of these estimates, it is undeniable that a large number of people throughout the world are convinced that they have been abducted by aliens.

Uninformed sceptics often assert that alleged alien abductees are simply lying about their experiences. The assumed motivations are financial, in that claimants may make money from books and film rights. They are also psychosocial, in that the abductee may become a celebrated case, appear at conferences and on talk shows, and generally have opportunities that would otherwise not be available to them. However, as Appelle (1996) points out, in the vast majority of cases abductees do not go public and although some cases may indeed be deliberate hoaxes, most informed sceptics generally accept that the majority of claimants are sincere in their beliefs. If abductees are not deliberately deceiving other people, is it possible that they really were abducted by aliens? This seems highly unlikely, as the evidence presented in support of alien visitation is far weaker than uncritical and sensationalist media coverage typically implies. Even such celebrated cases as the alleged crash of a flying saucer and recovery of alien bodies near Roswell, New Mexico, in 1947 are in fact based on incredibly weak evidence (see, e.g., Klass, 1997; Korff, 1997).

Assuming that abductees are not deliberately deceiving others about their experiences and also assuming that they are almost certainly wrong in thinking that they really have had a close encounter with an alien, the question arises of how one is to account for their claims. A review of the literature reveals that a number of different approaches to answering this question have been adopted. One approach involves focusing on the personalities of abductee claimants and exploring factors such as levels of fantasy proneness (e.g., Bartholomew, Basterfield, & Howard, 1991; Bartholomew & Howard, 1998; Newman & Baumeister, 1996; Ring & Rosing, 1990; Rodeghier, Goodpaster, & Blatterbauer, 1991; Spanos, Cross, Dickson, & DuBreuil, 1993), boundary-deficit personality (e.g., Parnell & Sprinkle, 1990; Ring & Rosing, 1990), escape-from-self and masochistic fantasies (e.g., Newman & Baumeister, 1996), and the psychically sensitive personality (e.g., Johnson, 1994). Others have viewed alien abduction experiences as the product of biased investigators (e.g., Klass, 1988;

Matheson, 1998). Finally, some researchers have considered the claims of alien abductees in terms of possible clues from the fields of neuropsychology and neuropsychiatry. The focus of this paper is on the latter.

For more general reviews of the alien abduction phenomenon, the reader is referred to Appelle (1996), Appelle, Lynn, and Newman (2000), Bartholomew and Howard (1998), Devereux and Brookesmith (1997), French (2001), Newman and Baumeister (1996), Randle, Estes, and Cone (1999), and Rutkowski (2000).

SLEEP PARALYSIS

As Baker (1995) points out, a search for possible explanations of alien abduction experiences on the medical database MEDLINE yields no results if one types in words such as ''UFO contacts'' or ''alien abduction''. This does not, however, indicate that medicine has little to offer in the way of explanations for such claims. Indeed, for anyone familiar with sleep disorders, the accounts given by abductees may, according to some theorists, often be explained by a nonpathological sleep disorder known as sleep paralysis (e.g., Baker, 1995; Blackmore, 1994; Newman & Baumeister, 1996; Randle, Estes, & Cone, 1999). Given that many UFO experiences are associated with sleep (e.g., almost 60% of the intense experiences in a study by Spanos et al., 1993), this is a reasonable assertion. Sleep paralysis is a standard symptom of narcolepsy but can occur quite commonly in the general population (e.g., Everett, 1963; Dahlitz & Parkes, 1993). The muscles of the body are paralysed during the REM (rapid eye movement) stage of sleep which occurs several times during each night. Only on rare occasions, however, are people consciously aware of their paralysis during this sleep stage. For this reason a number of writers refer to the condition as ASP (awareness during sleep paralysis).

ASP is often associated with other puzzling symptoms and occurs as a person (usually lying on their back) is either about to fall asleep or is just waking up. An episode usually begins with the person feeling that they are becoming heavier and heavier. Although the subject is consciously aware of his/her environment they are unable to move (except for the eyes) or to speak. It is often accompanied by an increased heart rate, breathing difficulties, and acute feelings of anxiety or dread. Fortunately, ASP is a transient state and may only last from a matter of seconds, up to a period of several minutes. The results of a number of studies suggest that somewhere between 25% to 40% of the population have had some experience of it (e.g., Fukuda, Mayasita, Inugami, & Ishihara, 1987). Despite such relatively high levels of ASP the condition is not common knowledge among the general public. People are thus unlikely to describe their unusual experiences in terms of ASP, but rather to describe it in terms of a spirit encounter, or an encounter with a being from another planet. Indeed, accounts of alien abduction including the unusual sensations above are far more common in

modern Western society, for example, Streiber's (1987) best-selling book, *Communion: A true story*, than scientific accounts of ASP.

It has been found that ASP is likely to be accompanied by hypnagogic and hypnopompic imagery, which consist of anomalous sensory experiences. For example, Cheyne, Newby-Clark, and Rueffer (1999a) found that of 254 participants reporting sleep paralysis, 99 reported auditory experiences and 75 reported visual experiences. The word ''hypnagogic'' comes from the Greek ''hypnos'' (sleep) and ''agogos'' (leading). It refers to sensations, such as hallucinations (auditory and visual), a terrifying sense of presence (often described as threatening or evil; see, e.g., Cheyne, 2001), a feeling of pressure on the chest, and the feeling of floating. The word ''hypnopompic'' comes from the Greek ''hypnos'' (sleep) and ''pompe'' (procession) and refers to the same sensations when they are experienced after sleep, prior to complete awakening. The visual hallucinations may involve lights, animals, strange figures, and demons. Auditory hallucinations may include heavy footsteps, humming or buzzing noises, and sounds of heavy objects being moved. Various theories have been proposed to explain the association of such hallucinations with ASP and those of Terrillon and Marques-Bonham (2001) and Cheyne, Rueffer, and Newby-Clark (1999b) are outlined below.

In the past, hypnagogic and hypnopompic experiences were interpreted in terms of alleged attacks by the incubus (male demon) and the succubus (female demon). It was claimed that these demons would appear in the night and leap on to the victim's chest and try to choke the sleeper. Other demons were said to enter the victim's room and engage in sexual intercourse with them. Indeed, the Latin word ''incubus'' translates into ''one who presses or crushes''. The same core experience has been reported throughout history in many different cultures, although the interpretation of the experience may vary (Hufford, 1982). For example, Slavic folklore refers to the Vjek demon who tries to crush victims by lying down on their chests.

Episodes of ASP, although terrifying, are quite harmless, but in order to understand how a body can suddenly become paralysed when that person is in a waking state, one needs to first consider normal sleep cycles. When a person is asleep REM and non-REM (NREM) sleep alternates cyclically throughout the night. According to the activation-synthesis theory of dreaming (Hobson & McCarley, 1977; McCarley & Hobson, 1979), REM sleep occurs due to inhibitory action of REM-off cells in reciprocal interaction with REM-on cells. These mechanisms in the brain stem (specifically, reticular, vestibular, and oculomotor neurons) prevent motor output and block sensory input and provide the forebrain with internally generated activity. The role of the forebrain centre is to transform quasi-random activation into meaningful patterns.

For almost half a century REM and NREM have been acknowledged as being distinctly different phases of sleep (Aserinsky & Kleitman, 1953; Jouvet, 1967). REM sleep is characterised by low voltage fast EEG waves with slow theta

activity (e.g., Symons, 1993). Dreaming is more common and more vivid in this stage of sleep when compared to NREM sleep (e.g., Dement & Kleitman, 1957). In REM sleep, heart rate, breathing, and blood pressure vary, the eyes move rapidly and there are movements of the middle ear (e.g., Symons, 1993). In this state, the body is usually in a state of ''nonreciprocal flaccid paralysis'' and cannot move. This is thought to serve a protective function, to stop people from acting out their dreams or nightmares, thus preventing harm to the self or others. Patients who suffer from a rare condition called ''REM sleep behaviour disorder'' lack this normal nonreciprocal flaccid paralysis and often act out violent scenes of their dreams, sometimes leading to severe injuries to their sleeping partners.

Unfortunately, little is known regarding the physiology of ASP. It is thought, however, that the condition occurs as a function of post-synaptic inhibition of motoneurons in the pons region of the brain. Terrillon and Marques-Bonham (2001) have recently suggested that a low level of melatonin (the primary hormone of the pineal gland) in the blood serum may stop the depolarisation current in the nerves, thus preventing the stimulation of the muscle cells. They propose that ASP may occur due to the inappropriate timing of melatonin inhibition and, consequently, of low melatonin plasma levels. This would cause a brief imbalance of electrolytes (potassium and sodium) on either side of the nerve cell, resulting in paralysis. These authors admit, however, that their theory is somewhat speculative and further research in this area is required. Terrillon and Marques-Bonham (2001) have also argued that during ASP the nervous and endocrine systems carry on releasing the neural inhibitors which keep the subject paralysed, but these same systems may continue to release the neural activators that stimulate dreaming. The somatosensory input that occurs during REM sleep is not blocked as it is during normal sleep and this input may combine with REM sleep imagery leading to the experience of hallucinations.

Cheyne et al. (1999b; see also Cheyne, 2001) have recently proposed a neurological model of ASP which separately accounts for three sets of experiences. The first set of experiences (which they label ''The Intruder'') consists of a sensed presence, extreme fear, and auditory and visual hallucinations. Cheyne et al. suggest that these experiences are due to activation of the amygdala. The amygdala is known to be involved in normal fear reactions, particularly involving the nature and seriousness of threat stimuli (LeDoux, 1998). Cheyne et al. hypothesise that during ASP, due to a lack of external cues, this process of analysing the source of fear may last for several minutes, rather than the usual fraction of a second. In this situation, subjects may experience an awareness of a presence, and associated fear. As this persists, increasingly elaborate interpretations may be made, and endogenous (e.g., middle ear activity) or external stimuli (e.g., shadows or external sounds) may be interpreted within the context of the sensed presence thus resulting in auditory and visual hallucinations. This argument is certainly in line with

previous work by these authors which has shown a high correlation between fear and sensed presence (e.g., Cheyne et al., 1999a).

The second set of ASP experiences explained on a neurological level by Cheyne et al. (1999b) is labelled ''Incubus'', and includes feelings of a strong pressure on the chest or back and associated breathing difficulties and pain. Cheyne et al. suggest that these experiences are due to the fact that when a person in REM sleep tries to control their breathing (e.g., by breathing deeply) their lack of success may be interpreted by the brain as pressure. Due to their paralysis, the lack of feedback associated with their strenuous efforts may lead to painful spasms (Ramachandran, Rogers-Ramachandran, & Cobb, 1995) and feelings of being crushed or choked.

Cheyne et al. (1999b) label the final set of ASP experiences ''Unusual Bodily Experiences''. These include sensations of floating or flying and out-of-body experiences. Cheyne et al. suggest that as the person is paralysed during REM and thus cannot receive feedback, any vestibular activation will be interpreted as sensations of floating or flying. This interpretation will be further complicated if the person opens their eyes and receives conflicting information from the environment. This may lead to a perception of an out-of-body experience, a phenomena which has been indirectly linked to REM states within the context of lucid dreaming (e.g., Irwin, 1988). Although out-of-body experiences have been associated with feelings of terror and fear (e.g., Devinsky, Feldman, Burrowes, & Bromfield, 1989) they have also been linked to positive feelings and even bliss (e.g., Twemlow, Gabbard, & Jones, 1982).

The idea that all alien abduction descriptions reflect a ''classic textbook description'' (Baker, 1990, p. 251) of ASP and, in particular, hypnagogic hallucination is an interesting one. It is clear that there are a number of commonalities between this sleep anomaly and abduction experiences. As Appelle (1996, p. 43) points out:

> In addition to the high prevalence of nighttime occurrence, the unaccounted-for passages of time, and the experience of paralysis, both abduction experiences and sleep anomalies may be reported throughout the lifespan (abduction experiences have been reported by young children, adolescents, adults, and the elderly: the symptoms of sleep disorders may persist across the lifespan), and both may have a genetic or familial history (abduction experiences often occur within families and across generations; a similar relationship exists for victims of sleep disorders [Honda, Asaka, Tanimura, & Furusho, 1983]).

It is also undeniable that many descriptions of alien abduction experiences, such as feeling paralysed and seeing strange beings, do bear a striking resemblance to the experiences reported by those who suffer from bouts of ASP.

Some, however, have claimed that a direct link between sleep paralysis and alien abduction experiences has yet to be firmly established (e.g., Appelle et al.,

2000). It is certainly the case that there are many differences between sleep paralysis and alien abduction experiences. Furthermore, Terrillon and Marques-Bonham (2001), found that although about half of the respondents they recruited from a sleep web site invoked a paranormal cause to explain their ASP, none interpreted their experiences as alien abductions. From this they conclude: ''Either individuals who report alien abductions have chosen not to post messages, or the association between ASP and alien abductions is not as strong as it is generally thought'' (p. 115). However, such a conclusion is unwarranted. It is unlikely that self-reported abductees would visit a sleep-related website very often given that they would not view their strange experiences as being due to a sleep-related anomaly in the first place. There is clearly a need for further research into the possible links between sleep-related anomalies and alien abduction claims.

FALSE MEMORIES

As stated, the experiences associated with ASP fall far short of a full-blown alien abduction experience in which individuals may report being taken on board alien spaceships and subjected to painful medical examination. How is it that individuals can end up believing that they have had contact with extraterrestrials on the basis of an episode of sleep paralysis?

In some cases, it appears that abductees base their claim entirely upon their memory of what they experienced during the sleep paralysis episode and have no conscious recollection whatsoever of any actual contact with aliens. They do this because self-appointed UFO experts have widely disseminated the idea that typical symptoms of ASP are indicative of abduction by aliens. The most notorious example of this was the Roper Poll carried out in the early 1990s (Hopkins et al., 1992), a survey of anomalous experiences in a random sample of 5947 American adults. The authors' estimate that 3.7 million Americans had been abducted was not based upon reports of consciously remembered abductions at all, but was an extrapolation based on the incidence of occurrence of fairly common sleep paralysis symptoms. For many people, the explanation that their frightening experience of ASP was actually all that remained of an alien encounter once their memories had been wiped (almost) clean at least allowed them to begin to make sense of the episode. It also reassured them that they were not ''going crazy''.

Many sufferers at this point seek out the services of therapists specialising in alien abductions. They are likely to be subject to a variety of techniques alleged to uncover ''repressed memories'', such as hypnosis or guided imagery. Most will obligingly produce the now-standard account of a full-blown alien abduction. The dangers of the use of hypnotic regression and related techniques in this context have been emphasised by many commentators (e.g., Randle et al., 1999; Showalter, 1997; Spanos, 1996). The available evidence overwhelmingly

supports the idea that the accounts produced are false memories which are believed in with total conviction by the claimant.

Recent research has begun to address the neuropsychology of false memories. False memories for words can reliably be produced by presenting participants with lists of words (e.g., *thread, sew, pin,* etc.) which are all strongly associated with a target word (e.g., *needle*) which is not actually presented. During a subsequent recognition or recall task a large proportion of participants will confidently assert that the target word was indeed presented. An early study by Schacter et al. (1996) revealed that the pattern of activation in the brain when participants accurately recognised previously presented words was generally very similar to that found when they falsely identified target words which had not in fact been presented. Specifically, there was strong activation in the frontal lobes as well as activation in the inner parts of the temporal lobe near the hippocampus. Intriguingly, there were also hints of some differences in the pattern of activation. An area of the frontal lobe believed to be involved in monitoring memories appeared to show greater activity during false recognition compared to accurate recognition. Subsequent work using the more appropriate technique of measuring event-related potentials, however, supported the notion that brain activity is very similar whether word recognition is true or false (Johnson et al., 1997).

There is some evidence to suggest that abductees may be more prone to false memories than others. Clancy and colleagues (unpublished study, cited in Schacter, 2001) have very recently shown that abductees are more susceptible to false memories for words using the technique described above. Recent research has shown that it is possible to implant false memories in many people not only for simple words but for entire episodes (Loftus, 2001). It would be of great interest to directly compare abductees with appropriate control groups for susceptibility to this type of false memory. There is evidence to suggest that many of the features said to characterise abductees (tendency to dissociate, difficulty distinguishing fantasy from reality, etc.; see, e.g., French, 2001) are precisely those that would indeed lead to heightened susceptibility to false memories.

PSYCHOPATHOLOGY

It is often assumed that people who claim to have been abducted by aliens are mentally disturbed. This is the view sometimes taken by the mass media, who in the past have attributed sightings of UFOs to ''psychopathological disturbances in the witness'' (Schwarz, 1979, p. 113). Psychopathological disorders that may account for abductee experiences are characterised by delusions and include various forms of psychosis, personality disorders, and dissociative disorders. Although data are limited, those which are available suggest that serious psychopathology is no more common amongst those claiming alien contact than

among the general population. For example, Spanos et al. (1993) compared people who had reported intense UFO-related experiences (e.g., missing time or seeing and communicating with aliens) with those who had reported nonintense experiences (e.g., seeing unidentified lights in the sky) and with control groups not reporting any UFO experiences. The groups were not found to differ on objective measures of psychopathology. In addition, Parnell and Sprinkle (1990) administered the Minnesota Multiphasic Personality Inventory (MMPI) to 225 individuals reporting UFO experiences and concluded that there was ''no overt psychopathology'' (p. 45) in the group as a whole. The conclusion that abductees do not show higher levels of psychopathology was also reached by Bloecher, Clamar, & Hopkins (1985) with respect to nine abductees, Rodeghier et al. (1991) for 27 abductees, and Mack (1994) for his 76 abduction cases. Finally, Bartholomew et al. (1991) analysed the biographies of 152 subjects who reported temporary abductions or repeated UFO contact and found them to be ''remarkably devoid of a history of mental illness'' (p. 215).

The data do, however, suggest that abductees are not psychologically representative of the population as a whole. In the study by Parnell and Sprinkle (1990), those who claimed to have communicated with aliens ''had a significantly greater tendency to endorse unusual feelings, thoughts, and attitudes; to be suspicious or distrustful; and to be creative, imaginative, or possibly have schizoid tendencies'' (p. 45). Rodeghier et al. (1991) reported relatively higher levels of loneliness, unhappiness, and poorer sleep patterns. Mack (1994) reported high levels of childhood trauma, as did Ring and Rosing (1990). The latter investigators also reported that, as children, abductees were more sensitive to ''non-ordinary realities''. In addition, Stone-Carmen (1994) found that a staggering 57% of her sample of abductees reported suicide attempts. Finally, dissociative tendencies (i.e., the tendency for some mental processes to temporarily ''split off'' from the normal stream of consciousness) have been shown to be higher in abductees than nonabductees by Powers (1994). As already noted, the tendency to dissociate is associated with susceptibility to false memories.

The overall conclusion for the psychopathology hypothesis, however, must be that the idea that people who claim that they have been abducted by aliens are in some way mentally unstable is currently not strongly supported by empirical evidence.

ABNORMAL ACTIVITY IN THE TEMPORAL LOBES

Another interesting hypothesis which has been proposed to account for the unusual experiences which some people may interpret as being an alien encounter involves the temporal lobes. Penfield and Perot (1963) reported that auditory hallucinations can be brought about in participants by direct electrical stimulation of the temporal lobes. Following on from work such as this,

Persinger (e.g., Persinger, 1990; Persinger & Makarec, 1987; Persinger & Valliant, 1985) has argued that a variety of unusual experiences, including the experience of being abducted by aliens, can be accounted for in terms of abnormal activity in the temporal lobes. It has been found that people who suffer from partial complex or limbic (temporal lobe) epilepsy often report that their seizures are preceded by strange sensations. These include seeing shadowy figures and other visual and auditory hallucinations (O'Donohoe, 1994), hearing voices, smelling strange odours, feelings of levitation and anxiety (Ervin, 1975), and strange sensations around the genitals and anal sphincter (Rémillard et al., 1983). Persinger (1989) has also reported that temporal lobe seizures are associated with a feeling that something profound has occurred and with feelings of missing time. On the face of it, it is clear that many of these experiences are very similar to those reported by alien abductees.

This does not mean, however that people who report abduction experiences are simply suffering from temporal lobe epilepsy. Persinger (1984) believes that complex partial epilepsy falls at one end of a continuum, and that people may have differing degrees of abnormal temporal lobe activity. In addition, he asserts that people with higher degrees of such activity are more prone than others to experiences that resemble (in a less intense form) the experiences reported by limbic seizure sufferers. According to Persinger, people with these higher levels of temporal lobe lability report what he terms ''benign limbic experiences'', which include feelings of presence, flashback imagery, depersonalisation, and odd smells and beliefs.

Persinger has developed a technique whereby he applies weak complex magnetic fields directly to people's heads. One participant in his experiments was psychologist Susan Blackmore (Blackmore, 1994). She described a variety of unusual sensations including a feeling of having her limbs pulled, anger, fear, and disorientation. Although it is clear that such sensations are not strikingly similar to those reported by alien abductees, Blackmore argues that they nonetheless could provide the basic material through which alien abduction experiences could be created. More recently, Persinger and colleagues have reported that they were able to induce the subjective appearance of an apparition in a susceptible volunteer using this technique (Persinger, Tiller, & Koren, 2000). In this case the participant was a 45-year-old journalist and professional musician who claimed to have had a haunt experience four years previously. Persinger et al. report that within ten minutes of exposure to transcerebral magnetic fields over the right hemisphere, the man reported intense ''rushes of fear and cold shivering''. This participant reported that ''the synthetic experience of the apparition was very similar to the one experienced in the natural setting'' (p. 659). It is clear that if such an effect is replicated by independent investigators, it could be of tremendous significance in accounting for a whole range of ostensibly paranormal phenomena.

Finally, and even more controversially, Persinger (1990) has formulated the ''Tectonic Stress Theory'' (TST). This theory states that ''most UFO phenomena (not due to frank misobservation) are natural events, generated by stresses and strains within the earth's crust'' (p. 105). These stresses and strains are the result of movements of tectonic plates and can result in strong electromagnetic fields. Persinger suggests that luminous phenomena alleged to be associated with such tectonic activity are often wrongly reported as UFOs. In addition, the electromagmagnetic fields are said to result in overactivity of the temporal lobe in susceptible individuals, causing symptoms similar to temporal lobe epilepsy (e.g., visual and auditory hallucinations and bizarre experiences), and even full-blown alien abduction experiences.

To date, the presence of electromagnetic fields during alien abduction experiences has not been conclusively demonstrated and Persinger's theory has been criticised on theoretical grounds (e.g., Jacobs, 1990; Long, 1990; Rutkowski, 1984, 1990, 1994). In addition, the prevalence of temporal lobe lability among alien abductees has also not been established. For example, Spanos et al. (1983) compared 49 UFO reporters with control groups using the 52-item temporal lobe subscale of the Personal Philosophy Inventory designed by Persinger and Makarec (1987) to assess temporal lobe lability. They found no differences between groups. More recently, Cox (1995) compared 12 British abductees with a matched control group and a student control group and revealed no differences on the temporal lobe lability scale. It is clear that more research needs to be conducted to assess the validity of Persinger's claims.

SUMMARY AND CONCLUSION

In summary, the evidence relating to alien abduction experiences do not support the view that claimants really have been abducted (or, in general, that they are deliberately lying). Four areas of neuropsychology and neuropsychiatry have been considered as potentially supplying clues to understanding such claims. First, it has been argued that alien abductee accounts are often based on episodes of awareness during sleep paralysis. Second, the neuropsychology of false memories has been discussed. It is almost certainly the case that most (and probably all) claims of elaborate alien abduction are based on false memories. Third, research has been outlined which has explored the possibility that abductees are somehow mentally unstable. There is currently no strong evidence that abductees in general suffer from serious psychopathology at a higher rate than the general population. In more subtle ways, however, they are not representative of the general population. Finally, the theory that some abductee experiences are due to abnormal activity in the temporal lobes has been addressed, along with the suggestion that tectonic strain is somehow implicated. Potentially, such ideas may go a long way

towards explaining abduction experiences as well as other ostensibly paranormal experiences, but more supporting evidence is needed, particularly from independent investigators.

In fact, although neuropsychology and neuropsychiatry provide tantalising clues with respect to a fuller understanding of the alien abduction experience, it must be recognised that much more research is needed in all four of the areas discussed. Furthermore, even excluding the minority of cases based on serious psychopathology or deliberate hoaxes, there are still many cases on which the neurosciences can currently cast little light. To give but one example, many alleged abductions occur when people are driving in their cars. There are many anecdotal accounts of so-called ''highway hypnosis'' in which, especially during long monotonous drives, individuals may enter a dissociated state. In mild forms, this may simply produce the experience of missing time familiar to most experienced drivers. In some cases, however, it appears to form the basis of full abduction experiences. Clearly, this is an area that deserves further consideration by neuroscientists.

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