Dreaming in Urbach-Wiethe patients: The effect of amygdala damage on dreaming

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PLAGIARISM DECLARATION

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

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ABSTRACT

As it stands, there is a paucity of literature looking at the effect of damaged amygdalae on dreaming and dream content. Of the many functions, the amygdala is heavily involved in processing emotional stimuli and fear conditioning. In Revonsuo's threat simulation theory (TST), the amygdala plays an important role in the threat simulation mechanism. This mechanism evaluates the threatening situation, then chooses and executes the avoidant type behaviour to successfully avoid the potential threat. All of this is done in the dream world to ensure that humans have a safe virtual environment in which to practice these responses. To test this theory, a sample of people without a functioning amygdala was needed. Unfortunately, bilateral amygdala lesions are extremely rare in the human population. Urbach-Wiethe disease (UWD) is a rare, autosomal recessive disorder that presents with characteristic amygdala calcifications. A sample of 8 UWD patients and 8 matched controls (all females) from the Northern Cape in South Africa were used. Using this sample of patients allowed to test the effect amygdala damage has on dreaming. A total of 40 dream reports were collected using the Most Recent Dream method. These reports were analysed quantitatively using a variety of tests (Hall-Van de Castle test, The Affective Neuroscience Dream Scale, Dreamlikeness, Wishfulfillment, approach and avoidance behaviour, The Affective Dream Scale, and The Bizarre Elements Scale). The number of approach and avoidance behaviours was calculated to determine the accuracy of Revonsuo's threat simulation theory. Once the analyses were completed, it was determined that there were few significant results and these results provide both support and opposition for the TST. One significant finding is that Urbach-Wiethe patients' dreams had less dreamlikeness when compared to the matched controls. However, the overall results indicate that Urbach-Wiethe patients dream contents are much the same as the matched controls. This leads to tentative evidence suggesting that amygdala calcifications do not affect dream content. To date, no dream research has been conducted on patients with Urbach-Wiethe disease, so this researched was the first of its kind in the field.

Keywords: dreaming; Urbach-Wiethe disease; emotions; Hall-Van de Castle method; Affective Neuroscience Dream Scale; threat simulation theory, Affective Dream Scale.

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DREAMING IN URBACH-WIETHE PATIENTS: THE EFFECT OF AMYGDALA DAMAGE ON DREAMING

The field of dreaming and dream research is one that is constantly evolving. Since the 1950s, dream research has shifted from focusing on waking and dreaming to that of dream generation. Throughout this period, much progress has been made with regard to dream research. The dream research field is inundated with studies and research speculating the role of particular brain regions during dreaming and dream generation. The current research and theories do not fully account for the role of the amygdala in dreaming. Much of this research is polemic in nature, with little consensus. This is due, in part, to the fact that testing the role of the amygdala in dreaming requires a sample of patients with bilaterally symmetrical lesions of the amygdala. Finding patients with circumscribed amygdala lesions is extremely rare, especially when looking for bilateral amygdala lesions. When these patients are found they are usually in very small sample groups, which make the results difficult to generalize.

Urbach-Wiethe disease (UWD) is a rare recessive disorder which is associated with symmetrically bilateral lesions of the amygdala, with limited impact upon surrounding regions. This research studied whether patients with Urbach-Wiethe disease have the ability to recall their dreams, and characterized the content of their dream narratives. The aim of this research was to determine what happens to dreaming when the amygdala is calcified and no longer functioning. It also explored if the dream content of Urbach-Wiethe patients differed from the dream content of the matched controls. Specifically, the emotional content of the dreams was explored, focusing especially on the role of the amygdala, a structure thought to be intimately involved in the processing of anger/rage and fear/anxiety.

The goal of this research was to fill an important gap in the vast body of dreaming knowledge. However, this research did not focus on the varieties of dreams or the various characteristics associated with dreams, like much of the previous dream research. Rather, it looked at the possible amygdala involvement in dream narratives, the amygdala-controlled emotions experienced in dream narratives and any possible differences found in the dream reports. This research aimed to further clarify the role the amygdala plays in dreaming and dream narratives.

LITERATURE REVIEW

For several years, there has been much interest in the functional role played by the amygdala, especially in the role played in emotional processing and dream generation. Numerous studies have shown that the amygdala is involved in generating negative emotions, especially

anger and fear (Panksepp, 1998). Other researchers have found a wide range of functions in which the amygdala is involved (for examples see LeDoux, 2000), one of which is for the emotional content of dreams (Hobson, Pace-Schott & Stickgold, 2003).

In the field of dreaming and dream research, there are many competing theories of dreaming and the functions of dreams. The critical articles from the leading dream research authors will be explored and discussed below. Furthermore, this literature review will summarize the key articles in the dream research field and highlight the results of various studies and research. Lastly, it will explore the research and literature pertaining to the amygdala, as well as investigate Urbach-Wiethe disease (UWD).

Revonsuo's dream theory

Currently, Antii Revonsuo is one of the most eminent dream theorists. Revonsuo's 'threat simulation theory', also known as TST, has proven to be a significant and influential theory in the dream research field. This theory takes an evolutionary and biological perspective of dreaming. Critically, this theory encapsulates the functions of dreams, and puts dreaming in an evolutionary context by claiming that the function of dreaming is a biologically adaptive one. It is further believed that during our evolutionary history, dreaming provided humans with a selective behavioural advantage (Valli, Lenasdotter, MacGregor & Revonsuo, 2007).

Revonsuo (2000, p. 878) claims that the function of dreams is to "simulate threatening events in order to rehearse threat perception and the appropriate threat-avoidance skills and behavioral programs". Furthermore, it is assumed that dreaming allows the offline "simulation of the sensory-perceptual, motor, and social space that we experience during wakefulness (Valli et al., 2007). However, Revonsuo points out that although dreaming has this biologically adaptive function it is important to note that not every dream of every individual will realize this biological function.

According to the TST, it is believed that there is an overrepresentation of threatening situations in dreams, especially when compared with real-life or other dream events (Revonsuo & Valli, 2008). This assumption is based, in part, on Domhoff's research pertaining to the number of positive and negative emotions experienced in dreams (Domhoff, 1996). As will be explained later, Domhoff's (1996) research suggested that there was a predominance of negative emotions in dreams. Revonsuo (2000) further claims that the brain is hard-wired to develop threatening dream narratives for the dreamer in which to simulate the appropriate avoidance behavioural response. In order for this to take place, a mechanism is needed to evaluate and process the threatening situation or stimuli and elicit an appropriate

behavioural response that will overcome the threat in the dream. Revonsuo (2000) calls this mechanism the 'threat simulation mechanism'. This will be discussed in further detail below.

TST highlights that "the brain's dream-production system selects traumatic contents not because they represent unresolved emotional problems, but primarily because such experiences mark situations critical for physical survival and reproductive success" (Revonsuo, 2000, p. 889). It follows that the dreamer's threatening situation presented in the dream allows the dreamer to practice threat avoidance reactions in a safe, virtual environment without any hazardous consequences. The successful results allow for the situation and appropriate behaviour to be generalised to a similar situation in waking life. Furthermore, Revonsuo (2000, p. 894) believes that "threat simulation during dreaming increases the probability of coping successfully with comparable real threats, leading to increased reproductive success".

Revonsuo (2000) sees the TST and its threat avoidance mechanism as similar to mental training and implicit learning. He further believes that it is highly likely that rehearsing these threat avoidance techniques leads to improved performance in real-life threatening situations, in much the same way as mental training leads to improved performance in a multitude of tasks. In essence, the more the behaviour is practiced and the threat successfully avoided, the quicker one is able to select and complete the behaviour in a real life situation, which allows a better chance of survival.

This theory is based on a set of six propositions. These propositions explain various aspects and elements of the threat simulation theory. However, these propositions are not of importance for this study, as they were not explicitly tested. Nonetheless, they will be summarized as to provide the fundamental elements of this theory.

Revonsuo's six propositions

Proposition one states that dream content is not disorganized; it is too organized to have arisen by chance. Proposition two explains that dreams are specialized in the reproduction of threatening events. This proposition is derived from the fact that there are more negative emotions experienced in dreams, with the most common emotion being fear (Domhoff, 1996). Proposition three states that threats experienced during waking will affect subsequent dream content. The fourth proposition highlights that the threats experienced in dreams are realistic and therefore appropriate practice of threat avoidance responses. Proposition five states that the simulation of threatening events in dreams leads to improved performance in similar real life situations, even if these simulation episodes are not consciously remembered

by the dreamer. The final proposition can be summarized as follows: the ancestral environment in which humans lived contained frequent dangerous situations that influenced reproductive success. These ecologically valid cues would continually activate the threat simulation mechanism in the dreamer (Revonsuo, 2000).

Definition of threatening event

All through Revonsuo's threat simulation theory, the term 'threatening event' is utilized. In order to avoid ambiguity or confusion, this term will be defined. A threatening event is biologically defined as any event that may affect the survival and/or reproductive success of an individual. In their 2008 article, Revonsuo and Valli defined a threat as: "any adverse events that potentially endanger future reproductive success" (p. 1294). This includes events such as injury and/or death, isolation/rejection and a loss of material resources. These specific events endanger the dreamer in some way and can range from primitive threatening events (for example, being chased by a lion) to modern threatening events (such as being shot at).

What is the threat simulation mechanism?

The threat simulation mechanism is at the centre of Revonsuo's threat simulation theory. Without it, the dreamer is not able to process the threatening event or select the required behavioural response. It is hypothesised that the threat simulation mechanism (which is presumably a brain mechanism) is activated when an imaginary threat is perceived by the dreamer in the dream. Once the mechanism has been activated, the appropriate imaginary behaviour is quickly selected to overcome the threatening situation. These behaviours are specially selected by the threat simulation mechanism to avoid the threatening event successfully, and to ensure the dreamer has an improved chance of survival and/or reproductive success. In addition, once these behaviours have been sufficiently practiced the dreamer is better able to deal with a similar threatening situation in real life, using the behaviours learnt in the threatening dream. With practice from dreams, the behaviours can be chosen and utilized quicker when in a similar waking life situation.

From Revonsuo's (2000) article, it was determined that the amygdala is part of the threat simulation mechanism as the amygdala is involved in threat perception and processing the appropriate threat avoidance behaviour (LeDoux, 2000). As this theory relies on threat perception and avoidance, it is understandable that the amygdala plays a vital role in Revonsuo's theory. LeDoux (2000) explains that the amygdala is heavily involved in fear perception and the conditioned fear response. This will be explored further below.

How does the threat simulation mechanism work?

TST hypothesizes that dreaming is a safe environment in which to practice these threat avoidance skills. At its core, the threat simulation theory is based on fear conditioning (Revonsuo, 2000). The threat simulation mechanism is based on the 'FEAR' neural pathway, which is controlled predominantly by the amygdala (Panksepp, 1998). The amygdala also controls the execution of fight or flight behaviours, behaviours that are fundamental to the TST. This highlights that the threat simulation mechanism revolves centrally around the amygdala and the amygdalocortical network. Revonsuo (2000) believes that the amygdalocortical network, particularly the amygdala, evaluates the content of the visual scene to identify any potentially dangerous situations or anything that may potentially threaten the dreamer. Once the threat or the threatening situation has been identified, the threat avoidance stage follows. This stage consists of the rapid selection of the appropriate behavioural response to the dangerous situation. These behavioural responses consist of fleeing, defending, hiding, attacking, and so forth, and they are controlled by the amygdala. Once the appropriate behaviour has been chosen, it is executed and the threat is avoided. This simulation leads to the efficient release of the cognitive and motor skills needed to evade a threatening event. The increased efficiency of identifying a threat and choosing the appropriate behaviour leads to decreased latency when dealing with similar threats during waking life. Consequently, this leads to the increased probability of successfully coping with the threat and therefore leads to increased reproductive success.

The amygdala's role in Revonsuo's TST

The amygdala forms the basis of Revonsuo's threat simulation theory, as it is the putative threat simulation mechanism. Revonsuo explains that the amygdala, which is considered a 'hot' network, will "efficiently process the threatening cues and immediately activate threat-avoidance mechanisms" (Revonsuo, 2000, p. 887). In Panksepp's classification, this pathway is known as the FEAR system and this system "provokes freezing at low levels of arousal, and flight at higher levels" (Panksepp, 1998, p.779). Furthermore, the FEAR system is activated by various threatening events, both internal and external stimuli. This illustrates that the amygdala will arouse avoidant behaviour when activated in both waking life and dreaming. The amygdala is important for all avoidant type behaviour, not just the fight or flight response as this pathway will also activate behaviours such as hiding.

Summary of the threat simulation theory

The threat simulation theory claims that dreams have a biologically adaptive function. This function is to simulate threatening events in dreams as practice for real life threatening events. By practicing the appropriate avoidance behaviour, the dreamer has an increased chance of reproductive success in real life. The threat simulation mechanism (the 'FEAR' system- based primarily on the amygdala) is said to be activated when a threat is perceived by the amygdala in the visual field. Once this threat has been perceived, the threat simulation mechanism selects the appropriate avoidance behaviour, which then allows the dreamer to develop new skills. These skills can be carried across and generalised to real-life so that the dreamer is better able to cope with a similar threatening event. Due to this, Revonsuo believes that dreams have an overrepresentation of threatening events and avoidant-type behaviour, due to the nature and function of the dreams.

Evidence supporting Revonsuo's TST

There is a multitude of studies exploring the threat simulation theory, and most of these studies test each of the six propositions underlying the TST. Many of these studies produced similar results. Due to the number of studies, this will be a brief summary of the most relevant studies.

In 2007, a study conducted by Valli and colleagues studied the threat simulation theory with a sample of recurrent dreams. This study showed that the number of threatening events in their sample of dreams averaged 1.7 per dream. The majority of these threatening events are considered and judged to be "realistic and personally relevant threatening events" (Valli et al., 2007, p. 42). When the dreamer was reacting to these threatening events, the behaviour usually took the form of primitive defence behaviours such as fighting or fleeing (Valli et al., 2007).

When investigating recurrent dreams, Zadra, Desjardins, and Marcotte (2006) believed that the fear conditioning system is involved in dreaming. They noted that "simulation of threat recognition during dreaming (and presumably REM sleep) may very well fulfil the goal of priming an amygdalocortical network to perform rapid and appropriate emotional evaluation of the potential danger" (Zadra et al., 2006, p. 462). This is in line with Revonsuo's belief that the amygdala forms a major part of the putative threat simulation mechanism.

Research by Valli and colleagues in 2005 investigated the effect of threatening environments on children's dreams. This study highlighted that children who are exposed to

severe life-threatening events (such as living in a war-torn country) reported more threatening events in their dreams, especially when compared to the control group, who reported fewer threats in their dreams. This research provides evidence supporting the third proposition of Revonsuo's theory, which is believed to be one of the central propositions of the theory.

The vivid and threatening dream content of post-traumatic stress disorder (PTSD) patients highlight the amygdala's role in dreaming and supports Revonsuo's theory. The threatening and recurrent dream content indicates that the threat simulation mechanism is highly activated in PTSD dreamers as the majority of recurrent dreams contain at least one threatening event. These recurrent dreams tend to involve predominantly negative emotions (Zadra et al., 2006). This research conducted by Zadra and colleagues, (2006) indicates that there is evidence supporting Revonsuo's threat simulation theory.

Using a specially formed scale, the dream threat scale (DTS), Valli and Revonsuo (2009) investigated a series of dream reports. The scale looked at a range and variety of threats. Valli and Revonsuo looked at the nature of threats experienced, the targets of the threats, the severity of these threats, participation in the threatening event, the resolution of the event, and the realism of the threat. Their research confirmed each of the six propositions.

Emotions in dreams

There is little research exploring the types of emotions experienced during dreaming. The research that has been conducted focuses predominantly on negative emotions. This is because Domhoff, a leading dream researcher, found that negative emotions (fear and anger) constitute 80% of all reported emotions, and only 20% can be attributed to positive emotions (Domhoff, 2001).

Emotions play a predominant role in both the activation-synthesis theory and the AIM hypothesis (Hobson, Pace-Schott & Stickgold, 2003). The emotions are said to be the shaper of dream narratives. In their research, Hobson and colleagues (2003) found that negative emotions are principal emotions in dream narratives. Furthermore, in his article Domhoff (2005) explains that there are a variety of negative emotions experienced in dreams and that these negative emotions occurred twice as often as positive emotions (Domhoff, 2005). Recent research by Revonsuo and Valli (2008) reflected similar findings. They highlighted that dreams contain a high number of threatening events, and these events cause the dreamer to feel anxious or fearful.

The role of the amygdala in dreaming and the dreaming process is uncertain. There has been no research conducted which has explored the role of the amygdala in the dreaming

process. There is also no research that looks at the effects of amygdala damage on dreaming and dream reports.

The amygdala

In recent years, there has been much interest and research focusing on the amygdala and its function in waking cognition. Much of the earlier research focused on fear and the conditioned fear response. It was widely believed that the amygdala was at the centre of fear (Hamann, 2003). More recent amygdala research focuses on the role played by the amygdala in emotional memory. Since then, it has been discovered that the amygdala is involved in a far wider range of processes than originally thought. Furthermore, it has been found that this region of the brain has a diverse range of functions, most of which are imperative to our social functioning (Adolphs, 2003; Wang, McCarthy, Song & LaBar, 2005). Contemporary research has shown the extensive function of the amygdala. Due to the overwhelming number of studies and the vast amount of literature, the structure and function of the amygdala will be briefly outlined and discussed.

A brief overview of the general structure and function of the amygdala

Structure

The amygdala is an almond shaped area of tissue adjacent to the anterior portion of the hippocampus in the medial temporal lobes, and is made up of approximately 12 nuclei (LeDoux, 2000).

Current research pertaining to the function of the amygdala

The primary function of the amygdala is thought to be the processing of emotional stimuli (such as fear, disgust, surprise, anger, and joy). Studies (e.g., Adolphs, Russell, & Tranel, 1999) suggest that the amygdala is primarily involved in the processing of negative emotions such as fear/anxiety and anger/rage, and less so in processing positive emotions such as joy and surprise. This can be seen when the amygdala is activated by faces expressing particular emotions. For example, neuroimaging studies indicate that the amygdala is significantly activated when the subject looks at fearful and angry faces, and less so when looking at happy faces (LeDoux, 2000). Research by Adolphs et al. (1999) suggests that the amygdala also participates in generating fearful and aggressive behaviours in the subject. Panksepp (1998) found that the amygdala generates powerful fear responses, and this in turn, generates

the equivalent negative emotional states. These emotional states elicit the appropriate behaviours in the given situation.

It has been postulated that this region is of importance for the learned fear conditioned response and anxiety. Of particular importance is the amygdala's crucial role in the processing of the conditioned fear response (Adolphs et al., 1999). Davis (1997) has shown that the amygdala is also vital in the processing and generation of anxiety and anxious behaviours. Despite the amygdala's role in fear processing, research indicates that it is also preferentially involved in appraisal, especially in times of indecision and heightened vigilance (Rosen & Donley, 2006).

Due to its location, the amygdala is heavily involved in memory, particularly emotional memory. Adolphs, at the forefront of amygdala research, has shown that the information passing through the amygdala is prepared and consolidated before it reaches the hippocampus, where the information is then stored (Adolphs, 2003). Research further indicates that the amygdala "primarily enhances episodic memory for the gist of an emotional event" (Phelps, 2004). Research by Adolphs, Tranel, Damasio, and Damasio (1995) has shown that the amygdala plays an essential role when retrieving comprehensive knowledge, especially if the knowledge is related to fear and the concept of fear. Furthermore, the amygdala plays an essential role in eliciting knowledge retrieval and behaviours as a response to stimuli that are related to possible danger or threat to the organism. This processing is essential for the organism's survival (Adolphs et al., 1999). Further research indicates that the amygdala plays a modulatory function in the acquisition of declarative memories, especially those containing emotionally arousing material (Adolphs, Cahill, Schul & Babinsky, 1997).

According to research conducted by Adolphs et al. (1995), the amygdala is also used for the processing of facial expressions and plays a role in social grouping or categorization. This is imperative for our social knowledge and functioning. The amygdala is utilized in complex social situations and is used for aesthetic judgments, all of which require the neural networks for processing the above emotions. In a review of the literature, Adolphs (2003) found that due to the amygdala's location and connections, it also plays a key role in processing socially significant stimuli. Furthermore, Adolphs (2003) found that the amygdala is involved in mediating social judgments and ideas of attractiveness in others.

Research by Schwartz and Maquet (2002) indicates that the amygdala will mediate responses to any stressful situations and/or threatening stimuli. In the research conducted by Davis (1997), it was discovered that the amygdala might also play a role in emotion-mediated attention. The research indicates that the amygdala is utilized in almost all emotional

situations. Any emotionally salient situations cause the amygdala to activate as this region is predominantly involved in the processing and stimulating the appropriate behaviour in response to the stimuli or situation.

An interesting function of the amygdala is that of calculating value of a reinforcer. The amygdala is also capable of recalculating the value of the reinforcer when the circumstances change. For example, this would happen when the reinforcer is devalued (Morrison & Salzman, 2010).

Evidently, the functions of the amygdala are extensive and complex. Each function, whether it is the processing of emotional stimuli, consolidating memory or creating a learned fear response, is imperative for our social functioning. Damage to this delicate area can be socially detrimental. The consequences of amygdala damage will be explored below.

Research pertaining to the consequences of damage to the amygdala

As the above section indicates, the amygdala is involved in a variety of functions. This section will explore the effects and consequences of amygdala damage.

Most of the research looking at the function of the amygdala is based on single case studies of patients with bilateral amygdala damage (see Adolphs et al., 1995; Brand, Grabenhorst, Starcke, Vandekerckhove & Markowitsch, 2007; Gallagher & Chiba, 1996). Damage to the amygdala causes a range of effects, many of which can have unfavourable consequences. One such effect is the difficulty in comprehending facial expressions, especially those that are fearful or anxious in nature. Research by Adolphs et al. (1995) indicates that bilateral amygdala damage tends to compromise the subjects' ability to recognize fear in facial expressions. It is interesting to note that, although there is an inability to recognize fear, the ability to recognize and identify faces is left intact.

Damage to the amygdala can also affect the recall of emotional memories and knowledge. Recall of memories of fearful faces is also compromised. Adolphs et al. (1995) have found that damage to the amygdala impairs one's ability to process fearful facial expressions, as well as recalling images of fearful expressions. Consequently, the subject is unable to recognize and recall fearful facial expressions in others. Bachevalier (2000) found that those with bilateral amygdala damage were not able to make judgments of trustworthiness and approachability in unfamiliar faces. In other recent studies, it has been found that the participants with amygdala damage rated others to be more approachable and trustworthy than the control group did. Further research indicates that patients with amygdala damage are highly impaired when memorizing emotionally salient stimuli, when measured

with the picture recognition test. These participants tended to score poorly when remembering emotional and/or neutral pictures (Siebert et al., 2003). In a review of the literature by Hamann (2001), it was found that damage to the amygdala impairs not only the encoding of explicit emotional memory, but the consolidation of this type of memory as well.

According to Zillmer, Spiers, and Culbertson (2008), it has been established that damage to the amygdala causes the disintegration of the learned fear response.

When being tested using the Iowa Gambling Task, it was found that patients with amygdala damage performed badly on tasks that test decisions under ambiguity (Brand et al., 2007). Patients with amygdala damage also performed poorly in a task that tested decisions under risk, which was measured with the Game of Dice Task (Brand et al., 2007). These patients performed poorly because the decisions that needed to be made were related to emotional feedback processing, which is inefficient when there is amygdala damage (Brand et al., 2007).

Studies have shown that the consequences of amygdala damage can be profound. One such consequence is that an individual may approach a person or situation that ordinarily would evoke a fearful response. This could lead to devastating health, financial and social consequences for the individual (Brand et al., 2007).

The above findings roughly reflect what is to be expected from patients with Urbach-Wiethe disease in waking life. Amygdala research has yet to delve into the equivalent consequences in dream life and dream content.

Urbach-Wiethe Disease

Urbach-Wiethe disease (UWD), also known as lipoid proteinosis, is a rare, autosomal recessive disorder found predominantly in the Caucasian population, more specifically in those of European descent and those from consanguineous partners (Claeys et al., 2007; Emsley & Paster, 1985). The largest single population of these patients can be found in the Northern Cape Province of South Africa (Hamada, 2002), possibly due to the founder effect. According to Hamada (2002), this disorder is more prevalent in countries in which consanguinity is common. Despite this, there have been a few recently reported cases from non-European countries, such as west India (Kini et al., 2006). It has been discovered that both sexes are equally affected by this disorder (Rallis, Balatsouras, Papadakis, Economou, Kaberos, & Korres, 2006). Unfortunately, there is no cure for Urbach-Wiethe disease; one can only manage and treat the symptoms associated with the disease. This disorder can affect

one's quality of life, especially due to the disfiguring lesions and the hoarseness of the patients' voices (Rallis et al., 2006).

This genetically inherited disease was discovered and described by Urbach and Wiethe in 1929 and approximately 300 cases have been reported since that time. Originally, this disease was described as a dermatological condition by Urbach and Wiethe, but it has since been found that it is a multisystemic disease affecting the central nervous system, respiratory system and the gastrointestinal system (Francis, 1975).

Recent research has indicated that this disease is caused by a mutation of the ECM1 gene. Based on Hamada's (2002) research, the ECM1 gene is involved in bone mineralization and epidermal differentiation. For example, Urbach-Wiethe disease causes specific changes and damage to the brain, skin, and larynx, to name a few areas. Damage is caused by a deposit and build-up of hyaline-like material in the tissue.

Early signs of Urbach-Wiethe disease

The signs and symptoms associated with Urbach-Wiethe disease appear from an early age. An example of this is that most children born with Urbach-Wiethe disease are unable to cry at birth, and will develop a soft or hoarse voice within the first two years of their life (Francis, 1975). It has been discovered that most children with this disease will develop a waxy appearance, especially of the face (Friedman, Mathews & Swanepoel, 1984). Many of the other signs (see below) appear during early to late childhood.

Dermatological manifestations of UWD

There are a number of clinical manifestations of Urbach-Wiethe disease. Skin abnormalities are usually the first and most prominent signs of this disease (Claeys et al., 2007). Based on research conducted by Hamada (2002), Urbach-Wiethe disease has similar clinic-pathological features to certain varieties of porphyria. According to Feiler-Ofry, Lewy, Regenbogen, Hanau, Katznelson, and Godel (1979), a variety of dermatological manifestations are evident in patients with Urbach-Wiethe disease. One such sign is that the skin is damaged and scarred easily, causing pox-like or acne-form scars (Teive et al., 2004). Other dermatological manifestations of this disease, amongst others, include yellow papules along the margins of the eyelids, and general thickening of the skin and other mucous membranes (Desmet et al., 2005; Teive et al., 2004). This leads to a waxy appearance of the skin, a wood-like tongue, and lesions and wart-like plaques on the skin (Friedman et al., 1984). Furthermore, research indicates that these lesions may occur anywhere on the patient's body (Blodi, Whinery, and

Hendricks, 1960). Hamada's (2002) research indicates that the skin is frequently and easily damaged by any friction or minor trauma during the childhood years. This can lead to severe scarring of the skin. It is interesting to note that non-scarring alopecia occasionally occurs in these patients (Leonard, Ryan & Sheldon, 1981). Hyperkeratosis may be present in these patients, especially in areas exposed to mechanical friction, with the most common areas affected being the hands, elbows, knees, buttocks, and axillae (Hamada, 2002).

Neurological, neuropsychological, and neuropsychiatric manifestations of UWD

Although much of the earlier research conducted on Urbach-Wiethe disease focused on the medical and physical aspects of the disease, recent studies and research have looked towards the psychological and psychiatric effects of this disease. Neurological and neuropsychological conditions are very common in these patients and often develop slowly in Urbach-Wiethe disease. These symptoms reflect the calcification that leads to degeneration of the brain tissue. This damage is caused by the progressive deposit of hyaline-like material in the tissue of the brain and body (Teive et al., 2004).

One of the most common neurological symptoms includes epilepsy. This epilepsy varies from absence seizures (Francis, 1975) to generalized tonic-clonic seizures (Claeys et al., 2007) and it has been found that over half of those diagnosed with Urbach-Wiethe disease will have temporal lobe epilepsy (Emsley & Paster, 1985). In a study by Claeys et al. (2007), it was found that the seizures could take place as a visual or olfactory aura, followed by a loss of consciousness. Further research has determined that the seizures experienced by Urbach-Wiethe patients can occur with or without automatisms.

This disease presents with a variety of psychiatric symptoms. Teive and colleagues (2004) found that paranoid symptoms are frequent in Urbach-Wiethe patients. One study, which was conducted in South Africa, revealed that psychiatric disorders such as anxiety disorders, mood disorders, psychosis, and schizophrenia were relatively common in these patients (Thornton et al., 2008). Claeys and colleagues (2007) determined that there is evidence of depression in these patients, but it could not be determined whether the depression was a cause of the direct living situation or as a direct result of the disease. Despite this finding, depression is not a common symptom of Urbach-Wiethe disease.

Calcification of the amygdala

One of the characteristics of Urbach-Wiethe disease is lesions in the medial temporal lobes. Claeys and colleagues (2007) found that medial temporal lobe calcifications involving the amygdala are present in almost all of the reported cases of Urbach-Wiethe disease. According to Claeys et al., (2007), approximately 50-75% of Urbach-Wiethe patients present with these calcifications. These calcifications are very often bilateral, symmetrical and bean (or oval) shaped. According to Straut and Naidich (1998), these calcifications consist of dense amorphous masses of calcium and bone. There are also small blood vessels that are haphazardly arranged that have been found to contain thickened and completely calcified walls.

The bilateral lesions in the temporal lobes are possibly the focus of the temporal lobe epilepsy found in many Urbach-Wiethe patients, as well as the psychotic symptoms experienced by these patients. The degeneration and calcification of the amygdala occurs over time (Siebert, Markowitsch & Bartel, 2003) and is evident in adult patients, but not children. This is because the calcifications develop slowly during childhood and adolescence until the amygdala is fully calcified in adulthood (Claeys et al., 2007). This calcification is unique as it is rare to find circumscribed damage to the amygdala. Damage to the amygdala usually includes the surrounding structures. An example of this is that herpes simplex encephalitis attacks and destroys the limbic areas, particularly the amygdala, and the hippocampus (Zillmer et al., 2008). Herpes simplex encephalitis does not leave circumscribed damage of the limbic system, unlike Urbach-Wiethe disease.

Bilateral amygdala calcifications are not the only calcifications with which Urbach-Wiethe patients seem to present. Researchers have found that areas surrounding the amygdala are also affected. Leonard and colleagues' (1981) research has indicated that some Urbach-Wiethe patients have calcifications involving the amygdaloid complex as well as the hippocampal region. Teive and colleagues (2004) found that an Urbach-Wiethe patient of theirs presented with striatal calcifications and not the usual amygdala calcifications. Despite these rare cases, the literature indicates that the majority of Urbach-Wiethe patients present with bilateral amygdala calcifications only, and the above cases are the exception to the rule.

This literature review has outlined the prominent theories and studies pertaining to Revonsuo's threat simulation theory, the amygdala and Urbach-Wiethe disease. The role of a damaged amygdala in dreaming has yet to be explored and clarified. As this literature review has shown, there has been no dream research conducted on patients with Urbach-Wiethe

disease. As shown above, Urbach-Wiethe patients present with characteristic bilateral amygdala lesions, which provide researchers with a rare opportunity to explore the effect of damaged amygdalae on dreaming.

Rationale

Ethical considerations limit the scope of lesion research in human subjects. Due to these considerations, there has been a heavy reliance on animal studies when considering the effects of lesions in particular brain areas. The results from these animal studies cannot be accurately generalized to humans. The reason being is that, amongst other things, emotions are subjective states that cannot be described by animals and cannot always be accurately inferred from animal behaviour. There is also no way of obtaining dream reports from animals, if they dream. In human research, using the lesion method is an accurate way of directly inferring the function of a particular area of the brain. Naturally occurring and circumscribed bilateral amygdala lesions are extremely rare in humans, with very few large sample studies. The studies that managed to obtain such patients with amygdala lesions have only investigated emotional processing in waking life and not in dreaming and dream content.

Urbach-Wiethe disease provides a rare opportunity for researchers, as the majority of these patients present with highly circumscribed bilateral amygdala calcifications. These patients provide a unique opportunity to study the effect these lesions may have on dreams and the possible emotions experienced during dreams. Despite the paucity of Urbach-Wiethe disease patients worldwide, a larger neuropsychological study had access to a sizeable sample of Urbach-Wiethe patients in the Northern Cape (See Appendix A). Using these patients as a sample, it allowed the possibility of exploring the effect amygdala damage has on dreaming. Furthermore, it provided a chance to determine whether deficits (particularly in processing emotions) in waking life extended to dreaming and dream content. The TST utilizes the fear conditioning network which contains the amygdala- a primary region for fear conditioning (particularly the basolateral amygdala). As adult Urbach-Wiethe patients no longer have a functioning amygdala, it is possible to test the threat simulation theory using these patients as a sample. Furthermore, there is no research investigating affect experienced in dream reports in patients with damaged amygdalae. This study looked at these aspects, which have been neglected in dream research. This study will be the first of its kind in the dream research field.

Specific aims and hypotheses

Due to the fact that there has been a paucity of dream research exploring the effect of amygdala damage on dreaming, there was little available literature on which to base potential hypotheses or aims. Drawing from the available literature on the amygdala and amygdala damage, basic hypotheses regarding affect (particularly negative affect) were postulated. It was decided to start with the basics and work up towards more complex hypotheses. The underlying questions for this study were: Does having a calcified amygdala produce dreams different from matched controls? If so, in what way do these dreams differ?

The following questions were asked:

(1) Do patients with Urbach-Wiethe disease dream?

(2) If dreaming occurs in these patients, are the UWD dream reports shorter or longer than matched controls?

(3) Do Urbach-Wiethe patients have fewer incidents of negative affect in their dreams, particularly when looking at fear and rage, than the matched controls?

(4) Is affect, in general, lower in UWD dream reports than in control dream reports?

(5) Are Urbach-Wiethe dreams less dreamlike than the matched controls?

(6) Is the complexity and bizarreness of the dream lower than the control dreams?

(7) Is there an increase of wishfulfillment in UWD dreams when compared to matched controls?

RESEARCH DESIGN AND METHODS

Design

The present study was a quasi-experimental study that took an exploratory and descriptive approach. It also used a cross-sectional case control study design. As this is the first known study looking at the dream content of patients with Urbach-Wiethe disease, it was best to take an exploratory approach, especially with regard to the dream data. Little was known about the type and amount of data that was to be collected and it was important to keep an open mind. This research was quasi-experimental because the participants of the two groups could not be randomly assigned to any group. Therefore, there were two groups, the Urbach-Wiethe patients and the control sample. A descriptive approach was necessary for the dream content. This allowed for the dream content to be explored further, and an attempt to be made as to explore how amygdala damage may affect dreaming.

Participants/Sample

A total of 20 adult participants were recruited to take part in the present study. This included a sample of 10 adult Urbach-Wiethe patients from the Northern Cape region of South Africa and a sample of healthy participants from the same region. Due to there being difficulties obtaining access to the UWD patients, a larger sample was not possible. All of the participants ranged in age from 22 years old to 69 years old. Both male and female participants were recruited for this research. These sample groups were obtained from a larger, ethically approved neuropsychological study that was running concurrently to this study (see Appendix A). Due to unique events of geographical isolation, all of the participants came from the same area in the Northern Cape and they all belonged to a low socioeconomic category. All of the Urbach-Wiethe patients had been diagnosed with the disease for many years, some from childhood. This diagnosis is based on the standard set of clinical examinations and genetic tests. The gene mutation for Urbach-Wiethe has been mapped out and the genetic test identifies for this mutation. This allows for the accurate diagnosis and treatment of the disease. Rallis et al. (2006, p. 3) explain that “lipoid proteinosis was mapped to 1q21 and pathogenetic loss of function mutations were identified in the extracellular matrix protein 1 gene (ECM 1)”. The genetic test is positive for Urbach-Wiethe disease if this mutation is found. All of the UWD participants were diagnosed using this genetic test, and not solely on their symptoms.

A group of 10 healthy South African participants, matched for age, gender, and SES, were also studied as the comparative, or control group. The control group consisted of close friends and family of the Urbach-Wiethe patients. This ensured that the two groups were already matched for education, language, ethnic group, and socioeconomic background.

Due to the lack of sufficient data, a further 23 participants were recruited and asked to recall a dream. Sixteen of these participants were new recruits and formed the control group. The remaining seven participants created the UWD group. The Urbach-Wiethe patients were the same participants recruited earlier in the study. This allowed a larger sample of data to be analysed. This second group of participants were subjected to the same recruitment and exclusion processes as the first group of participants.

Inclusion and exclusion criteria

As Urbach-Wiethe disease is a particularly rare disorder, few exclusion criteria were imposed on the participants. Imposing too many exclusion criteria, based on IQ or education for example, would have led to a very small sample size, which would then lead to inaccurate or unusable results. However, relevant exclusion criteria were needed as to ensure that the groups were as homogenous as possible. The following were the final exclusion criteria: a) children with Urbach-Wiethe disease were excluded from this study because they had not yet developed the full characteristic amygdala lesions that this study is focusing on. Another reason to exclude children (anyone under the age of 18) was that it has been discovered that dreaming depends on the maturation of forebrain structures. Domhoff, a renowned dream researcher, discovered that the dream content of childhood and adolescent dreams differs from adults' dream content (Domhoff, 2001). Further research has shown that children's dream content is not adult-like, with regard to structure and frequency, until at least age 11 (Domhoff, 2003). The length and content of dream reports were only adult-like from the age of 13 or early adolescence.

b) Any adult who lived in the Northern Cape region and who had been diagnosed with Urbach-Wiethe disease was allowed to participate in this study. It cannot be ignored that Urbach-Wiethe disease causes damage to the amygdala as well as the surrounding areas. For this reason, only the Urbach-Wiethe patients who had MRI confirmed bilateral amygdala lesions were allowed to participate. Both male and female participants were included in the study. All participants were able to speak either English or Afrikaans.

c) The final exclusion criterion was that of alcoholism. Alcoholic participants had already been identified prior to this research. The identified participants were singled out and

removed from the sample. Due to the extensive neurological effects of alcohol and alcoholism, it was decided that any participants, whether they were part of the UWD group or the control group, were excluded if they were alcoholics. According to Tyas (2001), alcoholism affects neuropsychological functioning, and can lead to alcoholic dementia. Tomberg (2010) explains that MRI and CT studies revealed that alcoholism leads to reductions in brain volume, as well as losses of the frontal lobe area. Furthermore, research has shown that alcoholic patients will experience symptoms that range from mild memory and concentration impairment to severe memory impairment, like that seen in Wernicke-Korsakoff syndrome (Korbo, 1999). Due to the above, it was decided to exclude any alcoholics from the study. The brain damage caused by excessive alcohol consumption may have led to confounding effects in the results. By removing these participants, the possible confounding effect was eliminated.

Materials

A number of materials were utilized during this study. Each one is discussed below.

The Hall-Van de Castle method of content analysis

The Hall-Van de Castle 'Most Recent Dream' method (MRD) was used to collect the data-the dream reports (Hall & Van de Castle, 1966; Schneider & Domhoff, 2011). The MRD method is the standard method for characterizing dream content. This method of content analysis is possibly the best-known standard of quantitative analysis of dream content (Kinnear, 2005). It is known to be a reliable, comprehensive method and it can be adapted easily for modern statistical procedures. According to Domhoff (1996), a leader in the field of dream content analysis, it has been determined that this standardized method has the same reliability and validity as REM awakenings. The Most Recent Dream technique has shown consistent and trustworthy results that relate to age, culture, and psychopathology. Domhoff's (1996) research indicates that due to its versatility, researchers in various countries with different types of cultures, including India and Japan, have used this method. Furthermore, Domhoff (2003) states that the 'Most Recent Dream' method is stable across cross-cultural similarities and differences when looking at dream content. Due to this finding, the above test has been used successfully in a South African context (see Gouse, 2004; Kinnear, 2005; Malcolm-Smith, 2002, 2005; Badenhorst, 2006). This made it a very appropriate method to use in the current research.

The 'Most Recent Dream' method was chosen because it is an objective and structured method for the efficient and economical collection of dream reports (Domhoff, 2003). This method is also easier and quicker to administer to these vulnerable participants than it is to obtain data from REM awakenings. The 'Most Recent Dream' method requires no more than 30 minutes of the participants' time, whereas REM awakenings require the participants to spend a minimum of one night in a sleep laboratory. Sleep laboratory studies are an intrusive, costly, and time-consuming process (Domhoff, 2003).

This method of content analysis measures the frequency of certain aspects and characteristics that are common in dreams. Categories such as emotions, social interactions, and activities are coded according to the Hall-Van de Castle coding system (see Appendix B). The Most Recent Dream method is also versatile in many ways. One such way is that the categories can be combined or extended to fit the specific needs of a research question. If need be, new categories can also be created (Domhoff, 1996). Further research by Domhoff (2003) has shown that the Hall-Van de Castle system has the necessary reliability and validity for linking dream content to the neural system for dreaming. The coding system for the MRD method has an inter-rater reliability of between 61 and 98% (Schredl & Wittmann, 2005; Domhoff, 2003).

The Hall-Van de Castle method of content analysis is valid when the number of collected dreams is greater than 100 (Domhoff, 1996). Despite this, it was still performed on this data set as this method is the standard test when looking at dream content. The results derived from the Hall-Van de Castle method provide an outline or guide of the dream content.

Rosenthal and Rosnow (2008) believe that "when self-report measures are used in cross-cultural research, a usual concern is that the language may mean something different in each culture" (p. 176). Due to this potential problem, it was decided that the MRD test would be translated into Afrikaans. This is because the participants for this study live in a predominantly Afrikaans-speaking region. The Most Recent Dream method is typically conducted in English. The original (English) version was on hand in case a participant spoke English as their mother tongue. The test had been translated into Afrikaans using the back translation method. The translated version asks for exactly the same information as the English version. The process of back-translation is as follows: one external party translates the original piece of work from the original language to the target language; in this case from English to Afrikaans. Another external party then translates the translated piece back into the

original language. This is done to find any discrepancies of meaning in the work. This process is repeated until the two versions say and mean the same thing.

Briefly, the 'Most Recent Dream' form asks the participant to recall their most recent dream in as much detail as possible. The form then prompts the participant to recall certain characteristics, such as emotions or animals in the dream. For the full English version of the Most Recent Dream form, see Appendix C. The full Afrikaans version is available in Appendix D.

The Affective Neuroscience Dream Scale

The Affective Neuroscience Dream Scale, also known as the ANDS, is a newly developed scale used to measure emotions in dreams (Denny 2011; Hamilton 2011). This scale aims to measure the intensity of various emotions experienced in dreams. The method is closely related to the Hall-Van de Castle method of content analysis. However, the coding system for the Hall-Van de Castle method does not focus entirely on the emotions of interest to this study, and the intensity of these emotions. In fact, emotions make up a small aspect of the content analysis and intensity is not considered. Although the ANDS is not the first or only emotion classification system, it focuses on a wide range of emotions in dreams and it measures the intensity of the emotion experienced during dreaming.

The emotions have been classified into seven categories. These categories are based on Panksepp's (1998) taxonomy. These categories are 'rage', 'seeking', 'care', 'lust', 'fear', 'play', 'panic' and 'sadness'. 'Panic' and 'sadness' are subgroups of the 'grief' category. The reason for using this classification system is that these seven basic emotion categories are linked to specific neural pathways. Specifically, the amygdala is a central component of both the 'fear' and 'anger' systems (Panksepp, 1998).

This scale uses an interval rating scale, zero to three, which is applied to each emotion. Zero means that there is an absence of the emotion and 3 signifies the maximum intensity. Appendix E contains the Affective Neuroscience Dream Scale.

Approach and avoidance behaviour

In line with Revonsuo's threat simulation theory; there should be a predominance of avoidant-type behaviour in dreams as dreams simulate threatening events and the threat simulation mechanism being activated. To test this theory, the opposite neurobehaviour was selected to compare with the avoidance behaviour. It was therefore decided that the incidence of avoidance behaviour and approach behaviour would be compared between the control

group and the Urbach-Wiethe group. Avoidance type behaviour was operationalized as any action that shows that the dreamer is moving away from or freezing in the threatening situation. Zadra et al. (2006) defined avoidance behaviour as "the subject is fleeing, attempting to hide, or helplessly watching" (p. 452). The approach behaviour definition was taken from Panksepp's (1998) work on basic emotions. These approach behaviours are considered appetitive (foraging) and motivated and/or goal-seeking in nature. Any action that showed that the dreamer was actively investigating his/her environment and any type of behaviour that showed that the dreamer was moving toward something, be it an object or situation. Every instance of approach or avoidant behaviour was tallied to determine the frequency of these behaviours. The raters had a forced choice between either approach-type behaviour or avoidant behaviour, no neutral choice was allowed.

Dreamlikeness and wishfulfillment

De Gennaro et al. (2011) define the term 'dreamlike' as perceptually vivid, bizarre, and emotionally charged. Using this definition the raters judged the dreamlikeness of the dream reports on a zero to five scale, with zero signifying that no dream was recalled, and five meaning two or more images with elaborate detail and a well-developed narrative. The wishfulfillment scale used a zero to three rating scale with zero meaning that there are no elements of wishfulfillment in the dream, and 3 meaning the dream was completely wish fulfilling.

The Affective Dream Scale

The Affective Dream Scale (ADS), developed by Wainstein in 2012, was based on Panksepp's (1998) basic emotions. Panksepp's eight primary emotions were adapted for this scale. This scale measured the intensity of the following categories of emotion: anger/rage/aggression, sexual love/erotism, playfulness/joy/exuberance, seeking/curiosity/anticipation, care/nurturance/affection, fear/anxiety/apprehension, sorry/grief/loss, and dominance/power/control. An interval rating scale was used when coding the dream reports. These categories were rated on a scale of 0 to 3. Zero indicated that there was an absence of the emotion in the dream, while three indicated that the emotion in the dream was very intense. Appendix F contains the categories used to code the dream reports.

Positive and negative affect

This scale measured the intensity of affect experienced in the dream reports and it worked on an interval rating of zero to three. Zero implied an absence of the particular affect, whereas three indicated very intense affect. This scale was implemented on the total positive and total negative affect experienced in the dream reports. Raters were to identify the type of affect in the dream and the determine the intensity of the affect.

Revonsuo & Salmivalli's Bizarre Elements Scale

Drawing inspiration from the Hall-Van de Castle method of content analysis, Revonsuo and Salmivalli created a scale dedicated exclusively to bizarreness and bizarre elements in dreams. The underlying idea that drove the creation of this scale was that bizarreness is a "regular property of dreams" (Revonsuo & Salmivalli, 1995, p. 169). This bizarreness scale identifies and quantifies the bizarre elements experienced in dreams. The aim was to "separate different kinds of dream contents from each other and to report the occurrence of bizarreness across these contents" (p. 171). The scale attempts to address the question "how frequent are the distortions of different kinds of dream content" (p. 171)?

In their 1995 article, which highlights this scale and how it is used, Revonsuo and Salmivalli define bizarreness as "impossible, unlikely and inconsistent features in dreams"(p. 169). This definition is expanded to cover the 14 content categories (explained below). Furthermore, the research indicated that when using the scale, it was apparent that bizarreness and bizarre elements were frequent in dreams, some more so than other elements.

This Bizarre Elements Scale compares the occurrence of non-bizarre and bizarre elements. By using the non-bizarre occurrences, it provides the researcher with a baseline to compare against (1995). Every element is assigned to only one category and an element is identified if it presents new information. The new information must in no way be redundant (Revonsuo & Salmivalli, 1995). Appendix F contains and highlights the general principles and rules for Revonsuo and Salmivalli's (1995) *Content analysis of bizarre elements in dreams*.

This quantitative scale divides dream content into 14 separate contents. These contents are: self, place, time, cognition, language, actions, events, emotions, sensations, animals, plants, persons, objects, time, and body parts. For the definitions for each of these content categories, see Appendix G. Each of these categories is further divided into three mutually exclusive groups: non-bizarre, incongruous, and vague. A fourth category, which is not mutually exclusive with the above three categories, is a discontinuous element.

When the judges scored the dream reports, element identification was completed first. Next, the content/bizarreness scoring was completed. In order for any element to be coded, there needed to be adequate background information that explains how the dream events relate the personal waking reality of the dreamer. No elements were to be inferred.

The study conducted by Revonsuo and Salmivalli (1995) concluded that "bizarreness is not randomly distributed across different dream contents, and that different types of bizarreness are differently distributed across the various dream contents" (p. 180). This was highlighted with the examples that mental functions and language were incongruous with waking reality, and the setting of the dream event was frequently vague or discontinuous.

Procedure

Participants were interviewed in their homes after they performed and completed a comprehensive battery of neuropsychological tests and interviews. After completing the above tests and interviews, the participants were asked the standard questions from the Most Recent Dream form. First, participants needed to establish whether they knew what dreaming is. Next, they had to state whether or not they currently dream. If they did not dream, the interviewer tried to establish whether the participant ever dreamt or not. The interviewer would do this by asking whether the participant remembered dreaming during childhood. After the participant answered these questions, the interview was over. If the participant did currently dream, they would then carry on with the interview. Those participants who did dream were then required to state the date of the dream they remember having last. This question is asked so that the participant can focus on that particular dream and not on other dreams the participants might have had (Hall & Van de Castle, 1966; Schneider & Domhoff, 2011). The report specifies 'most recent dream' to ensure that the subjects are not tempted to recall recurrent dreams or nightmares (Domhoff, 2003). Next, the participants were required to recall and describe their most recent dream in as much detail as possible. The method calls for participants to mention aspects of the dream such as the environment, the emotions they experienced and the characters involved. All of these aspects were recalled in as much detail as possible. The answers were audio recorded during the interview. The interviewer encouraged the participants to describe as much detail as possible. The above test took between five and ten minutes to complete.

The Most Recent Dream report is usually read by the participant and the dream is written out. An exception had to be made in this case. The general level of education was

very low for these participants. Since the sample comes from a low socioeconomic background, it cannot be taken for granted that these participants are able to read and write. For this reason, the report was turned into an interview for every participant. After the interviews took place, the interviews were transcribed by an external party. This was done for two reasons. Firstly, it would be easier for the raters to code the dream reports on paper. The second reason is that Urbach-Wiethe patients have hoarse voices due to the deposit of hyaline like material in their vocal cords (Francis, 1975). If the raters could hear the difference in their voices, they might be able to distinguish the groups, despite not being aware of the sample. This could lead to a possible confounding effect. By not hearing the voices recall the dream reports, the raters could not tell the difference between the two groups. The transcriber was fluent in Afrikaans. This ensured that there was no loss of context and/or meaning when transcribed across languages.

The interviewer is well known to the participants, as she is a known nurse in the community. This nurse was used because the sample group is a vulnerable group of patients and the community is protective of these patients. The nurse was one of the gatekeepers to this community and few researchers are allowed to interact with these patients. Due to the already established rapport between the nurse and patients, the participants felt that they could open up and be candid with the nurse. The nurse assured the participants that all information would be kept confidential. The interviewer was unaware of the research questions and /or hypotheses.

In addition to the dream report, the original group of participants were asked to recall a recent happy memory. This was used to determine if there were any discrepancies with the data, word count, or the ability to recall a recent dream.

The interviews were structured clinical interviews. These interviews allow for scoring procedures to be performed on the data and norms can be created and applied (Kaplan & Saccuzzo, 2005). This type of interview allowed for the dream reports to resemble a written dream report when transcribed.

Raters and inter-rater reliability

Three independent and blind raters were used to code the dream reports. The raters were graduate students from the University of Cape Town who volunteered their time. The raters were blind to the aims of this study, as well as any dream theory. All of the raters were able to speak Afrikaans fluently and were able to fully understand the language. The raters were first trained to use the coding system. After this, a few exercises were completed to ensure the

raters understood the method. A sample of 20 dreams, collected from another source, was used to determine the percentage of perfect agreement. Domhoff's (1996) percentage of perfect agreement was used to determine inter-rater reliability. Once the percentage of perfect agreement was established, the raters coded the data.

Before the raters were recruited, it was decided to set the percentage of perfect agreement at 80%. This would be considered the lowest allowed percentage of perfect agreement. All incidences of obtaining inter-rater reliability used 20 separate dream reports that were collected from another source. The raters obtained 80% perfect agreement for the Hall-Van de Castle method of content analysis. To assess inter-rater reliability for the ANDS, the intra-class coefficient (ICC) was used. An ICC result of one indicates complete reliability and zero refers to a lack of reliability between the raters (Rankin & Stokes, 1998). According to Field (2009), social science research is prone to low reliability and establishing moderate reliability is common in social science research. The ICC for this scale was calculated to be 0.70 (95% CI: 0.63-0.76). This shows that there is moderate reliability for this scale, which is adequate for social science research. For the Affective Dream Scale the raters obtained 83% perfect agreement, while they achieved 90% perfect agreement for identifying approach and avoidant behaviours. The raters acquired 82% perfect agreement when coding dreams with Revonsuo and Salmivalli's Bizarre Elements Scale.

Data analysis

As it was not known what the data would look like, an open mind was kept with regard to data analysis. Once the data was collected, it was decided to take both a qualitative and quantitative approach. It was decided that the dream reports should be as authentic as possible and should resemble written dream reports because the Hall-Van de Castle method uses written reports. To achieve this, all unnecessary repeated words were eliminated (for example, I could see the, the, the). Speech sounds and/or marks were also eliminated (such as uhm, er, uh, etc.). By removing these unnecessary words the dream reports resembled a standard written dream report. It also allowed for easier coding. Each test had its own method of analysing the data. These methods are explored below. For all statistical tests performed, alpha was set at $\alpha = 0.05$.

Hall-Van de Castle method

The data obtained by the Most Recent Dream method was analysed quantitatively. Usually, this method requires that any dream report with a word count of 50 words or less should be

excluded. This is because, according to Hobson, Pace-Schott, and Stickgold (2000, p. 1024, cited in Domhoff, 2003) a dream experience needs a minimum of 50 words to be accurately described. This rule was ignored because the dreaming capability of the Urbach-Wiethe patients was not known. As an example, it may be that Urbach-Wiethe patients were only able to recall their dreams very basically, and only in less than 20 words. If this were the case, it would be a significant finding and could not be overlooked. All dream reports were therefore accepted and coded.

Domhoff and his colleagues have created a programme that aids in analysing the data. The programme, called DreamSAT, allows the user to enter all the coded information into a spreadsheet and the frequencies and results are calculated from this input (Schneider & Domhoff, 2011). The DreamSAT programme was used as it is more accurate and provides the results faster.

The Hall-Van de Castle method requires that various aspects of the dream be coded according to the test's coding system. Activities, characters and emotions, for example, are coded separately. A frequency for each of the categories was obtained, through a set of formulae, and was then compared to the test norms and the control group. Emotions were categorized into five groups, anger, apprehension, sadness, confusion, and happiness. This study looked more closely at, and analysed, the emotion categories that the amygdala is known to process. Anger/rage (coded as anger) and fear/anxiety (coded as apprehension) were focused on.

According to the Hall-Van de Castle method, the data collected is analysed using chi-square tests and contingency tables (Domhoff, 2003). Frequencies of various categories were determined then compared to established norms and the control group. Once the data had been analysed, the results were compared to the norms of this test.

The Affective Neuroscience Dream Scale

Using the ANDS it is possible to determine the incidences of the seven types of emotion experienced in dreams. The intensity of the experienced emotions was also investigated. A series of mixed design ANOVA tests were conducted on the research to determine whether or not there was significance between the participants and emotions.

Approach and avoidance behaviour

This method looks at the total number of individual approach and avoidant behaviours in each dream report. To analyse the data, chi-square contingency tests were employed. The chi-square test allows one to determine if behaviour type is dependent on amygdala damage.

Dreamlikeness and Wishfulfillment

Dreamlikeness measured the intensity of the quality of dreamlikeness in each dream report. Independent sample t-tests analysed the data to determine if there was a significant difference of dreamlikeness between the two groups of participants.

Wishfulfillment was measured and the intensity was focused on. An independent sample t-test was applied to the data to determine whether there was a difference in wishfulfillment intensity between the two groups.

The Affective Dream Scale

This scale measured the frequencies of the intensity of the eight different categories of emotions. A series of ANOVA tests were conducted to determine if there was any significance between the groups of participants and the categories of emotions. Amygdala controlled emotions were singled out (fear and rage) and further ANOVA tests were used to determine if there was significance between the two groups of participants and amygdala controlled emotions.

Positive and negative affect

This scale measured the intensity of both positive and negative affect experienced in the dream reports. Independent sample t-tests were utilized to determine whether or not there was significance of intensity between the two groups. One independent t-test was applied to the positive affect data and a second independent t-test was employed on the negative affect data.

Bizarre Elements Scale

As this scale tallies the number of occurrences of bizarre and non-bizarre elements in dreams, the data obtained using this method was analysed using chi-square tests of independence, as well as frequencies/percentages. Bizarre elements were compared with non-bizarre elements between the two groups of participants. Furthermore, chi-square tests of independence were conducted on both the overall number of bizarre and non-bizarre elements, as well as bizarre and non-bizarre elements of each category.

Ethical considerations

The Ethics Committees of Stellenbosch University Health Sciences faculty, as well as the Ethics Committee of the University of Cape Town's Psychology department have approved this study (see Appendix A). Before the study began, the participants were given basic information about the study and its aims. The participants were given consent forms to complete if they agreed to participate. The consent form outlined the procedure of the study. The participants were informed that their names would not be on the transcribed interviews, thus ensuring their anonymity and confidentiality. The form stipulated that the participants were allowed to withdraw at any stage of the research, and that participating (or not participating) would not influence the care they are given. Participants were briefed about the contingencies in place in the possible event that they became distressed at any time during the interview, particularly when recalling their dreams. Counselling and/or debriefing were both made available for those who may have needed it. A nurse was on standby in case the participants needed debriefing. The participants were given the nurse's contact number and told that they could contact her at any stage of the day, or night. Before the interview started, it was explained to the participants that all sensitive information would be kept confidential. It was specified to the participants that they did not have to answer any of the questions if the questions made them feel uncomfortable in any way. When the interview ended, the interviewer asked the participant if they had any questions. Any questions that were raised were answered. The interviewer also asked if the participant felt that she needed to be counselled or debriefed further. There were no benefits for participating in this study, other than contributing to the knowledge of Urbach-Wiethe disease. At no stage of the study were the participants deceived. As the participants knew the interviewer, a community nurse, a rapport had already been established. The participants felt comfortable speaking to her and were willing to disclose otherwise confidential information. At the beginning of the interview, the interviewer read out the consent form and asked the participant if he or she wished to participate. The participants then gave their verbal consent if they agreed. All participation for this study was voluntary.

RESULTS

Twenty participants were originally recruited to take part in this study. Four of these participants were excluded as they were alcoholics (see exclusion criteria above). Thus, the total number of participants $N = 16$. Both the control group and the Urbach-Wiethe group contained only female participants. It was an unfortunate coincidence that the male participants who were recruited for this study were all classified as alcoholics, and thus had to be excluded. However, this was an unforeseen added advantage for the study as the whole sample group was homogenous and perfectly matched, and any gender differences did not need to be taken into account, or affect the overall results. The control group contained eight women, with a mean age of 42.125 years ($SD = 15.54$). The ages for this group ranged from 23 to 69 years of age. The UWD group also contained eight women, with a mean age of 45 years ($SD = 14.45$). The Urbach-Wiethe participants' ages ranged from 26 to 63 years. An independent samples t-test was performed to determine whether the age means differed between the two groups. This test showed that $t\ (14) = 0.52$, $p = 0.61$, $d = 0.26$. This indicates that there was no significant difference between the two group's ages and Cohen's d indicates that there was a very low effect size.

As explained earlier, Hobson, Pace-Schott, and Stickgold (2000, p. 1024, cited in Domhoff, 2003), believe that a dream report or experience requires a word count of more than 50 words. It is believed that a dream can be recounted accurately in more than 50 words. However, this rule was cast aside (see data analysis above). As there has been no previous research looking at dream experiences in Urbach-Wiethe patients, it was unknown how the UWD participants would recall their dreams (whether the dream reports would be very long or only a couple of words). Looking at the word counts for the groups, it was found that the mean word count for the control group's dream reports is $M = 266.38$ ($SD = 140.16$). The word counts for this group ranged from 126 words to 416 words. The mean word count for the UWD group's dream reports was $M = 136.63$ ($SD = 145.02$). The Urbach-Wiethe dream reports ranged from 0 words to 444 words in length (one of the UWD participants did not recall a dream). An independent t-test was run to compare the word count means of these two groups. This t-test concluded that $t\ (14) = -1.82$, $p = 0.09$, $d = -0.9$. This indicates that there was no significant difference with regard to the dreams' word counts. Despite the Urbach-Wiethe dreams having fewer words, the UWD patients were able to adequately recall their dreams. They were in no way deficient of this ability. Table 1 (below) summarises the descriptive statistics.

TABLE 1

Descriptive statistics for control group and UWD group

	Control	UWD
N	8	8
Mean age *(SD)*	42.125 *(15.54)*	45 *(14.45)*
Age range	23 – 69	26 - 63
Mean word count *(SD)*	266.38 *(140.16)*	136.63 *(145.02)*
Word count range	126 – 416	0 – 444

New data

A new set of participants were recruited to provide further data for this study. Of these participants, only 23 matched the selection criteria and, once again, this was a homogenous group of female participants. This group of participants contained 16 control members and seven Urbach-Wiethe patients. The control group's age ranged from 22 years old to 69 years old, with a mean age of M = 40 years (SD = 12.84). The UWD group's age ranged from 27 years old to 64 years old, with a mean age of 45 years (SD = 14.45). An independent samples t-test was performed to compare the ages of the two new groups. The results indicated that t (21) = -0.83, p = 0.42, d = -0.37. This test revealed that there was no significant difference between the ages of the groups.

The new dream reports and their word counts were explored in the same way as the original data. When looking at the word counts of the new dream reports, it was found that the control group had a mean word count of M = 268 (SD = 120.61). The UWD group's word count mean was considerably lower, with M = 101.29 (SD = 30.92). The word count ranged from 109 to 501 words for the control group, and the UWD group's dream reports had a range of 67 to 149 words. An independent samples t-test was conducted to determine if there was a difference between the word counts of the groups. This test revealed that t (21) = 3.39, p = 0.003, d = 1.48. This shows that there was indeed a significant difference between the word count means of both groups. The effect size, Cohen's D, was also considerably large. Table 2 highlights the descriptive statistics for the new set of data. With the new participants, the data set expanded to N = 40.

Happy memory word count vs dream word count

From the original group of participants a happy memory was collected, in addition to the dream report. The two groups were compared to determine whether there was a difference between the word counts of each group. The control's happy memory word counts were compared to their dream word counts to determine if there was a difference in the ability to recall dreams. This test revealed that t (14) = -0.99, p = 0.34, d = -0.49. The results were not significant, indicating that there was no difference in the word counts, and thus no difference between recalling (and describing) a dream and a memory. Next, the Urbach-Wiethe group's dream word counts were compared to the word counts for their happy memories. The independent samples t-test revealed that t (14) = 1.14, p = 0.27, d = 0.57. The t-test was not significant; however, Cohen's d indicated that there was a medium effect size. The t-test indicated that there was no significant difference between the word count mean for the dreams and the word count mean for the happy memories for the UWD group which indicates that Urbach-Wiethe patients were able to recall and describe a happy memory and a dream in much the same way.

TABLE 2

Descriptive statistics for new control and UWD groups

	Control	UWD
N	16	7
Mean age *(SD)*	40 *(12.84)*	45 *(14.45)*
Age range	22 - 69	27 - 64
Mean word count *(SD)*	268 *(120.61)*	101.29 *(30.92)*
Word count range	109 - 501	67 - 149

The Hall-Van de Castle results

The original 16 dreams were analysed using this method. After analysing the data using the Hall-Van de Castle method of content analysis, the following information was revealed. The number of emotions experienced in the control group and UWD group dreams was calculated. With regard to the emotions experienced in the dream reports, the control group had a total of 15 incidences of emotion experienced in the control group dreams. Of these

emotions, happiness was the most prevalent emotion with just over half of the emotions being coded as happiness (54%). Sadness occurred in just under half of the incidences of emotions (45%), followed by anger and apprehension, both with two incidences each. In the Urbach-Wiethe group, it was found that there were a total of 11 occurrences of emotion experienced. The UWD group's most frequently expressed emotion in the dream reports was happiness, as just over half of the emotions were coded as happiness (54%). This is followed by apprehension, with just over a quarter of emotions experienced being coded as apprehension (27%). There were only two incidences of sadness in the series of Urbach-Wiethe dreams. The Urbach-Wiethe patients did not express anger and confusion (as an emotion) in their dreams.

Below are the findings according to the Hall-Van de Castle method of content analysis. These findings are represented graphically in what is known as an h profile, which is a bar graph displaying the differences between the groups (Schneider & Domhoff, 2011). Each category is expressed in the left hand column. This is a visual guide to the results obtained from the Hall-Van de Castle method. These results cannot be considered in isolation but viewing them as a whole will give an idea of structures of the dreams and the differences between them.

From the graph in figure 2, differences can be seen in the good fortune category, indoor setting category, aggressor category and the family category. There were only three significant differences found when comparing the UWD results and the control results. Family is significant with $p = 0.006$, $h = -0.73$. All types of good fortune is significant with $p = 0.035$, $h = 1.13$. The results indicate that UWD patients have a significant level for aggressor (where the dreamer is the aggressive character) with $p = 0.01$, $h = -3.14$. However, these results are of little importance for the present study, but they do serve as a guide to the contents and experiences in the dreams.

An important result to notice is that in the social interactions category the Urbach-Wiethe patients' dreams contained no physical aggression, in any form. All aggression in UWD dreams is below both the control group results and the test's norms. The UWD dreams are deficient in aggression, a reaction, or behaviour that is processed by the amygdala.

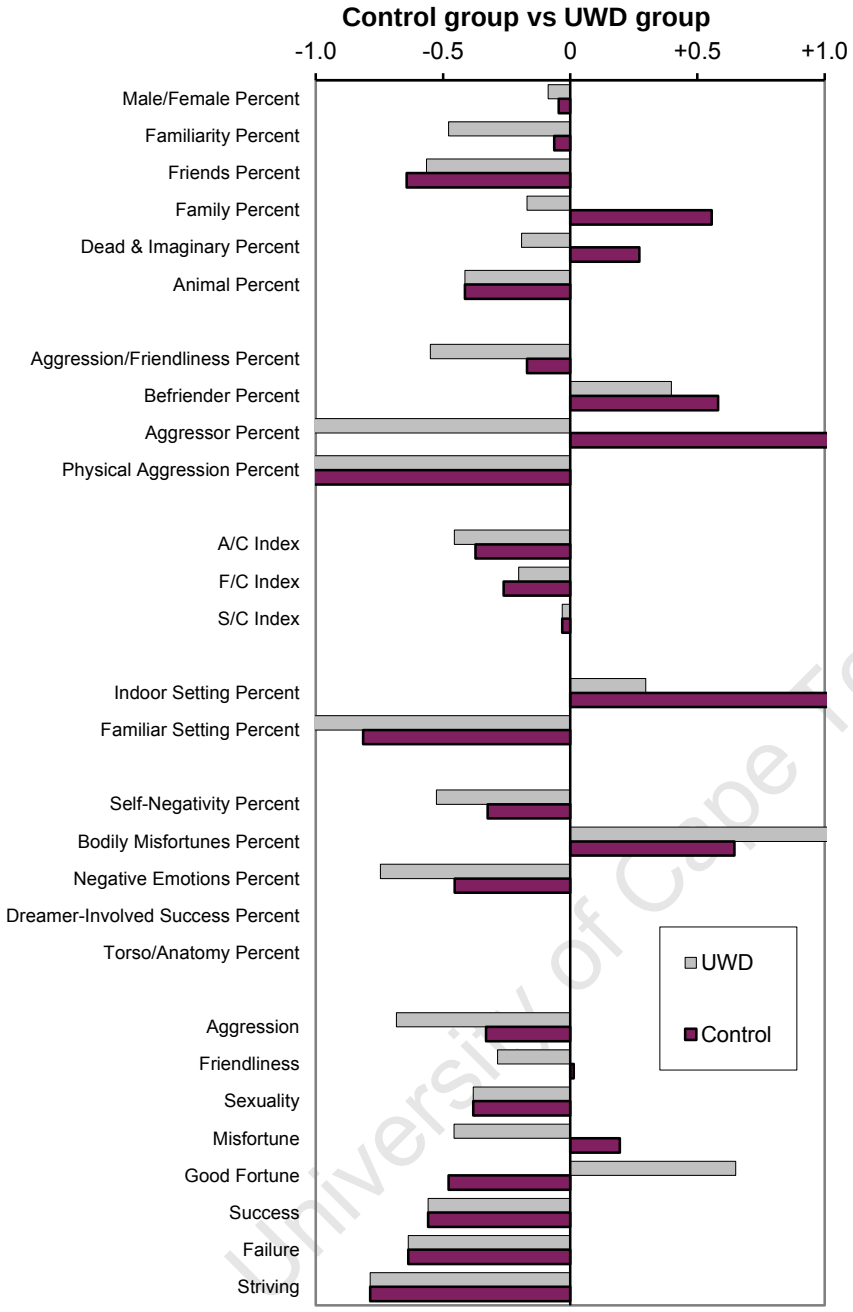

Figure 1. *A comparison of the control group and the UWD group*

The Affective Neuroscience Dream Scale results

This scale was also used on the original 16 dreams. The descriptive statistics for the range of emotions and their intensities were calculated and these results can be seen in table three. From here, the data for this scale was analysed using a number of mixed-design ANOVA tests. A 2 X 8 mixed-design ANOVA test was conducted to assess if there were any significant between-group differences. This ANOVA test indicated that there was no

significant main effect for group, F (1, 14) = 1.86, p = 0.194, η_p^2 = 0.117. Next, a 2 X 2 mixed-design ANOVA test was conducted to establish between-group and within-group differences for amygdala related (fear and anger) and non-amygdala related emotions (seeking and play). Between-group differences were investigated first. The cell means indicated that Urbach-Wiethe patients had the lowest intensity of amygdala related emotions, with M = 0.69, whereas the matched controls had the highest intensity with M = 1.31. Levene's test was non-significant for amygdala related emotions, F (1, 14) = 1.98, p = 0.18 and non-significant for non-amygdala related emotions, F (1, 14) = 0.16, p = 0.69. The assumption of homogeneity of variance was therefore upheld for both emotion groups. The mixed-design ANOVA test showed that there was no significant main effect found for group, with F (1, 14) = 1.86, p = 0.19, η^2 = 0.12. Furthermore, no significant within-subjects effect was found for emotion, with F (1, 14) = 2.64, p = 0.13, η^2 = 0.16. There was also no significant Group x Emotion interaction, F (1, 14) = 0.21, p = 0.66, η^2 = 0.02.

Table 3

Means and Standard Deviations of Emotional Intensity

	UWD (n = 8)		Controls (n = 8)	
Emotion	*M*	*SD*	*M*	*SD*
Fear	0.63	0.95	0.81	0.53
Anger	0.06	0.18	0.50	0.53
Play	0.88	1.03	0.50	0.96
Seeking	0.38	0.35	0.00	0.00
Lust	0.06	0.18	0.25	0.46
Care	0.25	0.46	0.94	0.90
Panic	0.00	0.00	0.00	0.00
Grief	0.13	0.23	0.19	0.26

Approach and avoidance behaviour in dream reports

Approach behaviour and avoidant behaviour experienced in dreams were calculated to determine the effect of amygdala damage on dream behaviour. This test was done on the original 16 collected dream reports. The number of individual approach and/or avoidant behaviours in the dreams was calculated and totalled. The control group experienced ten

approach type behaviours in their dream reports and only one avoidant behaviour. The Urbach-Wiethe patients' dream reports contained seven approach behaviours and only two avoidance behaviours. A chi-square test of contingency was performed to determine whether approach and avoidant behaviour was contingent on amygdala damage. The results indicate that $\chi^2(1) = 2.45$, $p = 0.41$, $r = 0.34$, therefore type of behaviour is not contingent on amygdala damage. The correlation shows a medium correlation between the groups.

Dreamlikeness and Wishfulfillment

These tests were performed on the entire data set of 40 dreams. The control group's mean incidence of dreamlikeness was $M = 4.58$ ($SD = 0.5$). This is very close to interval five- 'two or more images with elaborate detail and a well-developed narrative'. The UWD mean was $M = 3.88$ ($SD = 1.20$), which was close to interval four- 'two or more images with a story connecting them'. When looking at dreamlikeness, an independent sample t-test was performed to determine whether there was a difference in dreamlikeness between the Urbach-Wiethe patients and the matched controls. The t-test indicated that there was a significant difference between the groups, as $t(38) = 2.58$, $p = 0.01$, $d = 0.84$. There was a large effect size for this result.

When looking at the intensity of wishfulfillment in the sample of dreams, the controls had $M = 1.03$ ($SD = 1.15$) and the UWD group had $M = 1.22$ ($SD = 1.11$). Both group's means were close to interval one- this dream has some elements of wish fulfilment but is predominantly not a wish fulfilling dream'. The t-test performed to analyse the intensity of wishfulfillment was not significant, with $t(38) = -0.54$, $p = 0.59$, $d = -0.18$. This indicated that there was no significant difference of wishfulfillment intensity between the two groups.

The Affective Dream Scale

This scale was used to determine the intensity of eight different categories of emotions. Table 4 illustrates the means and standard deviations for each of the categories.

All 40 dreams were analysed using this method. A 2 x 8 mixed-design ANOVA test was conducted to assess if there were any significant between-group differences. This ANOVA test indicated that there was no significant main effect for group, $F(1, 76) = 1.86$, $p = 0.2$, $\eta^2 = 0.12$.

The 2 x 2 mixed-design ANOVA test showed that there was no significant main effect found for group, with $F(1, 76) = 1.64$, $p = 0.2$, $\eta^2 = 0.01$. The test further indicated that there was a significant within-subjects effect was found for emotion, with $F(1, 76) = 17.12$, $p <$

0.001, $\eta^2 = 0.18$. There was also no significant Group x Emotion interaction, F (1, 76) = 0.49, p = 0.48, $\eta^2 = 0.005$.

Table 4

Category means for the Affective Dream Scale

	Control (n = 24)	UWD (n = 16)
Category	M (SD)	M (SD)
Anger	0.54 (0.93)	0.19 (0.75)
Sexual	0 (0)	0 (0)
Playfulness	0.67 (1.13)	1 (1.26)
Seeking	1.58 (1.32)	1.13 (1.09)
Care	1.38 (1.35)	0.81 (1.22)
Fear	1.17 (1.31)	1.06 (1.22)
Sadness	0.92 (1.35)	0.25 (0.77)
Dominance	0.38 (0.82)	0 (0)

Positive and negative affect

When looking at positive affect in the entire data set, the independent t-test indicated that there was no significant difference of intensity between the two groups, as $t(38) = -0.79$, $p = 0.43$, $d = -0.26$. This suggests that the intensity of positive affect experienced in dreams is not significantly different between the UWD group and the matched controls.

The t-test utilized to analyse the negative affect determined that $t(38) = 1.25$, $p = 0.22$, $d = 0.4$. This test is not significant and indicates that there is no difference between groups when looking at the intensity of negative affect. There is a small effect size for this result.

Revonsuo and Salmivalli's Bizarre Elements Scale

The Bizarre Element Scale was performed on all 40 collected dreams. The data obtained from the bizarre elements scale was analysed using chi-square contingency tests. When comparing the total bizarre elements with the total non-bizarre elements between the control group and the Urbach-Wiethe group, it was found that χ^2 (1) = 0.004, $p = 0.95$, $\varphi < 0.001$. This indicated that bizarre elements were not contingent on the groups, and that there is a miniscule effect size.

The most prominent bizarre element categories were analysed individually. Self, persons, place, cognition, language, events, actions, and emotions were all analysed using chi-square contingency tests. All of the above tests were not significant [Self: χ^2 (1) = 0.92, p = 0.34; Persons: χ^2 (1) = 1.03, p = 0.31; Place: χ^2 (1) = 0.33, p = 0.56; Cognition: χ^2 (1) = 2.56, p = 0.11; Language: χ^2 (1) = 0.4, p = 0.53; Events: χ^2 (1) = 0.14, p = 0.7; Actions: χ^2 (1) = 2.32, p = 0.13; Emotions: χ^2 = (1) = 0.03, p = 0.86]. These analyses indicated that there was no significance in any of the categories. It was not viable to analyse the other categories (objects, time, body parts, plants, animals, and sensations) as the data was minimal and would have rendered inaccurate and misleading results.

The graphs below indicate the bizarre elements and non-bizarre elements found in the dreams, as well as the frequency of the elements in each group's dream reports.

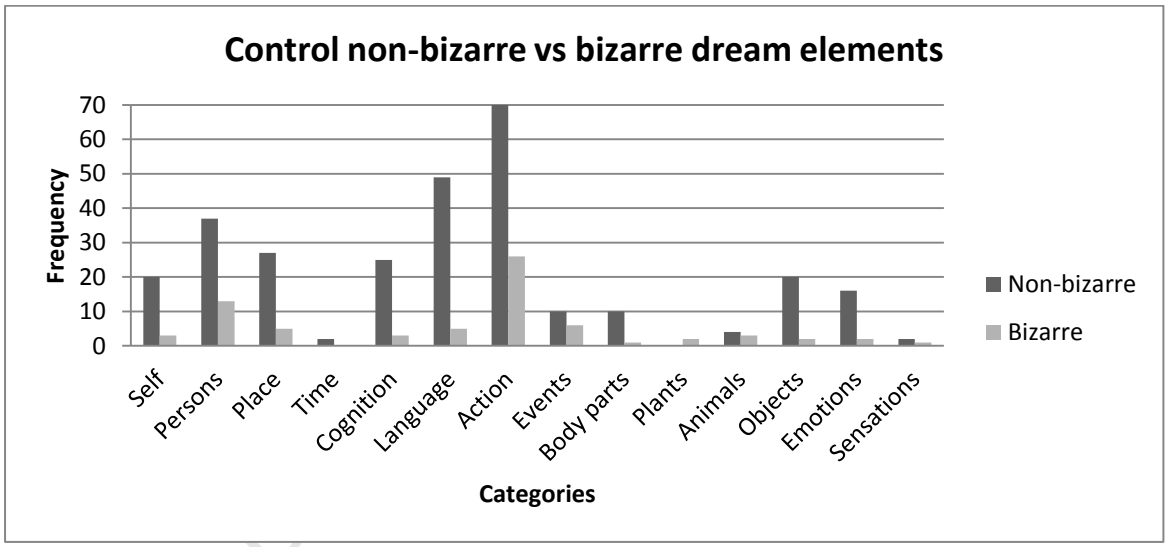

Figure 2. *Graph indicating the frequencies of bizarreness in each category for the control group*

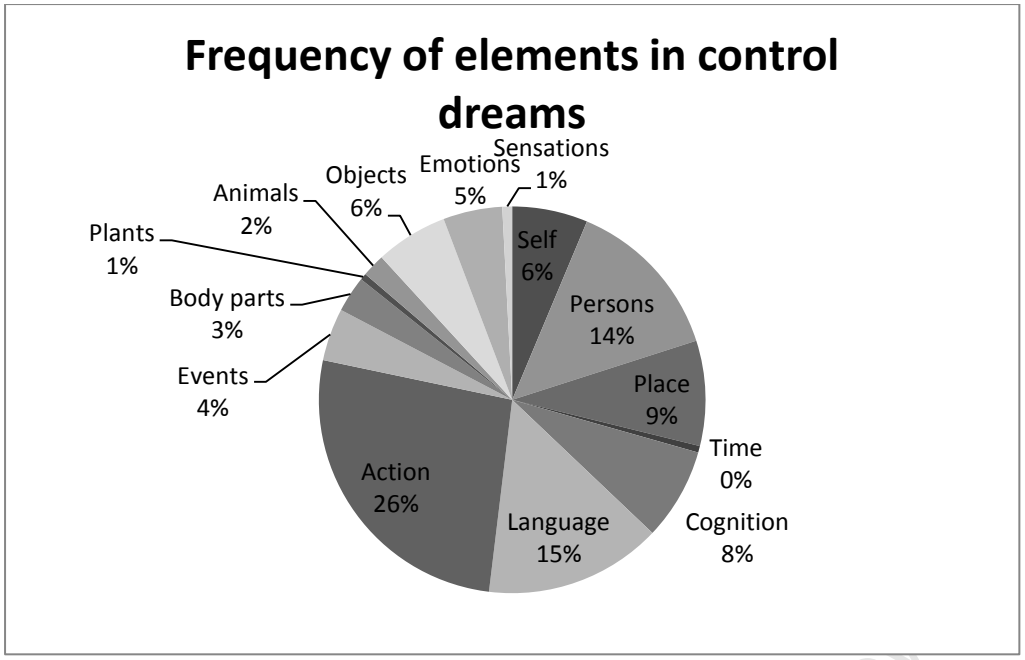

Figure 3. *Graph indicating the distribution of elements in control dreams*

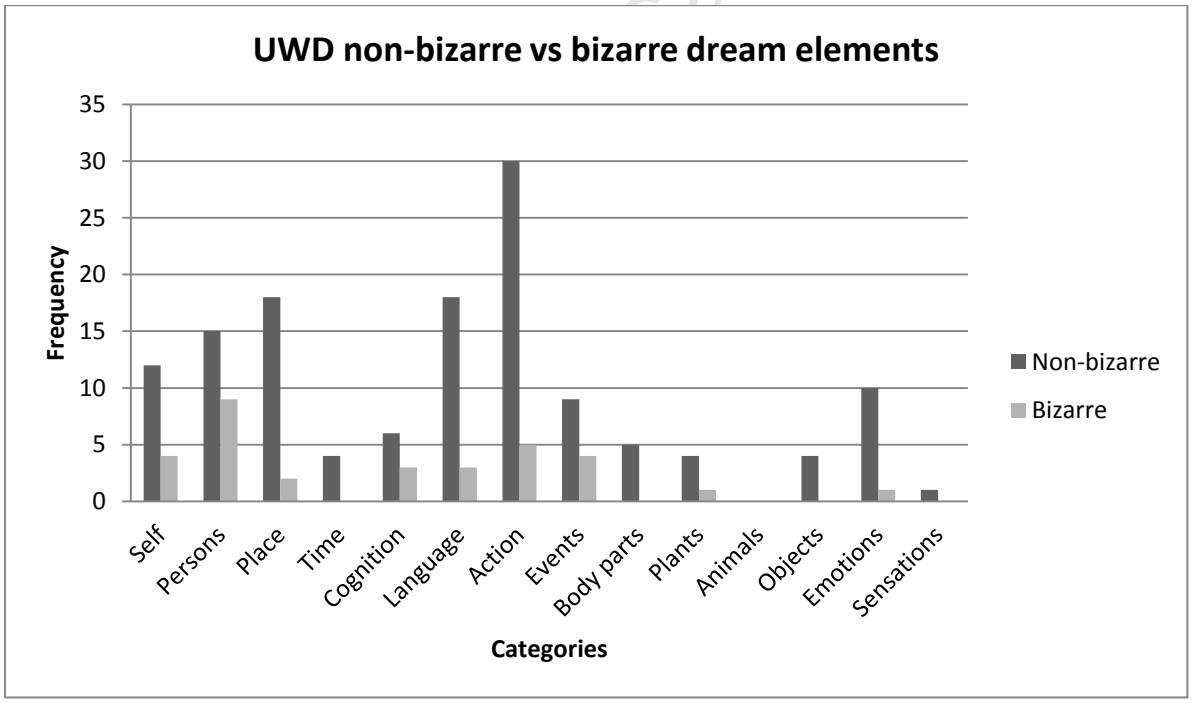

Figure 4. *Graph indicating the frequencies of bizarreness in each category for the Urbach-Wiethe group*

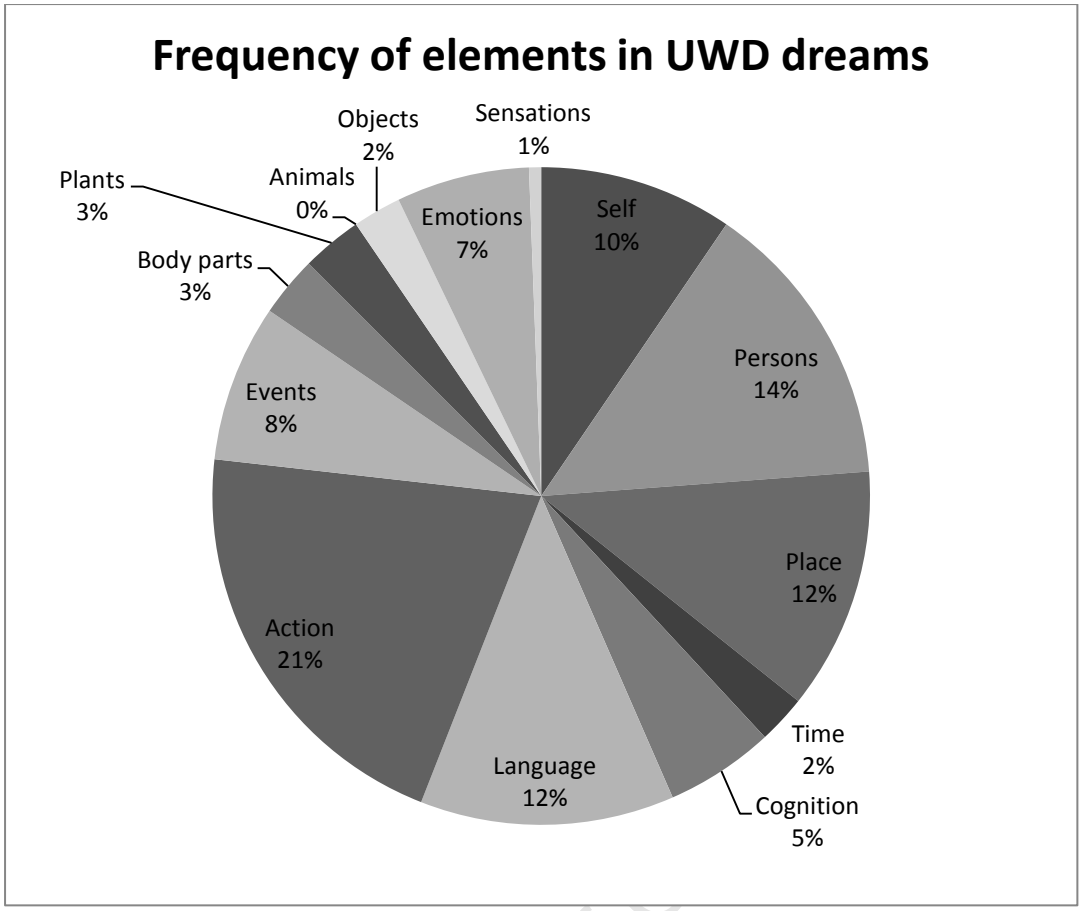

Figure 5. *Graph indicating the distribution of elements in Urbach-Wiethe dreams*

The pie graphs indicate that both group's most common category was the action category, with the control group having over a quarter (26%) elements being actions, and the UWD group had over a fifth (21%) of their elements being actions. Persons, language, and place were the next common elements found in both group's dreams. Both groups had the same four most common elements in their dreams.

DISCUSSION

The current study aimed to explore the dream content of a rare population of patients with bilaterally symmetrical amygdala lesions. This was done to determine the effect amygdala damage has on dreaming, as no dream research has explored the effects before. Dreams from the Urbach-Wiethe patients and a matched control group were collected and coded according to the Hall-Van de Castle method of content analysis. The dreams were further analysed using the newly developed Affective Neuroscience Dream Scale (ANDS), the Affective Dream Scale (ADS), dreamlikeness and wishfulfillment, as well as the Bizarre Elements Scale. The data was further analysed by investigating both approach and avoidance behaviours and the overall affect experienced in the dreams. These results were then compared to each other, across groups. Seven questions were asked at the beginning of this research, and each of these questions will be addressed below with regard to the results of the present study. All through the study, two underlying questions were kept in mind: Do Urbach-Wiethe dreams differ from matched controls? If so, in what way do these dreams differ?

Do patients with Urbach-Wiethe disease dream?

An important finding from the present study was that the Urbach-Wiethe patients were able to dream and recall their dreams. Of all the participants, only one Urbach-Wiethe patient did not recall a dream. This participant was unable to recall a dream, even when the interviewer pressed for more information and asked for any dream she might have had. This UWD patient explained that she was on Trepiline, an antidepressant, and claimed that since she started taking this medication she has not been able to dream. This could be due to the medication itself, the depression or a combination of the two. The patient's inability to recall a dream may also be due to a memory problem, as the amygdala is involved in the process of consolidation of emotional memories (Adolphs et al, 1997; Wilensky, Schafe, & LeDoux, 2000). Despite this one patient being unable to recall a dream, the rest of the sample group was able and capable of recalling their most recent dream. Some of the patients were eager to share more than one dream. This indicated that Urbach-Wiethe patients are able to dream and recall their dreams.

Are the UWD dream reports shorter or longer than matched controls?

Due to the lack of dream research conducted on Urbach-Wiethe patients, it was uncertain what the dreams would contain or how they would be recalled. To explore the data it was decided to compare the word counts of both groups. When looking at the word count means, the first set of data had a total of 15 dreams, and it was established that the word count means were not significantly different between the matched controls and the Urbach-Wiethe patients. This is despite the fact that the UWD patients word count mean was nearly 130 words fewer than the matched controls. This indicated that the UWD patients were capable of recalling their dreams and to the same extent as the matched controls. The second set of data, which had a total of 25 dreams, indicated that there was a significant difference between the word counts of the two groups. The Urbach-Wiethe patients' dream word counts had 167 words fewer than the control group. This was a significant result. The possible reason for the lower UWD word count is the Urbach-Wiethe patients' voice. Urbach-Wiethe patients present with a hoarse voice, which is evident from childhood (Francis, 1975). Due to the hoarse voice, the patients do not describe elements in great detail, only the main theme or elements are spoken about. This applies to recalling a dream in an interview. As the participants were interviewed and then the interview transcribed, the patients had to verbally describe their most recent dreams. The dream report section of the interview was at the end of the interview. This could have put a strain on their voices and thus they described their dreams in fewer words.

When looking at the happy memory word counts, there is a significant difference between the two groups. This supported the notion that having a hoarse voice will lead to somewhat shorter reports. However, there was no significance when comparing UWD happy memories with dream word counts. The same applied to the control group. The word count results suggested that the amygdala damage associated with Urbach-Wiethe disease could have an effect on the patients' ability to dream and recall dreams, but there is a possibility that the hoarseness is the reason for shorter dream reports.

Do Urbach-Wiethe patients have fewer incidents of negative affect in their dreams, particularly fear and rage, than the matched controls?

To answer this question the data was analysed using the Affective Neuroscience Dream Scale. Amygdala-controlled emotions were defined and grouped as fear and anxiety. Non-amygdala-controlled emotions, such as play and seeking, were used as a comparison. The results from the analyses indicated that there was no significant difference between the

incidence of amygdala-controlled emotions and non-amygdala-controlled emotions. This suggests that Urbach-Wiethe patients experienced roughly the same emotions in their dreams as the matched controls. There was no significant difference between the types of emotions experienced in their dreams. It would be expected that, due to the non-functioning amygdala in Urbach-Wiethe patients, there would be a reduction, if not a lack, of amygdala-controlled emotions in their dreams. This did not seem to be the case, as it did not appear that UWD patients experienced fewer or more amygdala-controlled emotions in their dreams. The controls and patients experienced similar emotions during dreaming. The number of amygdala-controlled emotions was not significant which suggests that the amygdala calcifications found in UWD patients did not affect the emotions experienced in their dreams.

Is affect in general lower in UWD dream reports than in control dream reports?

The results from the ANDS analysis displayed that the intensity of amygdala-controlled emotions did not significantly differ from the control group's results. This indicated that Urbach-Wiethe patients experienced the same intensity of amygdala-controlled emotions when compared to the matched controls. The intensity of positive and negative affect experienced in the sample dreams was also analysed to answer this question. There was no significant difference of intensity for both positive and negative affect between the groups. This indicated that the intensity of positive and negative affect does not seem to change once the amygdala becomes calcified and non-functioning.

According to Revonsuo's threat simulation theory, the Urbach-Wiethe patients' dreams should not contain negative affect as these emotions are controlled by the amygdala. The amygdala lesions should cause the UWD patients to have positive affect as a dominant affect in their dreams. As the amygdalae are damaged, it should not be possible for the amygdala to process negative affect and dream of threatening events. Despite what the TST or the literature says, Urbach-Wiethe patients' dream reports did not contain less negative affect or emotions. In fact, the UWD group experienced similar affect to their matched counterparts. This indicated that there was no reduction of the intensity of negative affect in Urbach-Wiethe dreams despite the calcified amygdala. This finding contradicts Revonsuo's threat simulation theory, particularly proposition two.

The findings from the previous question and this question are possibly due to the 'late' onset of the amygdala calcifications. Siebert et al. (2003) explain that the characteristic bilateral amygdala lesions found in Urbach-Wiethe patients are evident in adult patients, but not in children. As the calcification takes place over a long period of time, throughout

childhood and adolescence, it is possible that UWD patients learnt and remembered negative affect and emotions. It seems that the new emotional stimuli could no longer be processed and learned, but previously learnt information remains unforgotten.

Are Urbach-Wiethe dreams less dreamlike than the matched controls?

The term 'dreamlike' was defined as perceptually vivid, bizarre and emotionally charged (De Gennaro et al., 2011). The comparison between the matched controls and Urbach-Wiethe patients indicated that there was a significant difference between the two groups with regard to dreamlikeness- based on the above definition. The two groups did not have similar dreamlike characteristics. Wishfulfillment was looked at, as it may have been the reason for the dreamlike difference between the two groups. However, the results of the wishfulfillment analysis indicated that there was no difference between the two groups.

Is the complexity and bizarreness of the dream lower than the control dreams?

Using Revonsuo and Salmivalli's Bizarre Elements Scale, it was determined that there was no statistically significant difference between the two groups with regard to bizarre and non-bizarre elements. The dream reports were similar in that both groups had 'actions', 'language', 'persons', and 'place' as their top four categories when looking at the frequency of all the elements. When looking at the comparison of bizarre vs non-bizarre elements for each category, it can be seen that there are no significant differences between the groups. This indicates that UWD patients and the matched controls had a similar amount of bizarreness in each content category. Urbach-Wiethe patients did not have a lower incidence of bizarreness in their dreams.

Although the Urbach-Wiethe patients did not have a statistically significant lower narrative complexity when compared to the matched controls, their word count means were smaller than the matched controls. The characteristic hoarse voice explains why there is a fairly large difference (without being statistically significant) in word means between the two groups. The ability to recall or describe a dream is not deficient in these patients; however, details are sacrificed in order to convey the underlying theme. Speaking is not an easy task for Urbach-Wiethe patients but despite the fact that they sacrifice some details, they are in no way deficient in the ability to recall and describe their dreams.

Is there an increase of wishfulfillment in UWD dreams when compared to matched controls?
When wishfulfillment was investigated, it was determined that UWD dreams contain a similar amount of wishfulfillment than the matched controls as the test result indicated a non-significant result. There was no increase or decrease of wishfulfillment. The means for both groups were very close (control $M = 1.03$; UWD $M = 1.22$) which suggests that the two groups had similar wishfulfillment in their dreams, and that the Urbach-Wiethe group's dreams were not dominated by wishfulfillment.

Discussing the remainder of the tests
The remainder of the tests did not fall under a particular hypothesis or question, but they were used to create a 'profile' of Urbach-Wiethe dreams.

The approach/avoidance dichotomy was investigated to test Revonsuo's threat simulation theory, which highlights that the amygdala is an important part of the threat simulation mechanism and in normal people, there would be a large occurrence of threatening situations and threat avoidance in dreams. The results indicated that Urbach-Wiethe patients' dreams contained high levels of approach behaviour and low levels of avoidance behaviour. This corresponds with Revonsuo's theory, as a lack of a functioning amygdala would cause the opposite to occur. The Hall-Van de Castle analysis adds that the UWD patients tended to befriend people more than the matched controls. This is because the calcified amygdala would not process the threatening person and the dreamer would freely approach a character that would otherwise have created apprehension or fear in a normal dreamer. However, the Hall-Van de Castle results did not produce many statistically significant or relevant information. Of the important significant results, Urbach-Wiethe patients tend to befriend people more so than the matched controls and there are no aggressive interactions in UWD dreams.

Do Urbach-Wiethe dreams differ from matched controls, and how so?
A multitude of tests were performed on the data. The reason for this was that the present study was the first of its kind exploring and investigating dreams and dream content in a sample of patients with amygdala calcification (Urbach-Wiethe disease). The multitude of tests allowed for a 'profile' of Urbach-Wiethe dreams to be drawn up.

To determine whether the Urbach-Wiethe dream content differed significantly from the matched controls, the content was analyzed using the Hall-Van de Castle method of content analysis- the standard method of analyzing dream reports. This analysis revealed that

there were subtle differences between the content of the two groups' dreams. The Hall-Van de Castle results indicated that there was a significantly higher level of befriending amongst the UWD group. This suggested that the Urbach-Wiethe patients were unable to process fearful information presented in dreams and instead of being fearful or performing fearful behaviours; these patients performed the opposite behaviour- approaching and befriending. This finding could be related to the amygdala calcifications found in these patients.

Urbach-Wiethe patients had fewer dreamlike characteristics in their dreams when compared to their counterparts. This result was not related to potential wishfulfillment. The UWD group's dream reports contained less bizarre and perceptually vivid characteristics.

There were a number of small areas in which the dream content differed, but these results were not significant enough or were significant due to the size of the sample.

The results and their consequences for Revonsuo's TST

Revonsuo's TST is based on six fundamental propositions. The present study did not explicitly test these propositions, but instead explored the amygdala's role in the threat simulation theory.

According to Revonsuo, the amygdala plays a crucial role in the TST as it is the putative threat simulation mechanism. The TST holds that due to the overrepresentation of threatening events and the appropriate behavioural responses, the amygdala is highly aroused during dreaming. It is assumed that if there is damage to the amygdala, there should not be any threatening experiences and the associated negative affect and emotions. This is further highlighted by Panksepp's work. Panksepp (1998) explains that the amygdala is involved in generating negative emotions (such as fear and rage) as well as negative affect. If the amygdala is no longer functioning, there should be a lack of fear and rage experienced in dreams.

The present study has shown that patients with amygdala damage, due to Urbach-Wiethe disease, still experienced fear and rage in their dreams. In fact, their results were similar to the matched controls, indicating that UWD patients are not deficient of negative emotions and affect in their dreams. This contradicts Revonsuo's theory as it was assumed that lack of a functioning amygdala would lead to a lack of these emotions and affect in dreams. Furthermore, when looking at the approach and avoidant behaviour in the dream reports, it was discovered that the matched controls had a higher incidence of approach behaviours and a very low incidence of avoidant behaviour. This was not expected, according

to the threat simulation theory, as there should be an overrepresentation of threatening events and negative affect in normal functioning humans (Revonsuo, 2000).

Conversely, the present study indicated that there is also some support for Revonsuo's threat simulation theory. The results, according to the Hall-Van de Castle method, specified that UWD patients tend to befriend more in their dreams. This is in line with Bachevalier's (2000) work in which patients with bilateral amygdala damage were unable to judge trustworthiness and approachability in others. It was assumed that the UWD group's dream reports would contain more approach behaviour than avoidant behaviour, as they would not process or realise the potential threat. The results highlight that this is true.

As is evident, the present study both supports and opposes the threat simulation theory. Patients with amygdala damage still experience fear in their dreams despite the lack of a functioning amygdala. These patients also tend to approach and befriend more, which is in line with what is expected from patients with amygdala damage.

Conclusion

The present study investigated seven questions when looking at dream content in Urbach-Wiethe patients. From the data, it has been determined that Urbach-Wiethe patients do dream and the content of their dreams differ slightly from that of the matched controls. There were few significant results; however, all of the test results helped create a 'dream profile' of Urbach-Wiethe dreams.

An important finding to note is that the Urbach-Wiethe patients did not experience any significant difference between the emotions experienced in dreams. The intensity of the emotions in dreams between the groups was not significant, indicating that Urbach-Wiethe patients experience emotions in much the same way as the matched controls.

The results obtained from this study must be scrutinized carefully as this sample is very small (but larger than most UWD studies) and any significance could be due to this. As the first set of data was small and contained sporadic differences within the dream content, it was decided to obtain a larger sample. This allowed to determine whether the sporadic differences were due to the small sample size, or the actual dream content.

Overall, the Urbach-Wiethe patients displayed similar dreams and dream content when compared to the matched controls. The UWD dreams could be considered normal as they contain a similar amount of bizarreness, narrative complexity, emotions experienced, approach and avoidance behaviours, as well as emotional intensity. Despite the fact that

Urbach-Wiethe patients do not have a functioning amygdala, which is an important region for processing negative emotional stimuli, the UWD patients were in no way deficient in their ability to experience negative emotions or affects in their dreams. With regard to other aspects of dreaming, these patients experience similar dream characteristics when compared to the matched controls, which suggest that a non-functioning amygdala does not affect dreams, and dream content.

Limitations of the study

As with all dream research, there come limitations. This subjective field imposes important methodological limitations that must be taken into consideration. The first limitation is that researchers do not have direct access to the dream experience and have to rely on the participants' subjective report of the dream (Schwartz et al., 2005). The actual dream experienced may differ from the dream that is recalled by the participant. This is unavoidable and there are a number of reasons for this happening. One of the reasons is that participants may feel that recalling their dreams, even in clinical and confidential settings, is intrusive on their private life. Others may feel embarrassed about what they dream and censor the details accordingly. It is also possible that the dreamer remembers fragments of the dream and then tries to piece it together to form a cohesive and flowing report. This may provide the researcher with incomplete and inaccurate dream reports (Schwartz et al., 2005).

It is apparent that selective and bilateral amygdala lesions are extremely rare in the human population (Adolphs, Tranel, & Damasio, 2001). Due to these considerations, the sample size was smaller than would have been desired, as it was not possible to access all of the UWD patients in the community. Using Urbach-Wiethe patients as a sample group limited the number of participants in the study. The exclusion criteria further diminished the desired sample size. However, to test the hypotheses for this study, it was necessary to obtain patients with bilateral amygdala damage, as this study tested the effect of not having a functioning amygdala has on dreaming. Using patients with unilateral amygdala damage, although there are many more, did not allow the hypotheses to be tested accurately. Despite the sample size there were some significant and interesting findings. Although these findings cannot be generalized easily and have less statistical power, they do serve as a guide for future research.

As the level of education was uncertain amongst these participants, it was decided to interview them and then transcribe the interviews. However, due to the hoarse voices of the UWD patients, it was found that they recalled their dreams in fewer words, especially when

compared to the control group. Future research should consider using dream diaries as this would eliminate the difficulty of speaking and describing.

The present research tried to account for these limitations and work around them. In the briefing and consent form, the participants were repeatedly told that their interviews would be confidential and that they were to be as open as possible. The interviewer was also well known to the participants, which created a rapport between the interviewer and the interviewee. This allowed for these vulnerable patients to feel more comfortable and at ease in the interview environment.

Recommendations for future research

One recommendation for future research is that a series of dreams from each participant be collected. A dream diary would be best for this population. Using a dream diary would eliminate the interviewer, which would possibly eliminate any censorship that may potentially occur. It would also allow for each participant to recall as many dreams as he/she feels comfortable with and not be confined to one particular dream. This would also give a larger set of data to work with.

It would be ideal for there to be a larger sample of Urbach-Wiethe patients, but due to the nature of this disease, it does not seem viable. Researchers could potentially approach UWD patients worldwide and ask them to keep a dream diary but finding these rare and vulnerable patients may prove challenging. As these patients live in a variety of countries, particularly European countries, the dream reports would potentially be in a variety of languages.

By following the above guidelines, it is possible to find and create a larger sample with more dreams per patients. This would greatly improve the statistical power of the tests and make the results more generalizable.

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Appendix A

UCT ethical approval for the larger neuropsychological study

UNIVERSITY OF CAPE TOWN

Department of Psychology

University of Cape Town Rondebosch 7701 South Africa
Telephone (021) 650 3414
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4 May 2009

Dr. Georg Fodor
c/o Department of Psychology
University of Cape Town
Rondebosch 7701

Dear Dr Fodor,

I am pleased to inform you that ethical clearance has been given for your project:

Emotional experience in Urbach-Wiethe Disease: A neuro-psychoanalytic study.

I wish you all the best for your study.

Yours sincerely,

Johann Louw PhD
Professor

Appendix B

Example of the Hall- Van de Castle coding system

Classes of emotions

Anger (coded as AN)

Annoyed, irritated, mad, provoked, furious, enraged, belligerent, incensed, indignant

No coding distinction between weak expressions or strong expressions of anger

Apprehension (coded as AP)

(related to fear, anxiety, guilt, embarrassment)

Terrified, horrified, frightened, scared, worried, nervous, concerned, panicky, alarmed, uneasy, upset, remorseful, sorry, apologetic, regretful, ashamed

Sadness (coded as SD)

Disappointed, distressed, hurt, depressed, lonely, lost, miserable, hopeless, crushed, heart-broken

Confusion (coded as CO)

Surprised, astonished, amazed, awestruck, mystified, puzzled, perplexed, strange, doubtful, conflicted, undecided, uncertain

Happiness (coded as HA)

Contented, pleased, relieved, amused, cheerful, glad, relaxed, gratified, gay, wonderful, elated, joyful, exhilarate

Appendix C

English Most Recent Dream form

Age:

Gender:

Date:

Do you know what dreaming is?

Do you dream?

We would like you to tell us the last dream you remember having, whether it was last night, last month or last year. Please state when this dream occurred:

Please describe the dream exactly and as detailed as you remember it. Your report should contain, whenever possible: a description of the setting of the dream, whether the setting was familiar to you or not; a description of the people, their age, sex and relationship to you; and any animals that appeared in the dream. If possible, describe your feelings during the dream and whether the dream was pleasant or unpleasant. Be sure to tell exactly what happened during the dream to you and the other characters.

Appendix D

Afrikaans Most Recent Dream form

Ouderdom:

Geslag:

Datum:

Weet jy wat n drrom is?

Droom jy?

Ons wil he u moet die laaste droom wat u kan onthou neerskryf. Dit mag n droom van gisteraand, laas maand of laas jaar wees. Wanneer het u die droom gehad?

Beskryf die droom presies soos u dit kan onthou en met soveel besonderhede as moontlik. Die verslag moet die volgende bevat: beskrywing van die omgewing waar die droom plaas gevind het en of u en die omgewing herken het; n beskrywing van die mense, hulle ouderdom, geslag, en verband met jou; enige diere wat in die droom voorgekom het; wat was u emosies in die droom, positief of negatief; beskryf wat met u en die ander karakters gebeur het gedurende die droom.

Appendix E

The Affective Neuroscience Dream Scale (ANDS)

Please read the entire dream report and familiarise yourself with its content. Then look through the list of emotions below, and indicate which emotions are present in the dream report. An emotion is present if an element of the emotion is evident in the dream – not all the suggested conditions need to be evident. For instance, if the dream contains an element of 'worrying' but not of 'unable to relax due to fear or anxiety', FEAR is present, as one of the conditions has been met.

If the emotion is absent, please place a '0' in the *Score* column for that emotion.

If the emotion is present, please indicate the intensity of this emotion. The intensity refers to the strength of the emotion when the dream is considered as a whole. Indicate this by placing a '1', '2', or '3' next to the emotion under *Score*.

Emotion Definition	*Score*
FEAR: Feelings of sudden startle or persistent, anxiety, nervousness, worry and tension all indicate fear. Characteristic behaviours include hiding, freezing, fleeing, and heightened vigilance. These behaviours commonly occur in response to threat, danger, or expected pain or injury. Physical manifestations of fear include a strong and rapid heartbeat, rapid shallow breathing, dry mouth, sweating, trembling, diarrhoea, and general restlessness. Cognitive manifestations of fear include difficulties in decision making, ruminating in an anxious way, and the inability to relax.	
ANGER: Feelings of rage, hot aggression, hatred, contempt, intense frustration and irritation centrally characterize anger. These feelings are often expressed rapidly and automatically. Destructive, violent, vengeful, and threatening behaviour that is verbal or physical in nature frequently express anger. Anger can also be expressed in a cold and spiteful manner.	
PLAY: Rough-and-tumble play conveys the essence of this emotion – especially in children. Other forms of play include physical and non-physical games usually games with rules, toys, and the use of dramatic and linguistic "role playing" devices. Play can induce feelings of intense joy, exuberance, fun, glee, happiness, and (especially) laughter. Play can also have a pleasurable, competitive element.	
SEEKING: Feelings of intense interest, craving, engaged curiosity, eager anticipation, and excitement. Foraging, exploration, wanting and appetitive behaviours such as hunger, thirst, and sexual drive all encompass seeking. Cognitively, seeking includes the desire to solve problems or puzzles, as well as the search for higher meaning. Seeking also includes feelings of positive expectancy and optimism, such as the sense of being able to accomplish almost any goal.	
LUST: Feelings of gratification or pleasurable release or discharge from the consummation of any desire or appetites such as wanting, food, water, or sex. Erotic acts, sexual pleasures and delights, and orgasm centrally encompass this definition of 'lust'. Consummation of desire can	

also be experienced in the cognitive domain, such as the pleasure that is felt on finding a solution to a difficult intellectual problem.	
CARE: Feelings of nurturance, love, social attraction, affection and bonding particularly towards juveniles. Care is centrally characterized by maternal behaviour. Care also extends towards friends, pets, those who are sick and others in need. Cognitively care includes the desire to protect and look after (and to feel needed by others).	
PANIC: This emotion is epitomized by acute separation distress, where individuals feel the need to search for, call or cry out for their loved ones. Intense anxiety is experienced from the sudden, undesired or unexpected loss of a loved one. 'Panic' is differentiated from 'fear' by its association with an anticipated or actual loss ("something will be taken away from me") as opposed to the danger or injury to the self, and so on ("something will be done to me"). Panic is considered to be the acute form of grief.	
GRIEF: Bereft feelings of loneliness, sadness, pining, despair, hopelessness, and depression associated with loss characterize the essence of this emotion. These feelings also extend to thoughts of past relationships, and can include thoughts of guilt and regret.	

Scale:

- 0: Absent
- 1: Trace evidence of the emotion
- 2: Emotion present in moderate intensity
- 3: Emotion present at maximal intensity

Appendix F

The Affective Dream Scale (ADS)

Please rate all eight categories of emotion for each dream on a 0-3 scale, where zero indicates an absence of the emotion and three indicates that the emotion was very intense.

A	Anger/Rage: Aggression:	Anger refers to feelings of strong displeasure or hostility; annoyance; irritation; fury; resentment. Rage refers to feelings of violent explosive anger. Hostility; violence; feelings of aggression.
B	Sexual Love/Erotism:	Sexual love refers to the fulfilment of sexual gratification of any kind. The desire for sexual gratification, or the *anticipation* of any sexual interactions, should be rated under category D.
C	Playfulness: Joy: Exuberance:	Finding or making causes for amusement; pleasantly humorous or jesting; full of fun and high spirits. Any actions relating to play should be rated here as well. Happiness; pleasure; enjoyment; bliss; delight. Enthusiasm; excitement; liveliness; energy; high spirits; cheerfulness
D	Seeking/Curiosity: Anticipation:	To try to locate or discover; the act of searching for something; to try to obtain. *Curiosity* refers to feelings of inquisitiveness or interest. To look forward to, especially with pleasure; expectance; suspense; hopefulness.
E	Care/Nurturance: Affection:	To watch over; be responsible for; physical and emotional care and nourishment; to take care of or to nurture someone or something. A feeling of warm personal attachment or deep affection, as for a parent, child, spouse or friend. Feelings of love should be included here only if of a non-sexual type – if feelings of love are both sexual and affectionate, then both categories (B and E) should be chosen.
F	Fear: Anxiety:	A distressing emotion aroused by impending danger, evil, pain, etc., whether the threat is real or imagined; the feeling or condition of being afraid; dismay, dread, terror, fright, panic. Distress or uneasiness of mind caused by fear of danger or misfortune.

	Apprehension:	Uneasiness; worry; nervousness; hesitation.
G	Sorrow/Grief/Loss:	Mental suffering or pain caused by separation, loss or despair; a source of deep mental anguish, torment, distress.
H	Dominance/Power/Control:	Feelings of authority or control over others; asserting authority over others; control over events and people; feelings of power, high-status. DO NOT rate feelings of *wanting* power here, these should be considered anticipatory and rated under category D.

Appendix G

The Content Analysis of Bizarreness Scale.

Identification of Content Elements

General principles

(1) Every identified element is assigned to one and only one content category.

(2) Every dream element carrying novel information is identified when it is mentioned for the first time in the dream report. For example, an object and all the adjectives used to describe its features are each identified as distinct elements.

(3) If new features of a previously mentioned element are mentioned, they are scored as new elements. Redundant information is not to be scored.

(4) An element is identified only when it is explicitly mentioned in the dream report. No elements are to be inferred on the basis of context.

(5) Elements are identified only in such parts of the dream report which are described as real events from the point of view of the dreamer. If dreamed events or objects are represented as unreal in the dream (e.g. events or objects in a movie watched in the dream) they are not to be scored.

Classification of bizarreness

(1) Every bizarre feature is scored as bizarre only when it is mentioned for the first time in the dream. The bizarre element sets the context for what can be considered as a further bizarreness. Thus, the direct implications of a bizarre assumption in the dream are not themselves considered as independently bizarre. Only elements which bring further bizarre assumptions to the dream are scored as independently bizarre (cf. Hunt, 1982, p.594). Thus, dreaming of seeing a kangaroo in the bushes on my backyard is scored as a bizarre animal

(animal in a wrong context). But if I dream that I am in Australia and in this dream there is a kangaroo in the bushes, it is not an exotic animal in this context, but Australia is scored as a bizarre place (the place is an unlikely context for me). And if I next see cloudberries growing in a forest in Australia, this is of course a bizarre plant (plant in a wrong context).

(2) Every element is non-bizarre until shown to be bizarre. That is, if the judges disagree as to whether a certain element is bizarre or not, the burden of proof is on the one claiming that the element is bizarre.

There are 3 mutually exclusive bizarreness categories and 1 non-exclusive category.

Bizarreness Categories:

1. Non-bizarre element. A dream element (or its feature) which is ordinary and congruous with waking reality.
Example: I dream that I am in my room which appears as it is in waking reality [*non-bizarre place*].

2. Incongruous element. A dream element which has at least one of the following properties:

2a. Internally distorted or contextually incongruous elements. An element which has a feature that does not belong to it in waking reality or which appears in a context in which it would not appear in waking reality.
Example: My room is much bigger than it is in reality [internally distorted place]. My room is in the middle of a forest [contextually incongruous place].

2b. Exotic elements. An element which is highly unlikely to occur in the dreamer's waking reality, but the occurrence of which is nevertheless possible in principle.
Example: I was in a tropical jungle [exotic place].

I met the Secretary General of the United Nations [exotic character].

2c. Impossible elements. An element or a feature of an element the existence or occurrence of which is not possible in waking reality.

> My dead grandfather came to visit us [impossible character]. I was flying above the city like Superman [impossible action].

3. Vague element. An element or a feature of an element the character or identity of which is indeterminate, unknown or obscure in a way which does not occur in waking life.

Example: I was in a place which was my room but at the same time it was also a submarine [indeterminate identity of place]. I was in some city but I do not know or remember which one [vague identity of place].

Bizarreness categories 1-3 are mutually exclusive and each content element falls into one and only one of these categories. There was a further bizarreness category in addition to these which could be assigned to a content element.

4. Discontinuous element. An element which is temporally discontinuous; it suddenly and unexpectedly appears or disappears or is transformed in the dream. The content of a discontinuous element is always the one to which the element belongs after the transformation. In case the discontinuity is total (i.e. everything else but the Self changes) but the discontinuity is not in any way noticed or commented (e.g. "and *suddenly* I was..."), it is considered and scored as a whole new dream, not a discontinuity within one dream.

This category was not mutually exclusive with the others, since an element can be discontinuous independently of whether it is non-bizarre, incongruous, or vague.

Appendix H

Definitions of content categories in the Bizarre Elements Scale[1]

1. Self

The subject (or its features) who acts in or observes the dream world. The person or being from whose point of view the dream world is experienced and who appears in the first person in the dream report. The features scored as features of Self are those which belong to the identity of the Self (age, sex, size, race, profession).

2. Place

The immediate surroundings (and its features) and geographical location of the dream events or the dream self. For example: room, building, street, forest, train, city, country. Implies that the dream events are represented from a point of view within the place. If e.g. a building is observed only from the outside, it falls under the category of Object. Features of Place include, temperature and other weather conditions (darkness, lightness), and all "global" features which are not features of a single Object or other element in the Place.

3. Time

The explicitly mentioned temporal context of the dream events. Time of the day, date, month, season, year, era.

4. Persons

The human or humanoid or other intelligent characters, and groups formed by such characters, perceived by the subject in the dream. Features to be scored as features of persons include age, sex, size, race, profession.

5. Animals

Animate characters other than Persons perceived in the dream, and groups formed by such characters. Includes non-humanlike unknown monsters and alien creatures.

6. Body Parts

[1] Taken directly from Revonsuo and Salmivalli's Bizarre Elements Scale.

Human and animal bodies and their parts and features perceived in the dream. The parts can belong to a character (the beak of a bird) or they may be detached (a bearskin, a tooth). Also the fluids of the body (blood, slime, etc.) and perceivable injuries of the body (bruises, tumors, bumps, rash, pimples, etc.).

7. Plants

All kinds of vegetation (trees, flowers, bushes, mushrooms, grass) and their parts (berries, fruits, vegetables, roots, branches, leaves) perceived in the dream.

8. Objects

A part (or a feature of a part) of the inanimate environment, which is perceived in the dream. Different objects can be perceived in different ways (vision, touch, hearing).

9. Events

Causal changes taking place in the inanimate environment or in animate objects, which cannot be considered as the intentional actions of any single character (e.g. weather processes, the behavior of objects when not guided by dream characters, collective events like wars, riots, gatherings). Incidents which happen to the dream characters without their control (bumping into something, finding something etc.).

10. Action

Intentional acts carried out by the animate characters in the dream. The behavior of devices directly controlled or assumed to be controlled by animate characters (cars, airplanes). Also actions of speaking when no referral to the content of speech is made (content belongs to Language). If action is only planned but not carried out by the Self, it belongs to Cognition.

11. Language

Words and sentences uttered by the animate characters in the dream and other linguistic messages and symbols: writing, text, numerical symbols. The message is evaluated by its form and its content.

12. Cognition

The internal intellectual and mental functions of the Self. Internal speech, thoughts, beliefs, value judgements, reflection on events, planning, problem solving, decision making,

reasoning, mental imagery, knowing and understanding. The mental functions of other characters in the dream are not scored in this category but according to how they are perceived by the subject (as speech, action, emotion etc.).

13. Emotions

Emotional states and feelings experienced and expressed by the dreamer or expressed by other dream characters. Includes emotions, feelings, moods, emotional attitudes (desires), and actions which refer to expression of emotions (crying, laughing).

14. Sensations

Sense experiences which occur independently of voluntary cognitive processes and which do not refer to objects outside of themselves (e.g. pains, itches, sensations of heat, pleasure, odor, nausea, sleepiness etc.).