Dream Recall and Autobiographical Remembering

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The candidate confirms that the work submitted is his/her own and that appropriate credit has been given where reference has been made to the work of others.

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Abstract

Whilst it is generally accepted that most people struggle with recalling dreams and that there are vast individual differences in this ability, it is not known whether this is the result of memory processes or otherwise. Theories of dream generation are largely physiologically based and theories of interpretation (relying upon accurate dream recall) are often unsupported by empirical evidence. This thesis set out to explore dream recall from a cognitive perspective, focusing upon retrieval processes whilst awake. Dream memories display a unique relationship to memory in terms of being composed of memories from daily waking life and in terms of their poor recallability. In order to emphasise the mediating role of memory, the thesis aimed to design a new measure of dream recall, which could then be used to assess the profile of dream memories as compared with normal autobiographical remembering.

Experiment 1 involved the design of a new measure of remembering dreams and other memory experiences, through psychometrically validating the Dream Memory Questionnaire (DMQ). This was found to correlate with openness to experience, absorption in imaginings, fantasy proneness, attitudes towards dreams, thin boundaries and dissociative experiences in Experiment 2. Experiments 3 and 4 found no evidence of a relationship between long term recall and recognition memory performance for waking experiences, and the DMQ. Experiments 5-8 therefore investigated dreaming and its relationship to autobiographical remembering of waking experiences. Dreams were less detailed along a host of characteristic measures, in line with previous findings. As dreams were as similarly recallable and recognisable as waking memories (Experiment 7) and displaying a similar recollection trend over the lifespan (Experiment 5), it seemed that those dreams sufficiently encoded upon waking were able to be remembered in a similar way to waking experiences, although their lack of salience likely leads to problems at encoding as well as retrieval. Experiment 8 investigated the effect of rehearsal upon dream and event memory, finding that dream recall frequency (DRF) was unaffected, although it did alter the qualities of recalled memories. Experiments 10-11 explored the centrality of the self in dreams, finding that dreams do reflect "selves", highlighting that autobiographical memory processing, and so possibly consolidation, is evident across the sleep-wake cycle.

These data indicate that dream recall is a largely autobiographical process. Once dreams have been successfully encoded, which is largely difficult due to relative brain deactivation during sleep, dream memories are comparable to waking autobiographical memories despite their unique experiential profile. The results help support a continuity hypothesis of dreaming and waking cognition; dreams seem to reflect memories and the self from waking life. In addition recallability of dreams relies upon the cognitive and memory profile of an individual. Whilst personality traits do seem to account for some of the widespread variance in dream recall, it may be best accounted for together with a consideration of the extent to which a dream memory has been rehearsed. If dream memories traces are present upon waking, they do not seem to be lost as psychodynamic theories would suggest, although they do decay rapidly over time. The presence of the self in dreams indicates that autobiographical processing occurs during sleep, which may reflect consolidation of autobiographical memories.

A host of methods have been employed, ranging from experimental computer programmes testing memory performance to content analyses of diary dreams. This has demonstrated that there are many non-invasive methods for investigating dream recall retrieval out of the sleep laboratory. The studies, taken altogether, reflect a relationship between dreaming and memory that is intricate and complex. Adopting a cognitive approach to this field seems to offer hope for the eventual production of a theory of dreaming.

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AMI	Autobiographical Memory Interview
ATDs	Attitude towards dreams
BFI	Big Five Inventory
CEQ	Creative Experiences Questionnaire
CSM	Composite Scale of Morningness
DES	Dissociative Experiences Scale
DMQ	Dream Memory Questionnaire
DR	Dream recall
DRF	Dream recall frequency
IASD	International Association for the Study of Dreams
LTM	Long-term memory
ME	Morningness-Eveningness
PSS	Perceived Stress Scale
REM	Rapid eye movement (sleep)
NREM	Non-rapid eye movement (sleep)
SACL	Stress Arousal Checklist
STAI	State Trait Anxiety Inventory
STM	Short-term memory
SWS	Slow-wave sleep
TES	Tellegan Absorption Scale
TB	Thin boundaries
WBSI	White Bear Suppression Inventory

Preface

Soaring through the skies, swimming a river deep
I leave on an adventure every time I go to sleep

Anon

"Oblivion, that's all. I never dream" he said –
proud of it, another immunity,
another removal from the standard frame which she
inhabited, dreaming beside him of a dead
woman tucked nearly into a small bed,
a cot or a child's bunk, unexpectedly
victim of some friend or lover. "Comfort me",
said the dreamer, "I need to be comforted."
He did that, not bothering to comprehend,
and she returned to her story: a doctor came
to identify the placid corpse in her dream.
It was obscure; but glancing towards the end
she guessed that killer and lover and doctor were the same;
proving that things are ultimately what they seem.

Dreaming, Fleur Adcock

Trust your dreams.
They are sweet and beautiful.
Trust your visions.
They are soulful and powerful.
Trust your aspiration.
It is your earth-friend
And
Heaven-brother.
Trust your realisation.
It is your Eternity's real Self.

Sri Chinmoy

O soft embalmer of the still midnight,
Shutting with careful fingers benign
Our gloom-pleased eyes, embowered from the light,
Enshaded in forgetfulness divine:
O soothest Seep! If so it please thee, close,
In midst of this thine hymn, my willing eyes,
Or wait the "Amen", ere thy poppy throws
Around my bed its lulling charities.
Then save me, or the passèd day will shine
Upon my pillow, breeding many woes;
Save me from curious conscience, that still hoards
Its strength for darkness, burrowing like a mole;
Turn the key deftly in the oilèd wards,
And seal the hushèd casket of my soul.

To Sleep, John Keats

Once in the dream of a night I stood
Lone in the light of a magical wood,
Soul-deep in visions that poppy-like sprang;
And spirits of Truth were the birds that sang,
And spirits of Love were the stars that glowed,
And spirits of Peace were the streams that flowed
In that magical wood in the land of sleep.

Lone in the light of that magical grove,
I felt the stars of the spirits of Love
Gather and gleam round my delicate youth,
And I heard the song of the spirits of Truth;
To quench my longing I bent me low
By the streams of the spirits of Peace that flow
In that magical wood in the land of sleep.

Sarojini Naidu

Chapter 1: Introduction

1.1 Introduction to dreaming and REM sleep

It is widely accepted that humans dream. That is, whilst asleep people perceive internally generated, although rarely consciously controlled, "imagery during sleep" (Penguin Dictionary of Psychology, 1995, p226). Such sequences may also include series of thoughts, images, and sensations" (Oxford American Dictionary, 2005, p513) and "ideas, emotions, and sensations occurring involuntarily" (answers.com, n.d.). In most instances dreams are not consciously controllable. Most people are aware that they dream, although remember very few of their dream experiences. It is also widely accepted that such experiences are not restricted to the physical constraints of waking life. Individuals may be able to fly, speak in foreign languages or interact with people that they do not have the skills, knowledge, or means to do so in waking life. During sleep then, the mind is actively full of thoughts, generating and working through scenarios that may be familiar, unfamiliar or a combination of the two. Such sleep "mentation" can reveal much about an individual's life and concerns as well as cognitive and brain processes. This thesis investigates the profile of dreams and why they are difficult to remember, characterises them and compares them to memory for our own waking experiences.

1.1.1 Definition and prevalence

Healthy individuals, indeed all mammals, progress through a number of sleep stages in a systematic cycle which occurs approximately every 90 minutes. Each stage is characterized by specific patterns of EOG (electrooculography) and EEG (electroencephalography) activity, and can be broadly divided into periods of rapid eye movement (REM) and non-rapid eye movement (NREM). NREM sleep consists of four sub-stages, with stages 3 and 4 involving the deepest sleep and being referred to as slow-wave sleep (SWS) due to its characteristic steady EEG patterns. Different regions of the brain are also active compared to waking. The study of dreaming has thus been largely taken over by neuroscientists as opposed to cognitive psychologists. In humans about two hours of a normal night are spent in REM sleep in periods lasting from 5 to 40 minutes and becoming longer later in the night.

1.1.2 REM sleep and biological mechanisms

Aserinsky and Kleitman (1953) published ground-breaking findings about the association between dreaming and REM sleep. Dreaming was generally thought to occur in REM stages when dreams could be reported from about 95% of awakenings, due to the brain activity being relatively heightened at this time compared to the NREM stages when dreams were only reported in about 5% of cases (Dement & Kleitman, 1957). Countless studies have found that if people are woken up when in REM sleep, they are more likely to report a dream, compared to when they are woken from NREM sleep. However, the physiology of REM sleep has not provided a complete explanation of dreaming as some REM sleep occurs without dreaming, and some dreaming occurs without REM sleep (Herman, Ellman, & Roffwarg, 1978; Solms, 1999). More recent studies have shown that in about 80 per cent of occasions when people are woken from REM sleep they are able to report an ongoing dream. It seems likely, therefore, that some REM sleep occurs without concomitant dreaming, and this conclusion is reinforced by the fact that REM sleep is found in neonates and decorticates, where dreaming is thought to be improbable (Goodenough, 1978). Dreaming has also been found to occur in NREM sleep (e.g. Herman, Ellman, & Roffwarg, 1978) and the extent of this alters according to methodological inquiry. Experiments have found that by framing the question carefully (e.g. by asking "What was going through your mind just before I called you?" as opposed to "what were you dreaming?" (see Battaglia, Cavallero, & Cicogna, 1987), dream reports can be elicited from periods of NREM sleep in as many as 50% of instances (Foulkes, 1962). REM dreams are generally typical of what we think dreams are like, consisting of a relatively clear narrative. NREM dreams, on the other hand, are vaguer and less themed like a story (Battaglia *et al.*, 1987). Solms (1999), however, argues that the only differences between dreams of REM and NREM sleep relate to their length, with REM sleep dreams being longer. This may lead to other supposed characteristic differences, but appropriate methodologies should be able to elicit similar reports across the sleep cycle. Solms' position does not account for the differential functions of REM and NREM sleep in terms of memory consolidation (see 1.5.1). He argues that dreaming is not equivalent to REM sleep (see 1.2.3 and 1.2.4) in order to demonstrate how dreaming is a psychological process rather than an entirely physiological one (cf. Hobson & McCarley, 1977).

1.1.3 Neurological profile

Bonnet (1983) awakened participants after either stage 2 or stage 4 sleep and asked them to learn word lists. Both short term (immediate memory test) and long term memory (tested in the

morning upon waking) was impaired after stage 4 (deeper sleep) compared with stage 2 (lighter) sleep. Changes in physiological functioning of the brain over the sleep wake cycle indicates that the brain is most similar to its awake state when in REM sleep, and most dissimilar when in deepest sleep (stage 4 NREM). REM sleep is sometimes known as paradoxical sleep as the brain receives sensory input as if awake, to some extent. Frontal brain regions in stage 2 NREM sleep reflect higher levels of activation than in REM sleep (Loevblad *et al.*, 1997) although dreams from this stage are rarely systematically analysed in experiments. Rather, REM sleep dreams are compared with either deeper sleep dreams (stages 3 and 4 or SWS) or NREM sleep dreams are collected from different stages and averaged, which usually results in removing the effect of heightened higher order cognitions, requiring frontal activation, operating throughout those dreams. Bonnet's (1983) experiment highlights the influence of relative activation of frontal regions upon memory. Frontal regions may well be involved in conscious and effortful encoding strategies. Deactivation of such regions would likely lead to memory impairment for events or images experienced whilst asleep. This will change over the sleep cycle. Changes in neurophysiology throughout the night also highlight the differences between NREM and REM sleep.

Generally the brain is less active whilst asleep than when awake. REM sleep, on the whole, involves the deactivation of frontal regions and the activation of certain structures of the temporal lobe including limbic and paralimbic areas especially involved in emotion. NREM sleep generally shows a decrease in cerebral energy compared to REM stages (Maquet, 2000). The result is that, given the inability to perceive stimuli from the external environment whilst asleep, some memories are activated (this may be a by-product of consolidation processes – see 1.5.1). Visual images arise, often accompanied by emotional content or other sensory perceptions, although these are not controlled, planned or manipulated due to the deactivation of the frontal lobes. The extent to which dreams reflect material that is deeply motivated, perhaps arising from the "unconscious", is subject to scrutiny and is well debated between Solms (1997, 2000) and Hobson (1988, 2000), with the latter arguing that the lack of frontal control produces meaningless images as opposed to deeply meaningful and personally salient dreams. Hobson's and Solms' ideas will be discussed in more detail (see 1.2.3 and 1.2.4, respectively).

1.1.4 Cognitive profile

As a result of the aforementioned attenuation of frontal activity whilst asleep, processes involving planning, control, monitoring and problem solving are less likely to be found in sleeping mentation than in waking thought. Meta-cognitions, awareness of one's own thoughts and processes, are especially rare. The existence of lucid dreaming - the awareness of dreaming whilst dreaming - may seem counter to this idea, however lucid dreaming is rare and tends to occur in individuals who often remember their dreams (Kahan & LaBerge, 1994) whilst reality monitoring performance in waking life is relatively easy (Johnson, Kahan & Raye, 1984; Johnson, Suengas, Foley & Raye, 1988). Kahn and Hobson (2005) discovered that thoughts in dreams may be similar to waking thoughts in terms of perceptions surrounding an experience. However the meta-cognitive process involving "thinking about the scenario" (p429) is deficient in dreams. Some researchers believe that dreaming has a problem solving function (Walker, Liston, Hobson & Stickgold, 2002; White & Taytroe, 1993). This process does not seem to be conscious, though, and may therefore differ from conventional accounts of problem solving which involve frontal structures as opposed to emotional long term memories (thus the hippocampal and limbic systems).

Foulkes and colleagues (Foulkes, 1982; 1999) argue that the dreaming brain is in a reflective only state, dwelling upon previous thoughts and events. In contrast the waking brain is claimed to be able to switch between this mode and an encoding mode. This implies that the reflections (thoughts) active in the dreaming mind are less easily encoded than waking thoughts and experiences. Foulkes' ideas assume that there is continuity between the sleeping and waking mind in terms of content. This issue is addressed later (1.6.1).

Hartmann (2000) explains his findings that instances of higher order cognitions - specifically reading, writing and calculating - are found in dreams in rare cases, as the neural connections required for such processing do not seem to match the "loose" autoassociative connections typical whilst dreaming.

Kahan, LaBerge, Levitan and Zimbardo (1997) argue that the differences between dreaming and waking cognition are quantitative rather than quantitative. That is, appropriate methodologies whereby dream recall (DR) is not a mediating factor reflect that dreams do contain high order

cognitive functioning. Despite this dreaming cognition is not equivalent to waking cognition, which may likely result from differences in frontal activation over the sleep-wake cycle.

1.1.5 Characteristics of dreams

Dreams have been found to be less detailed than waking event memories along a host of characteristic ratings (Johnson, Kahan & Raye, 1984; Kemp & Burt, 2006; Kemp, Burt & Sheen, 2003). That is, dreams seem to be less vivid, salient, detailed, coherent, less characterised by visual and auditory imagery, more fragmented and negatively emotional than memories for waking events (Kemp, Burt & Sheen, 2003).

There is conflicting evidence regarding the nature of dreams. On the one hand, they are notoriously bizarre. Johnson, Kahan & Raye (1984) note that this feature allows dreams to be discerned from memories for waking experiences. On the other, they have been found to contain mundane references to waking life (Snyder, Karacan, Tharp & Scott 1968). These opposing views can be reconciled in that dreams seem to contain elements of waking life, although they are not recreated in their exact context (Fosse, Fosse, Hobson & Stickgold, 2003). For instance, a shop assistant encountered in the day may be dreamt about, but not in the environment in which she was initially perceived. This gives dreams their seemingly strange quality. In addition, whilst some of the most memorable dreams may be especially bizarre or emotional (Cipolli *et al.*, 1993, Schredl & Doll, 1998), this may not be characteristic of the many dreams that are forgotten.

1.1.6 Recallability of dreams

DR is notoriously poor. This means that whilst most individuals accept that they dream nightly, they rarely have any awareness of having dreamt. Laboratory investigations, in which dreamers are systematically awakened in different stages of sleep, have provided information about the characteristics of dreams that would have been forgotten under normal circumstances. Approximately 80% of REM awakenings and 50% of NREM dreams result in dream recall (Foulkes, 1962, 1979; Neilson, 2000). Between three and six dreams can be gathered from an individual who is awakened in every REM phase per night (Meier, Ruef & Ziegler, 1968).

The developmental nature of dreaming and consequently memory for dreams has been emphasised, whereby young children are unable to recall dreams (e.g. Domhoff, 2001; 2002;

Foulkes, 1979). It is not known whether or not some kinds of dreams are experienced in young, pre-lingual children. The frequency of dreaming (dream recall frequency; DRF) seems to decline slightly in older adults, although this may be a function of general memory ability. Older adults also spend less time in REM sleep than children and younger adults (Foulkes, 1982). It is assumed by many theorists that the proportion of REM sleep relates to learning and memory consolidation of waking life experiences.

1.2 Introduction to theories of dreaming

Following Freud's publishing of his ideas on dreaming, dream theories in general were largely psychodynamic. Few theories emphasise the function of dreaming, with the exception of Revonsuo (2000). Some researchers emphasise the functions of sleep, such as memory consolidation (see section 1.5.1) with dreaming being a by-product of this. The majority of contemporary models rely upon neuropsychological profiles of the sleeping brain, such as Hobson's versions of the Activation-Synthesis models, which have dominated recent conceptions of dreaming.

1.2.1 Freud

Freud described his ideas on dreaming in The Interpretation of Dreams (1900). His psychodynamic ideas that unconscious wishes, drives and fears that are highly unacceptable need to be pushed away by defence mechanisms, was not unique to the realm of dreaming. However he proposed a number of symbolisms though which dreams (and therefore the unconscious) could be interpreted. These ideas led the way for numerous psychodynamic theorists to attempt to unravel the supposedly universal themes emerging in dreams. Such ideas are criticised in contemporary literature for being overly analytical as dream content may not be as disguised as Freud suggested. His repression hypothesis is discussed in detail later (1.3.1). One aspect of Freudian theory of dreaming that has received widespread support is the day residue theory, that an individual dreams about thoughts and experiences from the previous day. Whilst researchers may disagree as to why this is the case (memory consolidation, disguising true meanings of unconscious thought, brain "sifting" and categorisation or simply thinking of currently relevant life issues as one would in waking thought), there is evidence to support the idea that dreams contain memories from the previous day (Marquardt, Bonato & Hoffmann, 1996; Nielsen, Kuiken, Alain, Stenstrom, & Powell, 2004; Nielsen & Stenstrom, 2005).

1.2.2 Revonsuo

Revonsuo's (2000) threat simulation theory of dreaming adopts an evolutionary account, proposing a function of dreaming as opposed to simply attempting to explain what the brain is doing whilst asleep. That is, dreams allow potentially hazardous situations to be modeled in a problem-solving manner. This is supposed to increase the likelihood of an appropriate response if the situation arises in waking life. Revonsuo's theory is discussed in more detail in Chapter 6 (see section 6.2.1).

1.2.3 Hobson

Hobson has proposed a number of versions of his activation-synthesis account of dreaming (Hobson, 1988; Hobson & McCarley, 1977; Hobson, Stickgold & Pace-Schott, 1998; Hobson, Pace-Schott & Stickgold, 2000). Initially the model was devised in order to account for the changes in brain activation between sleep stages (the activation part of the model), whilst a more cognitive focus, resulting from this, explains how dream mentation is so bizarre, random and unpredictable (synthesis). That is, REM sleep is initiated by the pons (Jouvet, 1962) as opposed to the cerebral cortex, resulting in uncontrolled thoughts requiring the brain to "make the best of a bad job" (Hobson & McCarley, 1977, p1347) by synthesizing the thoughts together into some narrative that is as meaningful as the individual can allow it to be. The main claim of this theory is that dreaming does not result from higher order processing. Rather, it is the product of reflex actions, and thus the content is intrinsically meaningless as it is beyond control. This controversial claim has been challenged, mainly by Solms (see below) who disagrees that uncontrolled thoughts are meaningless and that dreaming is a purely physiological process. In addition the assumption that dreaming is equivalent to REM sleep is being increasingly refuted over time (Foulkes, 1962; Solms, 1999; 2000). Antrobus (1990) cites work by Kondo (1988) in which diurnal rhythms are found to influence report length, bizarreness and clarity of the imagery, arguably mediated by increased cortical activation. This influence was more profound than that of REM cortical activation patterns.

Hobson, Pace-Schott & Stickgold (2000) propose a three-dimensional model accounting for dreaming in neurocognitive terms. A (activation) refers to Antrobus' (1986) thresholds for the existence of dreaming, regardless of sleep-/consciousness-state; I (information flow and source) refers to the intensity of the dream experience, whereby attention is focused inwards, to the

detriment of interference from external sensory stimuli; and M (mode of information processing) accounts for the cognitive functioning of the dreaming brain, as neurologically underpinned by the position upon an aminergic-cholinergic neuromodulation spectrum. Thus this model is excellently supported by research in neuroscience, whilst accounting for the cognitive functioning (or, indeed, cognitive deficits) during dreaming.

However this model is not easily applicable in accounting for memory for dreams and the individual differences within this. That is although "M" represents the likelihood that memory for dreams will be low, due to cholinergic activation of the brain, some individuals are more likely to remember their dreams than others, and certain dreams are especially recallable.

1.2.4 Solms

Proponents of the activation-synthesis accounts of dreaming argue that dreams are more random than meaningful, thus rendering a motivated dream to be impossible. Solms adopts a very different approach to the Hobsonian view, both theoretically and methodologically. Indeed Solms and Hobson are often cited as holding ideas diametrically opposed to one another's. Solms has investigated dreaming from a clinico-anatomical perspective (1997), asking his patients about their dreams and thus collecting a large number of dream reports from a number of patients suffering from various different kinds of brain impairments. Whilst investigating which brain regions are implicated in dreaming, Solms reports that damage to the part of the brain involved in motivation, the ventromedial quadrant of the frontal lobe, leads to a cessation of dreaming. This region is involved in dopamine transmission and is responsible for reward and motivation. In line with continuity theories, patients are less motivated in waking life, also. The pons, however, claimed by Hobson and colleagues to activate dreaming, was not found to be essential for dreaming to occur. In addition the occipito-temporo-parietal junction, concerned with converting perceptions into abstract thought, was found to be essential for dreaming to occur (Solms, 1997). This is interpreted (1997, 2002) as reflecting Freudian notions of regression in dreaming, whereby thoughts are converted into perceptions, whilst in waking life perceptions and experiences are converted into abstract thoughts. As a result, Solms argues that Freudian theory is neuropsychologically plausible. Unfortunately it is not specified as to how the occipito-temporo-parietal junction switches to a reversed operational mode, so the leap from the clear clinico-anatomical data to psychodynamic interpretations should be cautious. Solms however convincingly argues that dreaming is not equivalent to REM sleep, rendering the study of REM

sleep virtually useless in the understanding of dreaming. Rather, motivated memories from the past are fused and "seen" in dreams. In contrast activation-synthesis accounts such as those proposed by Hobson, Pace-Schott & Stickgold (2000), state that a certain level of cortical activation such as that experienced in REM sleep is required in order to dream. Such activation is claimed to involve random firings of neurons in active brain regions. The dream is the result of an individual trying to piece together the random thoughts and images that emerge from this activation. Solms' motivated and meaningful dreams, and Hobsons' random ones, may both be "synthesized" upon waking and encoded to memory, as frontal deactivation renders encoding difficult during the dream experience itself. Thus the two views may not differ hugely when considered in terms of accounting for DR.

1.2.5 Foulkes

Like Hobson, the cognitive model proposed by Foulkes (1985) concerned three main cognitive processes involved in the generation of dreams: mnemonics, planning and conscious organisation. Here dreaming seems to be initially triggered by both neurological activation and mnemonic devices from the memory store, thus adding a psychological element to Hobsonian physiological accounts. This mnemonic activation is planned by a process that selects which of the mnemonic sources available should be processed and how. The planner attempts to make sense of this initial activation and organises it. This process is ongoing – the conscious organiser continues to makes sense of the activity, with each "draft" depending upon the previous "draft" (Occhionero, 2004). Thus there is some consciousness involved in the process, although to use the term "control" may be too ambitious.

Cicogna and Bosinelli (2001) updated Foulkes' original model by elaborating upon the mnemonic activation process in terms of applying it to a model of memory (Tulving, 1996) which relied upon long-term memory (LTM) being divided into four dissociable sub-sections: a procedural system, a perceptual representations system, a semantic system and an episodic system. The independent nature of these systems is accountable, in this theory, for the bizarreness so characteristic of dreams, as each sleep stage/aspect of dreams relates to at least one of Tulving's memory systems.

In general Foulkes adopts a developmental approach to the study of dreams (Foulkes, 1979; 1982) in that dreaming is seen as a consequence of cognitive development. Dreams cannot be formed

(or, therefore, subsequently remembered) prior to the acquisition of relevant cognitive skills. Language skills, in particular, seem pertinent when considering the verbal requirement of remembering dreams, as do memory skills relating to encoding.

1.2.6 Domhoff

Domhoff (2001) made use of Foulkes' studies on the development of dreaming, as well as others' and his own empirical work on dream content and the neuropsychology of dreaming, when devising his "neurocognitive model" of dreams. Domhoff emphasizes the study of dreams over the lifespan (2007; pers. comm.), like Foulkes, adopting a developmental approach in much of his empirical work. Domhoff (2001) reports that dreaming develops over childhood. Further content analyses reveal that children under 5 have bland dream mentation, which he argues reflects an as yet under-developed cognitive system. Domhoff's paper is essentially a review of empirical dream work from a number of different areas and approaches, which he fuses to note that current concerns are reflected in dreams (the "continuity principle") whilst past concerns are also activated and present in dreams (the "repetition principle"). Domhoff (2000; 2001; 2002; 2005) emphasizes the role of the forebrain structures in dreaming. That is that preoccupations with brainstem regions associated with REM sleep (e.g. Hobson, 1988) do not account for the development of the cognitive processes associated with dreaming. Thus cognitive neuropsychological and physiological literature has not yet been assimilated into cognitive conceptions of dreaming. Domhoff sees dreaming as the outcome of a set of matured cognitive structures that can be determined via neuroimaging and cognitive enquiry, combined.

1.3 Theories of dream recall and its failure

Six main theories of remembering dreams exist, which aim to explain the difficulties or even failure of memory processes. They range from relating to the content of the dream (Freud's repression- and Cohen and MacNeilage's salience-hypotheses), to accounting for the cognitive processes that are unable to function as in waking life, resulting from activation of the brain (arousal-retrieval and functional state-shift models). Whilst DR is often not defined in scholarly articles, it generally refers to the propensity to remember dreaming mentation. This can be measured by DRF: the rate of occurrence in a given time period, more generally in terms of subjective frequency; the rate of occurrence without a given time period (such as "often",

"occasionally" etc.) or in terms of dream detail; the amount of information recalled from one particular dream or night's sleep.

1.3.1 Repression

Dreaming was proposed to be one of the few instances in which the unconscious had free reign (e.g. Jung, 2002). Dreams were famously described as being the "royal road to...the unconscious" (Freud, 1957) and therefore the inability to recall dreams reflects the impact of the ego's defences upon waking to expunge the offensive material and memories. Some evidence has supported such psychodynamic ideas (e.g. Goodenough, Witkin, Lewis, Koulack & Cohen, 1974, through the increase of "no content" dreams in a stress condition, and Kohler & Prinzleve, 2007, using methods of free association), however dreams can be recalled in some circumstances, in some individuals more than others, and even if trained to do so. Freudian theorists would be able to counter argue each of these claims, with arguments focusing upon how only acceptable material would be recalled and that may even have been modified since waking. Evidence has, however, been found to suggest that repression does not wholly account for DR failure (e.g. Cohen & Wolfe, 1973). Freud emphasised accessing the unconscious through indirect means, such as hypnosis and free association, implying that whilst dream content may be difficult to access, the memory trace is not lost indefinitely.

1.3.2 Interference

In a paper directly disputing the role of repression in remembering dreams, Cohen and Wolfe (1973) offered the explanation that dream material is simply displaced by other material encountered upon waking, thus rendering the dream material impossible to access. Whilst three of the five studies described in the paper offer evidence against repression, using the same measures adopted by Schonbar (1965) of field dependence, locus of control and inner life, the fourth and fifth studies demonstrate that, rather, stimuli perceived upon waking interferes with the dream memory trace thus inhibiting its recallability. The authors moved away from psychodynamic ideas into cognitive memory functioning upon memory for dreams. This idea has not been subsequently tested, and a replication is much needed. However contemporary theories of dreaming and DR tend to emphasise the differences in neurological arousal across sleep-wake states, and may well account for Cohen and Wolfe's findings in these terms. The experimental group made a phone call upon waking, whilst the control group remained in their beds for a

comparable length of time. It seems then that the tasks for the experimental group may have encouraged activation of the waking brain, whilst remaining in a sleepy state could have impaired the transition into waking activation, thus facilitating state dependent dream recall benefits. Cohen and Wolfe's application of memory theory to DR may also interact with certain individual differences traits, if those interested in dreams, for instance, are less distracted by intervening perceptions at the point of awakening.

1.3.3 Salience

David Cohen extended his ideas on the phenomenology of dreams by emphasising their characteristics (Cohen & MacNeilage, 1974). The combination of their vividness, emotionality (both positive and negative), bizarreness and activity (pace of events) produced a score of salience: a measure of the "subjected impact of the generated dream" (p699). It was found that frequent dream recallers dreamt significantly more salient dreams than infrequent dream recallers. Whilst salience may be a product of the dream generation process (an opinion that Cohen and MacNeilage emphasise) it may also result from processes of dream retrieval. That is, some dreams may be more characteristically detailed than others. It is assumed that high dream recallers tend to produce such dreams, resulting in their advanced skills of recallability. However high dream recallers may engage in different retrieval processes, perhaps drawing upon more information from a dream memory, thus recalling more salient dreams. It is not surprising that more salient dreams are likely to be better recalled, even though this proposition stands in direct contrast with repression hypotheses, but Cohen and MacNeilage demonstrate that salience may be a cognitive style or individual difference trend. Their results do not allow for the result to be further explained, however, in terms of whether the relationship between salience and dream recallability lies at the stage of encoding or retrieval. Correlating specific kinds of memory abilities with dream recallability (as an individual differences trait) may shed light on this.

1.3.4 Lifestyle hypothesis

Schonbar (1965) also focused upon individual differences in her studies leading to the Lifestyle Hypothesis. This claimed that there are similarities between individuals who are likely to recall dreams. That is being particularly introspective, introvertered, field independent (individuals able to separate and concentrate upon parts of a visual field), creative, with an internal locus of control, a divergent style of thinking and high imagination for example may increase the

likelihood of recalling dreams, but this may also further increase the likelihood of being "inner acceptant", Schonbar's definition of the lifestyle described above. Thus recalling dreams is a behaviour characteristic of the routine and lifestyle of certain individuals. Schonbar accounted for this in a psychodynamic framework, essentially noting that the traits held in common across dream recallers concern overcoming repression as a means of inhibiting DR. Further, it is implied through the name of the hypothesis that these relationships are not unidirectional. Cohen and Wolfe (1973) directly criticised the findings in Schonbar's paper when they were unable to replicate the results (in one instance a correlation went in the opposite direction). Schredl and Montasser (1996-7a) postulate that Schonbar's correlations could be mediated by memory abilities or right hemisphere activation. However Schonbar's emphasis upon the variation in DRF has been upheld in many contemporary studies in which individual differences traits are correlated with dream recallability (see 1.7.1 for a further discussion).

1.3.5 Arousal-retrieval model

Koulack and Goodenough (1974) proposed a cognitive theory that reflected the difficulty of recalling dreams given the decreased brain activity whilst asleep. The authors do not present their own empirical work as support of the model. Instead they review literature on memory, sleep and DR. Whilst the model requires more specific testing, more recent experiments manipulating arousal have supported Koulack and Goodenough's claims (e.g. Domhoff, 2001; Hobson *et al.*, 2000; Rosenlicht, Maloney & Feinberg, 1994; Solms, 1997; 2000).

The model specifically proposed that given the difficulty for dream memories to be encoded beyond short-term memory (STM) and into LTM, the context within which dreams are best recalled is immediately upon waking when the dream memory is still in short- as opposed to long term stores. As a result of the decreased processing of STM, which may be the result of the central executive component of working memory (Baddeley & Hitch, 1974) allocating resources such as attention or repetition of material in order to facilitate encoding, dreams are not easily passed through this stage to reach LTM. Upon waking it is proposed that STM processing becomes increasingly functional so new perceived material could be encoded more efficiently, thus accounting for interference effects (Cohen & Wolfe, 1973). Koulack and Goodenough state that STM storage is assumed not to vary over different states of arousal. Their model accounts for the recency effect whereby dreams generated later in the night are more recallable than older dreams (Cipolli, Calasso, Maccomlini, Pani & Salzarulo, 1984). Some early or old dreams are

encoded in some form and are recallable, however. Dream salience may be at work in those cases. However the model does not suffice as state dependent effects facilitate DR, and these cannot be accounted for by the model. That is, an overlapping of context between encoding and retrieval should lead to the more efficient recall of a memory. As Koulack and Goodenough imply that it is difficult for dreams to be encoded, an enhanced presence of cues at retrieval should not necessarily lead to enhanced recall. However maintaining the same context upon waking as was experienced during dreaming is frequently proposed as a method of facilitating DR. Whilst the arousal-retrieval model accounts for the difficulty for dreams to be encoded well, it is not explicitly concerned with cognitive processes of retrieval.

1.3.6 Functional state-shift

This arousal-retrieval model combines ideas from research on memory, learning and brain activation over the sleep-wake cycle. In addition it offers explanations for interference and salience effects. Individual differences may interact with arousal-retrieval effects (Hicks, Fortin & Brassington, 2002). Koukkou and Lehmann (1983) extended these arousal-based ideas in a framework focusing more upon the state dependent effects of DR as opposed to STM.

For DR to be successful, the context in which it is retrieved should match the context in which it was encoded. This mirrors state and context dependent memory effects which are well documented in the memory literature. Koukkou and Lehmann (1983) extended these ideas to encompass arousal and change of brain activation across the sleep-wake cycle. They argue that different sleep stages reflect differential patterns of activation, with waking being the most aroused, REM slightly less aroused, and SWS the least. For a dream to be recallable in a waking state, the state in which it is generated should match that waking state as best it can. Therefore more arousal, for instance from REM sleep, should lead to better DR. Whilst this trend has been demonstrated in numerous studies, methods of measuring DR increasingly demonstrate that dreams are both produced and recallable from NREM sleep. Differences in recallability may result from their characteristics, such as REM dreams being coherent, narrative structures whilst NREM dreams are more transient and "thought like". Koukkou and Lehmann may well interpret these differences as resulting from the differences in recallability of functionally different states. However evidence suggests that distinct sleep stages serve differing functions in terms of memory consolidation and learning (see section 1.5.1) thus the make up of dreams from REM and NREM sleep could result from processes of dream generation rather than effects of recall.

The model nevertheless acknowledges brain physiology over the sleep wake cycle and combines it with a cognitive account of DR. Koulack and Goodenough's (1976) model emphasises the role of memory processes in the impairment of dream encoding, whilst Koukkou and Lehmann's (1983) model accounts for variability at retrieval. Taken together, these two theories have been well supported, they are based upon clear theoretical grounding and acknowledge the unique context in which dreams are produced.

1.4 Introduction to Memory

Some of the theories of dream recall mentioned above rely upon central notions in cognitive psychology regarding the experience of remembering and forgetting, such as state- and context-dependent memory effects, salience of the memory trace and methods of encoding. The present section is concerned with aspects of autobiographical remembering - memory for one's own experiences (Conway, 1990; 2001; 2005; Conway & Pleydell-Pearce, 2000) - of which remembering dreams form a part. Episodic memories - detailed memories for specific events (Tulving, 1983; 2002) - are part of the autobiographical system (Conway, 2001) and are often discerned from semantic memories, which are meaning references lacking in autobiographical context. It may be more appropriate to conceive of declarative memory as containing a semantic and an autobiographical system, as memories for one's own experiences are not always accompanied by the awareness of an experience and its temporal context (Conway, 2001; Tulving, 1983; 2002). That is, when recalling an episodic memory with recollective experience, the awareness of the placement of self during a detailed experience, the rememberer would be aware that the sensation was a memory as opposed to a perception of a presently occurring experience. Memories of dreams are, by definition, autobiographical, but highly detailed sensory-perceptual dream memories could also be episodic, but only if sufficient detail was encoded during the experience to allow subsequent episodic retrieval.

1.4.1 The experience of remembering

At the time of perceiving or experiencing something, it has to be encoded sufficiently well in order that it be recalled at a later date. Many factors can influence the degree to which something is encoded, such as attending to it or encoding it semantically rather than merely physically (when reading a word, for instance; Craik & Lockhart, 1972). Rehearsing material or ruminating over memories may well increase their subsequent recallability. At the time of retrieval, a memory

needs to be accessible and detailed enough to be brought back to mind. Presence of cues can increase accessibility, more of which are present when recognising an item, as opposed to freely recalling it. Episodic memories may be experienced differently at this time of retrieval to semantic memories, due to the increased experiential detail incorporated in those memories. Considering a graduation ceremony, for instance, may likely require drawing upon a schematic representation of such a ceremony. An episodic memory for one's own graduation, on the other hand, would include more detail, such as emotions experienced at the time.

Whilst working memory models of STM (Baddeley & Hitch, 1974) do not accommodate the role of the self in STM, the addition of the episodic buffer (Baddeley, 2000) attempted to account for how an experience and its multi-sensory details can be encoded and bound into a unitary form. Retrieval of an episodic memory clearly requires accessing some similar kind of unitary code, and relies upon hippocampal activity. It seems likely that, given the attenuation of frontal structures during sleep, the central executive component of working memory is unable to fully monitor and administer appropriate processes to slave systems. This may well result in dreams being unable to be bound by the episodic buffer, resulting in dreams being poorly encoded and subsequently difficult to retrieve, especially by sensory-specific cues, leading to episodic memories for dreams being difficult to encode and retrieve.

1.4.2 Recollective experience

An idea initially developed by Tulving (e.g. 1983) is that remembering an episodic experience can be accompanied by a sensation of pastness, as if the memory is being relived, if adequate details are recalled. He referred to this unique sense as "autonoetic consciousness" and may be characteristied by a sensation of reliving. The sensation has been widely investigated, and found to be independent from a sense of "knowing", which is accompanied by mere familiairity of something at recognition, indicative of a semantic memory. The recognition task equivalent for episodic memories, in which autonoetic consciousness characterises the experience, is "remembering". (Dewhurst & Conway, 1994; Gardiner, 1988; Rajaram, 1993; Tulving, 1987, 2002). In order to experience autonoetic consciousness, the self must be identified and recognised to have existed episodically, before. Thus it follows that an awareness of the self should form part of such "remembering".

Dreams may be recalled without recollective experience if the self is not as present whilst dreaming as in waking life, due to physiological factors of sleep (attenuation of the forebrain). Thus dream memories may be known rather than remembered. However if one considers dream memories as being truly autobiographical, autonoetic remembering of dreams should be possible.

Grenier *et al.* (2005) compared the trends of memory features within dreams with recollection trends over time for autobiographical memories. The trends were comparable for both kinds of memories indicating that autobiographical memories for dreams and that the autobiographical system operates over the sleep-wake cycle. The findings are discussed in more detail throughout the thesis (see 4.1.1). Memories were compared along a host of characteristics, one of which was an "as is/generic" distinction, which is claimed to be similar in dreams to the remember/know distinction in memory research. "As is" references are "faithful replicas" of waking life, whilst generic references are distorted or unrecognisable. That is, generic memory elements lacked episodic richness. However the comparability of this distinction to remember/know judgements is questionable, as those coded as generic would not necessarily have been identified based upon familiarity alone - a requisite for noetic awareness. Rather, elements could have been recognised on the basis of logic. The "as is" references may have lacked their own episodic richness due to being confusable with elements of waking life, thus being quite different from something that is "remembered". Despite this an attempt to investigate the dreams from a memory perspective highlights the autobiographical nature of dreaming, even if some measurements do not truly capture the unique experience of dreaming.

Grenier *et al.*'s similarity between dreams and waking life is not as strict as Fosse *et al.*'s (2003) criteria which identified a dissociation between dreaming and episodic memory as based upon episodic memories not being replayed in dreams. In both cases dreams were being compared to waking life criteria, rather than vice versa. A large proportion of units within a dream were identified as "as is" by Grenier *et al.*, indicating that elements of dreams appear in an episodic manner.

In fact, there is much evidence to suggest that dreaming and waking thoughts, cognitions, processes and content overlap substantially (see 1.5).

1.4.3 Autobiographical memory and the self

Conway (1990, 2001, 2005) described the hierarchical structure of autobiographical memories from the broad lifetimes periods to general events to the most specific and detailed sensory-perceptual episodic memories (Conway, 2001). In this way autobiographical memories can be general and pertaining to the self although not necessarily episodic.

Autobiographical memories include the self as a reference point. That is, the rememberer has some current conception of the self in the form of the working self (Conway, 2005) encoded in the memory, which confirms that the experience was a personal one. The autobiographical system requires that "self" to be present and active in order that a memory be assimilated into an individual's unique LTM store. The self also guides and directs both the processes of encoding and retrieval. Conway's (2005) Self-Memory System models the relationship between memory and the self.

This conceptual self would likely be reliant upon a number of brain mechanisms. However as the frontal lobes are involved in the search for relevant information and the concurrent inhibition of irrelevant information (see Greenberg & Rubin, 2003), it may seem logical to assume that their attenuation during sleep would lead to a difficulty in encoding experiences in terms of the working self, which itself relates experiences to one's personal current context. Thus when a dream is encoded, if it is encoded, it lacks the top down processes such as goal planning, resulting in a more abstract memory trace. The lack of this contextual knowledge produces memories that are difficult to assimilate into other memory structures. This may affect dream memory in a number of ways. Firstly, the memory itself would lack the cognitive operations, in Johnson's terms, that may be more characteristic of a waking external event memory (Johnson, Kahan & Raye, 1984; Johnson *et al.*, 1988). Secondly, the lack of or reduced cognitive operations would make the dream difficult to encode at the time of being experienced. Some authors refer to this as the suspension of ego control (e.g. Freud, 1900). The autobiographical-based self-memory system framework provides a cognitive explanation for such ego control. Thirdly, due to the dream memories differing so greatly from waking memories, due to the reasons described above, there may be few cues present at retrieval, leading to the diminished likelihood of successful recall of clear and detailed dream memories.

These kinds of dream memories may be similar to childhood memories, which also lack sufficient knowledge, cognitive processes and frontal development for a referenced memory to be encoded. Tulving (1983) refers to contextless memories as "free radicals" as they are neither truly episodic (their source is forgotten) nor semantic, yet they are both autobiographical and experiential. He gives the example of jokes as being free radicals (p117), in that they are often encoded without contextual information, unless, for instance, that is especially pertinent to the joke itself. This results in them being particularly difficult to subsequently remember. Dreams, and even waking thoughts to an extent, share this profile of free radicals and thus blur the distinction between episodic and semantic memories. Again, using an autobiographical/semantic distinction of declarative memory ensures that free radicals such as thoughts as dreams are appropriately conceptualised.

Applying knowledge of autobiographical remembering highlights the processes involved in the (often unsuccessful) recall of dreams. As dreams are autobiographical experiences themselves, upon successful encoding (made difficult by the physiological activity of the brain during sleep) they should share the memory profile of waking autobiographical memories. Despite the difficulties of encoding dreams during their occurrence, dreams do seem to show evidence of being self-referential. This is described further below (see 1.6).

1.4.4 The reconstructive nature of remembering

One feature of Hobson's (Hobson, 1988; Hobson & McCarley, 1977; Hobson, Stickgold & Pace-Schott, 1998; Hobsons, Pace-Schott & Stickgold, 2000) activation-synthesis accounts of dreams is that the dream experience is constructed into a more coherent account after the experience has occurred. That is the memory is to some degree confabulated prior to and during its actual encoding upon waking. The dream memory is therefore a reconstruction of a series of disjointed and bizarre images and emotions. As dreams are often recalled in a different context to that in which they were experienced and encoded, initially being mainly visual, emotional experiences perceived without controlled encoding processes and awareness of self or time, being recalled in a verbal form in a more constrained waking environment, dream memories likely involve a degree of post-hoc production.

Autobiographical memories are not coherent mental repeats of an experience. Even episodic memories rarely contain replays of an experience, analogous to watching a film of an event[1]. Rather, memories are activated in fleeting fragments, are more recallable when rehearsed and demonstrate effects of mood congruency (see Matt, Vasquez & Campbell, 1992, for a review) and mood-dependency (e.g. Blaney, 1986). These effects imply that retrieved memories reflect the goals of the self (Conway, 2002; 2005; Conway & Pleydell-Pearce, 2000). In all, declarative memory retrieval is an often effortful process that is subject to the tangible nature of both the short term ("working") self (Conway, 2005) and the long term self (Conway, Singer & Tagini, 2004). DR may be especially reliant upon this tangible aspect of autobiographical remembering if the dream memories have not been consolidated into a coherent episodic form after being experienced. However the extent to which DR is a truly autobiographical process remains to be discovered, and is therefore a major aim of this thesis.

1.5 Introduction to the relationship between memory and dreams

In order to fully understand the relationship between memory and dreaming it is necessary to be aware of the functioning of memory whilst asleep. Badia (1990) summarises this by comparing the functioning to anterograde amnesia whereby old memories are retained and accessible, whilst new information cannot be encoded into memories for subsequent retrieval. Whilst asleep, long term memories (from waking) are accessible and working memory is active. However information perceived whilst asleep is not easily available upon subsequent awakening. State dependency cannot fully account for this profile, as memories from waking infiltrate sleeping mentation, whilst the reverse is not true. In addition it is impossible to ascertain whether material perceived during sleep would be accessible during sleep, due to methodological difficulties. Conditioning and habituation studies have illustrated that processing of memories (instructions) from waking is active whilst asleep, so long term memories are being retrieved. The difficulty arises when attempting to access material from sleep, in waking. As Badia compares this profile to that of anterograde amnesics who often suffer from trauma to their medial temporal lobe structures, especially the hippocampus, it is proposed that relative deactivation of the hippocampus whilst asleep may well be responsible for the inability to recall (declarative) material presented during sleep. This also implies that the difficulty relies upon a problem of encoding whilst asleep, rather than of retrieval whilst awake.

[1] An exception to this "replay" account of episodic remembering concerns memories for traumatic experiences; especially flashbacks typical of post-traumatic stress disorder.

There is ample evidence that long term memories are somehow processed during sleep, from studies of conditioning and learning. In addition LTM is seen to improve over different sleep stages, with autobiographical memories appearing in dream reports (Fosse *et al.*, 2003). The relationship between dreaming and memory is therefore complex and multifaceted. There is evidence for information processing whilst asleep varying over the sleep cycle and of both procedural and declarative memory systems, and the retrieval of autobiographical memories whilst asleep. Badia concludes that the encoding of new information and the consolidation of previously encountered information may be incompatible, and may well refer to waking and sleeping states, respectively. However the encoding of new information concerns externally presented stimuli, and may not relate to internally generated mentation that an individual is attending to whilst asleep. It is still unclear then as to whether the difficulty of recalling a dream may be the result of the experience having been inadequately encoded or the inactivity of the memory system (hippocampus) upon awakening due to sleep inertia.

1.5.1 Consolidation of memories during different sleep stages

Evidence of information processing during sleep comes from the wealth of literature concerning memory consolidation whilst asleep, whereby memory improves after a period of time spent asleep relative to waking. Indeed, memory (both procedural and declarative) consolidation is often regarded a function of sleep, and sometimes, dreaming. Although sleep following some period of learning seems to improve memory, it is generally assumed that this is due to memory consolidation during sleep rather than there being less interference or decay than when awake. That is, there is a whole host of evidence that learning and memory performance is improved after a period of sleep. Certain studies have investigated this in terms of specific sleep stages (e.g. Cavallero, Foulkes, Hollifield, & Terry, 1990).

There is much evidence to suggest that improvements in procedural memory follow REM sleep, as measured by, for instance, mirror tracing tasks (Fogel, Smith & Cote, 2007; Nielsen & Stenstrom, 2005; Plihal & Born, 1997; also see Stickgold, 2006) whilst NREM sleep leads to improvements in declarative memory (Nielsen & Stenstrom, 2005; Plihal & Born, 1997). More specifically, NREM sleep is thought to consolidate episodic memories. Wilson & McNaughton (1994) have demonstrated that hippocampal place cells indicative of episodic remembering, fire in a rapid episodic, imitative way during NREM sleep, but that the imitation is far less rapid -

more like in real time - during REM sleep. Thus episodic memories may be consolidated throughout sleep, but much more efficiently in NREM stages. It is worth again noting that REM sleep is far from equivalent to the state of dreaming.

Rauchs and colleagues (Rauchs, Bertran, Guillery-Girard, Desgranges, Kerrouche, Denise, Foret & Eustache, 2004) argue that REM sleep is important in episodic memory consolidation. They found that "remember" (episodic) but not "know" (semantic) responses in a recollective experience paradigm task were reduced in participants deprived of REM as opposed to SWS. Some of the same researchers (Rauches, Desgrange, Foret & Eustache, 2005), however, review literature that NREM sleep improves episodic memory abilities more than REM sleep. This discrepancy is difficult to resolve, although the validity of the recollective experience paradigm distinguishes between strictly episodic memories featuring autonoetic consciousness from memories of waking experiences. This study was the first to use such a design. Investigating the memory based components of dreams may also indicate the processing occurring over the sleep cycle. The hippocampus is relatively active during REM (compared to other brain structures), implicating LTM processing during that time. Episodic memories may appear in some form in dreams although their truly episodic nature is questionable (Fosse et al., 2003) due to memories often being activated in a slightly different manner to that in which they were experienced in waking life. Nielsen and Stenstrom (2005) note that dreams tend to lack autonoetic consciousness.

Whilst theories of memory consolidation during sleep suggest a possible function of sleep, to catch up with all the categorization of perceptions, thoughts, experiences and memories from the preceding day, they do not indicate anything specific about the functions or cognitions of dreams. Investigating the memory based components of dreams from various sleep stages may be more indicative of the processing active whilst dreaming (Cipolli, Faglioni, Mazzetti & Tuozzi, 2005). Dreams can be conceived of as thoughts of the sleeping mind, thus memories that are activated during consolidation may become thoughts if Solms' ideas of the reversal of perceptions to thoughts as in waking, holds true (Solms, 1997; 1999). It may be that memories triggered during consolidation could therefore appear in dreams, indicating the processing and cognitions involved in the dreaming brain.

1.5.2 Incorporations of memories into dreams

A major distinction between REM and NREM dreams lies in the actual content and make-up of those dreams themselves. Whilst recalled REM dreams may be considered to be bizarre, these ratings are only in comparison to waking memories (cf. Cipolli *et al.*, 1993). REM dreams may involve some bizarre situations and experiences (such as flying), yet on the whole they comprise normal and mundane activities, therefore include memories from waking life.

A comparison between REM and NREM dreams by Foulkes, Bradley, Cavallero, & Hollifield (1989) suggested that the different physiological states give rise to different types of dream – not just characteristically, but in terms of their make-up. They compared two REM dreams and two NREM dreams reported by each of 16 young men. They concluded that REM dreams are more elaborated and include a broader range of mnemonic origins, including episodic memories, general knowledge, and self-knowledge. This may be due to their increased recallability. In their study judges scored the degree of correspondence between the dream report and the real life source identified by the dreamer. They found that REM and NREM dreams did not differ in the number of identified sources but NREM dreams showed closer correspondence to the original sources. Further, Foulkes and Schmidt (1983) found that REM dreams were more likely than NREM dreams to contain self-representation, a finding partly reinforced by Baylor and Cavallero's meta-analysis and review (2001), implying that autobiographical memory is active during REM sleep as well as NREM sleep. Cavallero *et al.* (1990) however found that the difference between the episodic references found in REM and NREM dreams disappeared after controlling for length of reports, which were longer from REM dreams. Discerning between autobiographical and semantic memory consolidation functions could be more insightful and less confusing than data aiming to account for an episodic/semantic distinction over the sleep cycle.

Fosse *et al.*'s (2003) premise was that episodic memories may be consolidated during the night, so the researchers chose to see whether such memories were incorporated into dreams or not. Twenty nine participants kept a record of their waking events in detail over a period of 14 days. They also recorded their dreams and scored them for any signs of incorporation of the episodic memories. The researchers found that only 1.4 per cent per cent of the 299 dreams that had been scored, contained any replay of episodic events from the participants' recent waking lives. As a result it was concluded that "sleep has no role in episodic memory consolidation" (p.1). However, such a conclusion should only be drawn tentatively, for the following reasons.

It has already been mentioned that REM dreams are more coherent and memorable than NREM dreams. Also, these REM dreams are less likely than NREM dreams to contain episodic memories (Baylor & Cavallero, 2001), even though there is discrepancy over the extent to which episodic memory is improved after REM sleep (Rauches *et al.*, 2004; Rauches *et al.*, 2005). It may well have been then that Fosse *et al.*'s participants were scoring the incorporation of episodic memories into REM dreams, in which case it was unsurprising that such a low rate of events had been incorporated. Future studies should try to differentiate between REM and NREM dreams. Also, the incorporation of specific types of memories into dreams may not reflect the consolidation of such kinds of memories. Instead, it could be that memory consolidation is not related to sleep or dreaming at all (Vertes & Eastman, 2000). However there could be a relationship between events that are important to the self and dream consolidation. Finally, Fosse and colleagues operationalized memory consolidation as occurring only when episodic memories that had been reported from participants' waking lives and been totally replayed in exactly the same way as they had initially been experienced. Thus some episodic memories that had not been reported may have been incorporated into the dreams. Also, the incorporation may not have taken the form of total replay. In fact, 65 per cent of the dream reports seemed to reflect some aspects of waking life experiences. This proportion may have been higher if the judgments had been less strict. All in all, the relationship between episodic memory and dreaming is not a straightforward one, although it may be unwise to claim that there is no relationship there at all on the basis of this study. It is worth remembering that Grenier *et al.* (2005) found that a large proportion of units within the dream that they assessed were identified as "as is", thus further casting doubt on Fosse *et al.*'s strict criteria for separating dreaming from episodic memory.

1.6 Introduction to the continuity between dreaming and waking

There is a whole host of evidence that during dreaming material seen or encountered during the day is somehow re-experienced. The continuity hypothesis reaffirms this, and has been demonstrated via, for example, blind individuals dreaming without visual images (e.g. Hurowitz, Dunn, Domhoff & Fiss, 1999); speakers of a second language dreaming in that language if they have been speaking it during the day; even REMs following the same course as waking eye movements from the day. Thus it would seem to follow that dream material, specifically, would include episodic memories from the previous day. It does seem that the continuity between dreaming and waking extends beyond the re-experiencing of episodic experiences and memories,

as highlighted by trends of individual differences. The continuity hypothesis (Schredl & Hofmann, 2003) claims that there are similarities between dreaming and waking memory, specifically, episodic memory for particular experiences and episodes, even if they are not "replayed" (Fosse *et al.*, 2003). Schredl and Hofmann (2003) wanted to test the hypothesis in terms of which waking-life activities, i.e. which memories exactly, are re-experienced by being incorporated into dreams. They studied individual differences in the relationship between dream content and waking experiences. This idea has been reinforced and elaborated upon in numerous other studies, which have extended the time period and pinpointed the specific processes involved.

Many accounts of dreams (e.g. Solms', Freud's, Hobson's activation-synthesis theories) are not consistent with dreams being passively experienced, but rather suggest construction and control processes that differ from those in waking life. In particular, the most striking feature is the absence of any attempt to maintain consistency either within the dream or between dream events and general knowledge during the dream. Within the dream, the characters, scenes, and events shift and change unpredictably and there are gross discrepancies between dream events and the dreamer's knowledge of the real world. Moreover, such discrepancies appear to be either unrecognized or unheeded by the dreamer. Some researchers (e.g. Cavallero & Foulkes, 1993) emphasize the continuity between cognitive processes in waking and cognitive processes in dreaming, but some data (e.g. Montangero *et al.*, 1996) underlines some striking and important differences. It is paradoxical that, in the area of dream research, some studies are concerned to show the bizarre nature of dreams, whereas others stress that dreams are essentially coherent and orderly. It seems possible to support both views by judicious choice of examples.

1.6.1 Continuity of content

As described above (see 1.5) research demonstrating how dreams include or show references to memories from waking life indicate continuity of content across the sleep-wake cycle. Memory impairment for dream experiences may imply that dreams are less likely to appear in waking thoughts. Whilst dream memories do seem to be less salient than waking event memories (Johnson, Kahan & Raye, 1984; Johnson *et al.*, 1988; Kemp & Burt, 2006; Kemp, Burt & Sheen, 2003), this may be a facet of encoding difficulties whilst asleep rather than indicating that there is a lack of continuity of content over the sleep-wake cycle. Even activation-synthesis accounts of dreaming acknowledge that waking memories are activated and associated memories triggered

during dreaming, even if this is explained in terms of meaningless and random firings of neurons. The continuity hypothesis (Schredl & Hofmann, 2003) therefore needs to operationalise "continuity" in terms of meaningfulness in order that it be better understood.

1.6.2 Continuity of consciousness

During sleep it may become very difficult for an individual to perceive stimuli from their immediate external environment, however this is not equivalent to the idea that individuals are not conscious during sleep. Rather, consciousness is altered in that thoughts are experienced as perceptions, as opposed to perceptions being transferred to thoughts as in waking (Solms, 1999). A lack of volition (Hobson, 2000) whilst in REM sleep may correspond with a feeling of being unable to control perceptions in (most) dreams. This could be interpreted in a psychoanalytic framework in terms of deep rooted desires and fears being dwelled upon without the control and inhibitory role of consciousness. Whether one adopts a psychodynamic viewpoint or not, dreaming mentation can be thought of as a "stream-of-unconsciousness" due to the lack of metacognitive abilities during sleep.

Solms (1997; 1999; 2000; 2002) and Hobson and colleagues (e.g. 1998, 2000) disagree over the extent to which dreaming consciousness is a controlled experience. Hobsonian activation-synthesis accounts deemphasises the meaning of dreams and the control processes surrounding them. Solms' psychodynamic perspective, on the other hand, sees dreams as motivated manifestations of meaningful drives. However the experience of dreaming can be active, to some degree, without necessarily sympathising with psychodynamic interpretations of dream content and its meaning. De Witt (1988) has argued against what he calls the "hallucinatory movie" view that characterises dreaming as a passive sensory experience so that dreaming is like watching a film. This idea is consistent with introspective reports that dreams seem to be revealed or discovered rather than self-generated. Like a movie, dreams often have characters, places, and actions in meaningful scenarios, and there is often a narrative plot (especially in REM dreams) that has continuity and development. However, in opposition to this view, De Witt has put forward the "impaired consciousness model", whereby the dream is actively constructed and is at least partly under the dreamer's control, but normal processes of reality construction and reality monitoring: the process whereby one discerns between an external event and an internally generated one such as a thought or dream, are impaired or inoperative. Reality monitoring impairments during sleep may well be the result of attenuated frontal lobe activation or, perhaps

in Solms' view, the product of occipito-temporo-parietal junction activity which he claims is responsible for the reversal of transferring perceptions into thoughts, as occurs in waking consciousness (1997; 1999).

1.6.3 Continuity of cognition and memory

According to Cicogna and Bosinelli (2001) "all the operations involved in dream generation are obviously unconscious" (p.35). The dreamer is rarely aware that they are dreaming, with the major exception being lucid dreaming (Kahan & LaBerge, 1993; Schredl & Erlacher, 2004), whereby a dreamer is aware that he or she is dreaming at the time. This occurs in about 3 per cent of dreams (Cicogna & Bosinelli, 2001). Thus, in the majority of cases, the processes involved in dreaming differ greatly from the conscious awareness characteristic of waking thought, which may reflect profound differences between remembering dreams and remembering normal autobiographical experiences, if the self is less central in dreams. Both lucid dreaming and self-reflection in dreams was increased experimentally by Purcell and colleagues (Purcell, Mullington, Moffitt, Hoffmann, & Pigeau, 1986), who manipulated the learning of remembering dreams. The group engaging in the most self-reflective and lucid dreaming over the course of the experiment had learned attention patterning schemas in waking, thus had utilised mnemonics as a memory aid. Here the cognitive processes of engaging in controlled memory encoding functioned whilst asleep, just like in waking.

It might be assumed that due to the relative deactivation of frontal lobe structures during sleep, metacognitive awareness would be impaired as evidenced through sleeping mentation. However Purcell *et al.* (1986) demonstrate that there is much variance in lucid dreaming behaviours, implying that metacognitive abilities are neither entirely active nor inactive whilst asleep, and Wolman and Kozmova (2007) argue that rational thought processes are evident during dreams. In both cases dreaming thought is not entirely comparable to waking thought; it is simply more structured and controlled than many researchers would imply. Similarly McNamara (2000) found evidence of counterfactual thought in dreams as well as waking life. These seem typical of higher order cognitions that may not have been possible to consider when reporting in the night, due to being close to the dream state in terms of mental activity. It is assumed that brain activity upon waking allows for a more detailed dream report to be remembered. Indeed the authors emphasise that the dream is being recalled, rather than false information being generated. This provides

more evidence of the continuity of processes of remembering between sleeping and waking states.

Meier, Ruef, Ziegler and Hall (1968) specifically investigated this. The recall of dreams was found to display trends typical of waking memory processes, including recency, intensity (salience of dream material) and intraserial interference. In addition the authors claim that the longer the dream reports (when initially awakened in a REM period), the better recalled in the morning. This may simply further reflect intensity of dreaming, or even existence of dreaming. Further, the authors tentatively propose that there was evidence of retroactive inhibition, although it seems impossible to disentangle this from effects of recency. Meier *et al.*'s findings are clear and convincing that memory processes continue to function whilst asleep. The study is now out of date, however, especially with regard to the reliance upon waking an individual up in REM sleep only in order to collect dream reports. In a similar vein Botman and Crovitz (1989-90) found that retention function, a mathematical depiction of the typical number of recallable memories from any given period in the lifespan, was also reflected in the recall of dreams.

Despite this compelling evidence that there is continuity between waking and sleeping memory processes, DR is disproportionately poor. Memory processes alone therefore cannot entirely account for this. In an experiment on the influence of arousal upon memory, Stones (1977) woke participants from either REM or NREM sleep and required that they learn a list of 15 words. These words were divided into 5 groups of semantically related words, which were presented in their categories. Both immediate and delayed recall was impaired in NREM condition compared to REM, and a condition in which participants had not slept. In both of these two latter conditions performance was identical for the number of categories recalled, whilst performance was slightly (although insignificantly) poorer for the REM condition compared to the no sleep condition in terms of the number of items recalled per category. Based upon ideas by Craik and Masani (1969), measures of encoding and retrieval can be separately assessed. The number of overall chunks (or categories, in this case) is proposed to reflect retrieval performance, whilst the number of items per chunk reflects encoding performance, as efficient, attentive encoding would allow a more dense recall. Recall performance was divided in this way in order to assess measures of encoding as well as retrieval, and the results can be seen to reflect both impaired encoding as well as retrieval when awoken from a NREM phase. Thus the arousal of the brain in NREM sleep may well impair encoding, whilst sleep inertia following NREM may also prevent memory processes from operating as well as when the brain is more active. In this way cognitive psychology is seen

to elucidate relationships between brain physiology over the sleep wake cycle in terms of DR processes.

Montangero, Pasche & Willequet (1996) argue that a morning interview, following an awakening from (REM) sleep, adds information to the dream report that a laboratory night-time awakening would not access. Whilst the additional information from a morning report (cued by the dream descriptions collected from the night time awakenings) was dream-like in nature, the authors argue that distance from the dream report allows for a more balanced report to be elicited. In an example of a dream reported in the morning, the additional information concerned a name being on the dreamer's mind and described efforts of movements. Thus the dream had been encoded in the night, although was not able to be effectively retrieved until waking.

1.6.4 Problems with the continuity hypothesis

The continuity hypothesis in its simplest form states that a significant positive correlation between dreams and waking life content would provide support for any form of the continuity hypothesis. Schredl and Hoffman (2003) emphasize the need for the continuity hypothesis to be defined and modelled more clearly. Indeed a relationship between dreaming and waking life could take many forms, such as in terms of cognition, content or consciousness, for example, as have been described above.

In terms of DRF the continuity between remembering dreaming and waking experiences is difficult to ascertain. Previous studies have attempted to correlate a range of memory abilities with DRF (see 1.7.2.2 and 1.7.2.3). However there are many differences between these types of remembering. Remembering dreams (episodic, autobiographical, sensory perceptual, internally generated experiences) is not similar to remembering word lists (semantic episodic, non-personally relevant, brief perceptions of externally occurring stimuli), for instance. The neurological context in which dreams are generated is also drastically different from that of waking perception, largely in terms of the deactivation of the frontal structures which would otherwise contribute to attention towards dreams and the allocation of resources enabling their encoding for subsequent retrieval. This leads to intrinsic differences between dreams and waking memories. In addition the waking memories that may be incorporated into dreams may not maintain all features accurately as a result of the arousal and activation of the sleeping brain. It is

necessary that the continuity hypothesis stipulates how such overlap between dreaming and waking is possible.

The following section illustrates how some aspects of waking life lead to enhanced DR, which may well result from more general continuity of processes over the sleep wake cycle.

1.7 Introduction to dream recall correlates

The majority of investigations of DRF employ correlational designs (see Schredl & Montasser, 1996-7 a and b for a review) in order that the variance in DR can be accounted for by some variable(s). These often include personality traits or memory based measures, in some instances the former are measured by the latter (for instance field [in]dependence traits are measured with the embedded figures task).

1.7.1 Individual differences

A host of personality traits have been postulated to relate to DRF, ranging from the psychodynamic (e.g. Hartmann's "thin boundaries", 1991) to the more biologically oriented (e.g. anxiety, Schonbar, 1965). Thin boundaried individuals are defined as being "unusually empathic, unusually open in psychological interviews, quickly and intensely involved in relationships, and have a fluidity of thoughts and feelings, are more likely to remember their dreams than thick boundaried individuals" (Hartmann. 1991, p311). Although demonstrating the influence of individual differences upon memory processes, Hartman's boundary concepts may be criticised for simply defining characteristics associated with recalling dreams or not. Boundary thinness has been found to correlate significantly with remembering longer, more detailed dreams, and the dreams being more emotional and vivid, which have all been grouped together in a factor analysis (Hicks, Bautista & Hicks, 1999). Thin-boundaried persons also appear to regard their dreams more highly, that is they attribute importance to dreams (Schredl, Kleinferchner & Gell, 1996). However when Hicks *et al.*, controlled for dream length the other relationships failed to reach significance. According to Hartmann, Rosen & Rand (1998), "the trait continuum ranging from thick to thin boundaries is similar to the state continuum running from focused waking thought to dreaming, and (that) both continua refer to the same aspects of cortical activity" (p 31), which provides a potential neurological explanation for this effect, although it fails to explain why some individuals are more likely to lie at a particular point on the continua. It must also be emphasised

that this relationship is merely correlational, not causal, that is the cortical activity may be a result, as opposed to a precipitant, of this behavioural trait. According to Hobson *et al.* (2000) this may represent the point of neuromodulation from cholinergic to aminergic activation when waking up from REM sleep. This also mirrors Koulack and Goodenough's ideas on arousal, which predicted that arousal is necessary for dreams to be held in memory and later recalled.

Blagrove & Akehurst (2000) and Wolcott & Strapp (2002) warn that DR is a sensitive measure, and that relationships with DRF should not be confused with relationships concerning dream detail or characteristics of dreams. These sentiments are repeated by Beaulieu-Prevost and Zadra (2005), who challenged the oft-cited idea of a simplistic relationship between attitudes towards dreams and DRF. Attitude towards dreams and diary DRF were independently related to estimated DRF: the measure/approach usually adopted in papers claiming a positive correlation exists between DRF and attitude towards dreams (according to this study - this only seems to be the case in questionnaire studies. Diary studies certainly differ in their operationalisation of DRF). Also, estimations of DRF were found to be inaccurate, with attitude towards dreams mediating this effect. Nevertheless, the idea of a willingness to recall dreams as an influence upon DR has received support (Beauliou-Prevost & Zadra, 2005; 2007; Green, 1999; Wolcott & Strapp, 2002).

1.7.2 Cognitive correlates

As DR has been theorised to be a product of various cognitions (Cohen & MacNeilage, 1974; Cohen & Wolfe, 1973; Koulack & Goodenough, 1974), it has been correlated with a host of cognitive measures, especially memory based. However findings are often contradictory and the memory tasks are non-autobiographical.

1.7.2.1 General

Schwartz (2004) found that similar cognitive functions were clustered together using a variety of statistical procedures, such as recent memory, visuo-spatial processing, verbal activity, reasoning or emotions in a single-cased diary study, which also demonstrated the stability of these clusters over time (15 months) in accounting for memory for dreams.

Individuals scoring highly on standardised IQ tests, and who tend to struggle with more open-ended creativity assessments, are known as convergers. Those with the opposite bias are known

as divergers. Austin (1971) found that divergers have higher DRF than convergers. However as dream reporting tends to rely upon communicating thoughts clearly and verbally, it may be that successful reporting depends, in part, upon verbal abilities. Indeed some researchers have explained the gender bias of DR in terms of females having a more expressive communication style (e.g. Kramer, Delis & Daniel, 1988).

1.7.2.2 Memory based correlates

A central tenet of Koulack and Goodenough's (1974) model is that DR relies upon STM function. Cohen (1971) found a correlation between STM and DR. LTM has not been investigated in this way, with the exception of a study by Schredl, Morlock and Bozzer (1996), in which high dream recallers were found to recall more childhood memories than low dream recallers. The authors note that personality dimensions could well account for this relationship as much as memory abilities could.

Relationships between DR (and DRF) and a variety of memory based correlates are discussed in detail throughout this thesis. However it should be noted that dream researchers tend to shy away from memory theory. Rather, comparisons of dreams and waking memories in terms of their characteristics have been conducted by memory researchers (Botman & Crovitz, 1989-1990; Grenier *et al.*, 2005; Johnson, Kahan & Raye, 1984; Kemp & Burt, 2006; Kemp, Burt & Sheen, 2003).

1.7.2.3 Visual memory

A number of different measures of memory ability have been proposed in accounting for variance in DR. However, different types of memory do not seem to be related to DR in a simplistic, illustrative way. However, as dreaming involves the visual system so heavily (the visual cortex is highly active when dreaming), visual memory has been hypothesized to relate to DRF. Okada, Matsuoka and Hatakeyama (2000) found evidence for relationships between waking visual imagery and dream recall when comparing frequent and infrequent dream recallers. However the imagery measures were based upon self-report questionnaires, and did not relate to visual memory, specifically.

Cory, Ormiston, Simmel and Dainoff (1975) assessed this cognitive ability of visual memory as an explanation of DR. A significant positive correlation was found. Consistent links between visual memory and DRF have also been reported for elderly persons (e.g. Waterman, 1991) and patients with dementia (Brunner, Kramer, Clark, Day, Trinder, & Roth, 1972; Kramer, Roth, & Trinder, 1975; both cited in Schredl, Wittman, Ciric, & Gotz, 2003).

However this relationship has not been replicated consistently (e.g. Schredl, Jochum, & Souguenet, 1997). Schredl, Frauscher and Shendi (1995) found a significant correlation between visual memory and DRF, but not with report length. Thus, with the exception of a few studies such as Cory *et al.*'s, there seems to be clear evidence against the basic memory ability theory, at least in terms of visual memory.

1.8 A note on methodology

A variety of measures of DR exist that largely aim to quantify DRF, including questionnaire measures, diary reports producing DRF values (usually the proportion of days in which a dream report was produced) as well as dream detail (characteristic) information, and laboratory awakenings.

Foulkes (1979) reviews the literature assessing the differences between home-recalled dreams, which usually utilize spontaneous morning reports, and laboratory controlled dreams, in which participants are often awakened at particular times throughout their sleep cycle. Dreams recalled in home environments are more likely to have occurred longer ago than the laboratory dreams, which may account for the characteristic and content differences between these two types of dream report. Specifically, Hall and Van de Castle (1966), who developed a famous dream coding system, found that dreams spontaneously recalled in the laboratory were significantly longer than "spontaneous" home dreams, suggesting that greater selectivity takes place when at home – possibly due to individuals not focusing upon their dreams when in their everyday routines. In addition, home dreams are more likely to be generally dramatic and emotional than laboratory dreams. While this could be accounted for by a lack of environmental input affecting dream content when in a laboratory controlled environment, it may well be that specific features of dreams (such as bizarreness or emotionality) make them more memorable, as with waking events. Cipolli *et al.* (1993) noted that the proportion of bizarre events to non-bizarre events is about 2:1. After a delayed recall, bizarre events were more memorable, suggesting a clear memory

advantage for such characterised memories. It has been suggested that this effect represents the richer encoding of the memory, hence possible greater memorability, as opposed to more bizarre events occurring. However as dreams reported from a home setting are likely to be slightly older than the laboratory dreams in general (as it often takes longer for a participant to report their dreams at home than in the laboratory) the home dreams may have to be slightly more memorable in order to be recalled at all. Thus characteristics of dreams seem to alter their recallability, but they are generated by the environment in which the dreamer is situated.

1.8.1 Laboratory based measures of dream recall

What the discovery of the strong correlation between dreaming and REM sleep has achieved is to provide a methodology for dream research. Previously, researchers had to rely on diaries in which people recorded their dreams at home, but the accumulation of data by this method is slow because people typically report only two or three dreams each week. By contrast, when subjects are brought into the laboratory to sleep and are awakened during REM sleep, several dream reports can be collected each night. The laboratory method also has other advantages. Although home-dream reports tend to be of vivid, emotional, and bizarre dreams, these turn out to be misleadingly unrepresentative. REM-sleep wakings produce more mundane, realistic, coherent, and well-formed dreams which are nothing like the weird and strange dreams in the home-dream reports (Cavallero & Foulkes, 1993). In the laboratory, the conditions of recall can be controlled and manipulated so that the effect of distractions and delay intervals can be systematically assessed and pre-sleep stimulation can be presented so as to study its effect on dream content. It has become possible, therefore, to apply the methods of cognitive psychology to dream research and to search for commonalities between memory processes in waking life and memory processes in dreams. However, dream research is still entirely dependent on self-reports, and there is no way in which dreams can be judged as accurate or not accurate. Studies are usually restricted to very small numbers of participants (perhaps because sleeping in a lab and being woken up several times a night is not an attractive prospect), and results have tended to vary from one laboratory to another. For whatever reason, cognitive psychologists have so far shown rather little interest in dream research.

Montangero *et al.* (1996) describe a method of gathering dream information by firstly waking an individual in a sleep lab (or at home, if EEG information can be collected appropriately, such as with the Nightcap (Mamelak & Hobson, 1989): a portable eyelid movement sensor, then reading

that gathered information back to the participant upon waking in the morning, and allowing additional information to be reported). In defending this approach the authors note that nighttime awakenings cannot elicit lengthy dream reports, necessarily, due to a fear that the participant involved will not be able to return to sleep (presumably ethical guidelines stipulate that this is a concern) and that allowing a participant to wake fully would prevent subsequent valid awakenings (and dream collections) in the later same night. This implies that the many studies that have employed laboratory awakenings in order to yield reports of sleeping mentation may not be validly comparable to DR when awake, if experimenters maintain a sleepy state at the time of recall.

1.8.2 Diaries and questionnaires of dream recall

Some researchers prefer a more ecologically valid method for collecting dream reports whereby participants rely on more subjective self-report measures in their home environment. Typically this involves keeping a dream diary, from which experimenters can assess either dream detail (the kinds of characteristics or themes typical of dreams) or DRF (usually by counting how many reports were elicited in the given timeframe). Questionnaires are also often used as a means of determining DRF (Schredl, 2004).

Both diaries and questionnaires have been employed in this thesis as a means of establishing both dream detail and DRF for a number of reasons. Firstly, sleep laboratory resources were unavailable. Secondly, diaries provide a way of gathering a dream report in a waking state, so relying upon waking autobiographical retrieval processes, which can then be used to validate a subsequently recalled report. Thirdly, both questionnaires and diaries are relatively convenient for a participant to complete. Fourthly, they allow an individual to report experiences that they may be embarrassed to verbalise in a more personal interaction, thus overcoming certain ethical issues.

1.8.3 Memory paradigms as a measure of dream recall

DR tends not to be investigated by memory researchers. Instead researchers who compare the dreaming and waking brain tend not to consider DR, and vice versa. This thesis proposes that in order to adequately conceptualise DR, it should be compared to sensations, processes and abilities of waking memory. Applying models of autobiographical memory to DR should ascertain the extent to which the profile of dreams matches that of waking autobiographical experiences.

1.9 Summary and aims

Whilst memory abilities have been correlated with DR in some studies, the designs are often correlational, therefore assuming that memory abilities influence DR abilities, and unable to investigate the influence of third variables. This thesis explores whether dream memories are autobiographical, by comparing their characteristics and recallability to waking autobiographical experiences and by investigating the role of the self. The continuity hypothesis (Schredl & Hoffman, 2003) is therefore re-focused, and cognitive (memory) variables are emphasised as accounting for many of the correlates of dream recallability. The thesis aimed to draw the resulting ideas together in order that the differences between the recallability of dreams and waking events be understood.

To summarise, evidence has been found for continuity over the sleep wake cycle in terms of how dreams and waking autobiographical memories function (Botman & Crovitz, 1989-90; Grenier *et al.*, 2005), however DRF is almost independent of waking memory abilities (Yu, 2006). In addition recent evidence has suggested that DRF decreases over the lifespan at a faster rate than the speed at which memory impairment becomes present (Giambra, Jung & Grodsky, 1996). Thus these two ideas are difficult to reconcile. Autobiographical and episodic memory functioning may be continuous throughout life (i.e. whilst asleep as well as when awake) but recalling dreams could rely upon a host of other processes. It is assumed that the influences are numerous due to the widespread variation in patterns of DR. This thesis therefore aimed to conceptualise the profile of remembering dreams, especially in comparison to remembering waking autobiographical memories. This was hoped to ascertain whether DR failure could be attributed to autobiographical memory processes. In particular this was done by focusing upon processes of retrieval as opposed to encoding. Differences between the sleeping and waking brains have been described, which likely account, at least in part, for why dreams are so difficult to recall (as they have not been sufficiently encoded). The dreams that have been encoded are similar to waking autobiographical experiences thus their comparability is enhanced. Such memories require to be investigated at the stage of retrieval as the physiological impairments at the time of generation and experiencing have already been overcome.

The specific aims of the thesis were to:

- Design a new method of conceptualising DR within the broader context of a memory experience measure out of the laboratory
- Ascertain the influence of individual differences and memory based variables as correlates and factors of DR
- Directly correlate different kinds of episodic memory measures with DR and memory experiences
- Directly compare memory for dreams with memory for normal waking experiences
- Directly compare the factors contributing to dream memories with memories for waking experiences including characteristics and retrievability
- Account for the effect of memory rehearsal upon dream memories and waking memories
- Investigate the relationship between dream content and the self
- Explore dream content in terms of comprehensibility
- Overall, ascertain the extent to which recalling dreams is a process of autobiographical memory.

Chapter 2: Developing a New Measure of Dream Recall

Introduction

Whilst laboratory measures of dreaming, such as waking an individual once they have entered REM sleep, may be valid, they are difficult to administer to a large sample. Self-report measures of dreaming and DR (and DRF) and few and far between. They have been criticised for being subjective and therefore invalid measures (e.g. Schredl & Montasser, 1996-7a). However Foulkes (1979) claims that laboratory measures may reduce the prevalence of dreaming in young children due to the laboratory being a relatively bland environment from which to collect dream material, whilst other investigations (e.g. Foulkes & Schmidt, 1983) have found a high rate of reported dreaming when in the laboratory, presumably resulting from altered environments and being woken in REM sleep. A self-report measure that would correlate highly with other measures, such as characteristic ratings or diary measures, would therefore be a reliable and usable measure of DR in a number of settings.

Diary measures of DR provide rich data about dreams themselves, although this is not always a convenient way of gathering data and ignores accurate DRF measures. A more suitable measure of DR would utilise a questionnaire. Investigations of DR have used a host of measures. Questionnaire measures in the past have neither been standardised nor validated and tend to include just two or three questions requiring participants to estimate their dreaming habits. Schredl (2004) reports that a single question measure, a seven point scale in response to the question, "How often have you recalled your dreams recently (in the past several months)?", is reliable over time (although the time interval is not specified, it is implied to be over weeks). However DR can change with routine, thus a questionnaire item such as this may not be entirely valid for a particular time.

This chapter presents two experiments. Firstly a new measure of DR as part of a memory experiences questionnaire is psychometrically developed and validated against diary measures of dreaming. Secondly, it is found to correlate with a host of individual differences traits. Overall a highly usable measure of DR has been produced as well as a measure of memory experiences more generally.

2.1 Experiment 1: Developing a psychometrically validated measure of dream recall: the Dream Memory Questionnaire

2.1.1 Introduction

Although much research has been conducted upon the characteristics of autobiographical remembering and false memories (e.g. Johnson *et al.*, 1988), relatively little research has investigated the potential cognitive relationships between the characteristics of autobiographical memories and memories for dreams. Despite this, evidence suggests that the characteristics facilitating waking event recall such as bizarreness (McDaniel & Einstein, 1986), emotionality (e.g. Loftus & Burns, 1982) and personal salience also facilitate recall in dreams when they are bizarre (Cipolli *et al.*, 1993), emotional (Cohen & MacNeilage, 1974; Hicks, Bautista & Hicks, 1999) and personally salient (Cohen & MacNeilage, 1974), for example. As dream memories are autobiographical experiences it would follow that dreaming relies on autobiographical memory functioning and processes. The development of the questionnaire described below adopts a unique perspective in that it requests information about sensations of autobiographical memory for waking experiences as well as dreams.

Research by Grenier *et al.* (2005) has also suggested that the similarities between dreaming and autobiographical remembering extend beyond the characteristics of those memories. Specifically, the patterns of recall over the lifespan are comparable. This includes the three main features of autobiographical remembering: childhood amnesia, the reminiscence bump and a recency effect (see Chapter 4 for more detail). Once dreams are able to be recalled, they tend to be very emotional in the early years (Bulkeley *et al.*, 2005; Foulkes, 1979). As earliest dreams are seemingly memorable for some individuals (Bulkeley *et al.*, 2005; Fiske & Pillemar, 2006), they seemed to serve an appropriate methodological validation for the questionnaire. That is, significant correlations between diary measures for the characteristics of earliest as well as recent dreams and the new questionnaire would provide evidence for the questionnaire's reliability and validity. Remembering early experiences have also been found to correlate with DRF (Robbins & Tanck, 1978; Schredl, Morlock & Bozzer, 1996).

2.1.2 Hypotheses and aims

Autobiographical memory experiences and dreaming behaviours aimed to be explored via designing a questionnaire consisting of items high in face validity and theoretical standing. The psychometric validation of this measure of memory (including dream) experiences, through using items analyses, indicated the types of items that are indicative of remembering dreams. This was also compared to measurements taken from actual dream reports to see if more commonly used diary-style paradigms can predict scores on the newly formed memory experiences measure, which shed light onto the reliability of these two distinct forms of measuring dream experiences. This study is therefore able to investigate the behavioural correlations between a range of sensations of autobiographical memory and recalling dreams.

This experiment aimed to develop a psychometrically sound questionnaire of DR as part of a measure of memory experiences, based upon items relating to dreaming and autobiographical memory. The questionnaire classified the behaviours associated with recalling recent and earliest dreams. Such an approach may help to clarify whether a likelihood of recalling dreams is a cognitive ability or one that is more associated with certain personality traits.

2.1.3 Method

2.1.3.1 Participants

Two hundred and thirty three individuals, opportunistically sampled and mainly comprising of Psychology students (30 males, 203 females; median = 20 years and 0 months) participated in this study by completing a paper questionnaire.

2.1.3.2 Stimuli

Items relating to sensations of dreaming, daydreaming and autobiographical remembering were devised based upon having high face validity. The questionnaire contained a number of hypothesised constructs, each assessed via at least 3 questionnaire items and formulated as based upon their relation to dreaming and memory experiences. The constructs were: daydreaming (Singer, 2003), déjà-vu (Zuger, 1966), general sleeping patterns, emotions in dreams (Cohen & McNeilage, 1974), remembering dreams, detail of dreams, routine of recall, post dream

experiences, senses in dreams, comprehensibility, attitudes towards dreaming (Beaulieu-Prevost & Zadra, 2005; 2007), intensity of dreams (Cohen & MacNeilage, 1974), individual differences in dreams, ruminating, continuity between dreaming and waking (Schredl & Hoffman, 2003), the development of remembering dreams, perspectives in dreams, returning/involuntary memories and control of dreams. For the questions loading onto each of these hypothesised underlying construct in the questionnaire, see Appendix A.

Most items can be seen to reflect dreaming behaviours explicitly, in referring to frequency of experiencing particular behaviours, assessing depth of detail or vividness, or accounting for the continuity between dreaming and waking behaviours. In addition a number of items refer to experiences of the sensation of déjà-vu, which can be defined as a sensation whereby there is an overwhelming sense of familiarity juxtaposed with knowledge that that familiarity is inappropriate (Brown, 2004). In experiential terms, this may feel extremely strange as if, for a fleeting moment, everything that is perceived has already been perceived before. In fact, the term "déjà" translates as, "before". Whilst the frequency of experiencing this sensation has been found to correlate with DR (Palmer & Dennis, 1979; Zuger, 1966), déjà-vu experiences may also be associated with the confusion of dream content being interpreted as having actually occurred (Neppe, 2003). The experience also typifies a sensation of memory with great individual differences variation, just as with DR. The questionnaire consists of a number of items referring to different déjà-states, as described by Neppe (1983).

All questions could be answered on a five point rating scale. These used a variety of frequency measures, such as "always", "for some of my dreams but not for others", "sometimes", "for some parts of my dreams but not for others", "never" as well as ratings using particular timepoints, such as "daily", "once/twice a week", "a few times a month", "once a month", "a few times a year/never".

Demographic information was also collected, including a question on how many hours the sample tended to sleep for each night. In addition to this first part of the questionnaire which was designed to measure dream memory, a second part required participants to recall three early and three recent dreams. The dreams were reported alongside the estimated time of occurrence. The reports were scored according to detail (the extent to which events from the dream were reported) and clarity (sensory-perceptual and emotional experiences) on a 5 point scale. Table 2.1.1 details the represented values below. These can be alikened to the detail and episodic richness ratings of

the Autobiographical Memory Interview (AMI, Kopelman, Wilson & Baddeley, 1989) respectively, although on a 5 point as opposed to a 4 point scale.

Table 2.1.1 Ratings used for the detail and clarity scores

1 – none
2 – very few details/experiences reported.
3 – Some details/experiences reported but it is clear that there are omissions, or the sensation was not strong.
4 – Lots of detail/quite a strong sensation reported.
5 – All details seem to be recalled. There are no gaps in the report.
(In addition for clarity responses: The sensations are so profound they may well indicate that they were woken up by the experiences, or there was a continuity of the experience into waking life, such as waking up crying or screaming.)

A mixture of both positively and negatively scored items was used. That is for the positive items a lower score indicated a greater likelihood of recalling dreams (such as 1 for "daily" or "always"). For the negative items, scores were reversed so that summing the scores from each item would give a total score for likelihood of recalling dreams. The result was that all items with a lower score reflected a heightened propensity to recall dreams.

The DMQ had thus been devised using a number of new measures in the field of dream memory, including 90 questions requesting self-report judgements on dream behaviours. In addition participants provided a diary style alternative measure of dream detail through their dream reports.

2.1.3.3 Procedure and Analyses

Questionnaires were distributed, participants were asked to complete them in their own time and instructed to answer all questions. If they could not remember dreams participants were asked to indicate so. Participants were also asked to indicate if they were not reporting a dream due to its content that they preferred not to reveal, so this missing data could be labelled appropriately. Completion of the questionnaire took approximately 45 minutes.

Descriptive responses to all items were studied. An iterative reliability (items) analysis was conducted in order to ascertain that only psychometrically stable items were included. Items were removed based on strict criteria (see below) in order to reduce the DMQ to a concise form. The finalised DMQ was factor analysed using principal components analysis and its factor structure confirmed. Gender was correlated with the final DMQ. In order to ascertain methodological reliability the finalised measures were also correlated and regressed with the length, detail, clarity and other measures of the diary style reports of both the earliest and recent dreams.

2.1.4 Results

A general idea of the frequency of dream recall (DRF) and the level of detail recalled from dreams (DR) emerged from the questionnaire responses. Approximately half (49.1%) of participants felt that they dreamt daily and 37.5% answered, once/twice a week. The remaining participants felt they dreamt a few times a month (7.8%), once a month (3.0%) or a few times a year/never (2.6%). Thus participants felt that they dreamt frequently. However asking participants how often they remembered their dreams gave rise to a different profile of results with just 18% responding daily; 42.1%, once/twice a week; 26.6% a few times a month; 7.3% remembering their dreams once a month and with 6% a few times a year or never. This shift towards more occasional DR was reflected in the responses to the question, "How often do you forget your dreams?", although the pattern did not mirror those of remembering dreams exactly, as there was a tendency to answer with a high frequency response in both instances. 21.1% felt they forgot their dreams daily, 28.8% once/twice a week, 27.6% a few times a month, 6% once a month and 6.5% a few times a year or never.

Table 2.1.2 below shows the descriptive statistics for the questionnaire items. In addition the mean response to the demographic question, "For how many hours do you sleep each night?" was 2.74 with a standard deviation of 1.04, indicating that on average participants slept for about 7 hours each night. Table 2.1.2 also illustrates how 14 items were skewed to the left (items with a mean below 2) whilst only 1 ("How often do you experience a sense of revelation upon waking, despite the dream being confusing?") was skewed to the right (mean >4), indicating a consistently low frequency of occurrence. Those items skewed to the left related to attitudes towards dreaming, indicating a positive attitude overall. Participants used the full range of responses available to them in the closed-ended questions, with the exception of question 58 ("Do you feel

that there are differences between people in the way that they dream?") whereby no-one responded with, "no – people dream in the same ways". Responses to, "Do you have a generally accepting attitude towards dreams?" omitted "never".

Table 2.1.2 Descriptive statistics for questionnaire items in order of ascending means

	N	Mean	Std. Deviation
Do you think that everybody dreams?	233	1.42	0.57
Do you have a generally accepting attitude towards dreaming?	231	1.44	0.80
How frequently do you find yourself ruminating?	233	1.51	0.77
Do you think you dream in colour?	229	1.56	0.99
Are you ever aware of being able to use the sense of hearing in your dreams?	232	1.72	1.01
How often do you feel you dream?	232	1.72	0.92
Have you ever experienced the sensation of déjà-vu?	233	1.70	0.85
How often do dream contain material relating to waking life, without replays?	232	1.82	0.90
Do you feel that there are differences between people in the way that they dream?	231	1.84	0.85
Do you tend to remain in the perspective of yourself when dreaming?	233	1.87	0.99
Would you like to remember more of your dreams?	233	1.90	1.19
Do you dream especially vivid dreams?	232	1.92	0.90
Do you feel your dream content has changed as you have gone through different life periods?	232	1.93	1.00
Déjà-fait?	220	1.97	0.88
Would you like to forget more of your dreams?	232	2.05	1.16
Do you dream especially intense or clear dreams?	232	2.06	0.87
How often are you aware that you have been dreaming?	232	2.08	1.09
How often do you experience the sensation of daydreaming?	232	2.10	1.29
Do you feel there are differences between people in the way they remember their dreams?	232	2.12	0.94
Déjà entendu?	221	2.17	1.13
Do you think that dream content can be analysed?	233	2.18	1.09
Do you enjoy your dreams?	233	2.18	1.02
Déjà arrive?	219	2.19	1.05
Do you feel that your dream content has changed as you have grown older?	231	2.21	1.10
Do you remember details of people and places as well as what you are doing in your dreams?	233	2.22	1.03
If you are familiar with the sensations described in 14-15, how long does it take for these sensations to disappear?	224	2.24	1.21
Do you remember details in terms of a story/theme?	233	2.29	1.09
How intense are your dreams?	231	2.31	0.96
Déjà-pense?	219	2.33	1.05

	N	Mean	Std. Deviation
Do you feel that dream content is unrelated to experiences in waking life?	233	2.35	1.11
How often are you distracted by daydreaming?	232	2.35	1.29
Déjà-reve?	220	2.37	1.13
Do you feel that your feelings in your dreams mirror those from waking life?	232	2.39	1.01
How often do you remember your dreams?	233	2.41	1.06
How often do you take on the view of somebody other than yourself?	232	2.46	1.16
Do you think that you dream more depending upon how much sleep you have?	233	2.51	1.20
Do you think you dreamt similar things when younger to what you dream now?	230	2.52	1.16
Do you have particularly emotional dreams?	233	2.55	1.01
Déjà-vecu?	221	2.56	1.25
Are you ever aware of being able to use the sense of touching in your dreams?	232	2.63	1.20
How frequently do you dream about events/memories from the previous day?	233	2.64	1.11
How often do you experience the sensation of involuntary memories interrupting you?	231	2.75	1.36
Have you ever experienced an awareness that you are dreaming, whilst dreaming?	232	2.75	1.18
How old were you when you started dreaming at night?	224	2.75	1.20
How much detail do you typically remember from each dream?	231	2.77	0.74
Do you feel that you remember your dreams routinely?	232	2.78	1.10
Do you think that dreams should be forgotten?	232	2.81	1.17
Do you feel you often understand why you dreamt particular material?	232	2.85	1.14
Do you feel continuity between experiences in dreaming and waking life?	232	2.86	1.20
Do you feel you understand why you dream the material you dream?	233	2.89	1.16
Déjà-recontre?	220	2.91	1.20
How frequently wake with lingering sensation of bizarreness?	232	2.94	1.08
Déjà-pressenti?	219	2.94	1.30
Déjà-su?	220	2.97	1.23
Do you think it is important to understand dream material?	233	2.98	0.86
If you daydream to what extent do you find you lose awareness of the external environment?	231	2.98	0.86
How often do you have dreams where you can see yourself from an observer perspective?	233	3.03	1.18
How intense are your daydreams?	232	3.05	1.10
Do you ever feel scared by your dreams' content?	232	3.05	1.00
How often does a memory of a dream involuntarily return to mind?	233	3.07	1.19

	N	Mean	Std. Deviation
Do you feel that you forget your dreams routinely?	231	3.08	0.96
How frequently do you dream about events/memories from the previous week?	232	3.09	1.03
How frequently do you find yourself ruminating and unable to return to a task?	233	3.10	1.36
If you responded "yes" to q88, do you feel you are more likely to remember your dreams if you deviate from that pattern?	116	3.10	1.31
How much detail do you typically forget from each dream?	230	3.10	0.75
Do you, on average, have a regular sleep pattern?	233	3.17	1.07
Emotionally neutral dreams?	232	3.20	1.22
Emotionally negative dreams?	232	3.24	1.10
How often do your dreams contain replays of experiences from waking life?	233	3.25	1.12
Emotionally positive dreams?	233	3.25	1.07
How frequently wake with insights into the meaning of the dream?	231	3.25	1.15
How many hours sleep?	232	3.26	1.04
How rapidly do you typically forget a dream?	230	3.34	1.12
Frequency of feeling of a dream, although not memory, involuntarily return to mind?	233	3.35	1.09
Frequency of sensation whereby you cannot understand the dream at all?	233	3.45	1.11
Do you ever try to control what you are doing whilst you are dreaming?	233	3.47	1.31
How often do you experience a sensation of profound incomprehension when waking?	231	3.48	1.15
Do you ever feel out of control of what you are dreaming?	232	3.53	1.26
Are you ever aware of being able to use the sense of taste in your dreams?	233	3.57	1.19
Are you ever able to control what happens in a dream?	233	3.58	1.25
Profound incomprehension whilst dreaming?	231	3.61	1.11
How old do you feel you were when you started daydreaming?	224	3.61	1.18
How old were you when you started remembering your dreams?	225	3.62	0.99
How often do you forget your dreams?	232	3.62	1.08
How frequently wake with sensation of clarity or understanding?	233	3.66	1.08
How often do you confuse memories for dreams and actual memories for events?	232	3.69	1.25
How often do you experience a sense of revelation upon waking?	232	3.80	1.19
Are you ever aware of being able to use the sense of smell in your dreams?	233	3.81	1.11
Do you feel in control of what you are dreaming?	233	3.82	1.26
How often do you experience a sense of revelation upon waking, despite the dream being confusing?	231	4.01	1.03

Whilst it may not always be appropriate to calculate means from non-linear scales, this measure of central tendency seemed more appropriate than either the median (which would not be comparable to the variance) or mode (which would not reflect the precise point along the 5 point scale at which responses were the most gathered). Some items also required more clarity regarding the dreams that they referred to. For instance, items relating to sensations of experiences upon awakening should have been answered as a percentage of all dreams [recalled] rather than being unclear. It was assumed that participants responded in this way, although there may well have been differences in the understanding of these items.

In addition there was an open-ended question included in the questionnaire (84) asking participants why they felt that there would be differences between the ways in which people dream. Personality, memory abilities, creative abilities and whether people wanted to remember their dreams were given as examples. Only 4 responses were collected. They referred to levels of arousal whilst asleep and waking, how well rested the individual was, individual differences in defence mechanisms, and age in that younger people do not remember their dreams, presumably referring to a cognitive developmental idea of remembering dreams.

2.1.4.1 Testing normality of the data

Variances were similar so homogeneity of variance was assumed. Means were not always based around 3, however. The spread of responses along the remaining items indicated that the data may have been normally distributed. Normality was explicitly tested by calculating a z-score from the skewness statistic and with the Kolmogorov-Smirnov test. As a result Pearson's correlation coefficients have been calculated on this data.

Those items producing a z score +/- 1.96, thus indicating significant difference from normality, were questions 20, 27, 34, 36, 45, 57, 59, 81, 84, 87 and 90. Questions 83 and 84 were omitted from further analyses as responses were not limited to a 5 point scale, thus skewing the data and making comparisons difficult.

2.1.4.2 Factor analyses for whole questionnaire

On the whole high correlations were found between items of the questionnaire. As a result a principal components analysis was conducted on the 89 items in the first part of the questionnaire

(excluding questions 83 and 84, but including the demographic item "On average, for how many hours do you sleep each night?" to see if the resulting factors mapped onto the hypothesised constructs that the questionnaire had as the basis for its design. The 8 (theoretical) constructs extracted using the default extraction limit of eigenvalues >1, are detailed below. The final 3 factors (6-8) were comprised of items that had already loaded onto previous factors.

Factor 1 accounted for >11% of variance in the unrotated principal components analysis was a general factor encompassing most items in the questionnaire, so was named the "**strength of memory trace**" factor. The factor included questions loading onto the constructs of remembering dreams generally and the involuntary return of that memory to mind. Intensity of dreams and the post-dream sensations loaded onto this. It seemed unrelated to remembering/ruminating upon experiences from the previous day and confusing dreams and normal memories.

Factor 2 accounted for almost 6% of variance and included items relating to ruminating and involuntary memories, feeling out of control and confused as well as experiencing déjà-pressenti. This factor resembled a construct of being distracted or affected by experiences and was so named "**distraction and autobiographical sensations**"). This seemed to relate to general feelings rather than post-dream states.

Factor 3 accounted for 5.6% of variance in this analysis and consisted of items loading onto the original constructs of understanding dream material; comprehensibility (comprehension; bizarreness items etc); continuity; detail of people and places in dreams; enjoying dreams; perspective in dreams. As this factor contained items relating to subjective views rather than the sensations of incomprehensibility (which load onto factor 1) this construct was termed "**attitudes and comprehensibility**".

Factor 4 accounted for a further 4.8% of variance and included items relating to frequency of dreaming about memories/events from the previous day; dreams containing replays of events from the previous day (and week); replays of experiences from waking life; rapidity of forgetting a dream. The construct was therefore named, "**continuity**".

Factor 5 accounted for 4.2% of variance accounted for and included frequencies of sensations whereby the dream could not be understand the at all; such as, "do you think that all dreams should be forgotten?"; feeling scared by dreams' content; feeling out of control in dreams;

dreaming from the observer perspective; dreaming in colour; hearing in dreams; feeling that everybody dreams, and sleep patterns. This construct was difficult to classify but resembled a "**disinterest**" in dreams and dreaming.

For factor 6 no items principally loaded onto this. It seemed to encompass a lot of the emotion-related items, as with factor 7, but to a lesser extent. Factor 7 was a construct of enjoying dreams (positive and neutral emotions in dreams; enjoying dreams; experiencing the sense of touching in dreams). When rotated this loaded onto factor 1, mainly, and enjoying dreams loaded onto factor 3. Factor 8: No items principally loaded onto this factor. Trends were difficult to decipher.

2.1.4.3 Reliability analyses

In order to produce a psychometrically validated questionnaire measure of DR an items analysis (reliability analysis) was performed on 89 items (all the 90 questions excluding 83 and 84 due to not being on a five point scale) as well as the initial question, "how many hours' sleep do you get a night?". The first reliability analysis on these 89 items produced a Cronbach's alpha of .869 (.873 when based upon standardised items) indicating reasonable internal consistency of the questionnaire. Performing the items analysis on the 80 items that were found to be normally distributed slightly reduced the alpha coefficient to .857. The inter-item correlations increased from .067 to .070. The value was still exceedingly low, reflecting that certain items were negatively correlated with other items, resulting in a mean inter-item correlation close to 0. Considering that these should be ~.6 it was evident that certain items were required to be removed. Despite this the Cronbach's alpha coefficient demonstrated reliability between the items as a whole.

A number of items were removed in an iterative style. Each time an item was removed, the items (reliability) analysis was re-conducted. During this process, Cronbach's alpha values (measuring internal consistency) was, at times, reduced. As it seemed important to maintain a relatively high ineternal consistency in the questionnaire, the non-normally distributed items were re-entered into the analyses. The table below shows which items were removed along with reasons for their removal.

Firstly, items 45, 46, 47, 48, 49, 51, 52 and 53 were removed in a block due to being relatively low in face validity. These items referred to developmental aspects of dreaming, such as

dreaming similar content when younger to the current time. Whilst these developmental aspects are worthy of study, these items only questionably loaded onto the designated construct of remembering dreams. In addition items 89 and 90 were also removed due to being low in face validity. They referred to opinions on other peoples' dreaming behaviours. Whilst corresponding to attitudes towards dreams generally they did not correspond to attitudes to one's own dreams. They also provided confusing output in the correlation matrix, that is some of the correlations were negative. In addition item 58 was also removed as the responses were not distributed evenly (there were no "never" responses). In addition some of the reversed items still produced a substantial number of negative correlations with other items, indicating an unclear relationship to the overall construct of recalling dreams, so the following items were also removed from subsequent analyses: 26, 28, 31, 35, 39, 50, 57, 76 and 82. All these items are listed below in Table 2.1.3.

The iterative items analysis thus began at this point with just 68 items. The Cronbach's alpha at this stage had already increased to .903 (.905 when based on standardised items). The mean inter-item correlation had also increased to .123 which, although had improved substantially, still required increasing further. Table 2.1.4 displays the items that were removed throughout the iterative items analyses, with their reasons for removal.

Table 2.1.3 Items initially removed from analyses due to being low in face validity

Item number	Item
26	If you are familiar with the sensations described in questions 14 and 15, how long do these sensations take to disappear?
28	Do you think that dreams should be forgotten?
31	Do you feel that dream material is unrelated to experiences in your waking life?
35	How often do your dreams contain replays of experiences from waking life?
39	Do you remember details of places and people as well as what you're doing in your dreams?
45	do you think you dreamt similar things when you were younger to what you dream now?
47	do you think your dream content has changed as you have grown older?
49	do you feel your dream content has changed as you have gone through different life periods...?
50	How rapidly do you typically forget a dream?
51	how old were you when you started dreaming at night?
52	how old were you when you started remembering your dreams?
53	how old do you feel you were when you started daydreaming?

Item number	Item
57	Do you feel that you forget your dreams routinely (i.e. do you consistently forget your dreams daily/monthly, as has been indicated above, or do you forget dream frequently for a few days and then not for months, for example)?
58	do you feel there are differences between people in the way they dream?
76	If you answered, "yes" to question 70 (déjà-vu), have you ever experienced the sensation of having already dreamt something before ("déjà-reve")?
82	Do you think that you dream more depending upon how much sleep you have?
83	do you think that everybody dreams?
84	why do you think there are differences between people in the way that they dream?
89	If you responded... (item dependent upon previous responses)
90	do you feel there are differences between people in the ways that they remember their dreams?

Items were removed based upon the following criteria:

- Being low in face validity
- From the correlation matrix, correlations were either low or negative
- Item means were especially low or high
- If an item was deleted it would have little effect on the overall scale mean, but a great effect on the scale variance
- An especially low corrected item-total correlation (aim to achieve up to 0.5 here)
- The Cronbach's alpha would rise if the item was deleted
- Low squared multiple correlations, indicating that they were poorly predicted by other items.

Table 2.1.4 Items removed from the reliability analyses with reasons for removal

Removed item:	Reason(s) for removal
How often do you forget your dreams?	Cronbach's alpha if item removed up to .905 High scale variance if item deleted Corrected item total correlation = very low (0.07) Relatively low squared multiple correlation (regression equation with this item as the DV) 37 negative correlations from the matrix

Removed item:	Reason(s) for removal
How many hours' sleep?	Low in face validity Cronbach's alpha if removed up to .906 Corrected item total correlation = very low (.01) Relatively low squared multiple correlation (.51) 35 negative correlations in matrix
Would you like to remember more of your dreams?	Low face validity Low mean (1.90) Very low corrected item total correlation (0.04) 26 negative correlations in matrix Cronbach's alpha if removed up to .908 Relatively low squared multiple correlation (.38)
Do you think that dream content can be analysed?	Low face validity 27 negative correlations from matrix Low corrected item total correlation (0.07) Little effect on scale mean if deleted, but relatively large effect on variance. Relatively low squared multiple correlation (.34) Low corrected item-total correlation (.07) Cronbach's alpha up to .909 if deleted
Do you feel in control of what you are dreaming?	16 negative correlations from matrix The most extreme negative correlation values (.39) in the matrix Low corrected item total correlation (.18) Increased Cronbach's alpha if deleted (9.10)
How much detail do you typically forget from each dream?	20 negative correlations from matrix Low corrected item total correlation (.11) Cronbach's alpha if deleted remains at 9.10
Do you ever feel scared by your dreams' content?	18 negative correlations from matrix Cronbach's alpha remains at 9.10 Relatively low item total correlation (.16)
Do you think you dream in colour?	Low item mean (1.48) 16 negative correlations in matrix Relatively low item total correlation (.17) Relatively low squared multiple correlation (.45)
Emotionally neutral dreams?	16 negative correlations in matrix Relatively low item total correlation (.19) Relatively high Cronbach's alpha if removed (.909) Big effect on scale variance if item deleted
Do you tend to remain in the perspective of yourself while dreaming?	Low mean (1.83) Relatively low item total correlation (.21) Keeps Cronbach's alpha relatively high (.908) 14 negative correlations in matrix

Removed item:	Reason(s) for removal
Do you ever feel out of control of what you are dreaming?	13 negative correlations in matrix Low item total correlation (.16) Keeps Cronbach's alpha high (.909)
Do you, on average, have a regular sleep pattern?	Low in face validity 10 negative correlations in matrix Relatively low item total correlation (.17) Relatively low squared multiple correlation (.30) Increases Cronbach's alpha if deleted (.911)
Frequency of sensation whereby cannot understand the dream at all	11 negative correlations in matrix Relatively low item total correlation (.21) Keeps Cronbach's alpha high (.910)
How much detail do you typically remember from each dream?	9 negative correlations in matrix Relatively low variance (.74) Keeps Cronbach's alpha quite high (.910) Item total correlation = .30
Do you have a generally accepting attitude towards dreams?	Removal has biggest effect on scale variance Low mean (1.43) 6 negative correlations in matrix Item total correlation relatively low (.24) Relatively low squared multiple correlation (.35) Keeps Cronbach's alpha relatively high (.909)
How frequently do you dream about events/memories from the previous day?	9 negative correlations in matrix Low item total correlation (.21) Keeps Cronbach's alpha high (.909)
How often do you have dreams where you can see yourself from an observer perspective?	9 negative correlations in matrix Increases Cronbach's alpha if deleted (9.10) Low item total correlation (.21) Relatively low face validity
Are you ever able to control what happens in a dream?	1 negative correlation in matrix Lowest item total correlation (.29) Relatively low squared multiple correlation (.40) Keeps Cronbach's alpha high (.909)
How frequently do you dream about events/memories from the previous week?	2 negative correlations from matrix Low item total correlation (.27) Low squared multiple correlation (.37) Keeps Cronbach's alpha at .909

Removed item:	Reason(s) for removal
Déjà-recontre?	Low in face validity
	Concerns over item's clarity/interpretation
	4 negative correlations in matrix
	Low item total correlation (.29)
	Low squared multiple correlation (.40)
Have you ever experienced an awareness that you dreaming whilst dreaming?	
	1 negative correlation in matrix
	Low item total correlation (.30)
	Very low squared multiple correlation (.31)
	Keeps Cronbach's alpha high (.908)
Emotionally negative dreams?	3 negative correlations in matrix
	Low item total correlation (.29)
	Low squared multiple correlation (.42)
	Keeps Cronbach's alpha high (.907)
If you daydream to what extent do you lose awareness of the external environment?	
	2 negative correlations from matrix
	Lowest item total correlation (.29)
	Low squared multiple correlation (.37)
	Debateable face validity
How often do you take on the view of somebody other than yourself?	
	Debateable face validity
	Lowest squared multiple correlation (.26)
	Low item total correlation (.31)
	Keeps Cronbach's alpha high (.905)
	One correlation coefficient = .00
Do you ever try to control what you are dreaming whilst you are dreaming?	
	Lowest item total correlation (.29)
	Lowest squared multiple correlation (.31)
	Keeps Cronbach's alpha high (.904)
	Face validity debateable (lucidity)
	2 negative correlations in matrix
Are you ever aware of being able to use the sense of hearing in your dreams?	
	Low mean (1.68)
	Lowest item total correlation (.30)
	Lowest squared multiple correlation (.38)
How often do you remember details in terms of a story/theme?	
	Unclear item (omission of dreams)
	Lowest item total correlation (.31)
	Relatively low squared multiple correlation (.46)
	Keeps Cronbach's alpha high (.903)
	5 negative correlations in matrix
Do you feel continuity between experiences in dreaming and waking life?	
	Lowest item total correlation (.30)
	Keeps Cronbach's alpha high (.902)
	2 negative correlations in matrix
Déjà-su	Lowest item total correlation (.31)
	Keeps Cronbach's alpha high (.901)
	High variance (1.243)
	3 negative correlations in matrix

Removed item:	Reason(s) for removal
How often do dreams contain material relating to waking life, without replays?	Lowest item total correlation (.33) Lowest squared multiple correlation (.34) Low mean (1.81)
Profound incomprehension whilst dreaming?	Keeps Cronbach's alpha relatively high (.90) Lowest item total correlation (.34) Lowest squared multiple correlation (.40) 1 negative correlation in matrix
Do you feel that your feelings in dreams mirror those from waking life?	Lowest item total correlation (.34) Lowest squared multiple correlation (.34) Little reduction in Cronbach's alpha (.90)
How often do you confuse memories for dreams and memories for actual events?	Lowest item total correlation (.37) Lowest squared multiple correlation (.37) Little reduction in Cronbach's alpha (.90)
How often do you experience a sensation of profound incomprehension when waking?	Low item total correlation (.38) Lowest squared multiple correlation (.39) Little reduction in Cronbach's alpha (.90) One negative correlation in matrix
Are you ever aware of being able to use the sense of touching in your dreams?	Lowest item total correlation (.34) Lowest squared multiple correlation (.39) Keeps Cronbach's alpha high (.893)
Déjà-pressenti?	Low item total correlation (.37) Lowest squared multiple correlation (.38)
Déjà-pense?	Lowest item total correlation (.30) Lowest squared multiple correlation (.39) One negative correlation in matrix
Déjà-vecu?	Lowest item total correlation (.30) Low squared multiple correlation (.42) 2 negative correlations in matrix

Some remaining items had low means, however they remained in the questionnaire because this reason alone did not suffice in removing them. Their variance was suitable and they tended to be especially high on face validity. All item total correlations were now over .3. Whilst it would be ideal for values to approach .5 only few items remained and those below .3 tended to have high squared multiple correlations. Again, removing them on this basis alone did not suffice. Also, as the questionnaire was designed so not to be unidimensional, lower coefficients were expected.

Table 2.1.5 details the descriptive statistics for items on the final questionnaire.

Table 2.1.5 Summary item statistics for the 30 items in the final DMQ

	Mean	Minimum	Maximum	Range	Variance
Item Means	2.67	1.52	4.02	2.51	0.49
Item Variances	1.16	0.44	1.86	1.42	0.11
Inter-Item Covariances	0.25	-0.01	0.98	0.99	0.02
Inter-Item Correlations	0.22	-0.01	0.71	0.71	0.02

Finally, the Cronbach's alpha was found to be .891 (when based on standardised items it is similar at .893) and the inter-item correlation had increased to .218. Thus the final, psychometrically validated questionnaire consisted of 30 items, as shown in Table 2.1.6.

Table 2.1.6 Items comprising the final DMQ

1. How often do you feel you dream?
2. How often do you experience the sensation of daydreaming?
3. How frequently do you find yourself ruminating?
4. How often do you remember your dreams?
5. How frequently do you find yourself ruminating and unable to return to a task?
6. How often are you aware that you have been dreaming?
7. How often do you experience the sensation of involuntary memories interrupting you?
8. How often do you experience a sense of revelation upon waking?
9. How often are you distracted by daydreaming?
10. Do you feel you often understand why you dreamt particular material?
11. Emotionally positive dreams?
12. How frequently wake with lingering sensation of bizarreness?
13. How frequently wake with sensation of clarity or understanding?
14. How often do you experience a sense of revelation upon waking, despite confusing dream?
15. How frequently wake with insights into the meaning of the dream?
16. Do you feel you understand why you dream the material you dream?
17. How often does a memory of a dream involuntarily return to mind?
18. Frequency of feeling of a dream, although not memory, involuntarily return to mind?
19. Do you have particularly emotional dreams?
20. Do you feel that you remember your dreams routinely?
21. Are you ever aware of being able to use the sense of smell in your dreams?
22. Do you dream especially intense or clear dreams?
23. Do you dream especially vivid dreams?
24. Are you ever aware of being able to use the sense of taste in your dreams?
25. Have you ever experienced the sensation of déjà-vu?
26. Have you ever experienced the sensation of déjà-entendu?
27. Have you ever experienced the sensation of déjà-fait?
28. Have you ever experienced the sensation of déjà-arrive?
29. How intense are your daydreams?
30. How intense are your dreams?

The scores on each of the final 30 items were summed to produce a general score on the DMQ measuring an awareness of memory experiences (if the score was low). The mean DMQ score was 80.19 and the standard deviation, 15.80.

2.1.4.4 Factor analysis on final DMQ

Initial unrotated solutions produced confusing findings as the first factor, with an eigenvalue of 7.42 and 24.74% variance accounted for, had all 30 items loading onto it with loading scores of at least .35. Most loading scores were around .5. This indicated a degree of unidimensionality. That is, all items were measuring the same construct of remembering dreams. There were 7 other factors produced with eigenvalues greater than 1, although their distributions were confusing and a scree plot seemed to better imply that just 6 factors were extracted altogether. In order to clarify the factor structure of the DMQ, a number of factor analyses were conducted. These were:

1 – Unrotated. 8 factors were produced. 66.23% cumulative variance was accounted for.

2 – As above. Absolute values <0.4 were suppressed, that is items with low loading values were not visible in final analyses. No items loaded onto factor 8 here. Only 1 loaded onto factor 7 (emotionally positive dreams?), which also loaded onto factor 1 more highly. Thus a 6 factor structure seemed to be appearing.

3 – Varimax rotation, as above. 8 factors were produced. Variance spread amongst the factors sufficiently.

4 – As above – although 6 factors were forced. 58% cumulative variance was accounted for.

5 – As above – reduced the suppressed absolute values from 0.4 – 0.3 to see where "do you dream particularly emotional dreams?" loaded. It was anomalous.

There were few differences between the factor structures of the Varimax rotation principal components analysis and the structure whereby 6 factors were forced. The factor structure has been detailed below. The initial (unforced) structure contained a separate factor for "intensity of dreams" and "awareness of having dreamt", which were combined in the final analyses, and also a separate factor (factor 8) for "emotionality", although this only contained the 2 emotion-related items as well as the anomaly, "do you feel that you remember your dreams routinely?". This was amended in the forced structure so the anomalous item loaded onto factor 1, alongside other similar items; "Emotionally positive dreams?" was grouped with the other senses items; and "do you dream particularly emotional dreams" was omitted from interpretations as its loading score was <0.4. (In actuality it loaded onto factor 1 with a low loading score of just 0.37).

Table 2.1.7 shows the final factor structure of the varimax rotated principal components analysis, forcing 6 factors.

Table 2.1.7 Loading plot showing the 30 items of the DMQ and its Varimax rotated component matrix

Item	Awareness of dreaming	Daydreaming	Comprehensibility of dream sensations upon waking	déjà-states	Comprehensibility of content	Senses
Do you dream especially vivid dreams?	0.74					
Do you dream especially intense or clear dreams?	0.71					
How often do you remember your dreams?	0.70					
How intense are your dreams?	0.70					
How often are you aware that you have been dreaming?	0.65					
How often do you feel you dream?	0.64					
Do you feel that you remember your dreams routinely?	0.49					
Do you have particularly emotional dreams?						
How often are you distracted by daydreaming?		0.83				
How frequently do you find yourself ruminating?		0.76				
how often do you experience the sensation of daydreaming?		0.75				
How frequently do you find yourself ruminating and unable to return to a task?		0.70				
How often do you experience the sensation of involuntary memories interrupting you?		0.64				
How intense are your daydreams?		0.59				

Item	Awar e-ness of drea m-ing	Day-dreaming	Compre-hensibility of dream sensations upon waking	Déjà-states	Compre-hensi-bility of content	Senses
How often do you experience a sense of revelation upon waking, despite confusing dream?[2]			0.79			
How frequently wake with sensation of clarity or understanding?[2]			0.74			
How often do you experience a sense of revelation upon waking?[2]			0.70			
How frequently wake with lingering sensation of bizarreness?[2]			0.54			
Frequency of feeling of a dream, although not memory, involuntarily return to mind?			0.50			
How often does a memory of a dream involuntarily return to mind?			0.48			
déjà-fait?				0.83		
Have you ever experienced the sensation of déjà-vu?				0.76		
déjà -arrive?				0.73		
déjà-entendu?				0.67		
Do you feel you understand why you dream the material you dream?					0.86	
Do you feel you often understand why you dreamt particular material?					0.77	
How frequently wake with insights into the meaning of the dream?					0.76	
Are you ever aware of being able to use the sense of taste in your dreams?						0.74
Are you ever aware of being able to use the sense of smell in your dreams?						0.69
Emotionally positive dreams?						0.45

[2] These sensations refer to when a dream has occurred. That is, the proportion of time that a dream is recalled and the sensation is prevalent.

Values in Table 2.1.7 above correspond to the degree to which each item loads onto the factors described. Specifically, factor loadings represent the partial correlation between the item and the rotated factor, ranging from 0 to 1. It can be seen that in all factors values are high, with the possible exception of the final item corresponding to dreams being emotionally positive. However this item has been included, nonetheless, due to it not meeting criteria for exclusion during the items analysis.

2.1.4.5 Dream report measures of dream recall

For each of the three early and three recent dreams that were reported, the time since occurrence (in months for early dreams, in days for recent dreams), the age of the respondent when they had had the dream, length of the report (word count) and the detail and clarity (a measure of sensory-perceptual/emotion in the dream) scores of these were recorded. Table 2.1.8 shows the descriptive trends for these variables. As outlined in the 2.1.3.2, a higher score for both detail and clarity indicated more detail or clarity, respectively, in the dreams. The N statistic depicts the number of participants who managed to recall all three dreams at either the early or the recent stage. Of all participants, approximately just over half of them managed to recall all the required dreams.

Table 2.1.8 Descriptive statistics for the mean early and recent dream reports

	N	Range	Mean	Std. Deviation
Time early (days)	123	716	175.77	118.97
Time recent (hours)	119	3242	117.10	313.39
Age early (years)	124	58	10.07	7.11
Age recent (years)	119	70	23.02	9.20
Length early (words)	124	250	43.20	35.76
Length recent (words)	119	267	55.42	46.20
Detail early 1-5	124	5	3.06	0.89
Detail recent 1-5	119	5	3.50	1.03
Clarity early 1-5	124	5	3.88	0.82
Clarity recent 1-5	119	5	3.56	0.85

The lengths of the dream reports differed significantly between the early and recent dreams (T (95) =-4.07, $p<0.01$) with the early reports being on average 13 words shorter than the recent reports. Detail scores of the reports also significantly differed (T (95) =-5.14, $p<0.001$) whereby the recent dreams were more detailed than the early dreams, with an approximate mean difference of 0.4. However trends for the clarity scores, which also differed significantly (T (95) =3.59, $p<0.001$) were in the opposite direction: the earlier reports scored higher on clarity by approximately .25 on the 5 point rating scale.

2.1.4.6 Reliability of the DMQ:

In order to assess the reliability between the newly validated questionnaire (the "DMQ total" variable was used) and the dream reports aspect, various correlations were conducted. Table 2.1.10 shows the relationships between the DMQ and the dream report measures of DR. Specifically, the detail and clarity ratings of both the early and the recent dreams were significantly correlated with the DMQ scores. Although these coefficients are not impressively high in terms of reliability coefficients, there is enough shared variance to indicate that dream reports and self report questionnaire items are generally measuring the same underlying phenomenon.

In addition the more time between the occurrences of the earliest recorded dream, the greater the awareness of dreaming as well as other experiences of memory, as measured in the DMQ. Also the younger the age at the time of the recent dreams' occurrence, the greater the awareness of these experiences. This led to the investigation of associations with age generally. Indeed, total score was significantly correlated with age in months ($r=.243$, $p<0.001$) implying that an awareness of dreaming decreases as one ages (recall that although this relationship is not negative, a lower score for dream recallability indicates a heightened recall). Many relationships between the lengths of the reports and other scores were found: early lengths correlated with early clarity. Both early and recent detail scores significantly correlated with early length. There was also a significant correlation between the early and recent lengths, indicating a possible effect of individual differences. Recent length scores correlated with both early and recent detail scores and early clarity scores. Recent clarity scores did not correlate with any length measurements. Early detail scores correlated significantly with both early and recent clarity scores, and also with recent detail scores. As the recent age scores correlated negatively with the recent detail scores, indicating that the older the participant at the time of dreaming, the more detailed the report.

However this was not the case in terms of time since dream occurrence. Other significant correlations for the recent detail scores were with both early and recent clarity scores. Both early and recent clarity scores correlated with one another.

Those variables found to correlate significantly with DMQ total (time early, age recent, detail early, detail recent, clarity early, clarity recent) were entered into a regression equation, to further assess the reliability of these differing methods of assessing memory experiences.

With the outcome variable of DMQ total, the regression value (R) was .35 and 12% of variance was accounted for. The model did not fit the data ($F(6, 81) = 1.709$, n.s. The unstandarised beta coefficients, as depicted in Table 2.1.9, indicate that the only significant predictor of DMQ total was clarity of the recent dreams ($T=-2.38$, $p<0.02$).

Table 2.1.9 Significance of predictor variables in the regression equation for DMQ total scores

	Unstandardized Coefficients		Standardised Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	94.54	10.76		8.79	0.00
Time early	0.00	0.03	0.01	0.04	0.97
Age recent	0.33	0.41	0.21	0.81	0.42
Detail early	0.27	3.29	0.01	0.08	0.94
Detail recent	-1.22	2.21	-0.07	-0.55	0.58
Clarity early	1.39	3.19	0.07	0.44	0.66
Clarity recent	-7.41	3.11	-0.33	-2.38	0.02

Dependent Variable: DMQ Total

Awareness of dreaming correlated with length of recent dreams ($r= -.23$, $p<0.01$), detail of early ($r=-.22$, $p<0.01$) and recent dreams ($r=-.29$, $p<0.01$), and clarity of early ($r=-.20$, $p<0.05$) and recent ($r=-.29$, $p<0.001$) dreams. When this factor (awareness of dreaming; Factor 1) was used as an outcome variable in the regression equation, the model significantly fitted the data ($F(6, 90) = 2.52$, $p<0.05$). Table 2.1.10 details the significant predictor variables (detail and clarity of recent dreams).

Table 2.1.10 Significance of predictor variables in the regression equation for Factor 1: Awareness of dreaming

	Unstandardized Coefficients		Standardised Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	23.24	3.01		7.72	0.00
Time early	0.01	0.01	0.28	1.25	0.21
Age recent	-0.13	0.11	-0.26	-1.14	0.26
Detail early	1.31	0.92	0.19	1.42	0.16
Detail recent	-1.64	0.61	-0.33	-2.69	0.01
Clarity early	0.73	0.89	0.12	0.82	0.41
Clarity recent	-1.90	0.84	-0.29	-2.25	0.03

Dependent variable: Factor 1 (awareness of dreaming)

Table 2.1.11 depicts the relationships between the total DMQ score and the other dream measures. Six (of ten) of these measures were significantly correlated with the DMQ score. High correlations were found between other measures of the dreams, indicating consistency across these measures.

When further regression analyses were conducted, the model did not significantly predict the "daydream" factor outcome ($F(6, 93) = 1.97$, n.s.). However age at the occurrence of the recent dream was a significant predictor ($T = 2.13$, $p<0.05$). For the remaining factors, the model did not fit the data in any case, nor were there significant individual variable predictors. Specifically, for the "comprehensibility of sensations upon waking" factor, $F(6, 94) = 1.65$, n.s.; for the "déjà-states" factor, $F(6, 86) = .83$, n.s.; for the "comprehensibility of dream content" factor, $F(6, 93) = .97$, n.s.; and for "senses", $F(6, 94) = .20$, n.s. However these factors did correlate significantly with some of the dream report measures (apart from the senses factor). Daydreaming related to time since the early dreams ($r=.21$, $p<0.05$), age at the early dreams ($r=.31$, $p<0.01$), age at the recent dreams ($r=.30$, $p<0.01$) and detail of the early dreams ($r=-.19$, $p<0.05$). Comprehensibility of dream sensations upon waking related to time since the early dreams ($r=.32$, $p<0.01$), age at the recent dreams ($r=.25$, $p<0.01$), detail of recent dreams ($r=-.29$, $p<0.01$) and clarity of early ($r=-.20$, $p<0.05$) and recent ($r=-.22$, $p<0.01$) dreams. Déjà-states related to detail of early ($r=-.16$, $p<0.05$) and recent ($r=-.16$, $p<0.05$) dreams, and clarity of recent dreams ($r=-.20$, $p<0.05$). Finally, comprehensibility of dream content related to clarity scores of recent dreams ($r= -.19$, $p<0.05$).

Table 2.1.11 Correlation Matrix showing the relationships between dream report measures and the DMQ total score

	Time early	Time recent	Age early	Age recent	Length early	Length recent	Detail early	Detail recent	Clarity early	Clarity recent
DMQ total	***0.23***	0.04	0.07	***0.23***	-0.03	-0.00	***-0.27***	**-0.21**	***-0.26***	***-0.33***
Time early	-	0.09	**-0.17**	***0.88***	-0.02	-0.05	**-0.16**	-0.11	0.02	0.10
Time recent		-	**0.22**	**0.19**	-0.06	-0.02	-0.06	-0.05	-0.11	0.03
Age early			-	0.17	0.08	0.16	0.07	0.11	**0.16**	**0.19**
Age recent				-	0.05	0.09	-0.14	-0.12	0.04	0.07
Length early					-	***0.73***	***0.43***	***0.28***	***0.30***	0.15
Length recent						-	***0.22***	***0.46***	***0.25***	**0.16**
Detail early							-	***0.70***	***0.64***	***0.63***
Detail recent								-	***0.59***	***0.49***
Clarity early									-	***0.72***

Values in **bold** type reflect correlations significant at the $p<0.05$ alpha level.
Values in ***bold and italics*** indicate correlations significant at the $p<0.01$ alpha level.

Thus whilst the daydream factor related more to the times of the early dreams, awareness of dreaming, comprehensibility of dream sensations upon waking, déjà-states and comprehensibility of content related to detail and clarity scores. These measures are also appropriate measures of dream characteristics. In addition the awareness of dreaming factor correlated with length as well as the detail and clarity ratings and is therefore is an especially good measure of actual DR.

2.1.5 Discussion

This study has produced a clearly structured 30 item measure of awareness of memory experiences and, specifically, Factor 1 measured the awareness of dreaming, which correlated with measures of early and recent dreams. The measures of detail and clarity, which are similar to the detail and episodic richness ratings of the Autobiographical Memory Interview, seem to be especially related to DMQ scores and are therefore suitable characteristic measures of dreams as memory experiences for future studies.

The sample was predominantly female, making clear gender comparisons difficult. This gender bias was the result of recruitment difficulties. As the questionnaire was lengthy non-students had little incentive for its completion. (Students were able to be rewarded with course credits, resulting in a largely student-based sample.) The majority of Psychology undergraduates are female, however the literature on gender differences in DR does not provide reliable and convincing evidence to suggest that females are more likely to remember their dreams than males.

2.1.5.1 Discussion of structure of DMQ

Despite the sample being student based and disproportionately female, it was large enough for adequate factor analyses and correlations to be conducted. This was based on the fact that a previously conducted unpublished study (Horton, 2004) in which a similar questionnaire was distributed to undergraduate Psychology students at the University of Durham, produced an average correlation coefficient between all variables of 0.28. From a table cited in Baggaley (1982), which stipulated that the required sample size should equal this value multiplied by the number of items, a sample size of at least 185 was required (90 items x 2.06). This was well exceeded, so the analyses can be considered statistically thorough. High correlations were also found between all items. In addition the mean correlation coefficient between all 89 questionnaire items included in the initial reliability analyses was .09 from this study. This increased to .22 for

the 30 items on the final DMQ. As this is high and similar to that found in the previous study, a degree of reliability over time for these measures has been demonstrated. High correlations and a degree of shared variance would be expected, however, as items are not entirely independent. Some items repeated information, for example. They were also designed to measure the same underlying constructs.

Whilst it may be deemed that the DMQ has a reasonably complicated structure with 6 factors, the analyses were rigorous and systematic, and the factor analyses were confirmatory (in that they related to hypothesised constructs) rather than being totally exploratory. Also, there were many similarities between the factor structure of the questionnaire pre- and post-reliability analyses, indicating that the items were removed based upon statistical grounds whilst the theoretical structure was upheld.

Certain items on the questionnaire had a potentially discontinuous response scale. Specifically, items 27-49 referred to frequencies of particular dreaming behaviours, however instead of a structured pre-defined frequency scale, a more subjective scale was included (usually, for some dreams, sometimes, for some parts of dreams, never). All these items, with the exception of item 43 (Do you dream particularly emotional dreams?) were removed. This remaining item should perhaps be amended in future uses of the DMQ to ensure that the rating scale used is of a more clearly defined ordinal nature.

2.1.5.2 Findings from the DMQ

Whilst this study aimed to devise a measure of DR as part of a measure of memory experiences, it also provided some initial data on the norms of dreaming in a student population. However further distributing the DMQ may provide more valid data in this area, as respondents had to complete a lengthy questionnaire including reporting up to six dreams. Fatigue or boredom effects may have prevented participants from adequately considering responses.

The first finding of note concerns the open-ended responses to question 84 ("why do you think there are differences between people in the way that they dream?"). Whilst only four responses were collected, these referred to widely documented theories of individual differences in DR, such as cortical arousal, personality dimensions of creativity, differences in memory abilities and age; reflecting cognitive developmental theories of dreaming. Participants were therefore aware

of the processes surrounding DR. This is reassuring considering the self-report nature of the DMQ as a measure of DR.

Overall there was less variance in the DMQ scores than anticipated. However investigating this in terms of individual differences in other abilities or personality traits would further elucidate the extent of the variance in the DMQ scores.

2.1.5.3 Individual differences implications

The cited effects of gender upon DR were not able to be investigated in this study due to the uneven gender balance of the sample. Whilst it may be difficult to disentangle certain personality trait effects, such as gender and openness to experience and thin boundariness, for instance, future studies should further investigate the gender effects of DR. Whilst this study has not provided any evidence to suggest that these effects exist, a sample comprising an equal number of males and females would facilitate comparisons. The relationship between the DMQ and other traits also require investigation.

2.1.5.4 Reliability of the DMQ: relationships with dream reports

As the regression equation predicting the DMQ with aspects of the dream report measures was not significant, it appears as if the second aspect of the questionnaire could not accurately predict the total scores from the validated items from the main part of the questionnaire. Thus the different aspects of remembering dreams may not be similarly composed of cognitive, i.e. memory based aspects as well as the detail, length and clarity ratings of dream reports themselves. It is worth remembering that these measures are different and thus it is not surprising that the two aspects are tapping into the same underlying construct. However they were significantly correlated and so there was some degree of agreement between the measurements here. In addition there were some significant findings when the factors of the DMQ were regressed separately. Factor 1 (awareness of dreaming) was significantly predicted by a number of dream measures.

The measures from second part of the questionnaire that best correlated with the factors of the DMQ were detail (early) and clarity (early and recent). These ratings are very similar to the detail and episodic richness (respectively for detail and clarity) ratings used in the Autobiographical

Memory Interview. Thus similar methodologies for rating memories and dreams can be adopted. Whilst statistical agreement between the DMQ and the dream report measures were found, this reflects how the DMQ is a reliable measure of memory experiences, such as dreams. However measuring awareness of these experiences in numerous ways should also be encouraged, as diary report measures or laboratory awakenings may still produce different indices of DR, and they do not all seem highly reliable (Foulkes, 1979; Schredl, 2001).

Taken altogether the questionnaire, composed of these six factors, appears to be a well-rounded measure of DR (within Factor 1) and memory experiences (the DMQ as a whole). Both detail (from diary style measures) ratings and self report questionnaires have correlated together significantly. This has implications for the methodological reliability of the construct of DR. In addition investigations of DR using simplistic measures of just one or two self report questions or detail measures of reports, for instance, are reminded that DR is composed of a number of different factors. Individuals interested in specific aspects of DR are encouraged to use items of this questionnaire that tap into those specific constructs, such as detail, clarity or more sensation-based experiences.

Whilst this study has demonstrated that DR relates to aspects of autobiographical remembering such as rumination or experiencing the sensations of déjà-vu, there is much evidence to suggest that DR is at least as much a product of individual differences in personality, as individual differences in memory styles. Thus the DMQ needs to be correlated with a number of trait measurements in order to further incorporate the DMQ as a measure of DR into the literature on dreaming, as well as to empirically investigate the contentious relationships between DR and personality.

2.2 Experiment 2: Trait Correlates of the Dream Memory Questionnaire

2.2.1 Introduction

Experiment 1 developed the Dream Memory Questionnaire (DMQ) as a psychometrically validated tool for measuring memory experiences and DR. Whilst it related to diary-style measures of dreaming, as well as sensations of autobiographical memory, Experiment 2 aimed to see if the DMQ related to trait measures that have been found to relate to other dream memory indices in the past. Many investigations of dream recallability have focused upon the correlates of DR (see Schredl & Montasser, 1996-7 a and b for a review). Such traits included openness to experience (e.g. Kothe & Pietrowsky, 2001), gender (Blagrove & Akehurst, 2000; Spanos *et al.*, 1980), fantasy proneness (Giesbrecht & Merckelbach, 2006), morningness-eveningness (Blagrove & Akehurst, 2000), absorption in imaginings (Beaulieu-Prevost & Zadra, 2007), thin boundaries (Hartmann, 1991), stress (Duke & Davidson, 2002), anxiety (Schonbar, 1965), arousal (Hicks, Fortin & Brassington, 2002), and attitudes towards dreams (Beaulieu-Prevost & Zadra, 2005 and 2007; Schredl *et al.*, 2003).

Schonbar (1965) proposed the lifestyle hypothesis as an explanation for the relationships between a host of personality variables and DR (see 1.3.4 for more information). It was proposed that individuals who are "introspective, field independent, introverted, creative and those who have an internal locus of control, a divergent style of thinking, and high imagination recall dreams more often..." (Schredl & Montasser, 1996-7a, p185). According to Schonbar, these traits are similar and reflect a whole way of life, and recalling dreams is a part of that. Whilst the theory was not explained in great detail, the personality traits relating to DR do seem to be similar and could be measuring the same underlying construct.

Other personality traits proposed to relate to DR can be explained by other theories of recall generally. The arousal-retrieval (Koulack & Goodenough, 1974, see 1.3.5) and the functional-state shift (Koukkou & Lehmann, 1983, see 1.3.6) models place arousal as central in their explanations of why some dreams are recalled, and others forgotten. Arousal may also mediate the relationships between DR and stress, and anxiety.

There is a wealth of research investigating the relationships between state and trait factors, and DR (see Schredl and Montasser, 1996-7 a and b for a comprehensive review). However the findings are far from clear. With almost all the personality traits described above, there are as many studies unable to replicate the relationships, as there are positive findings. Schredl and Montasser (1996-7 a and b) note that the traits seemingly stable in their relation with DR are fantasy proneness, thin boundaries and creativity. Blagrove and Akehurst (2000) note that DRF correlates with interrogative suggestibility, hypochondriasis and confabulation of narrative memory. Such findings may be indicative of the demand bias of self-report measures. In addition Wolcott and Strapp (2002) extensively compare the relationships between DRF measures and various traits, and dream detail measures. In fact the profile of the two measurements were quite different, with DRF relating to emotionally disturbing dreams and trying to interpret dreams, whilst dream detail was correlated with a positive attitude towards dreams and Type B personality.

As the DMQ requests information about DRF as well as characteristics of autobiographical remembering, Factor 1 is proposed to be a measurement of both DRF and dream detail in a general assessment of dream recallability. This experiment therefore aimed to iron out the discrepancies between the individual differences correlates of DR as well as investigating relationships with memory experiences. DRF has been found to have small correlations with a number of individual differences traits and cognitive measures. The DMQ allows for such relationships to be assessed beyond merely DRF and into the realm of memory experiences more generally. Watson (2001) attempted to do this in terms of sleep experiences and schizotypy and dissociation, finding high correlations. A similar study was then conducted (2003) focusing upon DRF and schizotypy, as well as a number of other personality traits (mainly openness to experience). Ine ach case, Watson concluded that these measures seem to tap into a common contruct of "unusual cognitions and perceptions" (2001, p526).

The current study was interested not only in DRF and its correlates, but also memory experiences more generally. Whilst the DMQ produces one score reflecting a likelihood of recalling memory experiences, its component factors were also correlated with the traits described above, as well as the White Bear Suppression Inventory, a measure of thought suppression, in order to investigate the relationships between these variables. This questionnaire was proposed to be a measure of the repression hypothesis. It was hypothesized that all these measures would correlate significantly with the DMQ, with lower scores relating to openness to experience, morningness (as opposed to

eveningness), absorption in imaginings, stress, anxiety, arousal, "Q" scores (see below), fantasy proneness, thin boundaries, thought suppression and a positive attitude towards dreams. As a lower score on the DMQ indicates a higher propensity to recall memory experiences such as dreams, some of the predicted relationships were negative. It was not hypothesized that there would be a relationship with the DES, however, as recalling dreams is not a dissociative experience, despite the fact that there is evidence between false memory styles and dissociativity (Wilson & French, 2006), sleep experiences and dissociation (Giesbrecht & Merckelbach, 2006) and DRF and dissociation (Suszek & Kopera, 2005). It is anticipated that in this study, involving the use of a well designed and psychometrically valid measure of memory experiences for the first time, dissociative experiences will not correlate with scores on the DMQ.

2.2.2 Method

2.2.2.1 Participants

Altogether two hundred and twenty one respondents completed the questionnaires, which were only available online. However certain parts of each task were omitted so the mean N for the final scores is approximately one hundred and seventy (see Table 2.2.1 below for sample sizes for each questionnaire). The sample mainly comprised of Psychology students from the University of Leeds (78%), who were rewarded with a course credit upon successful completion. Twenty one participants (10%) were students of Social Sciences from Leeds Metropolitan University. The remainder of the sample was gathered opportunistically. Demographics indicate that the sample was predominantly female (166 compared to 33 males; 22 participants did not disclose their gender), with a median age of 19 years. 81% of the overall sample were or had been students of psychology at the time of completing the questionnaires. Due to the predominantly female and young sample, scores were not compared across males and females, or age groups. 14% of the sample had a sleeping routine whereby everyday was largely the same, 35% had a consistent routine whereby most days were the same, 25% had a reasonably consistent routine, but it was not strict, 15% had a more inconsistent routine, but they felt that they likely slept for a similar amount of time each night, and 11% felt that their sleeping routine varied considerably. When asked to report for how long participants slept on average each night, 11% slept for less than 5 hours, 29% between 5 and 7 hours, almost half the sample (47%) slept between 7 and 9 hours, and just 3% slept for more than 9 hours. 10% of the sample felt that their routine was too varied to report an average sleep time.

2.2.2.2 Materials

The group of questionnaires were administered over the internet, and can be found at http://www.psyc.leeds.ac.uk/q/dreams. It consisted of a number of measures, comprising (in order):

- The DMQ (see Experiment 1/Appendix B)
- Big Five Inventory (BFI; John, Donahue & Kentle, 1991) measuring five personality traits (openness to experience, extraversion, agreeableness, conscientiousness and neuroticism), with openness to experience being the main trait of interest
- Composite Scale of Morningness (CSM; Smith, Reilly & Midkiff, 1989) measuring morningness-eveningness
- Dissociative Experiences Scale (DES; Ellason, Ross, Mayran, & Sainton, 1994)
- Tellegan Absorption Scale (TES; Tellegan & Atkinson, 1974) measuring absorption in imaginings
- Perceived Stress Scale (PSS; Cohen, Kamarck & Mermelstein, 1983)
- State Trait Anxiety Index (Spielberger, 1983).
- Stress and Arousal Checklist (Duckro, Korytnyk & Vandenberg, 1989) measuring stress, arousal and a "Q" score, measuring an ability to identify and express emotion.
- Creative Experiences Questionnaire (CEQ; Merckelbach, Horselenberg, & Muris, 2001) measuring fantasy proneness
- Hartmann's Boundaries Questionnaire (Hartmann, 1991) measuring thin boundaries
- White Bear Suppression Index (WBSI; Wegner & Zanakos, 1994) measuring thought suppression
- Attitudes Towards Dreams (Beaulieu-Prevost & Zadra, 2005)

The entire questionnaire took approximately 45 minutes to complete, and consisted entirely of multiple choice responses (with the exception of the DES, in which participants submitted the percentage of time that they experienced or engaged in particular behaviours).

2.2.3 Results

2.2.3.1 Descriptive Statistics

Each questionnaire produced scores that could be summed or average in order to produce at least one overall measurement. These were subsequently correlated with scores from the DMQ. Table 2.2.1 shows the descriptive statistics across the traits measured. A large range of DMQ scores were found, indicating great variance in memory experience and DR trends in the sample.

Three tests of normality of data were conducted before correlation analyses were carried out. The Kolmogorov-Smirnov test was firstly conducted, and indicated whether the distribution was significantly different to a normal distribution. The standard alpha level of $p<0.05$ was adopted. Histograms with a normal curve allowed the distributions to the compared, requiring the data to have a bell shape, and P-P plots required the data to be distributed linearly (normally). If at least 2 of the tests implied normality, that variable would be subjected to parametric tests (Pearson's correlations). If normality was not assumed, Spearman's rho correlation was conducted. Normally distributed variables were: DMQ factor 6, openness to experience, agreeableness, conscientiousness, neuroticism, CSM, absorption, STAI, CEQ, thin boundaries factors 1-3 and 5-12, and attitude towards dreams. Non-normal variables were: DMQ factors 1-5, extraversion, DES, PSS, SACL stress, SACL arousal, SACL "Q" score and thin boundaries factor 4.

The DMQ total variable was normally distributed, however it was included in both the parametric and non-parametric analyses in order that appropriate relationships could be compared. In addition the variable had a kurtosis statistic of 1.64, which is indicative of a tendency to cluster around a mid-point (normal distributions have a kurtosis value of 0). Thus this variable was not inappropriate for analyses using both Spearman's as well as Pearson's correlation coefficients.

Table 2.2.1 Descriptive statistics for trait scores

	N	Minimum	Maximum	Mean	Std. Deviation
DMQ total	186	5	135	80.48	16.84
DMQ factor 1	188	1	36	15.20	5.49
DMQ factor 2	188	1	30	15.81	6.07
DMQ factor 3	188	2	30	21.18	5.07
DMQ factor 4	188	1	19	8.53	3.04
DMQ factor 5	188	1	15	9.17	3.22
DMQ factor 6	188	1	15	10.37	2.26
BFI openness	186	21	46	35.02	5.64
BFI extraversion	186	3	40	27.13	6.41
BFI agreeableness	186	3	44	32.34	7.52
BFI conscientiousness	186	3	43	30.18	7.05
BFI neuroticism	186	10	40	24.95	6.06
CSM	185	14	49	31.14	6.92
DES	179	0.72	50	15.63	10.48
absorption	181	6	135	84.09	23.65
PSS	182	2	50	28.34	6.67
STAI	182	5	73	44.17	11.33
SACL stress	178	0	18	5.16	4.57
SACL arousal	181	0	12	5.20	3.52
SACL "Q" score	180	0	22	4.88	4.50
CEQ	182	1	22	9.43	4.52
Thin boundaries factor 1	178	0	36	19.96	7.75
Thin boundaries factor 2	175	0	46	25.51	8.54
Thin boundaries factor 3	178	0	42	23.87	8.56
Thin boundaries factor 4	178	0	21	8.76	4.51
Thin boundaries factor 5	178	1	33	18.95	6.08
Thin boundaries factor 6	175	1	16	9.53	3.04
Thin boundaries factor 7	178	2	31	17.24	5.64
Thin boundaries factor 8	178	0	46	26.21	8.33
Thin boundaries factor 9	178	0	27	15.86	5.24
Thin boundaries factor 10	178	0	26	15.36	4.91
Thin boundaries factor 11	178	0	39	22.54	6.53
Thin boundaries factor 12	178	0	24	12.82	3.98
Thin boundaries total	178	11	362	230.50	63.64
WBSI	174	6	74	51.52	11.47
ATDs	174	1	6.67	4.05	1.29

2.2.3.2 Correlations

As can be seen from Tables 2.2.2 to 2.2.4, the DMQ correlates with a number of the personality variables. Specifically, the total DMQ score was significantly correlated with high scores on extraversion, the DES, WBSI (thought suppression), openness to experience, neuroticism, absorption in imaginings, CEQ, attitudes towards dreams, thin boundaries (total) and its factors 1 ("sleep/wake/dream"), 2 ("unusual experiences"), 3 ("thoughts, feelings, moods"), 4 ("childhood, adolescence, adulthood"), 6 ("sensitivity"), 7 ("neat, exact, precise"), 8 ("edges, lines, clothing"), 9 ("opinions about children") and 11 ("opinions about peoples, nations, groups").

Whilst the DMQ was related to a number of traits, the factors within the DMQ showed a slightly different profile. The coefficients significant at the Bonferroni corrected alpha levels (see each Table for specific values) have been adopted as significant in all these analyses. From Tables 2.2.2 to 2.2.4, so not comparing parametric traits with non-parametric traits, it can be seen that the traits correlating with the total DMQ score also tended to correlate with the factors of the DMQ as well. However Factor 1 ("awareness of dreaming") correlated with "Q" score, Factor 3 ("comprehensibility of dream sensations upon waking") correlated with the WBSI (this neared significance for the DMQ total, $p<0.05$), Factor 5 ("comprehensibility of dream content") correlated with the stress measure of the SACL, and Factor 6 ("senses") correlated with the STAI. Table 2.2.5 shows the non-parametric relationships between all factors of the DMQ, and all other traits (omitting the factors within the Boundary Questionnaire, for clarity). Factors 2 and 4 were correlated with neuroticism, whilst the DMQ total score was not, and Factor 2 was also correlated with the WBSI, whilst the DMQ total score was not.

Table 2.2.2 Spearman's correlation coefficient matrix for the non-parametric variables

	DMQ factor 1	DMQ factor 2	DMQ factor 3	DMQ factor 4	DMQ factor 5	extra-version	DES	PSS	SACL stress	SACL arousal	"Q" score	Factor4	WBSI
DMQ total	***0.77***	***0.60***	***0.83***	***0.46***	***0.63***	**-0.15**	***-0.36***	-0.06	-0.09	-0.04	0.08	***-0.29***	**-0.14**
DMQ Factor 1		***0.26***	***0.59***	***0.19***	***0.50***	**-0.15**	-0.11	-0.01	-0.02	-0.06	***0.21***	***-0.19***	-0.07
DMQ Factor 2			***0.33***	**0.15**	***0.17***	0.00	***-0.33***	**-0.16**	-0.11	0.09	-0.06	***-0.21***	***-0.22***
DMQ Factor 3				***0.36***	***0.55***	***-0.18***	***-0.36***	-0.04	-0.05	-0.07	0.06	***-0.23***	-0.12
DMQ Factor 4					***0.22***	**-0.13**	***-0.34***	0.04	-0.10	0.03	-0.12	***-0.19***	-0.03
DMQ Factor 5						-0.02	***-0.21***	**-0.14**	***-0.25***	-0.04	0.07	**-0.16**	-0.07
Extraversion							0.04	***-0.17***	***-0.17***	***0.17***	0.00	**0.15**	0.05
DES								***0.36***	***0.27***	***-0.17***	0.08	***0.44***	***0.36***
PSS									***0.56***	***-0.22***	***0.26***	0.10	***0.35***
SACL stress										***-0.22***	***0.20***	**0.13**	***0.30***
SACL arousal											-0.04	-0.01	-0.12
SACL q												0.04	0.07
Factor 4													***0.27***

Bold type indicates coefficients significant at $p<0.05$ level
Bold and italicized type indicates coefficients significant at $p<0.01$ level (also significant at the Bonferroni corrected level of $p<0.0005$)
"Factor 4" refers to Factor 4 of Hartmann's Boundary Questionnaire

Table 2.2.3 Pearson's correlation coefficient matrix for parametric variables

	DMQ Factor 6	Openness	Agree-Ableness	Conscient-lousness	Neuro-ticism	ME	Absorption	STAI	CEQ	WBSI	ATDs	Thin Bound-aries total
DMQ total	***0.48***	***-0.32***	0.00	0.01	**-0.13**	-0.01	***-0.35***	-0.03	***-0.49***	-0.10	***-0.45***	***-0.19***
DMQ factor 6		***-0.16***	-0.01	0.08	0.06	-0.06	-0.02	***0.22***	***-0.20***	***0.23***	**-0.15**	**0.16**
openness			0.04	-0.06	0.04	0.02	***0.46***	0.03	***0.36***	***0.18***	**0.14**	***0.19***
agreeableness				***0.19***	***-0.21***	0.06	***0.19***	-0.11	**0.15**	-0.08	**0.14**	***0.28***
conscientiousness					-0.02	***0.30***	-0.08	-0.03	**-0.16**	-0.08	-0.03	0.10
neuroticism						-0.05	0.11	***0.68***	***0.23***	***0.33***	0.08	**0.13**
ME							-0.04	**-0.15**	***-0.17***	***-0.19***	**-0.16**	***-0.18***
Absorption								***0.27***	***0.61***	***0.35***	***0.29***	***0.65***
STAI									***0.22***	***0.53***	0.05	***0.36***
CEQ										***0.25***	***0.40***	***0.45***
WBSI											0.11	***0.35***
ATDs												***0.28***

Bold type indicates coefficients significant at $p<0.05$

Bold and italicized type indicates coefficients significant at $p<0.01$ (also significant at the Bonferroni corrected level of $p<0.0006$).

Table 2.2.4 Pearson's correlation matrix for the factors within Hartmann's Thin Boundaries Questionnaire (except factor 4)

	factor1	factor2	factor3	factor5	factor6	factor7	factor8	factor9	factor10	factor11	factor12
DMQ total	**-0.31**	**-0.21**	**-0.18**	-0.11	**-0.15**	***-0.22***	***-0.20***	***-0.21***	-0.12	***-0.20***	-0.11
factor1		***0.68***	***0.77***	***0.65***	***0.44***	***0.47***	***0.64***	***0.67***	***0.45***	***0.61***	***0.60***
factor2			***0.75***	***0.68***	***0.58***	***0.46***	***0.57***	***0.66***	***0.53***	***0.71***	***0.59***
factor3				***0.69***	***0.46***	***0.47***	***0.63***	***0.67***	***0.47***	***0.68***	***0.59***
factor5					***0.55***	***0.36***	***0.56***	***0.64***	***0.41***	***0.63***	***0.52***
factor6						***0.37***	***0.34***	***0.56***	***0.31***	***0.48***	***0.39***
factor7							***0.38***	***0.37***	***0.60***	***0.50***	***0.37***
factor8								***0.56***	***0.45***	***0.57***	***0.41***
factor9									***0.40***	***0.60***	***0.50***
factor10										***0.58***	***0.40***
factor11											***0.57***

Bold type indicates coefficients significant at $p<0.05$

Bold and italicized type indicates coefficients significant at $p<0.01$ (also significant at the Bonferroni corrected level of 0.0007).

Table 2.2.5 Spearman's correlations between the DMQ and its factors, and all other traits

	DMQ Total	DMQ factor1	DMQ factor2	DMQ factor3	DMQ factor4	DMQ factor5	DMQ factor6
openness	***-0.33***	***-0.25***	***-0.19***	***-0.25***	***-0.27***	-0.10	***-0.21***
extraversion	**-0.15**	**-0.15**	0.00	**-0.18**	**-0.13**	-0.02	-0.06
agreeableness	-0.09	**-0.15**	0.01	-0.03	0.04	-0.03	-0.09
conscientiousness	-0.05	-0.11	**0.17**	0.00	-0.09	**-0.15**	-0.02
neuroticism	**-0.13**	**-0.15**	***-0.20***	-0.06	-0.02	***-0.19***	0.06
ME	-0.03	-0.08	0.09	0.00	-0.06	-0.04	-0.07
DES	***-0.36***	-0.11	***-0.33***	***-0.36***	***-0.34***	***-0.21***	-0.05
absorption	***-0.39***	***-0.26***	***-0.31***	***-0.32***	***-0.26***	**-0.16**	-0.08
PSS	-0.06	-0.01	**-0.16**	-0.04	0.04	**-0.14**	0.08
STAI	-0.05	0.01	**-0.19**	-0.02	-0.03	-0.12	**0.16**
SACL stress	-0.09	-0.02	-0.11	-0.05	-0.10	***-0.25***	0.04
SACL arousal	-0.04	-0.06	0.09	-0.07	0.03	-0.04	-0.10
"Q" score	0.08	***0.21***	-0.06	0.06	-0.12	0.07	0.10
CEQ	***-0.50***	***-0.34***	***-0.45***	***-0.42***	***-0.27***	***-0.21***	**-0.18**
TB factor1	***-0.34***	***-0.24***	***-0.28***	***-0.31***	-0.08	***-0.20***	-0.01
TB factor2	***-0.25***	**-0.16**	***-0.14***	***-0.24***	-0.10	***-0.27***	0.04
TB factor3	***-0.24***	-0.08	***-0.26***	***-0.20***	-0.10	**-0.13**	0.00
TB factor4	***-0.29***	***-0.19***	***-0.21***	***-0.23***	***-0.19***	**-0.16**	-0.06
TB factor5	**-0.15**	-0.07	-0.09	**-0.17**	-0.06	**-0.17**	0.00
TB factor6	**-0.17**	**-0.13**	0.00	***-0.19***	-0.06	***-0.24***	-0.01
TB factor7	***-0.27***	***-0.23***	**-0.15**	***-0.22***	**-0.14**	***-0.18***	0.04
TB factor8	***-0.25***	**-0.14**	***-0.21***	**-0.15**	***-0.21***	**-0.15**	-0.03
TB factor9	***-0.28***	***-0.21***	-0.12	***-0.23***	***-0.22***	**-0.18**	-0.08
TB factor10	***-0.18***	-0.05	**-0.15**	**-0.17**	***-0.25***	**-0.18**	0.07
TB factor11	***-0.22***	**-0.16**	**-0.17**	**-0.13**	**-0.14**	**-0.15**	0.00
TB factor12	-0.12	-0.06	-0.05	-0.12	-0.05	-0.09	-0.04
WBSI	**-0.14**	-0.07	***-0.22***	-0.12	-0.03	-0.07	0.11
ATDs	***-0.47***	***-0.44***	-0.10	***-0.41***	***-0.30***	***-0.44***	**-0.16**
TB total	***-0.29***	***-0.18***	***-0.20***	***-0.24***	**-0.17**	***-0.23***	0.01

Bold type indicates coefficients significant at $p<0.05$
Bold and italicized type indicates coefficients significant at $p<0.01$ (also significant at the Bonferroni corrected level of 0.0007).
"TB" refers to Thin Boundaries: the factors within Hartmann's Boundary Questionnaire.

2.2.3.3 Reliability of DMQ

DMQ scores were similar to those obtained in experiment 1. The means (and SDs) for the total scores from Experiment 1 and 2 were 80.2 (15.8) and 80.5 (16.8), respectively. These did not

differ significantly (T (388) -.18, n.s.). In fact, the means are almost identical and the variances are comparable. This implies a high degree of reliability of the DMQ scale when administered in a predominantly female and student sample.

2.2.4 Discussion

The DMQ was found to correlate with openness to experience, absorption in imaginings, fantasy proneness, attitudes towards dreams, thin boundaries and a number of components of thin boundariness. In addition it was correlated with dissociative experiences. It was not related to thought suppression (although this almost reached significance), the Big Five personality traits excluding openness to experience (extraversion, agreeableness, conscientiousness, and neuroticism), or any of the stress, anxiety and arousal measures (PSS, STAI, SACL (stress), SACL (arousal), "Q" scores and morningness-eveningness). In addition the DMQ did not relate to thin boundaries factors 5 ("interpersonal"), 10 ("opinions about organisations and relationships") and 12 ("opinions about beauty, truth"). The traits that related to the DMQ tended to also relate to the DMQ's component factors, showing stability across the range of questions.

Overall the DMQ related to a number of traits, as predicted. Its lack of a relation with thought suppression (WSBI scores) was slightly surprising. This correlation requires further analysis, as it neared significance when correlated with the DMQ overall, and reached significance when related to Factors 2 ("daydreaming") and 3 ("comprehensibility of dream sensations upon waking") of the DMQ. Its lack of a relationship with factor 1 ("awareness of dreaming") reinforces the finding that thought suppression is unrelated to dream recallability overall.

The most surprising finding concerns the strong relationship between the DMQ and the DES scores. It was predicted that the correlation would not be significant, due to dreaming (and presumably other memory experiences) not being a dissociative experience. However the clear finding can be explained in two ways. Firstly, the DES may measure, among other things, an awareness of particular experiences. Such awareness may well be crucial in DR, when being sensitive to perceptions and experiences that are not typical in everyday wake life, is important. Secondly, all the traits measured in this experiment (with the exception of the BFI personality traits (excluding openness to experience), stress, anxiety and arousal) may essentially be measuring the same construct, that of a general awareness of ones own experiences, for example.

Indeed, the many traits discussed here do seem similar in terms of their component measurements.

Support for the latter explanation comes from the inter-item correlations, which are high, with an overall mean of .26, which increased slightly to .27 when only those variables significantly relating to the DMQ total were included (NB the direction of the relationship was ignored in these calculations, as the mixture of positive and negative relationships would have lowered the mean inter item correlation and detracted from the overall strength of relationship).

As a result of the overall high correlations between these variables, it may be logical to consider the similarities between the variables. Indeed John and Srivastava (1999) note that the Big Five personality traits were so called because they were generic traits that encompassed many facets of each personality trait. Whilst each trait's independence has been reinforced in numerous studies and factor analyses, the "openness to experience" trait has itself been termed "intellectance", "imagination" and "culture", to name but a few (John & Srivastava, 1999). Considering that the traits described above are indeed highly similar, they may relate to DR via the mediator of attitude towards dreams. That is, being generally aware of one's own experiences, such as dreams, may increase a positive attitude towards dreams, and vice versa. A positive attitude towards dreams may encourage rumination or rehearsal of dream experiences, thus relating both cognitive and individual differences explanations for the relationships between certain personality traits and dream recallability. The high degree of similarity between these factors seem to support Schonbar's lifestyle hypothesis. However I propose cognitive mechanisms underlying the ways in which the traits influence DR.

Other than the remaining Big Five personality traits, the variables measuring arousal, stress and anxiety did not correlate with DR. Schredl *et al.*'s (2003) structural equation model of DR predicts that the relationship between stress and DR is mediated by sleep, and does not have a direct influence upon recallability itself. Previous relationships have been found between stress and arousal measures, and DRF (see Schredl & Montasser, 1996-1997a and b for a review) however this experiment did not find evidence of such a relationship. This is not surprising as stress and arousal may increase DRF in some instances (heightened arousal, for instance) and decrease it in others (by attending to the stressor as opposed to dreams, for example). In addition, both the arousal-retrieval model (Koulack & Goodenough, 1976) and the functional state-shift hypothesis (Koukkou & Lehmann, 1983) aim to account for variance in DR entirely in terms of

arousal. It is worth remembering that the DMQ's Factor 5 ("comprehensibility of dream content") correlated with the stress measure of the SACL, and Factor 6 ("senses") correlated with the STAI. Despite this there is convincing evidence that these measurements of stress and arousal did not relate, overall, to dream recallability. Whilst high stress was predicted to relate to high DR, the relationship could also be negative. Some studies (e.g. Witkin & Lewis, 1965) found a decrease in DR following stressful films. The findings were explained in terms of repression. Indeed, some old studies have found repressors to have lower DR than sensitizers (e.g. Tart, 1962). Thus with potential explanations of a relationship between stress and DR being negative (repression hypothesis) as well as positive (e.g. salience hypothesis or being mediated by sleep quality and arousal), it is not overly surprising that clear correlations were not found. As stress may be a state as well as a trait factor, and can be measured in a number of ways, further measurements over time for each individual may offer a more clear account of the relationship between stress and DR. In addition arousal was measured in a self-report design, which may have lacked validity. Psycho-physiological measurements would be preferable in future investigations. Despite this the CSE has been found to be both a reliable and valid measure, and yet the predicted relationship between morningness and dream recallability was not supported. This offers persuasive evidence that self-report measures of arousal may not predict dream recallability. Rather, neurocognitive models of dreaming such as Hobson *et al.*'s (e.g. 2000) claim that neuro-modulation over the sleep-wake state can affect arousal. Measures such as the CSM do not take this into account. Thus the relationships between arousal, stress and dream recallability may not have been tested most accurately in this experiment.

In conclusion this experiment offers convincing evidence that DR and memory experiences generally are related to a number of personality traits, including openness to experience, dissociative experiences, absorption in imaginings, fantasy proneness, thin boundaries and having a positive attitude towards dreams. It is proposed that these traits are largely similar and relate to a personality style involving awareness to ones own experiences in life. Such a style may lead to an increased positive attitude towards dreams, which may result in rehearsal of dream experiences, thus consolidating them in LTM.

Summary

This chapter presented two experiments. A psychometrically validated measurement of memory experiences was developed, which was subsequently found to relate to a number of alternative

measurements of dream recallability, such as time since the earliest remembered dream and detail and clarity (like episodic richness) ratings of earliest and recent dream reports. Factor 1, in particular, measured an awareness of dreaming. Its relationship with measurements of earliest dreams indicates two things. Firstly, memory for early experiences may require a particular autobiographical memory profile that is conducive to recalling dreams. Secondly, early dreams may be particularly detailed or vivid and therefore predictive of current dream patterns. Such dreams that are characteristically detailed or episodically rich early in life may continue to be so throughout life. This implies that individuals who are likely to dream particular kinds of dreams may have a personality profile that is sensitive towards DR. Experiment 2 investigated this further, correlating a number of traits with the DMQ.

As the DMQ related to so many similar traits, it may be appropriate to adopt a "lifestyle" approach to DR, in which individuals who are open to experience tend to also score highly on dissociative experiences questionnaires, and adopt a positive attitude towards dreams et cetera. Thus recalling dreams may well form part of that individual's routine as influenced by their general personality profile, rather than their scores on just one or two independent trait measures. In addition this profile may increase the likelihood of attending to dreams, being aroused enough to encode them upon waking, rehearsing them and ruminating on them in waking life.

In conclusion there is evidence that recalling dreams relies upon processes of autobiographical remembering. An aim of this chapter was to assess whether a likelihood of recalling dreams is a cognitive ability, or one that is more associated with certain personality traits. Much variance in the DMQ scores, some of which related to variance personality traits, was found. DR therefore may well be the product of both cognitive and personality factors. However these two aspects may not be entirely independent. As there is such variance in DR, there is likely great variance in styles of autobiographical remembering, also. Finally, a particular personality trait, such as being open to experience, may result in encoding experiences in a more deep way or rehearsing them, thus leading to enhanced DR.

Chapter 3: Experimental Investigations of Memory Correlates of Dream Recall

Introduction

Widespread individual differences in recalling dreams, on a daily basis, have been observed. It has proved difficult to adequately account for these individual differences. The previous questionnaire studies (Experiments 1 and 2) addressed this issue. Schredl (2003) also attempted to do this by investigating personality traits, attitude ratings and memory measures in the form of a structural equation model. His final model included a number of correlates of DRF, but taken altogether they only accounted for a modest 8.4% of variance. His significant predictors were personality (as measured by openness to experience, thin boundaries and absorption), creativity, nocturnal awakenings and attitude towards dreams. In addition he also assessed visual memory, although this was not included in the final model as it did not adequately account for the variance. Individual measures of visual memory, however, correlated with DRF (object recall r=.44, map retracing r=.37, film scenes recall r=.72, film detail recall r=.50; these correlations refer to the relationships between visual memory and the overall model), whilst the sum of the measures which produced the general construct of visual memory, did not (r=.07). The relationship between DR and visual memory has been investigated in several studies, although a clear pattern has not emerged. It would seem, however, that a relationship must exist as Solms (1997), for instance, noted that damage to the visual cortex led to a total cessation of dreaming. Damage to other brain areas did not have this effect. The act of remembering a dream typically involves the recall of a series of images in a markedly incoherent structure or narrative. Thus it seems likely that there should be a positive correlation between visual memory ability and DR.

Whilst some investigations have found a positive correlation between DR and visual memory (e.g. Cory, Ormiston, Simmel & Dainoff, 1975; Lloyd, 1976; Schredl, Frauscher & Shendi, 1995; Simmel & Dainoff, 1975), the relationship has not always been found (e.g Cohen, 1971, Schredl *et al.*, 2003). Schredl (2003) suggests that this is the result of the choice of task used, in that pure visual memory measures seem to relate to DRF, whilst tasks confounded by elements of verbal memory, such as recalling tasks with a written component, do not. As stated above, combining these different measures of visual memory has proved problematic.

Whilst the empirical studies on DRF have touched upon visual memory as a predictor of DR, other aspects of memory have not been investigated. As a result Schredl's explanation that verbal memory tasks confound the relationship between visual memory and DRF may be inappropriate. It is surprising that memory abilities generally have not been investigated in relation to dream memory in the past, as memory abilities may relate to DR for two main reasons. Firstly, as mentioned above, the process of recalling dreams involve recalling memories for ones own experiences, namely, visual autobiographical memories. Secondly, numerous studies have noted the continuity in terms of cognitive processing between waking and dreaming consciousnesses (see Fitch & Armitage, 1989, for a review). In addition studies that focus upon individual differences traits correlating with DRF also tend to conclude that there is evidence, again, for the continuity between dreaming and waking consciousnesses.

Schredl *et al.* (2003) note that consistent links between visual memory and DRF that have been reported for elderly persons (e.g. Schredl *et al.*, 1996b; Waterman, 1991) and patients with dementia (Brunner *et al.*, 1972; Kramer *et al.*, 1975 both cited in Schredl *et al.*, 2003). In another experiment DRF in an older population (70-90) was only half the frequency found in the college student population (Khan & Fisher, 1968, cited in Robbins, 1988). This is taken to support the idea that DR is accounted for by memory abilities as STM is reported to decline in older populations.

In order to further test these theories, developmental studies testing various age groups (or treating age as a variable in correlation studies) may be more appropriate. This comparison of the inconsistent findings in young adults with the consistent findings in persons with lowered cognitive functioning might suggest what Schredl *et al.* (2003) called a "threshold model". According to this view when within a normal range of cognitive functioning (presumably young adulthood) a correlation between visual memory and DRF does not exist. However when below a certain threshold, the lowered cognitive performance leads to reduced DR and the emergence of the correlations. The evidence for this is slight, with just two studies supporting the relationship between visual memory and DRF in older populations. Cognitive functions certainly require investigation.

Whilst other investigations of the relationship between DR and memory have used a variety of memory tasks, none have used systematic experimental presentations, grounded in memory research. This chapter presents two experiments that employ recognition tasks, based upon a

paradigm employed in classic memory research. In addition Experiment 4 uses a recall task measure, in order to compare the retrieval processes at work when recalling dreams and episodic memories.

3.1 Experiment 3: Long-Term Memory Correlates of the Dream Memory Questionnaire: Recognition of Pictures, Words and Nonwords

3.1.1 Introduction

As a dream memory trace seems to decay so rapidly, there may be a relationship between short or medium term memory and memory experiences. Indeed, Koulack and Goodenough's (1974) arousal-retrieval hypothesis states that being aroused immediately after a dream enables the dream's memory trace to be transferred from STM to LTM. Due to STM's duration being approximately two minutes at most, immediate arousal when waking would lead to a dream memory being consolidated in LTM. However the majority of investigations into dream memory rely upon LTM for DR, and self report measures of dream memory. The present experiment investigates the relationship between LTM abilities and awareness of memory experiences (dreams in particular through the measurement of Factor 1 of the DMQ), with an interval between learning and test of approximately three minutes. Whilst this is a relatively short interval between learning and test, it is a measurement of LTM which may mimic the time interval between dreaming and waking, when rousing from a night's sleep. The hypothesis was that DMQ scores would significantly correlate with the visual memory measures, but not with the measures of verbal memory.

The present study uses the validated DMQ as a measure of memory experiences, and Factor1 as a measure of awareness of dreaming (DR). LTM in this instance is defined as memories of stimuli and episodes that were presented or experienced approximately three minutes previously. Significant negative correlations between memory measures and DR were predicted, as a low score on the DMQ indicates a heightened propensity to recall dreams.

3.1.2 Method

3.1.2.1 Participants

Level 2 Psychology students participated in this experiment as part of a course requirement. Whilst 166 participants completed the DMQ, only 151 completed the full experiment due to time restrictions. The sample was predominantly female (N=130, N=21 males) and the median age was 19 years and 3 months.

3.1.2.2 Stimuli, Design and Procedure

Firstly the 30 item Dream Memory Questionnaire was administered as a computer task. Secondly participants engaged in some memory experiments, involving three types of recognition task: a visual and a verbal, with both words and nonwords.

The experiment began with a practice trial, in which 5 words, 5 pictures and 5 nonwords were initially presented, then immediately represented for a recognition task. In order to eliminate order effects as much as possible, the three types of stimuli (words, nonwords and pictures) were presented together in blocks. In each experimental block 5 words, 5 pictures and 5 nonwords were each presented in a random order for 2000 ms. When ready, participants saw a random presentation of these stimuli again, as well as 15 lure items (made up of 5 words, 5 nonwords and 5 pictures). Thus the recognition task for each block involved 30 presentations. The task involved recognising whether or not the stimuli had been seen before by hitting a "Y" or "N" key as appropriate. The randomisation of presentations in each block prevented the need for counterbalancing. There were four experimental blocks altogether.

Words were selected from the MRC linguistic database, and were matched upon length (6-8 letters), imageability (250-450), frequency (using the Kucera-Francis written frequency norms 1-35. These were low frequency words), meaningfulness (250-450) and concreteness (250-450) criteria. The targets and lures were paired and matched along alphabetical dimensions. That is, each target had a matched lure that began with the same letter. The nonwords were all disyllabic and orthographically legal, and were 6-8 letters in length. The images were all of black and white natural scenes and were extracted from the Stirling University database. The targets and lures were again matched in terms of similar features, e.g. if the target's main feature was a rock, so,

too, was the lure's. The images were all of comparable size and quality. Scenes were selected as suitable nonverbal material as the could not be easily labelled. Whilst verbal suppression may have provided an effective control for verbal processing, the scenes were able to be presented quickly, allowing comparisons to be made across the different kids of stimuli.

Altogether there were 4 experimental blocks, each with 15 targets and 15 lures presented (10 words, 10 nonwords and 10 pictures). The entire experiment took approximately 10 minutes to complete. Times taken to make recognition judgements were recorded on the Superlab programme, and recognition accuracy was analysed.

3.1.3 Results

Analyses focused upon recognition performance and reaction times taken to respond for each of the stimuli types (pictures, words and nonwords). Performance consisted of percentage overall correct recognition (percentage of "yes" responses to target stimuli that had been presented before and "no" responses to new (foils) stimuli); number of "hits" ("yes" responses to targets); and number of "false positives" ("yes" responses to foils). The hits and false positive (FPs) values range from 0 to 5 as there were 5 presentations of each type of stimulus (pictures, words and nonwords) in each of the four blocks. The values therefore represent a block mean for that stimulus.

Table 3.1.1 Means (and SDs) for the hits, false positives (FPs), overall recognition performance (%) and reaction times (RTs) for each stimulus type in milliseconds

	Pictures	Words	Nonwords
Hits	4.2 (0.7)	4.2 (0.6)	4.2 (0.7)
FPs	0.3 (0.4)	0.6 (0.5)	0.7 (0.6)
Recognition	89.0 (7.4)	86.3 (7.7)	82.7 (10.5)
RTs	1065.9 (193.7)	1176.5 (275.8)	1274.4 (260.7)

Hit rates were identical for pictures, words and nonwords. They therefore did not differ significantly ($F(2, 312) = .482$, n.s.), indicating comparable high performance levels. Overall recognition was highest for pictures, which also had the lowest false positive (FP) rate. Overall

correct recognition for pictures, words and nonwords significantly differed ($F(2, 314) = 48.91$, $p<0.001$), with pictures being the easiest to recognise and nonwords the most difficult to recognise. Similarly there was an effect of stimulus type on reaction times ($F(2, 314) = 105.52$, $p<0.001$) with pictures being responded to most quickly and nonwords taking the longest. FP rates also significantly differed ($F(2, 312) = 44.68$, $p<0.001$) with nonwords foils being most likely to be incorrectly recognised and pictures, the least likely. Table 3.1.1 outlines the descriptive statistics for these.

Responses to the 30 questions in the DMQ were summed and used as a general measure of dream memory. A low score indicated a greater likelihood of recalling dreams. The mean total score was 82.19 (SD = 15.66) with responses ranging from 40 to 134. This total score did not significantly correlate with any of the recognition performance values (for pictures, words or nonwords), nor for the reaction times. These can be seen in Table 3.1.2.

The DMQ was divided into factors that arose from Experiment 1 (awareness of dreaming; daydreaming; comprehensibility of dream sensations upon waking; déjà-states; comprehensibility of dream content; senses), and scores from items loading onto each of these factors were totalled. These did not correlate with any of the six memory measures either (see Table 3.1.2).

Percentage of correct recognition task scores and reaction times for the three stimuli types were compared across high, medium and low dream recallers. Groups were created by dividing the DMQ total score into 3 equal groups (high recallers scored between 40 and 74; medium recallers between 75 and 89; low recallers between 90 and 134). The groups did not differ across any of the accuracy or reaction time scores.

Factor analysis

In previous studies (Experiments 1 and 2) a clear factor structure was found for the DMQ. Factor analyses conducted on this data produced extremely similar factor structures. The recent factor analysis on data from this study found there to be one general factor which accounted for 28.62% of the overall variance in the 30 questionnaire items. This reflects the unidimensionality of the scale. However when conducting a further factor analysis using a varimax rotation, three main factors emerged.

Table 3.1.2 Pearson correlation coefficients between the DMQ and its factors, and recognition performance (N=157)

	Pictures correct	Words correct	Nonword correct	Pictures hits	Words hits	Nonword hits	Pictures FPs	Words FPs	Nonword FPs	Pictures RT	Words RT	Nonword RT
DMQ	0.06	-0.11	-0.08	0.02	-0.09	-0.08	-0.09	0.04	0.05	0.07	0.12	0.13
factor1	0.01	-0.15	-0.12	0.03	-0.11	-0.09	0.03	0.07	0.08	0.11	0.14	0.09
factor2	0.02	0.02	0.01	0.00	0.03	0.00	0.00	0.04	0.04	0.10	0.07	0.14
factor3	0.15	-0.02	-0.06	0.08	-0.06	-0.06	**-0.17**	-0.04	0.02	-0.01	0.06	0.06
factor4	0.01	-0.12	-0.05	-0.03	-0.10	-0.05	-0.10	0.04	-0.01	0.00	0.01	0.04
factor5	0.01	-0.11	-0.10	-0.05	-0.10	-0.07	-0.10	0.06	0.05	0.06	0.14	0.13
factor6	-0.02	-0.07	-0.07	-0.03	-0.06	-0.12	-0.02	0.02	-0.02	-0.01	0.04	0.07

Bold type indicates correlation significant at the $p<0.05$ alpha level.

No correlations were significant at the $p<0.01$ level.

Variables "pictures correct", "words correct" and "nonwords correct" all indicate scores for overall recognition performance.

Largely similar to the previous factor of "comprehensibility of dream sensations upon waking", a cluster of "sensations and comprehensibility" items was found. This was comprised of questions (in order of loading scores) 16, 15, 10, 17, 11, 18 and 12 (see Appendix B for the DMQ). The second factor almost identically corresponded to the original factor of "daydreaming", and was termed "daydreaming and ruminating", which comprised items: 9, 29, 2, 5 and 3. Finally, the third factor precisely corresponded to the "déjà-states" factor, and included items 27, 28, 25 and 26. Although it can be seen that there is much overlap between these factors and those found in the original factor structure of the DMQ, the new factors were also correlated with the memory scores as a precautionary measure. As can be seen in Tables 3.1.2 and 3.1.3, none of the separate factors in the DMQ, either original or new, correlated with any of the recognition memory measures, apart from the FP rate for pictures with New factor 1, and the RTs for nonwords with New factor 2. However when the alpha levels were Bonferroni corrected (that is divided by the number of correlation conducted here - 36), both of these correlations lost significance.

Table 3.1.3 Correlation coefficients for all recognition performance measures, RTs and the three new DMQ factors

	New factor 1	New factor 2	New factor 3
Pictures correct	0.07	0.02	0.01
Words correct	-0.07	-0.01	-0.12
Nonwords correct	-0.09	0.06	-0.05
Pictures hits	-0.02	-0.03	-0.03
Words hits	-0.09	-0.05	-0.10
Nonwords hits	-0.05	0.04	-0.05
Pictures FPs	**-0.17**	-0.07	-0.10
Words FPs	0.00	-0.02	0.04
Nonwords FPs	0.06	-0.01	-0.01
Pictures RT	0.03	0.11	0.00
Words RT	0.12	0.09	0.01
Nonwords RT	0.09	**0.18**	0.04

Coefficients in **bold type** indicate correlations significant at the $p<0.05$ alpha level.

Variables "pictures correct", "words correct" and "nonwords correct" all indicate scores for overall recognition performance

3.1.4 Discussion

These data found no evidence of a relationship between recalling dreams and visual or verbal memory performance in a sample of young adults. Similarly, the factors underlying the DMQ such as those relating to sensations of everyday memory (rumination, déjà-states etc), did not relate to medium term memory abilities. Support for the sturdy factor structure of the DMQ was found.

Unlike Schredl *et al.*'s (2003) study only one measure of long term visual memory was used in order to maintain comparability to the other memory measures. More measures may be required in order to ensure validity of the visual memory measure.

It may not be surprising that this conceptualisation of LTM has not been found to relate to the dimension of DR, as the time between dreaming and waking is rarely extremely short. Previous studies have tended to use similarly lengthed (visual) memory measures, also. Longer term memory, instead, may well account for some of the widespread variance in DR, especially when DR is measured when reliant upon self report measures. Laboratory awakenings or dream detail measures of recall may not rely so much on long term recall processes, and may therefore have a different relationship with memory performance generally.

3.2 Experiment 4: Long-Term Memory Correlates of the Dream Memory Questionnaire After a Week's Delay: Recall, Recognition and Recollective Experience

3.2.1 Introduction

Whilst initial consolidation of a dream may rely upon arousal immediately upon awakening (Koulack & Goodenough, 1974), estimations of DR tend to rely upon LTM. Experiment 3 found clear evidence that remembering dreams is unrelated to long term verbal and visual recognition memory (with a time interval of approximately three minutes). As the act of recalling dreams relies upon longer term memory processes, as does normal autobiographical remembering of which remembering dreams forms a part, a similar experiment was conducted to see if scores on the DMQ correlated with visual and verbal recognition memory for items learned a week previously.

There is ample evidence that there are two, distinct methods of retrieving the personal past. "Remembering" involving recollective experience (Gardiner, 1988; Tulving, 1985) concerns a deeply episodic mode of retrieval, in which autonoetic consciousness and a feeling of "pastness" (Tulving, 1983) characterises the experience. In experimental terms, this might involve viewing a picture that has been presented before, and recognising its contextual features, how it looked on the page, and recalling a host of other features associated with the original presentation of the picture. These might include sensory-perceptual elements such as thoughts or emotions. In contrast the alternative method of retrieval is more semantic in that it does not include the recall of elements of the original experience alongside the memory information itself, and refers to "knowing" that something has happened, or been perceived or experienced before. A feeling of knowing may be judged on the basis of feelings of familiarity rather than a holistic episodic experience during recall.

Whilst these two aspects of retrieval have been investigated in detail in an experimental context involving episodic memories (e.g. Dewhurst & Conway, 1994; Gardiner, 1988; Rajaram, 1993; Tulving, 1983), they have not to my knowledge been directly compared to autobiographical remembering of more lengthy experiences. As dreams are often described to be characteristically sensory-perceptual experiences, it would logically follow that they are remembered rather than

known, when retrieved. Thus this experiment predicts that remembering will correlate with DR, as measured by the DMQ, whilst knowing will not. In addition, in order to increase the comparability between dream memory and recollective experience, a separate judgement for "familiar" memories has been introduced, in addition to the usual "remember" and "know" responses, as some dream memories are sensory-perceptual and episodic, although vague at the same time. Neither the "remember" nor the "know" response would adequately conceptualise such an experience at retrieval, so the "familiar" response seems more appropriate.

Dewhurst and Conway (1994) conducted five experiments comparing recollective experience judgements in memory for visual and verbal stimuli, and stimuli that had been processed in a visual or verbal manner. They consistently found a picture superiority effect. That is, visual stimuli, or stimuli that had been processed in a visual manner, were better recalled and retrieved with more recollective experience than verbal or verbally processed stimuli. It is argued that pictures are represented in a rich sensory-perceptual code, encouraging deeper encoding, thus providing more cues at retrieval for a sense of recollection rather than mere knowing. In addition theories such as Paivio's (1971) claim that pictures are encoded in a visual as well as a verbal code, thus enhancing their recallability. This paper thus provides insight into the nature of recollective experience, whilst also indicating that memories that are mainly visual may well be likely to be encoded deeply and "remembered" at retrieval. As dreams are largely visual experiences, Dewhurst and Conway provide a cognitive framework leading to the hypothesis that DR may relate to remembering with recollective experience.

A recollective experience paradigm was included in order to ascertain the extent to which different types of stimuli had been remembered. A second measure of visual memory was also added: pictures of everyday items, such as apple, clock and telephone. These were easily identifiable and able to be recalled as well as recognised. Thus these pictures as well as words were also used in a spontaneous recall task. This experiment is the first to use recollective experience judgements as correlates of DR. Whilst Experiment 3 did not support the idea that DR is related to memory performance, it was anticipated that recollective experience (i.e. "remembering" stimuli as opposed to simply finding it "familiar") would be correlated with scores on the DMQ. Performance on recall tasks was also hypothesised to relate to DMQ scores (as well as DMQ Factor 1 scores, as this factor measured an awareness of dreaming, specifically), as these memory measures seemed to be more similar to recalling dreams than overall recognition task performance. Participants viewed material at the first meeting and initial recall and

recognition measures were taken in order to replicate the results from the previous experiment. After a retention interval of one week memory was tested again in order to test memory over a longer time frame.

3.2.2 Method

3.2.2.1 Participants

The sample consisted of undergraduate Psychology students who received course credits on completion, and postgraduate Psychology students. 35 individuals took part (30 females and 5 males). The median age was 22.

3.2.2.2 Stimuli

The experiment was presented on a computer programme. Words, pictures (of natural scenes, from now on referred to as "scenes"), nonwords and sketches of easily identifiable objects (from now on referred to as "pictures") were presented at a rate of one per 2000 milliseconds. Materials were selected based upon the criteria described in Experiment 3, with the addition that the pictures were used as a second measure of visual memory. All stimuli can be found in Appendix C. Approximately half of the pictures were taken from an experiment administered through the Open University. The remaining half was collected from the internet. They were of easily recognisable and nameable everyday objects, such as "brick" or "apple". The pictures were sketches of black and white objects. All images (scenes and pictures) were all of comparable size and quality, and were matched as based upon semantic grouping (such as clothing, which included pictures of a glove (lure), a t shirt (foil), socks and shoes (foils used in the second session).

The experiment took place over two sessions. During the first session, 15 words and 15 pictures were presented in a block in a random order. 15 nonwords and 15 scenes were then presented in the same way. These two blocks were separated with a fixation cross on the screen, until participants were ready to continue, as it was important that the participants could distinguish between the different blocks and therefore the kinds of stimuli, for the following recall task. These blocks were not counterbalanced; the first block always presented the words and pictures, and the second, the scenes and nonwords, as only the words and pictures could be recalled after

all stimuli had been viewed. Thus the presentation of the scenes and nonwords acted as an interference task between presentation and test. The recognition and recall tasks followed, and are described below. A practise block was also initially included for each of the sessions, including the presentation of 5 screens of each type of stimulus and the same number of recognition trials. Stimuli was only presented (i.e. learned) during this first session. Memory was immediately tested, and then re-tested a week later, in the second session. During the second session new stimuli was added, which acted as foils in the recognition task. These were also matched upon the dimensions described above.

3.2.2.3 Procedure

Session 1: Following the practice trials, the words and pictures, and scenes and nonwords were presented in 2 blocks. A free recall task for the pictures and words (and scenes and nonwords) followed. Participants were asked to discern between the stimulus type (picture or word). The recall task was always unexpected, as participants had not been warned that there would be a recall task. All participants showed surprise when asked to recall pictures and words, and discussions during debriefings revealed that participants did not expect any of the recall tasks at any time. This surprise was intentional. It was anticipated that if participants did not encode pictures and words in order that they be recalled, the act of learning the stimuli would be more passive and therefore similar to the act of dreaming, whereby material cannot be intentionally encoded for recall during the experience itself.

A recognition task for each of the stimulus types followed. The order of the recognition tests followed the same order as presentation (that is pictures and words were presented before scenes and nonwords) in order to ensure a similar length of time between encoding and retrieval for all stimulus types. Each task included the 15 original re-presentations for each stimulus type and 15 foils. So, each block (of 2 stimulus types) included 60 different presentations. Both recognition tasks taken together involved 120 presentations and recognition choices. For each stimulus viewed in the recognition task participants would answer according to a recollective experience paradigm. Participants decided whether they remembered (R), knew (K), found the item familiar (F) or just made a guess (G) recognition judgement. Table 3.2.1 below details the instructions given to participants regarding the recollective experience judgements. These instructions were printed and visible to participants during all recognition tasks. A remember response referred to an episodic memory, whereby contextual detail such as remembering an item's position on the

screen or an emotion felt at the time of encoding. A know response was more semantic: although the participant would be sure that they recognised the item, it would lack the contextual detail of a remember response. If participants could not place how they knew that they had seen an item before as it lacked the contextual detail or the certainty of the other responses, although they were still reasonably sure that it had been presented before, they would choose a familiar response.

Table 3.2.1 Instructions for recollective experience task

Recognition judgement	Written instruction	Oral instruction (additional information)
Remember (R)	In this case you would remember lots of contextual detail about when you first saw that word or picture, such as how it looked on the screen, how it made you feel, how it made you think of something in particular.	Choose this response if you can recognise this exact stimulus from before, including what it looked like.
Know (K)	In this case you would be certain that this item appeared before, but you would not remember actually seeing it for the first time.	Choose this response if you recognise the stimulus, but you don't recall the instance in which you initially saw it. So you might recall having seen a house, but not this house in particular.
Familiar (F)	In this case you would not be certain that you had seen the item before, but some aspects of it would imply that you may have done so. It may evoke a feeling that it appeared before, but lacking in certainty (knowledge) or episodic richness (remember).	If you're not certain that you either remember or know that you've seen this before, but something about it indicates that you have, then choose it feels "familiar" somehow. You might not be able to identify what is familiar exactly.
Guess (G)	In this case select "G" if you are simply unsure about your choice of response.	
No (N)	If you do not recognise this item at all, press **N** for **NO**, I do not recognise this item.	

Whilst numerous studies distinguish between remember and know responses in a recognition task, it was considered appropriate to also include an "F" response, in case participants were unable to categorise their recognition judgement with such certainty as an "R" or "K" response. The inclusion of this response also allowed recollective experience judgements to be similar to a dream memory; parts of a memory may be accessible or familiar, without clear recollective experience or knowledge of a dream having occurred being present.

Session 2: A similar procedure was adopted, still maintaining a fixed order and involving more tasks. Participants began with a recall task whereby they were asked to write down the words and pictures that they had been presented with at the beginning of the previous session (15 target pictures and 15 target words). They then engaged in a recognition task for the scenes and nonwords that they had initially seen. The foils in this case differed from those used in the previous recognition task (later referred to as "new foils"). There were 15 target nonwords and 15 target scenes, and the same number of new foils. A second block of words and pictures followed. Participants at this point completed the Dream Memory Questionnaire (DMQ) which was also presented on the Superlab programme. Participants were then asked to engage in a third and final recall task in which they were required to recall as many pictures and words as possible that they had seen in the previous session. This included the foils from session 1 as well as the targets, so a maximum of 30 words and 30 pictures could be recalled. Participants engaged in a final recognition task comprising two blocks: firstly one for words and pictures, followed by a block of scenes and nonwords. This task involved recognising stimuli that had been presented in the first session, again including the foils. So there were 30 items to recognise for each stimulus type. The foils (lure items) were made up of the 15 foils from the previous recognition task from the second session ("new foils") and 15 more new foils (later referred to as "new new foils"). Again each recognition task included recollective experience decisions for the recognised items. If not recognised participants would answer "N", for "no".

The tasks and dependent variables for each stimulus type are listed in Table 3.2.2. As can be seen, each of the four stimulus types (words, pictures, scenes and nonwords) were presented and then recognised in three different tasks. The recognition task in session 1 was a near replication of the procedure employed in Experiment 3. The two recognition tasks in the second session investigated longer term memory. The second of these also investigate recognition of lure items, as well as targets, which had been presented a week previously.

Table 3.2.2 Tasks and dependent variables at Sessions 1 and 2

Words and Pictures:	Scenes and Nonwords:
• Immediate recognition (tested at session 1)	Immediate recognition (tested at session 1)
• Delayed recognition (tested at session 2)	Delayed recognition (tested at session 2)
• Delayed recognition incl. original foils (tested at session 2)	Delayed recognition incl. original foils foils (tested at session 2)
• Immediate recall (tested at session 1)	
• Delayed recall (tested at session 2)	
• Delayed recall incl. original foils (tested at session 2)	

The experiment aimed to correlate the recall and recognition measures for each of the different stimulus types with a score obtained from the Dream Memory Questionnaire. In addition, the proportion of remembered, known, familiar and guess responses were of interest for the different stimulus types over time. The recollective experience trends over these three tasks could then be compared.

3.2.3 Results

3.2.3.1 Performance at Session 1

Recall performance was measured by a count of the number of correctly recalled target words and pictures. These were then converted into percentages and compared. Similarly recognition performance was calculated as a percentage, with "no" being a correct response for foil stimuli, and with "remember", "know", "familiar" and "guess" responses all being counted as correct for target items. Performance at session 1 was similar for all stimulus types (pictures, words, scenes and nonwords). Table 3.2.3 illustrates the descriptive statistics for recognition accuracy. Performance was highest for pictures. Performance was above chance level for all stimulus types indicating that stimuli were being recognised.

Table 3.2.3 recognition accuracy (%) for all stimulus types at Session 1 (N = 38)

Stimulus type	Mean	SD	Minimum	Maximum
Pictures	84.06	11.13	53.33	100.00
Words	71.84	10.70	50.00	96.67
Scenes	60.79	10.89	40.00	83.33
Nonwords	68.77	9.81	50.00	86.67
Targets	76.05	14.08	36.67	100.00
Foils	66.67	17.19	33.33	95.00

In addition to this overall accuracy score, the hit and FP rates have been calculated separately for each stimulus type, at each level of recollective experience.

Table 3.2.4 Hit and False Positive (FPs) rates for each of the recollective experience ratings, for words, pictures, scenes and nonwords at Session 1

	R		K		F		G		N	
Stimuli	Hits	FPs	Hits	FPs	Hits	FPs	Hits	FPs	Hits	FPs
Pictures	8.8	.3	1.9	.3	2.1	1.1	.6	1.4	12.0	1.3
Words	4.2	.4	2.9	.3	2.4	1.3	2.1	2.7	10.4	3.2
Scenes	3.4	1.5	1.8	.8	3.5	2.8	1.6	1.9	8.2	4.2
Nonwords	2.5	.3	2.5	.3	3.3	1.3	2.0	2.5	10.6	4.7

Table 3.2.4 shows details the hits for all stimuli types, across each level of recollective experience judgement. For the "no" responses, the hits refer to the foil stimuli, whilst for the "R", "K", "F" and "G" responses, the hits refer to target stimuli. The values correspond to the mean values, out of a possible 15 presentations. Overall, the foils were more likely to be falsely recognised than the

targets, rejected. Pictures were most likely to be remembered. Overall performance was most accurate for pictures. Trends were similar for words and scenes. Nonwords had the same rate of "R" and "K" responses.

In order to try to replicate the findings of Experiment 3, the recognition performances (proportion of hits and false positives for each stimulus type, at each level of recollective experience) have been correlated with the DMQ scores and scores for the DMQ Factor 1: the awareness of dreaming factor collected during session 2. DMQ scores ranged from 59 to 122, with a mean (and standard deviation) of 84.54 (19.21). Factor 1 scores ranged from 10 to 36, with a mean (and standard deviation) of 17.91 (6.63). These norms are similar to those obtained in the previous experiment. The DMQ and Factor 1 scores were correlated with each of the recognition task scores. The proportion of K responses for target scenes ($r=.31$, $p<0.05$), R responses for scene foils ($r=-.29$, $p<0.05$), and familiarity judgements for target nonwords ($r=-.36$, $p<0.05$) were significantly correlated with DMQ scores. However once these were Bonferroni corrected they lost significance. No significant correlations were found between the Factor 2 scores and the recognition task scores. Thus no significant correlation coefficients at all were found. All these correlations can be found in Appendix D. Table 3.2.5 demonstrates how no significant correlations were found between either the DMQ total scores and the recognition variables as split by stimulus type, or the Factor 1 scores and the recognition variables.

Table 3.2.5 Correlation matrix showing relationships between variables

	Pictures	Words	Scenes	Nonwords	Targets	Foils
DMQ score	0.10	-0.21	0.21	0.01	0.18	-0.11
DMQ Factor 1	.05	-.25	.12	-.16	.10	-.15
Pictures	*	0.28	***0.47***	**0.38**	0.23	***0.48***
Words		*	**0.33**	0.27	0.07	***0.53***
Scenes			*	0.11	0.17	***0.47***
Nonwords				*	**0.35**	0.24
Targets					*	***-0.57***

Bold type indicates correlation significant at the $p<0.05$ alpha level.
Bold and italicised indicates correlation significant at the $p<0.01$ alpha level.

3.2.3.2 Performance at Session 2

During the second session the LTM measures after a retention interval of a week were also collected, hence differing substantially from the previous experiment. Recognition performance can be seen to be similar to when immediately tested (see Table 3.2.6), with performance for pictures, scenes and foils improving slightly, and worsening slightly for words, nonwords and targets overall. For each stimulus type the differences between scores from Sessions 1 and 2, were only by approximately 2% of overall recognition accuracy. That is, recognition performance after a retention interval of a few minutes was largely similar to that when tested after a retention interval of seven days.

Table 3.2.6 Descriptive statistics recognition accuracy (%) for all stimulus types at the first recognition task, Session 2 (N = 34)

Stimulus type	Mean	SD	Minimum	Maximum
Pictures	88.82	8.24	56.67	100.00
Words	64.22	11.11	36.67	86.670
Scenes	70.00	11.10	46.67	93.33
Nonwords	64.41	10.14	40.00	93.33
Targets	74.75	16.65	26.67	96.67
Foils	68.97	17.24	35.00	95.00

Performance was highest for pictures, well above chance for scenes, and similar for the verbal measures (words and nonwords). One participant correctly recognised all picture targets, and correctly rejected all foils, resulting in a 100% overall accuracy score.

Table 3.2.7 shows that pictures were most likely to be remembered, with the picture foils least likely to be falsely recognised. Performance for the nonwords was relatively poor, with the highest proportion of foils being falsely recognised, and producing almost as many "K" responses as "R" responses, indicating that nonwords were difficult to recognise with recollective experience.

Table 3.2.7 Hit and False Positive (FPs) rates for each of the recollective experience ratings, for words, pictures, scenes and nonwords at Session 2, part 1 (first recognition task)

	R		K		F		G		N	
	Hits	FPs	Hits	FPs	Hits	FPs	Hits	FPs	Hits	FPs
Pictures	8.5	.2	2.4	.1	1.8	.9	.9	.6	13.1	1.1
Words	3.7	.9	2.0	.8	3.6	2.3	1.7	2.8	8.2	3.8
Scenes	3.8	.3	2.4	.6	4.0	2.7	1.2	1.7	9.7	3.6
Nonwords	2.5	.5	2.1	.2	2.8	1.8	2.3	2.4	10.0	5.5

The second recognition task in the second session involved recognising all stimuli seen the previous week, including previous foils as well as targets. Table 3.2.8 summarises the performance in this task.

Table 3.2.8 Descriptive statistics recognition accuracy (%) for all stimulus types at the second recognition task, Session 2 (N = 35)

Stimulus type	Mean	SD	Minimum	Maximum
Pictures	73.43	9.55	40.00	95.00
Words	48.90	6.84	36.67	60.00
Scenes	65.81	8.92	41.67	80.00
Nonwords	60.43	7.99	40.00	75.00
*Targets	71.86	18.99	18.33	100.00
*Foils	51.55	20.64	20.00	93.33
*New foils	51.19	20.62	15.00	88.33
*New new foils	75.62	17.24	30.00	98.33
Targets and foils	61.70	17.48	22.50	95.00
New and new new	63.40	18.13	25.83	93.33

*Here targets and foils refer to the stimuli from session 1. The new foils were presented for the first time in the first task of session 2, where these foils were presented alongside the targets (from session 1). The new new foils refer to stimuli presented in this final task for the first time. Table 3.2.9 below details how the recollective experience trends across stimulus types are largely similar to those described in the previous sessions, with pictures being most likely to be recollectively experienced with "R" responses.

It can be seen that performance is lower on this task compared to the previous tasks (both at Session 1 and the first task in Session 2), with accuracy for words and foils being around chance level. One participant was able to correctly recognise all the targets that had been presented the week before. There is a significant difference between performance for the targets* and the foils* (see Table 3.2.6 for details; $T(34) = 6.404$, $p < 0.0001$), whereas this was not the case in the previous task of session 2 ($T(35) = 1.120$, n.s). Thus participants did not seem to recognise well the stimuli presented as foils in session 1. In contrast performance was very high for the stimuli presented at session 2 only (88.33% for new* and 98.33% for new new foils*), so participants were able to discriminate between new and old stimuli, overall.

Table 3.2.9 Hit and False Positive (FPs) rates for each of the recollective experience ratings across conditions at Session 2 (second recognition task)

	R		K		F		G		N	
	Hits	FPs	Hits	FPs	Hits	FPs	Hits	FPs	Hits	FPs
Pictures	10.7	3.1	1.7	1.6	1.1	2.7	.2	1.0	6.4	.8
Words	6.3	1.5	1.8	.9	2.8	3.2	1.4	2.3	7.0	2.3
Scenes	5.6	2.0	2.5	1.2	2.6	3.2	.8	1.3	3.0	7.1
Nonwords	4.3	1.2	2.1	.8	2.5	2.2	1.3	1.5	4.6	9.2
New Pictures	-	2.5	-	.9	-	1.8	-	1.0	8.7	-
Newnew Pictures	-	.4	-	.1	-	.6	-	.7	13.1	-
New Words	-	2.9	-	1.7	-	3.7	-	1.8	4.7	-
Newnew Words	-	.9	-	.6	-	2.6	-	2.1	8.8	-
New Scenes	-	1.6	-	.9	-	2.2	-	1.4	8.8	-
Newnew Scenes	-	.5	-	.1	-	1.4	-	1.4	11.5	-
New Nonwords	-	1.0	-	.7	-	2.6	-	1.6	8.8	-
Newnew Nonwords	-	.3	-	.2	-	1.1	-	1.5	12.0	-

Table 3.2.10 shows the correlations between the DMQ scores and all the recognition performances in both tasks in Session 2 (testing memory for the stimuli viewed one week earlier). The DMQ did not relate to any of the scores.

Table 3.2.10 Correlation matrix for recognition accuracy scores for session 2 (N=34)

	DMQ Factc	pictures 2	words 2	scenes 2	nonwords 2	targets 2	foils 2	pictures 3	words 3	scenes 3	nonwords 3	targets 3	foils 3	new 3	newnew 3
DMQ score	***0.77***	-0.16	0.00	0.12	0.09	0.11	-0.08	-0.08	0.31	-0.02	0.10	0.21	0.19	-0.13	-0.13
DMQ Factor 1		-0.12	-0.08	0.01	-0.07	0.17	-0.24	-0.01	**0.36**	-0.02	0.04	0.19	**0.36**	-0.15	-0.24
pictures 2			***0.64***	***0.51***	**0.40**	**0.41**	**0.34**	***0.58***	-0.07	***0.53***	0.32	**0.37**	-0.12	0.22	0.19
words 2				***0.51***	**0.41**	0.27	***0.50***	**0.41**	-0.11	0.25	0.16	0.07	-0.21	0.25	0.31
scenes 2					0.24	0.19	***0.50***	***0.50***	0.10	***0.61***	0.19	0.22	-0.17	**0.39**	0.25
nonwords 2						***0.49***	0.13	0.25	-0.16	0.13	***0.53***	0.27	0.14	-0.04	0.06
targets 2							***-0.58***	0.19	**0.35**	0.19	**0.41**	***0.84***	***0.62***	***-0.54***	***-0.54***
foils 2								0.32	**-0.40**	0.26	-0.05	***-0.55***	***-0.71***	***0.77***	***0.77***
pic 3									-0.06	***0.56***	**0.34**	0.14	-0.11	***0.48***	**0.35**
words 3										0.03	0.13	***0.56***	***0.50***	**-0.38**	***-0.41***
scenes 3											0.16	0.23	-0.25	***0.43***	**0.34**
nonwords 3												*0.29*	*0.20*	*0.10*	*0.14*
targets 3													***0.55***	***-0.64***	***-0.66***
foils 3														***-0.68***	***-0.72***
new 3															***0.83***

Bold type indicates correlation significant at the $p<0.05$ alpha level.

Bold and italicised indicates correlation significant at the $p<0.01$ alpha level.

Table 3.2.11 details the poor performance in the recall tasks. To recap, the first took place immediately after stimuli had been presented. The second occurred at the beginning of session 2 and the third took place after the second recognition task, so the targets stimuli had been viewed again. In all tasks pictures were better recalled than words. In task 1 16 participants were unable to recall any words at all. Similarly 15 recalled no words in task 2. By the third recall task only 5 participants were unable to recall any words. Performance was slightly more stable for the pictures, with 2, 3 and 1 participants being unable to recall anything in the respective tasks. Performance was extremely poor overall, with no participants recalling even half of the items that they had learned.

Table 3.2.11 Descriptive statistics recall accuracy (%) for all recall tasks (N = 38 for session 1, N = 34 for session 2)

	Task	Mean	SD	Minimum	Maximum
1	Words	7.02	6.75	0	20
1	Pictures	23.15	11.67	0	46.67
2	Words	5.29	5.87	0	5.87
2	Pictures	21.96	12.87	0	12.87
3	Words	12.35	9.16	0	9.16
3	Pictures	48.43	17.85	13.33	17.85

Table 3.2.12 shows how none of the recall scores correlated significantly with the DMQ scores.

Table 3.2.12 Correlation matrix for all recall task scores with DMQ scores

	Recall1 pictures	Recall2 words	Recall2 pictures	Recall3 words	Recall3 pictures	DMQ Total
recall1words	0.08	***0.59***	0.30	**0.36**	0.10	-0.07
recall1pics		0.27	***0.77***	0.22	**0.41**	-0.14
recall2words			0.27	**0.35**	0.23	-0.13
recall2pics				0.27	***0.52***	-0.11
recall3words					**0.41**	0.11
recall3pics						0.10

Bold type indicates correlation significant at the $p<0.05$ alpha level.

Bold and italicised indicates correlation significant at the $p<0.01$ alpha level.

Whilst words were correctly identified (with accurate spelling) on the whole, pictures were incorrectly labelled in a few instances. For example, the picture, "glove" was recalled as, "hand". In these instances, it was clear when the target had been recalled but described with an alternative name.

3.2.3.3 Recollective Experience

The target stimuli were recognised with different recollective experience judgements. The trends for these are illustrated below, for each stimulus type. The mean proportion of recognition judgements, for each stimulus type, did not correlate with DMQ scores in any instance (when Bonferroni corrected, thus removing the likelihood of a Type I error). The correlation matrices for these can be found in Appendix D. The figures below illustrate the recollective experience trends for targets, for pictures, words, scenes and nonwords. All response ("R", "K", "F", "G" and "N") frequencies are for targets. Figure 3.2.1 shows that pictures were best recognised and remembered.

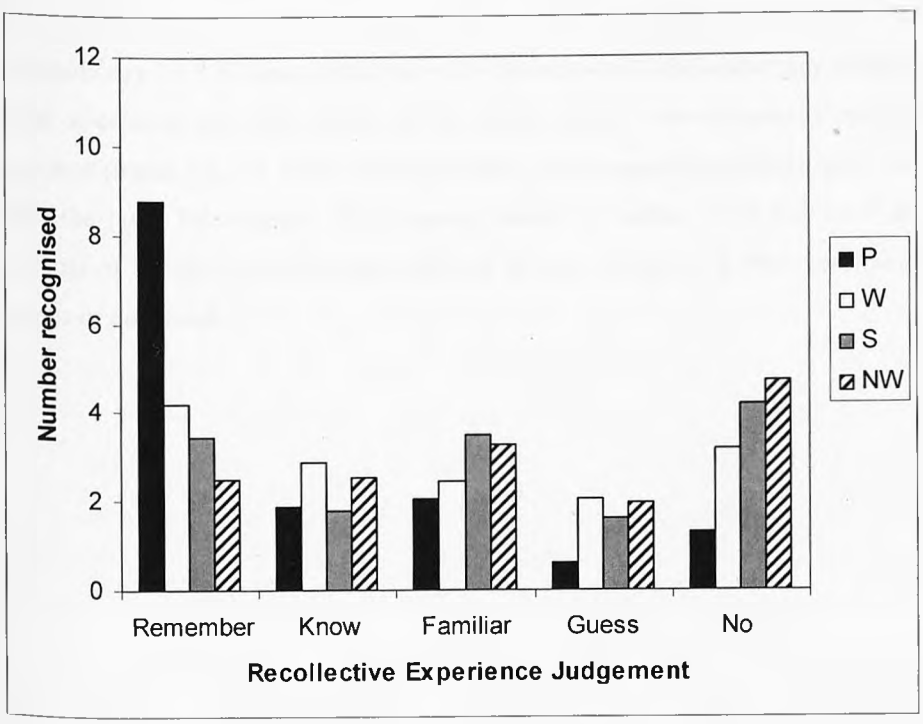

Figure 3.2.1 Recollective Experience judgements during session 1 for target stimuli for pictures, words, scenes and nonwords.

There were few guesses and the fewest "no" (incorrect) responses for the target images. Just under a third of the words were remembered with recollective experience, the mean of which only being higher than the "no" (incorrect) responses by about one word (4.21 and 3.18, respectively). Scenes and nonwords seemed to be difficult to recognise. In both cases there were fewer remember responses than incorrect responses yet a relatively high proportion of familiar responses (out of the recognised judgements). For all stimuli types apart from nonwords, targets were more often remembered than known.

By the second session, a week later, the patterns of recollective experience had changed slightly. Figure 3.2.2 details this. Pictures were still well recognised, with a high number of remember responses being selected (8.47 at session 2 compared to 8.76 at session 1). There was a decline across recollective experience judgements K, F and G. The words were similarly remembered, found familiar and incorrectly judged to have been new stimuli (approximately 3.9 words), although the proportion of K responses had decreased since session 1, being replaced with F judgements on the whole. Scenes showed a similar pattern to the words and not changing much from the first session, with the most popular recollective experience judgement reflecting a sense of familiarity (in 3.97 cases out of the 15). The nonwords showed a very different trend. In over a third of cases it was most likely of the stimuli types to be incorrectly recognised with a "no" response (mean = 5.47). They were least likely to be remembered and known, reflecting difficulty with the task. This mirrors the accuracy scores in Tables 3.2.4 and 3.2.7 above. Overall the patterns of recollective experience did not change at session 2 from session 1 for the pictures, scenes or nonwords.

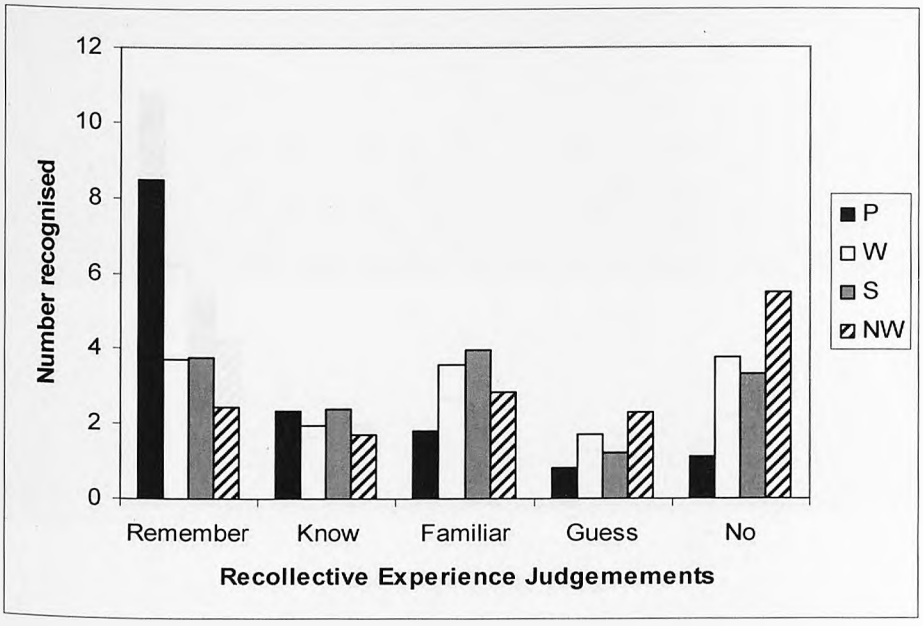

Figure 3.2.2 Recollective Experience judgements during session 2 for target stimuli for pictures, words, scenes and nonwords.

The second part of session 2 involved targets stimuli being seen again. Figures 3.2.3 and 3.2.4 show the distributions of recollective experience judgements made for the targets during this task, as well as the foils from the first session, respectively.

Figure 3.2.3 shows how whilst a similar pattern emerged for the targets as in the previous task in session 2, accuracy in recognition improved for all stimulus types (see Tables 3.2.8 and 3.2.9). On the whole the R responses became more popular, being used for approximately two more presentations for each stimulus type. This caused a reduction in the number of K responses (especially for pictures and words) and F responses (especially for pictures and scenes). Incorrect ("no" responses) were made similarly, apart from with the scenes, in which there was an improvement in accuracy (70.00% as opposed to 65.81% in the previous task).

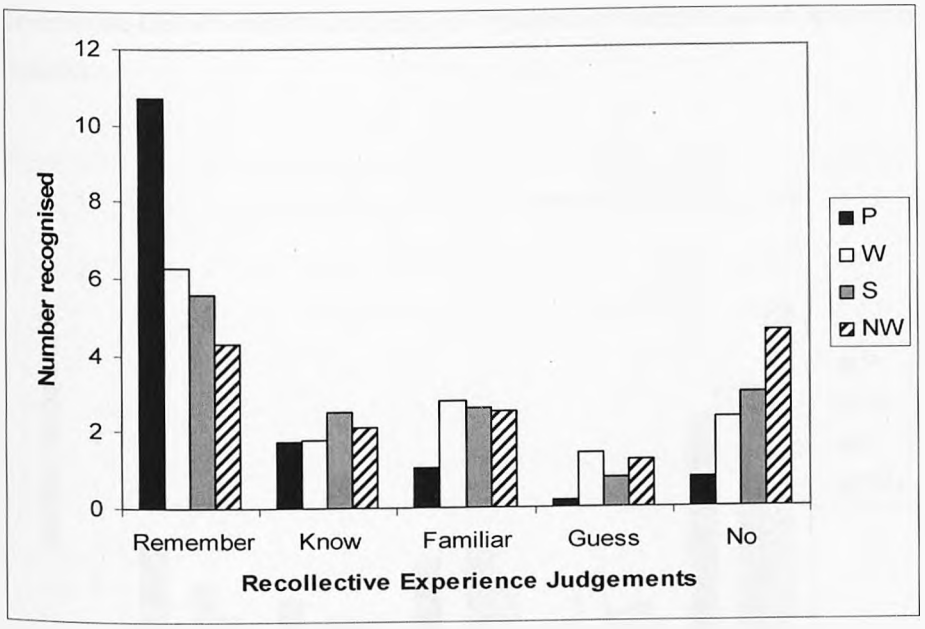

Figure 3.2.3 Recollective Experience judgements during session 2 for target stimuli for pictures, words, scenes and nonwords.

Finally the stimuli presented as foils in session 1 were represented in the final recognition task. Both Table 3.2.9 and Figure 3.2.4 reflect the difficulty in this task for all stimulus types. Nonwords were most likely to be incorrectly dismissed as not having been presented before ("no" responses) in 9.20 (61.3 %) of cases. Familiar judgements were more popular than remember judgements for all stimulus types expect for pictures which were, once again, most accurately recognised, with remember responses being used for 3.11 images. In all cases more F judgements were made than K or G judgements.

A stimulus (pictures, words, scenes and nonwords) x recollective experience (R, K, F, G, N) x time (Session 1, Session 2 recognition task 1, Session 2 recognition task 2) repeated measures ANOVA found no main effect of time (F (1.09, 35.81) = .42, n.s.), indicating that the trends described above did not change significantly over the three tasks. Thus the patterns of recollective experience for all stimuli types were relatively stable for target stimuli. A significant stimulus x recollective experience x time interaction was found (F (11.38, 5.56) = 2.05, $p<0.005$), however, and these trends have been described in detail above. Overall the patterns of recollective experience varied over time, with recollective experience decreasing over the tasks, and as a result of the kind of stimuli used, with pictures being most likely to maintain their recollective experience over time. The effect was small (partial eta squared = .58). In both analyses

Greenhouse-Geisser corrected degrees of freedom were adopted as the sphericity assumption was violated.

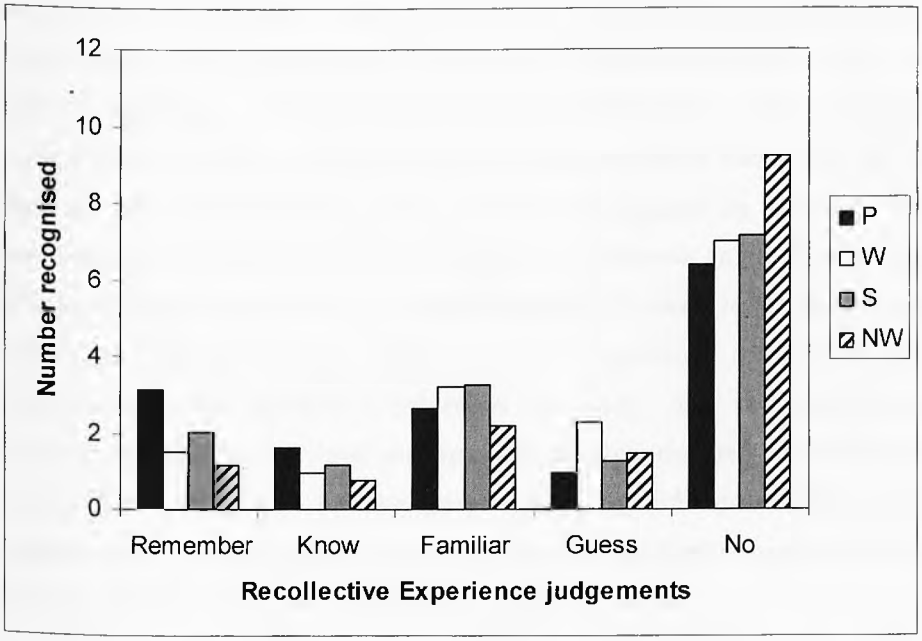

Figure 3.2.4 Recollective Experience judgements during session 2 for foil stimuli for pictures, words, scenes and nonwords.

The four figures above detail the recollective experience trends in all tasks. None of the values, in any task, correlated with the DMQ scores.

3.2.4 Discussion

No evidence has been found to support a relationship between dream recallability and memory abilities. In this case, LTM over seven days does not seem to correlate with DMQ scores or DMQ Factor 1 scores in any way. In fact, the correlation coefficients did not near significance in any case. Many correlations were in the opposite direction to that which was predicted, that is, they were positive. As a low DMQ score (as well as a low Factor 1 score) indicates a higher propensity to recall dreams, a negative correlation would have indicated a clear relationship between the two variables in question.

The scenes stimuli may be considered most valid as a measure of visual imagery in this experiment as they are most similar to dream images. The most valid measures of visual memory may include making "dream like" films such as those used in Montagnero *et al.*'s (2003) experiment, in which memories of films and dreams were compared. Such measures are impossible in a recognition task. Schredl *et al.* (2003) used a number of measures of visual memory, including a recall task similar to that utilised here, as well as a map reproduction task and a recall task for a 3 minute silent film. The correlations between these different measures were not reported. In addition visual memory was assessed by a sum of the recall and map retracing tasks, and also by the film recall task. The separate values are not reported for these. It may be that the tasks were not all valid measures of visual recall, thus confusing the results. Further support for this comes from the lack of a significant correlation being found between creativity and visual memory in Schredl *et al.*'s study - two variables hypothesised to relate. However all measures of visual memory individually correlated with DRF (the p value is not reported for the recall task, however), even though they did not contribute to a holistic structural equation model that successfully accounted for the widespread variance in DR not did they, when taken together as a measure, significantly correlate with DRF.

Word stimuli were carefully considered in that low frequency words were deemed to be more distinctive for the recognition tasks. However such low frequency would perhaps render it difficult to make associations to the words in an attempt to consciously encode them for subsequent recognition. In addition, the low frequency words were likely too lengthy and complicated for recall. Performance for the word stimuli in the recall tasks was very poor. Spelling ability may have confounded recall of complex words in this experiment, however it is maintained that the low frequency words may have been more of a valid measure of verbal recall than high frequency words, which would be less distinctive. Future studies should use the same words as [objects in the] pictures to facilitate comparisons. Frequency could also be manipulated to see if recall performance could improve. Despite this, there is no reason to believe that verbal memory would correlate with DMQ scores.

This experiment also investigated the role of recollective experience in recognition judgements, predicting that R (remember) responses would be significantly correlated with the DMQ. This was not found to be the case. Whilst adopting this individual differences approach to recollective experience, that is assuming that some individuals ar more likely to recognise stimuli with recollective experience than others (and that those individuals would, in theory, be more likely to

recall their dreams), such an approach is also problematic in that individuals who consistently recognise stimuli with or without recollective experience is likely to perform at either ceiling or floor level. In this kind of experiment whereby variance is of interest, a range of responses are the most indicative of an appropriate measurement system. Thus this experiment provides convincing evidence that recollective experience does not relate to DR. Indeed, Nielsen and Stenstrom (2005) claim that autonoetic consciousness: the sensation of recollective experience, is not possible whilst dreaming. Thus individuals who recognise stimuli with recollective experience are not necessarily likely to recall their dreams with the same sensation. Autonoetic consciousness may well be an indication of the strength of a memory trace, but individual differences in this area require further investigation.

The recollective experience trends indicated the episodic nature of the memories over time. Specifically, the pictures seemed to be most confidently recognised, with more remember responses than the other stimulus types, in each task. Thus the pictures may well be considered an appropriate measure of visual memory, making the finding of no relationship between this measure and the DMQ scores, all the more convincing. However the uncertainty surrounding the recognition judgements for words, scenes and nonwords reflect that the task was not too easy. Their similar trends could reflect that they are appropriate measures of recognition memory.

The recollective experience judgements may also reflect the difficulty of the task. Whilst recognition performance was often above change level, by the third task this was not the case for the foils and the new foils: the distracter items in both sessions. Whilst some participants commented on the difficulty of the task, recognition performance for the stimulus types, overall, were always above chance.

The recall task performances, on the other hand, showed floor effects. Whilst the pictures were substantially more recallable than the words, the tasks did seem difficult for participants. Although this was intentional, in order to be as comparable to dreaming as possible in that the stimuli were not encoded deeply at the time of presentation, the lack of variance in the recall scores illustrate that the recall task measures may not have been appropriate in this case. Whilst Experiments 3 and 4 have provided clear evidence that a relationship between waking memory abilities and DR is unlikely, it would be unwise to assume that recall is unrelated to DRF entirely. Despite this the comparability of word lists and highly sensory-perceptual episodic memories for dreams, is questionable. The memory processes involved in dream recollection are more likely to

be autobiographical, sensory-perceptual, and perhaps constructive in nature, rather than non-autobiographical episodic recall. The remaining studies described in this thesis therefore focus upon autobiographical memory and its relationship to DR.

Taken altogether, whilst the recall task was hypothesised to correlate especially highly with DR, doubt may be cast on the validity of the measures. Despite this no relationships were found between any LTM measures and DRF.

Summary

The findings from Experiment 3 were replicated in that no relationships between DRF and memory visual or verbal abilities were found. Recognition performance was better in experiment 3, however in experiment 4 more stimuli were presented in the learning phase, as pictures were also presented and a recall task may have acted as an interference between learning and recognition for some stimuli. There was a greatest decrease in the percentage of words recognised between experiments 3 and 4. As the stimuli used were identical, this may have occurred, in part, by chance. Despite this performance was comparable in both experiments, with scenes being best recognised and nonwords, worst, indicating that the smaller sample of Experiment 4 was adequate in obtaining representative memory score norms.

Picture stimuli in Experiment 4 demonstrated a picture superiority effect, as described and replicated by Dewhurst and Conway (1994) in a series of experiments. The effect, whereby images are recalled more accurately than words, was also extended to include recollective experience, in that visual memories were more likely to be judged as being "remembered" rather than "known". The findings in this chapter also support this finding for the pictures, but not the scenes. Whilst Dewhurst and Conway focus upon the differences between visually- and verbally-processed stimuli, the scenes used in this chapter were purely visual stimuli, yet they did not display a picture superiority effect. It may therefore be appropriate to adopt Paivio's (1971) notion of "dual processing" as an explanation of this effect. Paivio claimed that visual stimuli were encoded in both a verbal as well as a more rich, visual code, which would increase the number and types of cues for visual memories to be retrieved. As the pictures described in Experiment 4 were sketches of nameable everyday objects, they could be processed both visually and verbally. However the scenes were too complicated to be easily named and were therefore

unable to be encoded verbally in the short presentation time of 2 seconds. The scenes were recognised, on the whole, without recollective experience.

Whilst the picture superiority effect distinguishes the visual from the verbal stimuli in terms of performance, Paivio's explanation implies that there may well have been a verbal element to the visual memory tasks. As described above, the picture stimuli may well have been verbally encoded in some instances. A major hypothesis for these experiments was to discern whether purely visual measures would correlate with DR. The pictures were overall best recalled, showing a picture superiority effect, and retrieved with recollective experience, also in line with Dewhurst and Conway's (1994) findings. However they may well have been muddied by verbal elements, which may partly account for why they did not relate to DMQ scores. The scenes were purely visual, and were less well recalled. Paivio (1971) offers an explanation as to why the more purely visual measure of the scenes stimuli were not retrieved with recollective experience. This may be the result of them not being encoded in a verbal way as well as a visual way. As this had led to decreased recallability, without recollective experience, Paivio's explanation could also account for the difficulty in recalling dreams overall.

Paivio's explanation, however, does not account for why the scenes were uncorrelated with the DMQ scores. It could be that the scenes still contained a slight verbal component, however their relative poor recallability and lack of recollective experience do not imply this to be the case. An additional task, such as an articulatory suppression task, would ensure that the verbal processing component at encoding was reduced. A future study could incorporate an articultory suppression task whilst viewing the scenes, in order to assess whether a truly pure visual measure would still not correlate with DMQ scores.

An alternative explanation for these findings is that purely visual memory may not be able to be retrieved with recollective experience, which would account for dreams not relating to remember responses. However, DMQ scores also did not relate to other recollective experience judgements, lending little support to this idea.

Whilst Waterman (1991) did not find a relationship between visual memory and DRF, he did find a relationship between visual memory and dream length measures (word counts). He encouraged that word counts be used as a measure of dream detail. Further, he found a relationship between dream length and verbal STM measures. Whilst verbal memory may in theory increase the

likelihood of lengthy dreams being reported (although no such evidence for this has been found in previous studies), and visual memory and imagery skills may increase the likelihood of dreaming overall, these two factors do not seem to suffice in accounting for the widespread variance in DR.

Whilst there is little evidence to suggest that visual or verbal LTM measures are related to DR, damage to particular cognitive functions certainly damage dream recallability. Thus there may be a host of cognitive processes involved in the successful recall of a dream, resulting in each process accounting for minimal variance in DR when investigated individually. However each of those processes may well be crucial in the dreaming process.

As there is strong neuropsychological evidence that the visual system is involved in dreaming, as damage to the visual cortex leads to a cessation of dreaming (Solms, 1997), it would be worthwhile to note whether long term visual memory is implicated at all in DR. Developmental approaches to the formation of dreaming, such as those posited by Domhoff (2001; 2002) and Foulkes (1979; 1999), emphasise the importance of the sophistication of cognitive structures. Whilst visual memory may well develop early on in life, its measurement is dependent upon verbal responses. Similarly, it has been suggested that DR depends upon verbal and narrative abilities. Whilst this experiment did not find any evidence for a relationship between verbal medium term memory and DR, other general cognitive abilities may well indirectly influence the likelihood of recalling dreams.

Taken together these two studies offer clear and convincing evidence that the propensity to remember dreams is unrelated to normal waking memory abilities. This was even the case for visual memory, despite the picture stimuli being recollectively experienced, best recognised and the least verbally contaminated of all the measures. Although the measures used were episodic they were not autobiographical. As dream recall involves not only memory for one's own experiences but also experiences that are pertinent to the self, the following two chapters focus upon autobiographical measures as predictors of DR.

Chapter 4: Characteristics and Recallability of Old Dreams

As Chapter 3 found convincing evidence that DR is not related to episodic memory in recognition tasks, it was concluded that DR, due to being inherently autobiographical, may well instead relate to autobiographical memory processes. Indeed, dreaming has a complex and intricate relationship with the self, showing individual differences effects (see section 1.4.3) and reflecting elements of waking life (see section 1.6). In addition what Jung described as the suspension of ego control in dreams may be the result of neurophysiological activity, with decreased activation of the dorsolateral prefrontal cortex (Hobson *et al.*, 2000) leading to a lack of volition whilst asleep. This may result in, according to some psychodynamic theorists, the free reign of unconscious desires in dreams (Freud, 1900), and subsequently the free reign of the self.

There are therefore many reasons to predict a relationship between dreaming and autobiographical remembering. As described above both dreaming and autobiographical memory concern the centrality of the self in the generation and recall of their experiences. In addition dreams are autobiographical experiences that may be sensory-perceptual in nature (Conway, 2001). The following chapters further investigate this relationship.

There appears to be mixed evidence concerning the comparability of dreams and autobiographical memories. Whilst dreams are, in theory, autobiographical, they are internally generated and are experienced independently of a more general waking life context. Dreams are especially incoherent (Hobson *et al.*, 2000) making it difficult for them to be manipulated into a meaningful memory. Yet due to a number of studies finding emotions to be especially prevalent in dreams (Hicks, Bautista & Hicks, 1999; Schredl & Doll, 1998), along with their more sentient experiential nature, dream memories may be more similar to sensory-perceptual episodic memories (Conway, 2002) than general autobiographical memories, which may lack such feelings and experiences. In addition, whilst continuity theorists (e.g. Schredl & Hoffman, 2003) emphasise the overlap between dreaming and waking cognition, reality and source monitoring frameworks rely upon internally generated experiences such as dreams being less detailed characteristically, in order to facilitate distinguishing between such experiences. There thus seems to be a need to explore these discrepancies between the characteristics of dreams and waking autobiographical memories.

In general, authors emphasising the strong characteristics of dreams, such as emotionality or bizarreness, tend to focus on dreams only without comparing them to waking episodic memories (e.g. Cipolli *et al.*, 1993; Schredl & Doll, 1998). The few studies that have directly compared the characteristics of dreams and memories have done so in a reality monitoring framework (Johnson, Kahan & Raye, 1984; Kemp & Burt, 2006; Kemp, Burt & Sheen, 2003). That is, they have generally found that dreams contain less perceptual and contextual detail than memories for actual experiences. This facilitates accurate reality monitoring judgements, in addition to internally generated memories such as dreams, thoughts or delusions containing more cognitive operations than externally generated memories. The extent to which dreams contain cognitive operations can be questioned, though, in that the neurophysiology of dreaming does not lend itself well to an awareness of cognitive operations at the time of experiencing the dream. Indeed, Johnson *et al.* (1984) suggest that dreams are unique in not featuring conscious cognitive operations. This may mean that the characteristic differences between dreams and memories are especially profound.

Kemp, Burt and Sheen (2003) report three experiments which aimed to classify the frequency and characteristics of dreams that could be mistaken for events, and events that could be confused as dreams. In particular, their third experiment employed a diary design in which fourteen participants tried to report a dream and event on a daily basis. Characteristic ratings were completed at the time of diary completion as well as a few months later, when the reports were re-presented. Participants also later faced a reality monitoring task in which they had to judge whether the reports they had generated were dreams or events on a scale of 1 (definitely real) to 7 (definitely a dream). Events were judged to be more real than the dreams, and the dreams more dream-like, which were unsurprising findings. Whilst the seven point scales were insightful into the qualitative judgements of reality monitoring processes, they did not allow accuracy in reality monitoring judgements to be explicitly assessed. Despite this the majority of the events (446/459) were rated as "definitely real", and dreams (296/309) were judged to be "definitely a dream", illustrating the ease with which the reality monitoring decisions were made, and the certainty of the judgements. A sample of independent raters also classified the reports using the same scale, and also tended to use the extreme ratings, although less often than the actual participant diarists, indicating their similar confidence in their judgements. The overall mean classification accuracy of the raters was 83.8%. This implies that the characteristic information available in the reports provide clues as to their source, that the reports themselves may often indicate whether they were dreamt or real, and that cognitive operations - information that would not be available to

independent raters - were not necessary in forming accurate reality monitoring decisions between memories of dreams and actual events.

Dreams were also rated as significantly less memorable than the events, and the memorability ratings further decreased between the times of reporting and subsequent testing. Dreams were generally rated as significantly less vivid and salient than the events, and more negatively emotional. Diarists' ratings were significantly more fragmented, less coherent and less characterised by visual and auditory imagery. In fact, dreams were significantly less detailed than the events along 15 of the 16 dimensions in the administered questionnaire (based on Rubin *et al.*, 1999, subsequently published in 2003).

Extending the comparison of dreams and waking memories beyond their characteristics only requires that remembering dreams be assimilated into theories of autobiographical remembering generally. Thus the assumption that remembering dreams is governed by similar processes to autobiographical memory, that are inherent to memory researchers, must be checked. The following two chapters will therefore assess the continuity between autobiographical memories for waking events and dreams in terms of retrieval modes and characteristics.

It is widely recognised that memory for dreams is relatively poor (e.g. Reed, 1974) and that theories of DR tend to focus upon recall failure (Cohen and Wolfe, 1974; Freud, 1900; Koukkou & Lehmann, 1983; Koulack & Goodenough, 1974). The salience hypothesis (Cohen & MacNeilage, 1974) relies upon some dreams to be characteristically more detailed than others, thus increasing their chance of being recalled. This, coupled with the evidence that dreams and waking memories differ characteristically with waking memories being more detailed, leads to the idea that dreams are likely to be less well recalled than waking autobiographical memories.

The experiments in the present chapter and in Chapter 5 investigate the characteristics and recallability of dreams as systematically compared to autobiographical memories for the first time. Whilst autobiographical memories have been investigated in detail, the characteristics of remembering dreams have not (with the exception of studies by Domhoff, 2002; Foulkes, 1981; Montangero, Ivanyi & de Saint-Hilaire, 2001; and Montangero, Pasche and Willequet, 1996).

4.1 Experiment 5: Comparing the Characteristics and Trends of Dreams and Autobiographical Memories

4.1.1 Introduction

There is evidence that dreams and autobiographical memories may differ in terms of their characteristics, although there also exists a convincing theoretical argument that there is continuity between dreaming and waking memory processes. In order to investigate this and test the claim that dreams rely on autobiographical memory processes, it is necessary to recap what is understood by autobiographical memory.

Autobiographical memories refer to memories for one's own experiences (Conway, 1990). A defining feature of autobiographical memory is that it is centred around the self (Conway & Pleydell-Pearce, 2000; Conway, Singer & Tagini, 2004). Whilst these memories often refer to episodic memories for specific waking events, they can also refer to thoughts, dreams and plans. Such internally generated autobiographical memories are distinguished from real experiences in reality monitoring tasks (e.g. Johnson *et al.*, 1984). Rubin, Wetzler and Nebes (1986) describe the distribution of autobiographical memories across the lifespan. That is, memories generated by adults tend to be characterised by three main features. Firstly, there is evidence of childhood amnesia: the inability to recall experiences from below the age of approximately 4 years of age. Secondly there is an increase in the number of memories corresponding to the ages of approximately 15-25, known as the "reminiscence bump". There are a number of proposed mechanisms for this effect, such as cortical development increasing the likelihood of memories generally being encoded in a more deep and detailed manner, more experiences occurring at that time of life thus resulting in more experiences being recalled later on in life, and that this time in life is a crucial one for identity change, development and consolidation, thus reflecting the relationship between autobiographical memory and the self. Finally, a recency effect is usually evident, whereby experiences that have occurred more recently in life tend to be more likely to be recalled in a fluency task.

Some researchers have been interested in dream recallability over the lifespan, but they have tended to compare groups of individuals, rather than investigating time as a continuous variable (e.g. Foulkes, 1979). Grenier *et al.* (2005) compared dreaming and autobiographical memory by

systematically comparing the temporal references found in dreams and waking memories. That is, the units within a dream were identified by experimenters and the sources analysed by the dreamer in terms of their time since occurrence. Specifically, the waking memory components of the dreams were plotted over time. There was a linear decrease in the number of references over time. Whilst the main focus of the paper was not on DR over time, the references in dreams of older participants (aged 60-77) were compared to autobiographical memories. A similar trend was found for dreams and autobiographical memories, with memories showing recency effects, childhood amnesia and a reminiscence bump, which was slightly more pronounced for the autobiographical memories than the dreams. It should be noted that whilst the dream references were being plotted over time in terms of when those references occurred in waking life, the autobiographical memories were generated according to a semantic cueing method. Thus only aspects of a dream that had appeared in waking life were being compared with whole episodic memories. The level of detail seems incomparable between these two types of memories, so Experiment 5 aimed to overcome this problem by comparing whole dreams and whole episodic memories, as opposed to just components of them.

Dritschel, Williams, Baddeley & Nimmo-Smith (1992) describe a method of accessing autobiographical memories over the lifespan: the fluency method. Here, as many autobiographical memories as possible are recalled in a given time. They may be in response to specific cues (known as the Galton technique, as based upon Galton, 1883), dependent upon the investigation of interest. In Dritschel *et al.*'s paper, comparisons are simply made between autobiographical episodes, personal and nonpersonal semantic information, in terms of numbers of recollections from different lifetime periods. The present experiment builds upon this design in using the fluency method to compare the accessibility of dreams and waking autobiographical episodes, but investigates the characteristic differences between those types of memories in more detail.

This experiment therefore aimed to collect information on the characteristics and quantities of recalled memories for dreams as compared to autobiographical memories, hypothesising that dreams are less sensory-perceptual in nature than autobiographical memories. Autobiographical fluency tasks, as described above, provide a measure of dream and waking memory recallability, whilst allowing trends over the lifespan to be plotted. It was predicted that dreams are more difficult to access than autobiographical memories, as reflected through the quantity of memories retrieved in the fluency tasks. Finally, as a reflection of the function of autobiographical memory

over the sleep-wake cycle, it was predicted that the frequency of recalled autobiographical memories and dreams over time would follow similar trends, including evidence of childhood amnesia and a recency effect. A reminiscence bump was not predicted to be found for dreams or waking autobiographical events due to the relatively young age of participants.

4.1.2 Method

4.1.2.1 Participants

Twenty postgraduate Psychology students were recruited as part of an opportunity sample consisting of 8 males and 12 females. Ages ranged from 21 to 57 and the median age was 25 years.

4.1.2.2 Materials

Participants were provided with response sheets for recording brief details of their autobiographical memories and dreams, as well as the time at which the events occurred, for the autobiographical fluency tasks. For each of the selected memories a questionnaire on memory characteristics was completed (see Appendix E), which was based upon 3 previously administered questionnaires: a recollective experience questionnaire (Heaps & Nash, 2001); the Memory Characteristics Questionnaire (Johnson *et al.*, 1988); and the belief and recollection questionnaire (Rubin, Schrauf & Greenberg, 2003). Items were slightly amended in order to allow the same 5 point scales to be used (see ratings used by Heaps & Nash, 2001) with the exception of item 31, which requested information about the perspective of the memory (field/image). All items from the Memory Characteristics Questionnaire (Johnson *et al.*, 1988) were used. Some items from this were very similar to those used by Rubin *et al.*, and Heaps and Nash. Almost all items from Rubin *et al.*'s questionnaire were also used. The resulting Characteristics of Autobiographical Memories/Memories for Dreams questionnaires were identical for both types of memories. Testing took place in a quiet laboratory.

4.1.2.3 Design

Each participant engaged in an autobiographical fluency task for both autobiographical memories and dreams. A description of each recalled memory was briefly written, along with the time (age)

at which the event occurred. Three dreams and three autobiographical memories were selected (see 4.1.2.4) and categorised into "earliest", "other" and "recent" memories. The questionnaire (see Appendiz E) was completed for each selected memory.

4.1.2.4 Criteria upon which memories were date-matched

Of the generated dreams, an earliest, other and recent memory was selected. This also occurred for the generated autobiographical memories. The earliest generated memories were selected that were as closely related as possible in terms of date of occurrence. Thus, the earliest dream generated may have occurred at age 5, but the dream selected occurred at age 6 as the earliest autobiographical memory occurred at this same age. The same rules applied for the recent dreams. The "other" category utilised memories that had occurred at some point between the earliest and most recent memories selected, aiming to use events that had occurred mid-way between the earliest and recent time points.

4.1.2.5 Procedure

Participants were asked to undertake an autobiographical fluency task, which involved recalling as many autobiographical memories as possible in 5 minutes, making brief notes about each one that would allow later identification of that event or experience. The same procedure was then repeated for memories for dreams. The experimenter then selected 6 memories: 3 events and 3 dreams (an earliest, other and recent memory) based upon the date-matching criteria described above. The participant was asked to bring the specific memory to mind, although not to recall it aloud for ethical reasons, and to complete the questionnaire upon that memory. If the participant did not want to refer to their memory explicitly, they were instructed to refer to the memory with a false description (i.e. by naming the memory inaccurately). Participants were reminded that recalled memories would not be content analysed. The memories were brought to mind for the questinnaire's completion in a random order, with dreams and autobiographical memories being alternately recalled. After this period the participants were debriefed and a general discussion of remembering and recalling dreaming, followed.

4.1.3 Results

4.1.3.1 Fluency trends

The mean number of dreams generated in the fluency task was 5.25 (SD = 1.62): significantly fewer than the number of autobiographical memories generated (M = 9.40, SD = 2.91); T (19) = 6.59, $p<0.001$. There was little variation in the number of memories generated, overall.

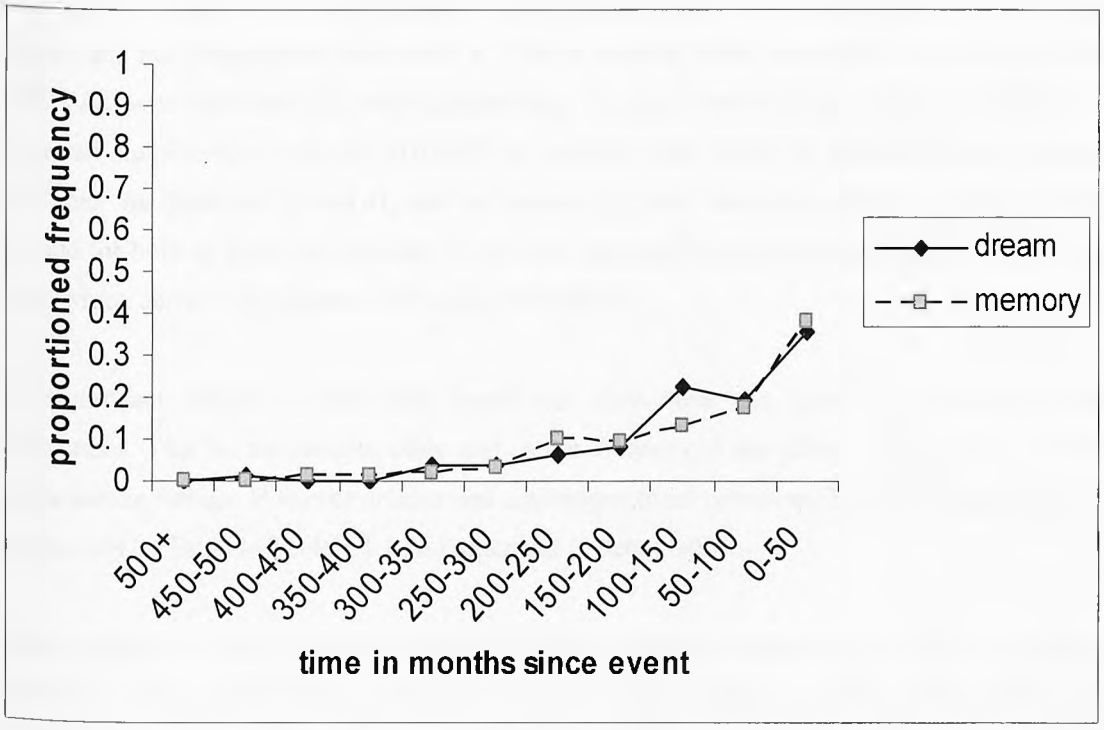

Figure 4.1.1 Line graph showing the proportioned frequency of autobiographical memories and memories for dreams recalled over time

Figure 4.1.1 illustrates the age of the participant at the time of experiencing the autobiographical events and dream memories, with the proportioned frequency of memories generated in the fluency tasks as a function of time since occurrence. A clear recency effect can be seen, with a decreasing frequency of memories recalled the older the memories are. As this trend tails off, a childhood amnesia effect is assumed but is not explicit. Importantly, the trends are largely similar for both the dreams and the episodic memories. The only difference was that slightly more dream memories were recalled 50-100 months ago, compared to the memories of events.

4.1.3.2 Characteristics

Descriptive statistics were also collected for each of the questionnaire's dependent variables. Table 4.1.1 shows the descriptive statistics for each of the 42 questions, for both types of memories. The detailed descriptive statistics for both types of memory divided by earliest, other and recent can be found in Appendix F.

In order to test whether the dreams differed from the autobiographical memories, and whether time had an effect on the characteristics of the earliest, other and recent memories, 2 (memory; dreams and autobiographical memories) x 3 (time; earliest, other and recent) repeated measures ANOVAs were conducted for each characteristic. As there were 42 characteristics a Bonferroni corrected alpha level of $p<0.001$ (0.05/42) was adopted. The sphericity assumption was violated for "time" for questions 24 and 41, and for "memory x time" interaction for questions 21, 29 and 32, and for both of these for question 33. In these instances the Greenhouse Geisser statistic was used, which corrects the degrees of freedom accordingly.

No significant effects of time were found, nor were there any significant memory x time interactions. That is, the earliest, other and recent dreams did not differ in terms of any of the characteristic ratings. However dreams and autobiographical memories did differ along a host of dimensions, as listed in Table 4.1.1 and described in detail below.

Autobiographical memories were significantly more clear (as opposed to dim), colourful (as opposed to black and white), involving more visual detail, involving sound, smell, taste, were more vivid, more detailed (as opposed to sketchy), ordered comprehensibly (as opposed to confusingly), the storyline was realistic (as opposed to bizarre), the location was clear/distinct (as opposed to vague), general setting was familiar, the event seemed longer, the event (definitely) had serious implications, and feelings at the time were more positive. Overall the events were remembered very well (as opposed to hardly), there was less doubt overall regarding the accuracy of the memory and participants were more confident about testifying in court over the details of the event in question than the dreams. It was more characteristic of the autobiographical memories for participants to relive the original event whilst remembering, to travel back to the time when it happened, to hear it in one's mind, to come to the participant as a coherent story, to be significant for their life. And overall, more of the event was remembered for the autobiographical memories.

Table 4.1.1 Characteristic ratings that significantly differed between autobiographical memories and dreams: Mean (and SD)

Characteristic	Memories	Dreams	Main effect of Memory (effect size, power)
1=Dim/5=clear*	4.25 (.51)	2.77 (1.11)	F= (1, 19) 35.10, p<0.001 (.65, 1.00)
1=Black and white/colour=5*	4.38 (.70)	3.17 (.98)	F= (1, 19) 35.10, p<0.001 (.65, 1.00)
Visual detail 1=little or none/5=a lot*	4.13 (.52)	3.10 (.71)	F= (1,19) 40.66, p<0.001 (.68, 1.00)
Sound 1=little or none/5=a lot*	3.13 (1.01)	2.15 (.70)	F= (1,19) 17.88, p<0.001 (.49, .98)
Smell 1=little or none/5=a lot*	1.87 (.77)	1.22 (.54)	F= (1,19) 15.55, p<0.001 (.45, .96)
Vividness 1=little or none/5=a lot*	4.02 (.54)	3.13 (.79)	F= (1, 19) 15.83, p<0.001 (.46, .97)
Sketchy/detailed 1=little or none/5=a lot*	3.75 (.66)	2.52 (1.05)	F= (1, 19) 26.79, p<0.001 (.59, 1.00)
1=order confusing/5=comprehensible*	4.18 (.66)	2.38 (1.02)	F= (1, 19) 44.54, p<0.001 (.70, 1.00)
Dtoryline 1=bizarre/5=realistic*	4.62 (.52)	1.97 (.73)	F= (1, 19) 192.21, p<0.001 (.91, 1.00)
Location 1=vague/5=clear*	4.35 (.71)	2.22 (1.08)	F= (1, 19) 57.91, p<0.001 (.7, 1.00)
Setting 1=unfamiliar/5=familiar*	3.93 (.78)	2.28 (1.11)	F= (1, 19) 28.31, p<0.001 (.60, 1.00)
1=short/5=long*	3.33 (.57)	2.52 (.93)	F= (1, 19) 16.90, p<0.001 (.47, .97)
Actual implications 1=not at all/5=definitely*	2.77 (.96)	1.53 (.69)	F= (1, 19) 45.55, p<0.001 (.71, 1.00)
Recall overall memory 1=hardly/5=very well*	4.03 (.77)	2.67 (.91)	F= (1, 19) 35.14, p<0.001 (.65, 1.00)
Accuracy of memory1=much doubt/5=no doubt*	3.78 (.77)	2.63 (.97)	F= (1, 19) 29.963, p<0.001 (.61, 1.00)
Confidence in memory 1=not at all/5=definitely*	3.70 (.69)	2.25 (.76)	F= (1, 19) 42.66, p<0.001 (.69, 1.00)
Reliving 1=not at all/5=totally*	3.53 (1.02)	2.75 (1.06)	F= (1, 19) 15.37, p<0.001 (.45, .96)
Travel back 1=not at all/5=totally*	3.65 (1.033)	2.88 (1.16)	F= (1, 19) 18.93, p<0.001 (.50 .99)
Hear memory 1=not at all/5=totally *	2.83 (1.16)	1.92 (.94)	F= (1, 19) 16.73, p<0.001 (.47, .97)
Coherence of story 1=not at all/5=totally*	3.92 (.77)	2.43 (1.04)	F= (1, 19) 42.53, p<0.001 (.69, 1.00)
Significance 1=not at all/5=totally*	2.93 (.92)	1.72 (.70)	F= (1, 19) 62.85, p<0.001 (.77, 1.00)
How much remembered 1=little/5=lot*	3.70 (.57)	2.50 (.93)	F= (1, 19) 27.54, p<0.001 (.592, 1.00)
Feelings at the time 1=negative/5=positive	3.83 (1.00)	2.23 (.91)	F= (1, 19) 19.93, p<0.001 (.51, .99)

Significance tests refer to repeated measures ANOVAs. The reported statistics concern main effects of memory, whereby averaged dreams and events are compared. * denotes significant differences in the direction of autobiographical memories being more detailed than dreams.

Table 4.1.2 Characteristic ratings that did not significantly differ between autobiographical memories and dreams: Mean (and SD)

Characteristic	Memories	Dreams	Main effect of Memory
Thought about event 1=not at all/5=many times	3.30 (.69)	2.78 (.70)	F= (1, 19) 13.64, n.s.
1=merging of different events/5=extended event	3.83 (.55)	3.27 (.86)	F= (1, 19) 6.03, n.s.
Emotions now 1=not intense/5=intense	2.95 (.87)	2.48 (.94)	F= (1, 19) 4.26, n.s.
Effort to recall 1 = much effort/5 = little or none	3.88 (.88)	3.30 (.95)	F= (1, 19) 6.47, n.s.
1=field/2=observer perspective	1.35 (.40)	1.35 (.33)	F= (1, 19) 0.00, n.s.
Remember rather than know 1=not at all/5=totally	4.12 (.85)	3.28 (1.06)	F= (1, 19) 11.15, n.s.
Memory in words 1=not at all/5=totally	1.95 (1.03)	1.67 (.92)	F= (1, 19) 6.45, n.s.
Feel emotions now as then 1=not at all/5=totally	3.12 (1.07)	2.63 (.97)	F= (1, 19) 7.47, n.s.
Episodic nature 1=not at all/5=totally	4.37 (.84)	3.65 (1.12)	F= (1, 19) 7.49, n.s.
1=typical/5=atypical of childhood behaviours	2.45 (.96)	2.30 (.96)	F= (1, 19) .36, n.s.
Touch 1=little or none/5=a lot	2.35 (.96)	2.08 (.82)	F= (1, 19) 1.36, n.s.
Taste 1=little or none/5=a lot	1.63 (.73)	1.13 (.41)	F= (1, 19) 9.83, n.s. (.34, .85)
Storyline 1=simple/5=complex	2.23 (.77)	2.83 (.82)	F= (1,19) 7.19, n.s.
Implications felt at time 1=not at all/5=definitely	3.25 (1.02	3.00 (1.15)	F= (1, 19) .89, n.s.
Feelings at the time 1=not intense/5=very intense	3.90 (.80)	3.42 (.79)	F= (1, 19) 4.10, n.s.
Feelings now 1=intense/5=intense	3.98 (.80)	3.90 (.59)	F= (1, 19) .14, n.s.
Now feelings are 1=not intense/5=intense	2.70 (.81)	2.25 (.76)	F= (1, 19) 5.15, n.s.
Remember thoughts 1=not at all/ =clearly	3.45 (.83)	3.13 (.74)	F= (1, 19) 2.43, n.s.
Memory reveals about me 1=a lot/5=little	3.23 (.73)	2.43 (.77)	F= (1, 19) 12, 24, n.s.

Significance tests refer to repeated measures ANOVAs. The reported statistics concern main effects of memory, whereby averaged dreams and events are compared.

In contrast, no significant differences were found between autobiographical memories and memory for dreams in terms of the memory involving the sense of touch, the event seeming as if it would have serious implications (at the time of occurrence), remembering how one felt at the time when the event took place, intensity of feelings whilst remembering, remembering what was thought at the time, or for the memory revealing or saying a great deal about the rememberer. Similarly no differences were found between the memory types for frequency of thinking about the memory since its occurrence, or for whether the memory was a merging of different events as opposed to a continuous event. Intensity of emotions concerning the event did not differ between dreams' memories and autobiographical memories, and although more details were recalled for the autobiographical memories, no differences were found in terms of how much effort it took to bring the memory to mind. The perspective of the rememberer, i.e. whether field or image, did not differ between the memory types. Whilst event memories were more likely to be remembered rather than known, this difference was not significant. Neither memory type appeared to "come to [the participant] in words", with the mean response being very low (around 1 for both groups). Similarities were found for feeling the emotions at remembering as feeling at the time of occurrence. Perhaps not surprisingly, no differences were found between the event occurring once at one particular time, and typical of childhood behaviours.

As can be seen from Tables 4.1.1 and 4.1.2 the autobiographical memories produced higher mean values than did the memories for dreams for all questions apart from question 11 ("storyline is simple/complex"), and for question 31 ("image seen from field/image perspective") whereby the means were identical for the two memory types. Thus it seems that that these differences are quite profound due to the great number of questions demonstrating the same effect, similar and relatively small standard deviations, and due to the size of the differences overall.

4.1.3.3 Developmental trends

No significant differences were found over the three time periods, nor were the interactions between memory and time significant.

Although no significant effects of time were found for any of the characteristics, some interesting trends emerged from the data. Both earliest and recent events and dreams were clearer (as opposed to dim; question 1) than the "other" memories. Similarly the "other" memories were less vivid (question 8) than the earliest and recent dreams and events, more negative (question 19) and

recalled hardly as opposed to very well (question 24). In keeping with this trend, the other memories were less likely to have been thought about since the experience (question 27), than the earliest and recent memories. Over time (from earliest to recent) the dreams and events were ordered less confusingly and more comprehensibly (question 10), the story was more coherent (question 37) and the memory was more likely to come to the recaller in words (question 36). Unsurprisingly the typicality of childhood events (question 42) decreased over time. Finally, whilst for autobiographical events the episodic nature of the memory (question 40) increased with recency, it decreased for dreams.

4.1.4 Discussion

This experiment predicted three things: that dreams would be less detailed along a host of characteristics than autobiographical waking event memories, that dreams would be less accessible than such memories, and that both memory types would follow a comparable lifespan distribution when recalled. All hypotheses were supported. Reliable differences, however, were found for some types of characteristics but not others.

Clear and significant differences were found between the characteristics of generated event and dream memories in terms of vividness, colour, many ratings of detail, the senses (with the exception of touch), order of events, setting, serious implications, positivity of feelings at the time, confidence of the accuracy of the memory, autonoetic consciousness of the memory, significance for one's life and in terms of how much was remembered. No differences, however, were found between the two memory types in terms of whether the event felt significant at the time, intensity of feelings at the time, thoughts at the time, rehearsal of the event, intensity of emotions concerning the event, effort to recall the event, or its typicality of childhood behaviours. The differences therefore did not exist in terms of how the event was perceived at the time of occurrence. Rather the differences seem to lie simply in the characteristics of the memory for that event. There appears to be some kind of cognitive appraisal for the event in terms of significance, although this is unrelated to emotionality or rehearsal of the event. That is, after the experience has occurred, the memory may be assimilated into existing knowledge or memory structures thus facilitating (or inhibiting, in the case of dreams) details about that memory to be subsequently recalled.

Although more details were recalled for the autobiographical memories, no differences were found in terms of how much effort it took to bring the memory to mind. Despite this particular finding it is worth noting that significantly more autobiographical memories were recalled than dreams, so perhaps fewer dreams are accessible overall, but those that are accessible are easily so.

No significant differences between the two types of memories were found in terms of the developmental nature of either autobiographical memories or memories for dreams. That is, the characteristics of the earliest, "other" and recent memories were similar. It may be that the generated older memories were more detailed than the older memories that were not generated, and that the accessibility of the memories analysed in the experiment were especially memorable and detailed along the characteristic ratings. An investigation in dream and event recall using specific cues may manipulate recall more systematically. Also assessing these differences in terms of recall and recognition may aim to potentially overcome some of the confusions about dream inaccessibility, and in turn further enlighten an understanding of the encoding and retrieval of memory for dreams.

Despite the characteristic and accessibility differences between the two types of memories, the trends illustrating the recalled memories over time in terms of lifespan were comparable. Whilst no reminiscence bump was found, as predicted, likely due to the relatively young sample, both a childhood amnesia and a recency effect was suggested (see Figure 4.1.1), implying that dreams follow the same trends as autobiographical remembering. This is highly important for two reasons. Firstly, dreams are autobiographical and therefore rely upon autobiographical memory processes. This strongly implies that the differences between that characteristics and inaccessibility of the dreams compared to waking events are due to other factors, such as arousal, context-dependency or salience of the experience itself. Secondly, it may be speculated that, if testing an older sample, in line with Grenier *et al.*'s (2005) findings, dreams would produce a reminiscence bump. This affirms the autobiographical nature of dreams, as they would likely be more likely to be recalled from a lifetime period indicative of identity and self change. This is investigated in Chapter 6.

It should be noted, however, that a relatively young sample of students were recruited in this experiment. Whilst the figure reflects the proportioned frequency of recalled memories over time, the older time bins illustrated in Figure 4.1.1 refer to a small number of participants, rather than the whole sample. In order to demonstrate the reliability of these effects, both a larger sample and

one comprising older adults should be used. This would also increase the likelihood of predicting a reminiscence bump.

The differences between the characteristics of dreams and memories from waking life can also be attributed to a number of memory-based explanations. If we take the idea that dreams are sensory-perceptual at the time of being experienced as indicated by the findings in this experiment, as well as from other research (Cipolli *et al.*, 1993; Schredl & Doll, 1998), then the differences between dream memories and waking memories must occur after the dream has taken place. Due to frontal brain regions being attenuated during sleep (see Solms, 1997), it may be safe to assume that dreams are not encoded to subsequent recall at the time of being dreamt. The encoding process may begin upon waking. Thus the dream memory may have already begun to decay, as based upon arousal-retrieval theories of DR (Koulack & Goodenough, 1974) before there is a chance for a detailed, sensory-perceptual memory to be encoded. In addition, dream memories may differ from waking memories in that the retrieval itself is also problematic. There may be a number of explanations for this.

As dreams are difficult to recall under the conditions of waking consciousness, they may have been encoded in conditions that differ from the encoding of waking memories. Specifically, waking memories may be encoded in terms of language whilst dreams contain images and feelings only. This may well account for the storyline of dreams seeming to be significantly more complex than simple, and less coherent than waking memories. Foulkes (1982) also tested the hypothesis that dreaming develops as a function of language maturity, concluding that dreaming cannot be adequately accounted for entirely by linguistic processes – instead it is a multi-modal phenomenon. Foulkes also found that two boys with poor visuo-spatial skills had low reporting rates when tested between the ages of 11-15; an time by which DR is normally well established. Visuo-spatial ability may concern dream production whilst language may be concerned with formulating a dream narrative at both encoding and retrieval (perhaps more importantly at encoding). In order to fully test this claim, both children and adults with language difficulties should be scrutinised in their ability to recall dreams. Despite this the visual (and indeed other sensory) clarity of dreams was also found to be less profound in dreams than waking memories in the present study, indicating that other factors also prevent dreams from being as recallable as waking memories.

Firstly, a less detailed memory having been encoded means it is impossible for a detailed memory to be retrieved. Secondly, if only a weak memory trace was encoded, there would be few cues that could subsequently retrieve that memory. Thirdly, context dependency may also affect the cues present that would necessitate the successful retrieval of a dream memory. That is, waking life situations usually differ greatly from the environments in which dreams are experienced. Thus the cues present in waking life may not relate to dream memories in multiple ways. Koulack and Goodenough's (1974) arousal-retrieval theory also extends this idea of content dependency, whereby there is little overlap between dreaming and waking in terms of brain activity and arousal, reducing the number of cues present for successful DR in waking life, even further.

Overall this experiment has provided convincing evidence that whilst the trends for remembering dreams and waking autobiographical memories from the entire lifespan are largely similar, the characteristics of the memories themselves differ considerably. In addition the recallability of dreams seems impaired in comparison to waking memories. This may be the result of a number of factors, but as dreams are characteristically less detailed along a host of measures it may be safe to assume that the lack of detail encoded in the memory may account for their poor recallability. If a lack of cues present at retrieval hinders the recallability of dreams, then increasing the number of cues present should improve remembering dreams. The following two studies (Experiments 6 and 7) have employed a diary design in order to investigate the recognition of dreams as well as their recallability.

4.2 Experiment 6: Pilot Diary case study: Recall and Recognition of Dreams

4.2.1 Introduction

A finding to emerge from Johnson *et al.* (1984) was that memories for dreams decayed rapidly. However when dreams were re-presented, participants were able to recognise them with some degree of accurately. Johnson *et al.* concluded that dream memories are not lost, but rather that their accessibility became attenuated over time.

As Experiment 5 found such a clear difference in the accessibility of dreams compared to waking memories, with dreams being much more difficult to recall, it seemed necessary to investigate

whether the entire dream memory trace would decay over time, or whether dreams simply become difficult to access for other reasons. A way of investigating this is to use diary designs as they allow dreams to be recorded as they happen, so not relying upon the validity or fragility of retrospective memory. Domhoff (2007, pers. comm., 16th Jan) for example encourages the use of non-laboratory measures of dreaming and dream memory, in order to increase the ecological validity of the measure. This method also allows the decay of memories to be explored over time, in real time. Recognition as well as recall tasks present the recaller with different amounts of cues at retrieval, thus manipulating the accessibility of the dream memory. This experiment is the first study in which dreams have been explored in a recognition task. Recognition of episodic memory is frequently investigated experimentally, although the memories usually involve non-autobiographical presentations of pictures or words, which are occasionally processed as thoughts, for instance (e.g. Dewhurst & Conway, 1994).

The present experiment used a single-case design diary study. Dreams were recorded upon awakening over a period of months, and recall and recognition for those dreams was subsequently self-tested. The methodology served as a pilot for larger scaled diary studies, in which the recallability of dreams and events could be compared.

4.2.2 Method

4.2.2.1 Participant and Design

The participant (also the experimenter and author) was a female, 22 year old student at the time of keeping the diary. This study employed a single case design as a pilot method, employing repeated measures analyses. Variables of interest were the time of the dream recollection, both in terms of time between dreaming and recollection in days, and in minutes between dreaming and writing up the dream report. The dependent variables were characteristic ratings taking from the dream reports written each day (see below). 102 dreams were recorded over an 8-month period, alongside a number of ratings scored at the time. When the diary was completed recall and then recognition of the reports was self-tested after a retention interval of two weeks.

4.2.2.2 Materials and procedure

Dreams were written down as soon after waking as was feasible. The date and time lag in minutes between dreaming and writing up was noted, as well as the sleep state at the time of waking (the participant recorded an estimation of whether she was dreaming or not when awakened). The dream itself was recorded, consisting of a written report of the dreamt material. In addition a score of 1-5 was given for the emotionality of the content, understanding the content, the bizarreness and realism of the dream (bizarreness was operationalised as being shockingly odd content, whilst the realism rating referred to the likelihood that the events from the dream could actually take place in waking life). These ratings were also scored on a 1-5 scale to allow easy comparisons between all questions, and were coded as follows: 1 = none, 2 = little, 3 = quite, 4 = much detail, 5 = all detail (or in the case of recollective measurements, more detail recalled than was initially recorded). The measures were devised as they appeared high in face validity. They also summarised the characteristics investigated in Experiment 5, as well as in a number of autobiographical memory experiments (see 4.1.2.2). In addition to these ratings and the dream report itself, a subjective comprehensibility report was written noting whether the dreamer could understand why certain material was dreamt. That is, continuity between waking life and dream content was assessed in terms of memories of events from the previous day/week being incorporated into the dream, as well as other general feelings or issues from that particular day. Word counts of the comprehensibility reports were recorded, as was a count of the length of the dream report itself. The reports were also scored for both detail and clarity, with detail representing autobiographical features and clarity representing sensory-perceptual episodic richness (see Experiment 1 for a reminder of these ratings).

Memory for the dreams was then tested experimentally two weeks after the final dream had been recorded. The recollection interval varied from 15 to 260 days. The dream reports were each randomly selected and were read by the participant. Memory was assessed in a number of ways. A dream report was read through and as soon as a memory for the dream was recalled, as much detail as possible was brought to mind. The recall score referred to the amount of information that could be freely remembered about the dream at this point, and was also scored 1-5, with 1 reflecting nothing being recalled, and 5 reflecting that the entire memory was recalled. If the entire report had to be read before anything could be recalled, a score of 1 was given, as this would constitute recognition as opposed to recall. The recognition score instead reflected how much of the report was familiar after the entire report had been read through, and was also rated

1-5. A score of 1 referred to a report that was entirely unrecognisable, a score of 5 referred to a report that was entirely recognisable, with a score of 3 being allocated to a report in which half of the dream was recognisable.

All memories for dreams at this retrieval phase were re-scored for both detail and clarity on the same 1-5 ratings described above. Five other measurements were taken when assessing memory for the dreams: a perspective of the self in the dream memory was noted as being in the first person ("field" perspective), being external to a usual perspective ("observer" perspective; e.g. the ability to look down on oneself or take the perspective of someone or something else) or whether it was not obviously either of those two choices. Recollective experience was recorded at the time of recall, to assess whether autonoetic consciousness was a feature of recalling the dream. This was independent from the recognition score which, as described above, determined the proportion of the report that was recognisable. The usual 1-5 scoring mechanism was used, with 1 referring to a "remember" response, 2 a "know", 3 a "familiar", 4 a "guess" and 5 depicting no sense of actually remembering the dream material (see Table 3.2.1 for full definitions of these experiences).

4.2.3 Results

4.2.3.1 Descriptive statistics

Table 4.2.1 below details the descriptive trends for each of the ratings. There was great variance in the recording retention: the estimated time between dreaming and reporting the dream. In 8 cases (7.84%) the recording retention exceeded 300 minutes (5 hours). These instances occurred when, for instance, a dream was recalled from the previous day, or when instant recording of that dream was impossible. When these cases were excluded, the mean recording retention decreased to 47.14 minutes, although there was still a great deal of variance in this (SD = 50.80).

In 29.4% of cases the participant estimated that she was dreaming when awoke and was not dreaming at the time of being awakened but was not dreaming whilst awakened in the remaining 70.6% of times a dream was reported. There was very little variance in the perspective ratings. In fact, in only 7 cases (6.9%) a dream was recalled in the observer (or image) perspective as opposed to the field perspective.

Table 4.2.1 Means (and standard deviations) of the dream ratings based on 102 dreams)

Characteristic rating	Mean	SD
Recording retention (mins)	164.03	615.33
Understanding	2.51	1.11
Emotionality	2.93	1.13
Bizarreness	3.21	.99
Realism	2.62	1.07
Detail of report	3.31	.86
Clarity of report	3.24	1.13
Report length (word count)	324.89	201.21
Understanding length (word count)	95.26	6.59
Detail at retrieval	3.00	.13
Clarity at retrieval	2.79	.13
Recall	2.05	.11
Recognition	3.54	.12
Perspective	1.07	.03
Experience	2.41	.13
Day residue	2.46	.11

Both the detail and clarity ratings fell slightly between initially reporting the dreams and subsequently retrieving them (for detail: $T(101) = 2.46$, $p<0.05$; for clarity: $T(101) = 3.11$, $p<0.01$). Figure 4.2.1 illustrates a difference between the initial detail and clarity scores over time in terms of retention interval. There seems to be a general decline in detail scores over time, with less detail being reported the longer the recording retention. However the clarity scores of the report do not show this trend – this is evident from the haphazard trend illustrated in Figure 4.2.1.

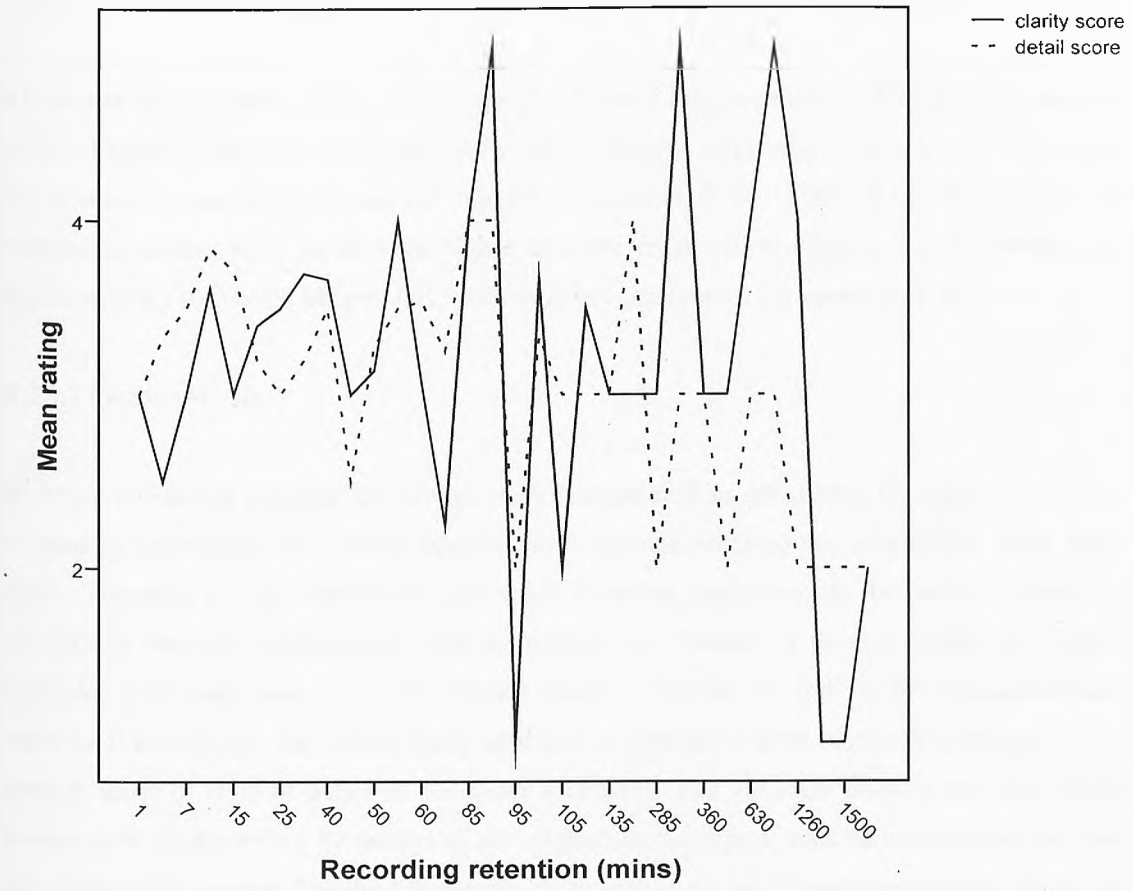

Figure 4.2.1 Detail and clarity scores of the initial dream reports as a function of retention interval

These trends are reinforced by their respective correlation coefficients: detail scores significantly correlated with recording retention ($r = -2.52$, $p<0.05$) whilst the relationship was not significant between the clarity scores and recording retention ($r = -0.38$, $p>0.05$). A linear regression also demonstrated how detail scores could be significantly predicted from the recording retention time ($F(1, 101) = 8.27$, $p < 0.01$), despite accounting for just 7.6% of the overall variance in detail scores. Similarly the clarity scores could not be predicted from the recording retention data, with the non-significant model accounting for just 2.4% of the variance in the clarity scores ($F = (1, 101)\ 2.43$, $p>0.05$).

4.2.3.2 Recall and recognition

43 dreams (42.2%) were given a recall score of 1. That is, they were not recalled at all. In contrast only 7 dreams (6.9%) were not recognised at all. No dreams received a recall score of 5, however 26 dreams (a quarter) received the highest recognition score. Table 4.2.1 shows that the recognition scores were on average higher than the recall scores. Indeed this difference was significant ($T(101) = -20.68$, $p<0.001$) with an effect size (partial eta squared) of .81.

4.2.3.3 Factor analysis

In order to identify whether the ratings were independent or measuring the same underlying constructs, a principal components analysis (with varimax rotation) was conducted. Three clear factors emerged, and are detailed in Table 4.2.2. These are comparable to the factors included in the Dream Memory Questionnaire (see Experiment 1). Namely, a general recollection factor emerged, with detail and clarity at retrieval loading onto this as well as the sensation-based variable of experience. The second factor appeared to distinguish these recollective ratings from a general sense of level of detail of the dream memories. The variables loading onto this factor tended to be characterised by ratings of the original dream report, such as word counts and the detail and clarity scores. The third factor can be conceived of as a "comprehensibility" factor, as the understanding, day residue, realism and bizarreness scores comprise this factor, which is in line with the hypothesised constricts when the measures were devised. Perspective of the dream did not load onto any of the three main factors that emerged.

Table 4.2.2 Variables loading onto the three factors emerging from a principal components analysis

	Factor		
	Recollection	Detail	Comprehension
Detail at retrieval	.922		
Recall	.920		
Recognised	.913		
Clarity at retrieval	.903		
Experience	.901		
Detail (initial)		.808	
Clarity (initial)		.728	
Dream length (word count)		.698	
Understanding length (word count)		.606	
Emotionality		.497	
Recording retention (mins)		-.471	
Understanding score			.860
Day residue			.781
Realism score			.673
Bizarreness score			-.629

4.2.4 Discussion

This experiment set out to pilot a diary method of testing memory for dreams. The method allowed an initial report of the dream memory to be recorded, allowing the subsequent recalled memory to be compared to the original record in order to ensure validity of recall. The experiment demonstrated some minor methodological issues for improvement, and some clear

theoretical findings. Namely, memory traces of dreams that have reached waking consciousness upon waking do not entirely decay over time. Whilst they are increasingly difficult to recall, they are recognisable providing that adequate cues are available. This discussion shall focus upon the methodological issues raised by this experiment.

Factors emerging from the principal components analysis were very similar to those obtained in Experiment 1, supporting the overall validity of the emerging constructs. Specifically the "detail" factor was comparable to the "awareness of dreaming" factor that forms part of the DMQ. The ratings designed to measure comprehensibility (understanding score, day residue, realism and bizarreness) clearly loaded onto a comprehensibility factor. Due to the clarity and independence of this construct, future studies should consider using just one, directly-measured comprehensibility rating.

The other ratings interestingly discerned between the strength of the original memory trace ("detail" factor) and the sensations experienced at retrieval ("recollection"). This experiment is the first investigation of dream memories in this way, directly comparing the memories at retrieval to the original report of the dream. Despite this the design was tailored towards the experimenter who was also the participant. If this design was applied to a larger sample, such subjectivity may prevent comparisons across individuals from being made. As a result a more standardised measure of recall and recognition is necessary. This would involve dreams (or other autobiographical memories) being written or reported orally for the recall task, whilst the recognition task would involve presenting sections of the original report. Recognition could either be in the form of a "yes/no" choice, or involve a recollective experience paradigm so to include the more experiential sensations as reflected in the "recollection" factor.

The detail and clarity scores were insightful both theoretically and methodologically. Firstly, as Figure 2.2.1 depicts, the detail of the dream declined over time whilst the clarity scores did not. This implies that the clarity of a dream does not seem to depend upon immediate recording of that dream, whereas detailed accounts of dreams require immediate recording. This is reinforced by the finding that recording retention had a relatively low loading score onto the detail factor. In other words the time between dreaming and recording a dream, so encoding it in some form, was only mildly influential upon the amount of detail recalled from a dream. Clarity may instead reflect the general salience of the dream, which influences its subsequent recallability, but is independent from the amount of detail that is recalled. In addition, in methodological terms, as

clarity measured the more experiential aspect of the dream in terms of sensory-perceptual information, which is a characteristic feature of highly detailed episodic memories (Conway, 2002), it is comparable to a measure of "episodic richness" used in the Autobiographical Memory Interview (Kopelman, Wilson & Baddeley, 1989). Indeed the clarity (of the retrieved dream report) ratings were extremely highly correlated with the experience ratings ($r=.90$, $p<0.001$).

Difficulties were encountered regarding the comparability of the recall and recognition scores. Whilst both were scored on a 1-5 rating scale, with 1 referring to no recall or recognition, respectively, the highest scores (of 5) were not comparable. Specifically, in the recall task a score of 5 referred to recalling more than the original dream memory, whilst in the recognition scores, 5 referred to correct recognition. Considering this it may not be surprising that a significant difference between these scores was found. However there is still convincing evidence to suggest that recognition was superior to recall for a number of reasons, aside from the theoretical inclination. Firstly, more dreams were recognised to some degree (scores 2-5) than recalled (scored 2-4). Secondly, the mean difference between the recall and recognition scores exceeded 1 (1.49) suggesting that the difference cannot merely be a result of the slightly incomparable rating scales (comparing 1-4 with 1-5). Thirdly, the trends for detail, clarity and experience showed that some dreams were recognised with recollective experience, implying that a strong sense of recognition was perceived in more experiential terms. Despite this it is worth noting that recall and recognition are difficult to compare directly when autobiographical memories are concerned, as more cues overall are provided in a recognition task if the recognition cue itself (the whole dream report) is longer than, for instance, a recall cue such as a report title.

Overall this experiment has piloted a diary design that has been elaborated upon in Experiments 7 and 8. More concise rating scales are now possible (e.g. comprehensibility). Comparing retrieved dream memories to an original report validates the memory to a degree. Dream reports are constructed after the actual experience has occurred, so the "original" report is already a memory of the event. However outside of a sleep laboratory, in as natural a setting as possible, this diary method is the most ecologically valid measure possible.

The clear findings resulting from this experiment are that recall of dreams memories from up to 6 months ago is relatively poor compared to recognition, which was accompanied in come cases by recollective experience. When providing ample cues at retrieval, dream memories are accessible. Thus recall failures in Experiment 5 as well as in everyday life may well be attributed to a lack of

available cues in the environment. Whilst dream memories do seem to decay rapidly in everyday terms, especially salient dreams may still be encoded upon awakening, for subsequent recall. Although it is now evident that dream memories do not decay entirely, their recallability and recognisability may not differ from autobiographical remembering of waking events. Thus Experiments 7 and 8 compare memory for dreams with memory for waking events, in different ways.

Summary

Experiment 5 compared the characteristics and retrieval of dreams and waking episodic memories, finding that retrospective dreams are less recallable, and therefore less accessible, than retrospective events. In addition, they are less detailed along a host of characteristic scales. Experiment 6 demonstrated that dreams are less recallable than recognisable. These studies have demonstrated the similarities between remembering dreams and waking experiences, implying that their differences in recallability may be the result of characteristic differences. That is, dreams may not be able to be so detailed due to the lack of self reflectiveness whilst they are being experienced. Thus the findings in Experiment 5, that memories for dreams are less detailed than waking events whilst being comparable at the time of being perceived, is difficult to explain. Indeed, these trends indicate that dreams can be highly sensory-perceptual experiences, but that much of this information is lost over time. Further, it is problematic to rely upon subjective retrospective reports of such experiences as they may well have been rehearsed since their occurrence.

In order to identify whether dreams are inaccessible as a result of loss of a memory trace, or the absence of retrieval cues, Experiments 7 and 8 systematically compare dreams and events across recall and recognition tasks.

Chapter 5: Characteristics and Recallability of Current Dreams: The Effect of Rehearsal

Introduction

The experiments in chapter 4 investigated the accessibility of dreams and waking events. Experiments 5 and 6 investigated long term memories for dreams that had occurred over the lifespan. Their retrospective nature meant that they could have been rehearsed, thus questioning the validity of the memories that were generated, and reducing the comparability between the two types of memories. In addition data described in Horton (*in press)* found that retrospectively recalled events were more rehearsed, as based upon a subjective rating scale, than retrospectively recalled dreams. The following chapter therefore focuses upon the characteristics and recallability of current dreams and events. Experiment 7 aimed to do this whilst controlling for rehearsal by using a diary paradigm and Experiment 8 manipulated rehearsal in order to observe its effects upon subsequent recall frequency and memory detail.

As previously described, Kemp, Burt & Sheen (2003) compared the characteristics of dreams and autobiographical ("actual") experiences and found that actual events were more detailed due to more contextual information being encoded at the time of experience. Whilst Experiment 5 reaffirmed Kemp *et al.*'s findings concerning the characteristic differences between dreams and actual experiences, Kemp *et al.* also mentioned that remembering dreams and waking experiences differed in terms of recall and recognition. That is, dreams are particularly difficult to recall, whilst they are still recognisable. It is well documented in memory literature that recognising an item is an easier task than freely recalling it, due to the presence of an increased number of cues from encoding, at retrieval. It is not surprising, then, that the same should be true for dream memories, given their inherently autobiographical nature. It is unclear as to whether dreams and waking experiences are similar in this respect, or not. That is, are dreams similarly more recognisable than recallable than events, or more so? As dreams are significantly more difficult to freely recall than waking events (as demonstrated in Experiment 5) and yet still recognisable, differences between remembering dreams and waking experiences may well exist. Kemp *et al.* did not investigate recall and recognition clearly. In fact it is not clear from their report whether recall or recognition was tested! The present experiment therefore aimed to investigate the nature

of retrieving dreams and waking events employing a systematic assessment of recall and recognition of dreams.

A main focus of Kemp *et al.*'s experiment was upon reality monitoring: the identification of whether an experience was a dream or an event. Performance is generally high in these tasks (Johnson *et al.*, 1984; Kemp *et al.*, 2003). The present experiment thus also includes a reality monitoring task, assessing both the distinction of dreams and events (as in Kemp *et al.*'s study) as well the distinction of experiences (dreams and events) and made up experiences (dreams and events) as in Johnson *et al.*'s (1984) study. Johnson *et al.*'s methodology employed in their second experiment is similar to the present design in that dreams were generated, and subsequently tested for reality monitoring and cued recall. In addition the present experiment employs a recognition task for the previously generated dreams and events. Comparisons of memory retrieval in context have never been previously investigated, although more ecologically valid and episodically rich measures of autobiographical memory are increasingly in use, for instance the use of SenseCam (Hodges *et al.*, 2006), which captures images from an individual's daily life can be used as a rich cue in a recall task.

Montangero, Ivani & de Saint-Hilaire (2003) directly compared the recallability as well as the characteristics of dreams and waking memories. Waking memories were manipulated to be comparable to dreams in that dream-like films were created and presented to individuals when awoken at specific times in a sleep lab, so to be as similar to dreams as possible. Thus dreams and the "events" (films) were able to be compared appropriately, as the films were presented to participants in the night (after they had been awakened 10 minutes after the second onset of REM sleep), when arousal levels and brain activity would be as comparable to the dreaming brain as possible. In addition the films were viewed and recalled by the participants, being similar to experiencing a dream and then recalling it. This then is the only study that has compared DR with event recall directly. Whilst the measures taken to ensure that the films would be comparable to dream memories, comparing waking events to dreams also offers illustrates the comparability of these two types of memories. The morning after dreams and film reports had been collected from participants (over the course of separate nights in a sleep lab, using a counterbalanced design) a recall test was administered the following morning. The general findings were that more information was recalled in the morning, than when the original experience was recalled in the night. In the case of the films, the validity of the memories of the extra information could be verified, and was found to be accurate in most instances (86%).

The findings of Montangero *et al.*'s experiment implied that dream memories are accessible. This is largely contrary to many other studies on DR, and indeed is incongruent with the findings of Experiment 5. However Montangero *et al.* provided suitable memory cues in the form of event specific knowledge about the dreams and films, and their recent occurrence may have contributed to the dreams being more recallable than older dreams. Indeed Johnson *et al.* (1984) found that recent experiences contain more contextual detail than older memories, thus facilitating accurate reality monitoring decisions.

Diaries have been used as an autobiographical memory research tool (e.g. Linton, 1982; Odegard & Lampinen, 2004) and also as a means of recording or improving recall for dream memories. They allow experiences to be recorded shortly after they have occurred, providing a detailed validity measure for subsequent recall tasks. Odegard and Lampinen (2004) used a diary style paradigm to investigate if people would falsely remember events that shared features with actual autobiographical memories, but the whole episode had not actually occurred. They built upon the design used by Barclay and Wellman (1986) and Conway, Gathercole, Collins and Anderson (1996) which involved later presenting participants with elements of their diary for recall and recognition tests. In the Conway *et al.* (1996) study, participants recorded false as well as true memories, and these subsequently appeared in the recognition task (along with new material, also). The Barclay and Wellman (1986) and the Odegard and Lampinen (2004) studies involved altering the actual memories slightly in order to create false event descriptions. This was done in order to create memory conjunction errors: the false recognition of a false memory, which includes features from at least two previously experienced items. The Conway *et al.* (1996) procedure involved creating false memories at the time of recording, and later reality monitoring them to a degree as part of the recognition exercise. These studies found that such errors are made, and used autobiographical lures in recognition tests for the first time.

The two experiments in the present chapter employ the diary paradigm, allowing for current dreams and events to be recorded shortly after they have occurred. Experiment 7 aimed to compare systematically the retrieval of dreams and events. Experiment 8 aimed to manipulate rehearsal in order to characterise its effects upon autobiographical remembering.

Experiment 7: Recall and Recognition of Current Diary Dreams and Events

5.1.1 Introduction

This experiment continues with the assessment of the continuity between autobiographical memories for waking events and dreams, in terms of retrieval modes and characteristics.

Experiment 6 found that the dreams became extremely difficult to access over time, whilst recognition performance was comparably easy. The present experiment aimed to extend these findings more systematically, by comparing the trends of recall and recognition to those for autobiographical waking events. In addition, characteristics were compared, as in Experiment 5, although in this case more details were collected for the memories themselves (in Experiment 5, participants were merely asked to bring the memory to mind, and complete a characteristics questionnaire on them, for ethical purposes. In the present experiment ethical considerations have been described below. See 5.1.2.3.5).

Whilst Horton (*in press*) found that retrospectively recalled events were more easily recallable than retrospectively recalled dreams, the memories may well have involved recalling thoughts or conversations about those experiences that had occurred since the actual dream or event. The present experiment aimed to investigate whether current dreams and events would show comparable patterns of recall and recognition. Investigating current dreams and events allowed everyday experiences to be characterised, whilst aiming to achieve greater validity of recalling and recognising the original memory trace as opposed to a rehearsed version of a memory, which may have been the case for the retrospective experiences.

It was predicted that dreams would be less detailed, episodically rich, positively emotional, salient and comprehensible than events. Findings from Montangero *et al.*'s (2003) research implies that dream memory traces are still stored in LTM, and are accessible if enough cues are provided. The present experiment aimed to use this diary method in order to investigate current dreams and events, and memory for them a short while later. As this experiment aimed to overcome the confound of rehearsal, it was predicted that dreams and events would both be similarly recallable and recognisable, given their less salient, everyday nature.

These were tested in a quasi-experimental study which involved 3 phases, involving a diary phase in which current dreams and events were recorded (Phase 1), a recall task (Phase 2) and a recognition task (Phase 3).

5.1.2 Method

5.1.2.1 Participants

Students at the University of Leeds were asked to participate in a "dream diary study". Participants were informed that they would be required to recall their dreams. They were asked if they usually recalled their dreams. Some participants reported that they struggled with recall, but would try the study nonetheless. Initially 63 participants were recruited. Whilst 37 people managed to record their dreams and events, only 25 completed the full task. The participants were lost due to the length of the study (it took some participants weeks to complete) and due to some unexpected difficulties encountered when completing the diaries at home. Specifically some participants found it difficult to report their dreams, and some admitted that diary completion was troublesome to incorporate into a morning routine. Overall the study ran for 18 months. This resulted in a sample consisting of 4 males and 21 females. The median age was 19 years. Participants were awarded with participant pool credits and were paid £10 upon successful full completion. The analyses reported here are of the 25 individuals who completed the entire study.

5.1.2.2 Materials and Design

For the first phase of the study a standard template was used per dream or event report (see Appendix G). For Phase 1 participants were given a pack of 30 templates (for 15 dream and 15 event reports). These templates included space for the report to be handwritten, 4 rating scales (emotionality, comprehensibility, personal importance/salience and surprise) as well as information about when and where the memory occurred. Characters involved in the memory were listed. For the second phase; the recall task, 10 reports were randomly selected, 5 of each type (dreams and events) and the titles of these reports were presented to the participant in question. For the recognition task, a similar template was employed, with 40 sentences in all. Details of each phase can be found below. All tasks were completed in pen and paper form.

Recent dreams and events were instructed to have occurred during the previous night or day, for dreams and events, respectively. The numbers of dreams and events reported were matched, in that participants reported the same number of events as dreams. At least 5 dreams had to be recalled at each of the first two stages. If more were recalled, 5 of these were randomly selected for the recall and recognition tasks. There was a latency period between 10 and 21 days between phases. This was to prevent rehearsal and recency effects for these experiences.

There were a number of dependent variables of interest, including the characteristic ratings as well as word counts of reports, the proportion of correctly recalled reports at Phase 2 and proportion of correct identifications of sentences in the recognition task (Phase 3). The recall task included a reality monitoring task whereby participants had to identify whether the cued report corresponded to one of their dreams or events, and the recognition task included a recollective experience paradigm, with participants indicating whether they had remembered, found familiar, known or guessed that they had recognised the sentence in question (see Table 3.2.1 for a reminder of definitions of recollective experience ratings).

Detail and episodic richness scores were assigned to the memories as based upon the ratings of the Autobiographical Memory Interview (AMI; Kopelman, Wilson and Baddeley, 1989). However when used in previous studies (Experiments 1 and 6) the ratings were only comparable to the actual AMI ratings in terms of quality (Experiment 1 used "clarity" as opposed to episodic richness) and rating (both previous usages employed a scale of 1-5), this experiment used the measures in the ways that they had been intended, on a scale of 0-3. The definitions of these are shown below.

Table 5.1.1 Definitions of the detail and episodic richness ratings, as outlined in the AMI

Detail (general AMI rating)

3 points: A detailed personal memory that is specific in place and time.

2 points: A specific personal memory with few or no details; OR a less specific event in which time and place are recalled.

1 point: A vague personal memory; OR an incident that occurred on multiple occasions but no single instance is recalled.

0 points: A response based on general knowledge; OR no response.

Episodic richness

3 points: Response is rich in detail, containing at least 2 elaborations, and evokes an impression of true re-experiencing.

2 points: Response has moderate detail and contains at least 2 elaborations.

1 point: Limited detail and/or limited elaboration of events.

0 points: No episodic information.

The episodic richness score is a basic extension of the detail score, although refers to the specificity of the occurrence. Elaborations almost always contained sensory-perceptual information, thus being comparable to the clarity rating used and described in Experiment 1.

For the recall task, 10 titles of randomly selected dreams and events were presented. These were composed of 5 dreams and 5 events (as described above, and below, in more detail). For the recognition task, the same 10 reports were selected and from each of these, 4 sentences were generated. Figure 5.1.1 shows the structure of the recognition task.

Table 5.1.2 Origins of sentences included in the recognition tasks

	Yes = correct recognition	No = correct recognition
Dream	2 experimental	2 control (one related, one not)
event	2 experimental	2 control (one related, one not)

There were 10 non-related control sentences in each task, which were the same across all the participants (see Appendix H). These sentences were matched along the dimensions of emotionality, comprehensibility and personal importance/salience and surprise as they typically appeared for each memory type. That is the dreams were more negatively emotional and surprising, although less comprehensible and salient than the events. The remaining 30 of the 40 items in this task were unique to each participant. The experimental sentences were the first two sentences that had been used in the dream/event reports. The related controls were sentences that had been constructed to relate to the title of the report so to create an experience that was believable and typical of a dream or event. Order of presentation of all items was randomised.

Example of a dream experimental sentence:

The garden was very strange and things seemed to be out of proportion.

Example of an event experimental sentence:

Gave first oral presentation at conference, in Coventry.

Example of a related control sentence (related to the title, "violin at Albert Hall")

It was amazing to be playing my violin at such a place - the audience was huge.

Participants had to wait for a period of at least 10 days (and no longer than 21 days) between phases 1 and 2, and 2 and 3. This was to ensure that LTM of both the recent as well as the old dreams and events was being investigated and to prevent recency effects to aid memory for some of these experiences.

5.1.2.3 Procedure

5.1.2.3.1 Phase 1

Templates were distributed to participants, and instructions administered. However the present experiment differed from Experiment 7 in that participants were required to record a dream whenever they could remember a recent one occurring. Thus if a dream could be recalled from the previous night, they were to record it as soon as possible after waking. Whenever a dream template was completed, an event template was to be completed for an episodic event from the previous day. This meant that if 2 or more dreams were recorded from one night, a corresponding number of event templates were to be completed for events that had occurred during the preceding day. This procedure was continued until as many dreams had been recorded as possible. Participants were instructed to keep the diary for at least 2 weeks. However, if participants could not recall any more dreams the materials were returned. Again if fewer than 5 dreams and events had been recalled then the participant was excluded from further phases. Information concerning the date of the diary report (both the date and the hour of occurrence), were encouraged to be recorded in this phase. In addition the ratings for emotionality (whether positive or negative), comprehensibility, personal importance and surprise were kept.

5.1.2.3.2 Phase 2

Once these materials had been returned by post, there was an intervening period before phase 2 could begin of about 10 days (this was for a maximum of 21 days for a couple of participants who

were unavailable for the next phase until that time). The recall task included the 10 titles of the dream and event reports – 5 for each type of memory.

The report's title acted as a cue in the recall task. An example of a recall task can be seen in Figure 5.1.1.

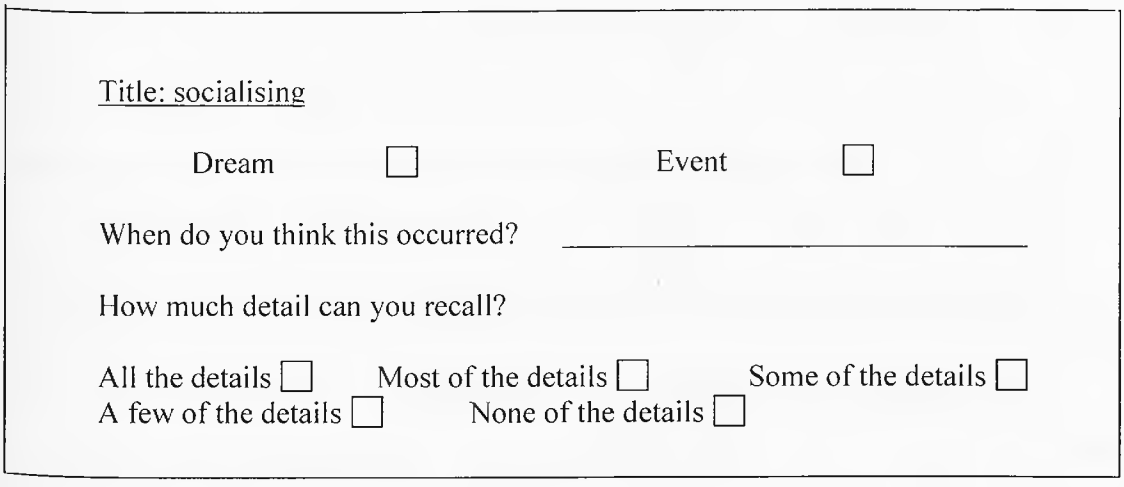

Figure 5.1.1 Example of an item in the recall task

The participant had to identify whether the report referred to a dream or an event, in a source monitoring task (referred to as a reality monitoring task from now on, as although the reports all referred to experiences that had actually been perceived by the participant, performance was also compared with a control group (see below; 5.1.2.3.4) to whom these experiences were novel).

This was followed by a large box in which the participant was instructed to record their memory of the experience in as much detail as they could. The order of the titles (dream/event) was randomised.

5.1.2.3.3 Phase 3

After another latency period of circa 10 days, the recognition task was distributed to participants. This was composed as described above, with the order of the sentences being randomised. Figure 5.1.3 shows the items included in this task for each sentence. Participants were instructed to identify whether each presented sentence had appeared in one of their reports or not. In addition they had to indicate the extent to which they remembered this using a standard recollective experience paradigm, as well as the extent to which they recalled recording the event or dream in question.

1. This sentence appeared in one of your dream/event reports:

I saved Sami (boyfriend) from an accident involving a low-flying aeroplane.

True ☐ False ☐

If true, please indicate the extent to which you recollect the actual event happening:

R ☐ K ☐ F ☐ G ☐

If true, please indicate the extent to which you remember reporting the event:

R ☐ K ☐ F ☐ G ☐

If true, please indicate the extent to which you have thought or talked about the event since its occurrence:

Not at all ☐ not really ☐ moderately ☐ a lot ☐ all the time ☐

Do you think this was a Dream ☐ or an event ☐ ?

Figure 5.1.2 Example of an item in the recognition task.

5.1.2.3.4 Control task

In order to ascertain that differences between reality monitoring of targets as opposed to lures in this task were not due to chance or logic (dreams are typically less detailed, for example, than episodic memories), an opportunity sample of 26 participants who had not completed the other phases completed a reality monitoring task. This control task was composed of 40 items, taking the same structure and format as a typical recognition task. However "target" sentences were taken randomly from the reports of 20 participants, as were the "lures" (although strictly speaking in this case they were all lures). As these sentences described events that should have been unfamiliar to the control group, the task was to guess whether the sentence came from a dream or event report, and also to indicate whether the sentence described something that had happened to the participant before. Thus there were directly comparable reality monitoring and recognition task data, respectively.

5.1.2.3.5 Ethical considerations

Participants were reminded that the reports of their memories would be treated both confidentially and anonymously. In order to reassure participants of this, all phases of the experiment were conducted out of the laboratory and in participants' own time, so materials were distributed by post. Information sheets reminded participants that they should report memories as honestly as they could. However if they did not wish to reveal particular information, that this would not be problematic. They should simply indicate when they did not report some detail, and state whether this was the result of a memory failure or a choice not to report the content. No participants responded in either way. Memory failure was therefore assessed through the main dependent variables (see above).

5.1.3 Results

A mean of 9.74 dreams were reported in this phase, and 9.15 events in a matched design. Only the dreams and events from the 25 participants who completed all parts of the study were analysed.

5.1.3.1 Descriptives

Table 5.1.3 details the characteristics of dreams and events. Events were significantly more salient, emotional (positively), comprehensible and containing more familiar characters than the dreams, which were longer and contained significantly more unfamiliar characters than the events. The emotionality scores for two participants were amended as they consistently described negative experiences and imagery, although scored them as "highly positively emotional" with a score of 2 (as opposed to -2). It was assumed that the rating scale had been misinterpreted as the scale differed to those of the other characteristics. See 5.1.4 for a discussion of this.

Table 5.1.3 Comparisons of the characteristics of dream and event reports

	Mean		
Characteristic	Event	Dream	T test
Word count	49.576	74.79	T(24) =5.59, p<0.0001
Salience	.47	-.28	T(23) =-4.45, p<0.0001
Emotionality	.38	-.17	T(23) =-4.53, p<0.0001
Comprehensibility	1.34	.03	T(23) =-7.84, p<0.0001
Surprise	.62	-.27	T(23) =5.53, p<0.0001
No. Familiar	1.95	1.67	T(23) =-1.27, n.s.
No. Unfamiliar	.11	.59	T(23) =5.57, p<.00001

5.1.3.2 Recall and recognition

As there were many variables of interest in this experiment, recall was operationalised according to a number of variables. A report was deemed to have been recalled if it received a response other than remember "none of the details" to the "how much detail can you recall?" question, and a score of 1, 2 or 3 (so not 0) had been given for both the detail and episodic richness ratings. In addition the recall task itself should have involved writing down something relating to the original memory itself. Vague responses such as, "...something about going shopping..." were not considered to depict episodic recall. The validity of the recall report was compared with the original report to ensure accurate recall. The numbers of reports fitting these criteria were counted, producing a recall score for each participant. No differences were found between the number of recalled events (70%) and the number of recalled dreams (67.5%; T (23) = -.340, n.s.).

5.1.3.2.1 Descriptives for recall tasks

In order to ascertain how much information of the original reports had been recalled, length (word count), detail and episodic richness ratings were collected and compared for the original reports and at recall.

Table 5.1.4 Means (and standard deviations) for report characteristics (N=25)

		Dream	Event
Word count	Original	74.79 (31.93)	49.58 (23.77)
	Recall	31.35 (22.58)	29.59 (20.55)
Detail	Original	2.81 (.19)	2.74 (.26)
	Recall	2.18 (.60)	2.26 (.62)
Episodic Richness	Original	2.20 (.23)	2.01 (.23)
	Recall	1.82 (.62)	1.91 (.57)

2x2 repeated measures ANOVAs were conducted on these data measuring a main effect of time (original and recall reports were compared), a main effect of memory type (dream or event) and the time x type interaction. For the report lengths there was a significant main effect of time with the original reports being longer than those in the recall task ($F(1, 24) = 54.96$, $p<0.001$). Experiences reported in the original diary phase were significantly longer – about twice as long – as those reported in the recall task (means were 62.18 for the original reports and 30.47 for recalled reports). There was also a significant main effect of memory type ($F(1, 24) = 14.79$, $p<0.001$) with dreams being significantly longer than events (means were 53.07 and 39.58, respectively). The time x type interaction was also significant ($F(1, 24) = 23.68$, $p<0.001$), illustrating that dreams decreased in length between the time of reporting the experience and recalling it, more than the events did.

The same analyses were conducted for the detail scores. The main effect of time ($F(1, 21) = 41.10$, $p<0.001$) showed that the original reports were much more detailed than the recalled reports. There was no significant effect of memory type ($F(1, 21) = .02$, n.s.) as means were very similar. The time x type interaction also did not reach significance ($F(1, 21) = .33$, n.s.). Table 5.1.2 demonstrates that dreams are slightly more detailed than events, and the initial reports were more detailed than those of the recall task.

A significant main effect of time was found for the episodic richness scores ($F(1, 21) = 5.10$, $p<0.05$). The original experiences were more episodically rich than those in the recall task (means were 2.11 and 1.86, respectively). The main effect of type was not significant ($F(1, 21) = .535$, n.s.) as means were similar. The time x type interaction ($F(1, 21) = 5.213$, $p<0.05$) showed that, as for the length of the reports, dreams lost their episodic richness over time more than the events. Events were significantly more accurately reality monitored at this stage than dreams (means were 83.2% and 72.8%, respectively; $T(24) = -2.40$, $p<0.05$).

5.1.3.2.2 Recognition task

If a presented target sentence (from an actual report) was judged to be "true", or a lure sentence, "false", that sentence had been correctly recognised. The percentage of sentences correctly recognised (out of the 40 items in each task) from dreams and events were compared. Results from the recollective experience paradigm have not been presented here for brevity. Recognition performance was similarly high for both dreams and events, with 75.87% accuracy for dreams and 77.61% for events ($T(24) = -.76$, n.s.).

Table 5.1.5 % Recognition performance (and SDs) for dreams and events

	Hits	FPs	Overall performance
Dreams	88.22	29.36	77.55
	(18.62)	(26.08)	(21.44)
Events	80.67	33.83	71.70
	(17.37)	(28.02)	(23.46)
	84.44	31.60	74.62
	(15.23)	(25.90)	(21.43)

Reality monitoring accuracy for the targets in the recognition task did not differ significantly between dreams and events ($T(20) = -2.024$, n.s.) although performance was higher for the events than the dreams (means were 85.7% and 78.6%, respectively). Table 5.1.5 displays the proportion of hits and FPs for the two types of reports (dreams and events).

5.1.3.3 Performance across experimental and control groups

In order to ascertain that the patterns of recognition and reality monitoring in this task were valid, a control group also completed both a recognition task (responding true/false to the question, "Has this ever happened to you?") and a reality monitoring task ("Do you think this was a dream or an event?"). Different patterns of results demonstrated that the experimental group were recognising the sentences in the recall task and remembering them in order to make reality monitoring judgements.

Overall recognition performance for across groups did not differ significantly ($T(45) = .66$, n.s.) with the experimental group being slightly more accurate than the controls (means were 76.74% and 72.60%, respectively). However it should be noted that for the experimental group, positively recognised targets and unrecognised lures produced an overall recognition score. For the control group, their recognition score was based upon all sentences being lures, that is the control participants' task was easier in that a perfect score would involve not recognising any of the items at all. Whilst it may be expected that the experimental group should perform at a significantly higher rate than the controls, their similar accuracy rates actually reflects different patterns of performance in the task.

The trends for the target and lure items have been broken down further across groups, in order to ensure that the experimental group were recognising their own experiences (and thus retrieving actual memories of dreams and events). Table 5.1.6 compares the recognition performance scores across groups for both the targets and the lures. Dreams and events have been collapsed together as there were no significant differences in their recognition accuracies.

Table 5.1.6 % Recognition performance (and SDs) for the experimental group (N=25) and the control group (N=26) for targets and lures

	Experimental	Control	Overall
Targets	85.71 (19.64)	83.33 (10.29)	84.44 (15.23)
Lures	82.38 (15.13)	61.88 (22.64)	71.44 (21.89)

Half of the lure sentences were related to a report, whilst half of the lures were unrelated (whilst still being matched upon appropriate dimensions so to be typical of dreams or events – see Figure 5.1.2 for a reminder of the structure of the recognition task). Thus the related lures should be more difficult for the experimental group to recognise correctly, if they are being confused by them. For the control group, all lures were essentially unrelated, so the comparisons for them involve comparing the unrelated lures (the same sentences seen by all participants) with a sample of related sentences seen by all controls. Mixed model ANOVAs confirmed this.

ANOVA analyses found that all effects were significant. That is, a main effect of sentence type was found ($F(1, 43) = 14.13$, $p<0.001$) whereby targets were recognised more accurately than lures. The experimental group performed at a significantly higher level overall in the task ($F(1, 43) = 7.86$, $p=0.01$). A significant sentence type x group interaction was also found ($F(1, 43) = 7.56$, $p<0.01$), as indicated in Figure 5.1.1. The experimental group performed similarly across both sentence types (with a slight decline in performance for the lures) whilst the control group struggled much more with the correct recognition of the lure items compared to the targets.

The related (sentences matched to each dream and event report) and unrelated lure sentences were compared across groups. Whilst there was no effect of sentence ($F(1, 43) = .08$, n.s.), the experimental group significantly recognised the sentences more accurately than the controls ($F(1, 43) = 11.07$, $p<0.005$). In addition a significant sentence x group interaction was found ($F(1, 43) = 46.71$, $p<0.001$) and is illustrated in Figure 5.1.3.

The experimental participants performed better on the unrelated lures whilst they were more confused by the related lures. This shows that they remembered their experiences. As the controls displayed the opposite trends, these data imply firstly that the groups were using different strategies for recognising the sentences, and secondly that the unrelated sentences were easier to recognise for the controls.

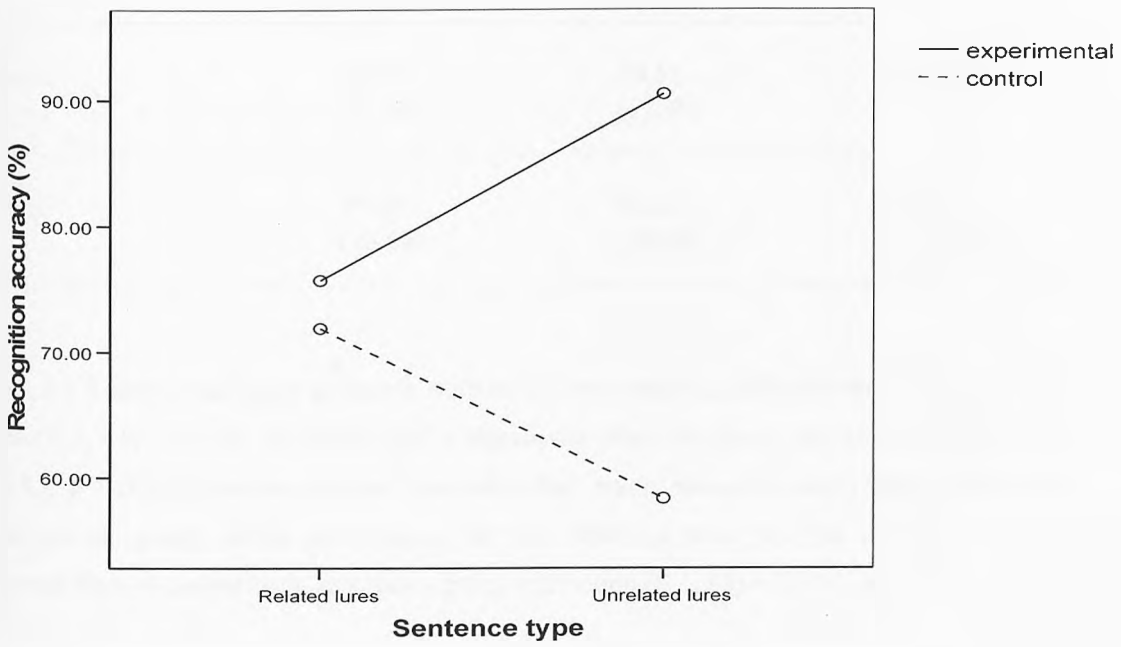

Figure 5.1.3 Recognition performance for the lure sentences across groups

Whilst a significant effect of memory type (dream or event) was found ($F(1, 45) = 11.77$, $p<0.001$), with dreams being more accurately recognised than events, there was no main effect of group ($F(1, 45) = .432$, n.s.). A significant memory x group interaction was found however ($F(1, 45) = 20.06$, $p<0.001$), demonstrating that the experimental group recognised dreams end events similarly, whilst the controls recognised the dreams much more accurately than the events. Differential trends, as depicted in Table 5.1.7, indicate that the two groups used different strategies for recognising the sentences.

Table 5.1.7 % Dream and event recognition task accuracy means (and SDs) for both the experimental group (N=23) and the Control group (N=24)

	Experimental	Control	Overall
Dreams	75.87 (27.66)	79.17 (13.49)	77.55 (21.44)
Events	77.61 (26.58)	66.04 (18.88)	71.70 (23.46)

Table 5.1.8 shows that target sentences were reality monitored significantly more accurately than lures ($F(1, 41) = 230.23$, $p<0.001$), and a significant effect of group was also found ($F(1, 41) = 84.83$, $p<0.001$). However targets were identified much more accurately than lures by the experimental group, whilst performance did not differ so much for the controls. This was reflected through a significant sentence x group interaction ($F(1, 41) = 154.34$, $p<0.001$).

Table 5.1.8 % Reality monitoring accuracy means (and SDs) for both the experimental group (N=25) and the Control group (N=26) for targets and lures

	Experimental	Control	Overall
Targets	82.14 (19.21)	75.91 (7.81)	78.95 (14.70)
Lures	13.57 (10.14)	69.09 (7.01)	41.98 (29.36)

Performance on the lure sentences by the experimental group was extremely poor (see Table 5.1.8), indicating that these participants were extremely confused by the lure sentences. Again, differences in trends across the groups imply that the reality monitoring strategies employed by the experimental and control groups, differed.

This is also seen when performance for dreams and events are compared across groups (see Table 5.1.9). Events were significantly reality monitored more accurately than dreams ($F(1, 45) = 72.25$, $p<0.001$), and controls significantly out-performed the experimental group ($F(1, 45) = 16.16$,

$p<0.001$). A significant memory x group interaction ($F(1, 45) = 32.18$, $p<0.001$) demonstrated that the controls performed extremely well when reality monitoring events, and the experimental group performed poorly (below chance) when reality monitoring dreams.

Table 5.1.9 % Dream and event reality monitoring accuracy means (and SDs) for both the experimental group (N=23) and the Control group (N=24)

	Experimental	Control	Overall
Dreams	40.87 (18.57)	52.29 (18.06)	46.70 (19.00)
Events	56.52 (18.12)	80.63 (26.26)	63.94 (28.26)

Different trends imply that the groups employed differing strategies in this task (see Table 5.1.9). Specifically, the controls may have used general knowledge successfully when deciding whether a sentence was typical of a dream or event, whilst the experimental participants may have been confused by their actual memories for those experiences.

5.1.3.4 Recalled versus forgotten reports

The characteristics of all the reports that were recalled in the recall task were compared with those that were not recalled ("forgotten") for each individual. This aimed to specifically pinpoint which, if any, of the characteristics seemed to be most important in ensuring that a memory was recalled approximately a month after being reported. For each individual participant the dreams and events that were correctly recalled and those that were forgotten in the recall task were compared upon 9 dimensions: report length (word count), detail and episodic richness (both taken from the Aautobiographical Memory Interview; on a scale of 0-3, number of familiar and unfamiliar characters featuring in the original report, and salience, emotionality, comprehensibility and surprise of the original reports. Table 5.1.10 illustrates the descriptive statistics for the recalled and forgotten reports (dreams and events) for the characteristics measured.

Table 5.1.10 Mean characteristics (and SDs) of remembered and forgotten reports

Characteristic		Dream	Event	Total
Word count	Recalled	75.79 (31.82)	53.81 (29.31)	59.04 (42.12)
	Forgotten	79.64 (53.63)	52.45 (22.05)	65.73 (29.32)
Detail	Recalled	2.87 (.23)	2.86 (.26)	2.85 (.17)
	Forgotten	2.78 (.34)	2.67 (.41)	2.75 (.32)
Episodic Richness	Recalled	2.18 (.27)	2.08 (.27)	2.75 (.32)
	Forgotten	2.09 (.52)	2.03 (.34)	2.06 (.33)
Number familiar	Recalled	1.67 (1.18)	1.70 (.84)	1.58 (.54)
	Forgotten	1.60 (1.14)	1.75 (.66)	1.75 (.76)
Number unfamiliar	Remcalled	.78 (.80)	.17 (.33)	.45 (.42)
	Forgotten	.52 (.62)	.18 (.53)	.30 (.43)
Salience	Recalled	-.15 (.98)	.78 (.86)	.38 (.70)
	Forgotten	-.21 (1.19)	.15 (1.12)	.16 (.86)
Emotionality	Recalled	-.39 (.52)	.41 (.83)	.05 (.47)
	Forgotten	-.27 (.69)	.24 (.84)	-.07 (.37)
Comprehensibility	Recalled	-.27 (.96)	1.23 (.86)	.42 (.75)
	Forgotten	-.34 (.95)	1.26 (.57)	.35 (.51)
Surprise	Recalled	.80 (.57)	-.35 (1.04)	.18 (.64)
	Forgotten	.74 (.80)	.18 (1.35)	.66 (.65)

There were few forgotten reports to be characterised and compared to the recalled reports. This resulted in low degrees of freedom coupled with relatively high SDs so few analyses were significant. Main effects of memory were found for report lengths ($F(1, 10) = 8.46$, $p<0.02$) with dreams being longer than events, number of unfamiliar characters described in the experience ($F(1, 9) = 6.82$, $p<0.05$) with more unfamiliar characters appearing in dreams than events, for comprehensibility ($F(1, 8) = 51.78$, $p<0.001$) with events being much more comprehensible than dreams, and for surprise ($F(1, 8) = 7.66$, $p<0.05$) with dreams being more surprising than events. These mirror the overall trends for the reports. Indeed a significant memory x remembered interaction was found for the surprise ratings of the reports. Whilst forgotten reports were less

surprising overall, recalled dreams were surprising, whilst recalled events were not (as indicated by their negative score). Recalled reports were also more salient than forgotten reports ($F(1, 8)=5.42$, $p<0.05$.

5.1.4 Discussion

Current dreams and events were similarly recallable and recognisable, thus upholding predictions about the comparability of autobiographical remembering for these distinct types of experiences. This was found despite dreams being less characteristically detailed than the events, in line with the findings from Experiment 5.

Performance in the recall task was reasonable (grand mean = 68.8%). Events were slightly better recalled than dreams on average, although not significantly so. Current dreams and events are less recallable than retrospective dreams and events (Horton, *in press*), with retrospective events being the most recallable. This implies that rehearsal of older experiences (especially events) greatly improved their subsequent recallability, although it was doubtful as to whether the actual experience was being recalled, or an elaborated version of it. Recognition performance was good (grand mean was 76.0%). It therefore seems that highly detailed autobiographical experiences can be recognised providing that adequate cues are present.

Dream reports were found to be longer than event reports both at the time of being initially reported and at recall, as they require more explanation. A daily event of going to the gym, for example, is clear and comprehensible. Dreaming of being in an unfamiliar gym with people that one would not normally attend with may warrant a lengthier report and, subsequently, a seemingly more detailed report. This does not reflect the intensity or detail of the original experience itself. Thus the method of reporting dreams and events in this way should perhaps be defined more strictly.

It was not surprising that reality monitoring performance was similar for dreams and events, as it is assumed that the conscious strategies used in making a reality monitoring judgement would be the same for all kinds of experiences (Johnson *et al.*, 1984) For example this would include assessing the characteristic of that memory; if weak the experience could be a dream. If stronger, an actual experience. However there was evidence from the comparisons of the experimental and control groups that the strategies employed when making these decisions, differed. This strongly

implies that the experimental group were recalling their own experiences (dreams and events) whilst the control group were using more general knowledge based strategies when deciding whether a sentence referred to a dream or an event. Specifically, the experimental group were more confused (indicated by poorer performance) by lures than targets, and of those lures, related rather than unrelated sentences. These patterns were the same for the recognition performances across groups, also. Overall individuals seem capable of ascertaining whether an experience refers is a dream or an event, as indicated by above chance reality monitoring performances in the control group as well as the experimental group. This further implies that dream memories differ characteristically from waking event memories, and may include detail that is typically dream-like or improbably in waking life.

Reality monitoring performances were higher in the present experiment, overall, than those reported in Johnson *et al.*'s (1984) experiments, in which participants were required to identify whether presented dreams were their own or belonging to a partner. Thus all presentations were of dream-like material. Findings from the present experiment refer to situations that are more typical of everyday reality monitoring decisions, and offer evidence that the characteristic differences between dreams and episodic memories often contribute to successful reality monitoring decisions. In Johnson *et al.*'s study the characteristic cues were removed.

In summary the enhanced recognition performance by the experimental group for the targets (as opposed to lures) and unrelated lures (as opposed to related) indicates that they were remembering their actual experiences, and being confused by lures that were similar to them. Controls, on the other hand, were better at recognising dreams (by accurately rejecting them) whilst the events tended to be more typical of everyday activities, resulting in controls recognising that some of those experiences could have occurred to them. The experimental group performed particularly poorly with the correct identification of dreams. This may reflect that the presented dream sentences of current reports were more typical of waking activities than retrospective recalled dreams, which may have been especially atypical or salient in order to have been recalled in the first place. Controls out-performed the experimental group, indicating that their reality monitoring judgements are accurate and can rely solely upon general knowledge about the feasibility of (dream-like) situations and their characteristics, without the need for a memory trace.

Many of the comparisons of the recalled and forgotten reports were not significant. This may be due to a number of reasons. Firstly dream and event reports may not have any characteristic in particular that determines whether an experience is recalled or forgotten. It may be that other factors determine this, such as conscious encoding upon waking, or subsequent rehearsal. Secondly the sample size may have been too small (especially considering the low numbers of reports than had been forgotten), with much variability in the values, for any significant effects to emerge. However recalled experiences were more salient than forgotten ones, and recalled dreams were more surprising than forgotten dreams (and indeed remembered events). This highlights the influence of salience upon subsequent retrieval of a memory.

The present experiment presented methodological problems in terms of DR, although also provided insights into its nature. That is participants were able to recall dreams when required to do so, in great detail in the case of the current dreams. Thus DR is not as poor as some authors would have us believe (Hobson *et al.*, 2000; Reed, 1974). Participants who remained in the whole experiment may have been inclined to recall their dreams, as those who dropped out may have struggled more. Thus measures of DR will often be muddied by sampling bias. Nevertheless the trends regarding dreams' comparability to waking memories are clear and the two diary studies provide a novel and systematic design for the study of real world autobiographical remembering.

A main concern is that of the validity of the reports at Phase 1. Whilst this has been touched upon with regard to the rehearsal of retrospective experiences, the same issue may well be problematic, although to a lesser degree, in the present experiment. Participants were not informed that their memory would be tested for the dreams and events that they reported. Whilst reporting those incidents in a diary and considering their characteristics when rating the memories was highly atypical of normal experiences, the dreams and events had to be recorded in order that the validity of subsequently recalled memories could be checked. This process could well have consolidated those memories much more than would have occurred in everyday life. In addition, dream memories do seem to decay rapidly upon waking, so matching the level of detail in dream memories with event memories at the time of initial reporting is extremely difficult. However attempts to do with would ensure that subsequent recall or recognition measures would be matched. An investigation manipulating rehearsal strategies of current dreams and events would overcome this shortfall of rehearsal of memories.

The emotionality scale was problematic for some participants, despite instructions surrounding it being emphasised. The scale differed from the other reports in that a negative score still referred to a strongly emotional experience (a negative one) rather than being unemotional. The reports of two participants seemed to describe sad or frightening experiences and were given a score of 2. These participants likely considered this to reflect the intensity of emotion, and so their scores were amended as seemingly appropriate; that is, the reports describing a negative emotion and given a score of 2 were given a score of -2 by the experimenter. The emotionality scores should therefore be treated with caution, and subsequent ratings should use a scale that is comparable to other characteristic scales in use.

Overall these data demonstrate that memories for dreams are autobiographical experiences that are recallable and recognisable, providing the dream memory trace is not initially lost. Whilst dreams are characteristically less detailed than waking experiences, they are comparable to them.

5.2 Experiment 8: Comparing the Recallability of Dreams and Events: The Effect of Rehearsal

5.2.1 Introduction

The previous diary study (Experiment 7) characterised the retrieval of current dreams. In addition further data was collected upon retrospectively recalled dreams and waking memories (Horton, *in press*). That is, dreams and waking memories were generated in a fluency task and then retrieved in a recall and recognition task, as described in Experiment 7. Retrospective memories could have been rehearsed, ruminated upon and altered between their occurrence, being reported in the fluency task and at retrieval. Overall older (retrospective) dreams were more recallable than recent dreams. In addition significant differences between the recallability of retrospective events and dreams were found, with events being more recallable (although similarly recogniseable). One explanation for this could be that the older experiences have been rehearsed more, especially if they were particularly self important or pertinent somehow. Indeed, the retrospective reports were significantly longer ($F(1, 24) = 6.57$, $p<0.05$), more episodically rich ($F(1, 24) = 8.73$, $p<0.01$), containing more unfamiliar characters ($F(1, 23) = 52.44$, $p<0.001$, more salient ($F(1, 23) = 34.68$, $p<0.001$) negatively emotional ($F(1, 23) = 25.99$, $p<0.001$), less comprehensible ($F(1, 23)$

=65.36, $p<0.001$) and more surprising ($F(1, 23) = 9.26$, $p<0.01$) than the recent experiences in Experiment 8.

Rehearsal is an important maintenance strategy in both STM and LTM. It can also alter the characteristics of a memory such as its emotionality (Ritchie *et al.*, 2006). In order to explore the mechanism of rehearsal in remembering dreams compared to remembering normal autobiographical waking events, a further diary study was conducted including rehearsal-instruction manipulation. Using recent diary dreams as in Experiment 8 should eliminate the confound of personal importance or age of the memory trace. It was predicted that rehearsal of memories would increase subsequent recallability, and may also mediate the positive relationship between attitudes towards dreams and DRF. A between groups design was employed in order to assess this, comparing a rehearsal group with a control group. A recall task assessed the extent to which reported dreams and events that were subsequently either rehearsed or not looked at, were recalled.

5.2.2 Method

5.2.2.1 Participants

Undergraduate Psychology students were recruited for an experiment in dreaming, and 56 people participated. They were rewarded with course credits. One participant did not complete the whole study and so their data has been excluded. They were equally divided into 2 groups at the time of signing up in an alternating fashion: a rehearsal group ($N = 27$) and a control group ($N = 28$). Participants were not aware that they had been assigned to a group, or that the experiment was interested in the effect of rehearsal on DR, although they were fully debriefed at the end of the experiment. The sample was predominantly female ($N = 49/55$) and the median age was 18.

5.2.2.2 Design and Procedure

Instructions for all participants were identical apart from the rehearsal instruction. Those in the rehearsal group were instructed to read over their dream and event reports after they had reported them, and once they had collected all the required reports, to read over all dreams and events daily until the second lab session. Control participants were instructed not to look at their reports at all after they had completed the templates.

Each participant initially met up for a short (10 minute) session, during which time their dream and event diaries were explained to them and distributed. They were told to collect 5 dreams in a diary fashion, using the same templates as in Experiment 7, over the next few days, leaving a few days free before meeting again. The second meeting was scheduled for 2 weeks later. Each time a dream was recorded, so too was an event that had occurred the preceding day. This could be any event - it did not have to relate to the dream in any way, so long as it was specific rather than lasting an extended period of time. This made the episodic nature of the dreams and events comparable in a matched design. In order to facilitate recall participants were instructed to keep the diaries by their beds and to report the dreams as soon as they could after waking. If they responded that they felt they did not usually recall their dreams, they were also advised to go to sleep each night with the intention of recalling a dream the next morning. Participants were informed that the study was interested in how much information was recalled, so they should try to report as much detail as they could. As a result they were reminded that their reports would not be content analysed, so they should not feel embarrassed about the material that they were reporting. In order to comply with ethical guidelines participants were therefore told that if there was anything that they preferred not to reveal, they could either communicate it in a cryptic manner or that they could write that they did remember the detail but chose not to report it. This would discern between memory failure and privacy. No participants chose to respond in this second way. The rating scales were described in detail to all participants. The Attitudes Towards Dreams questions were also completed (see Appendix I) at this point.

Two weeks later each participant returned for a lab-based session, which lasted approximately 40 minutes. The Attitudes Towards Dreams questions were completed again, with the previous responses hidden from participants. The Dream Memory Questionnaire was completed, whilst the experimenter added the titles of the dream and event reports to a recall task template (as described and used in Experiment 7). The titles were presented in a random order to the participant and functioned as recall cues. The recall task was subsequently administered and involved the participant recalling as much about the original dream or event as was possible. In addition they were asked to reveal whether they felt this was a dream or an event (reality monitoring task), and to indicate how much they felt they could recall on a scale of 1 to 5 (1 = all the details, 2 = most of the details, 3 = some of the details, 4 = a few of the details, and 5 = none of the details). The reality monitoring task served as a control to ensure that all participants were recalling the correct original memory. Scoring of the recall task (word count, detail and episodic richness ratings, used

as in Experiments 7) also involved comparing the recalled report to the original report in order to ascertain that recalled reports were neither confabulated nor confused.

5.2.3 Results

5.2.3.1 Descriptive Statistics

The majority (N=48) of participants were able to recall all 5 dreams (and events) over the 2 week period. 5 participants recalled 4, 1 recalled 3, and 1 recalled just 2. The characteristics of the dreams and events were averaged, and are shown in Table 5.2.1 below.

Table 5.2.1 Mean (and SDs) characteristic ratings for dreams and events across groups

	Rehearsal (N=28)		Control (N=27)	
	Dream	Event	Dream	Event
Word length	80.71 (32.27)	46.55 (35.90)	75.45 (30.42)	50.83 (26.04)
Detail	2.75 (.30)	2.51 (.50)	2.79 (.22)	2.72 (.40)
Episodic Richness	2.41 (.26)	2.13 (.42)	2.49 (.29)	2.15 (.36)
No. familiar	1.93 (.89)	1.75 (.87)	1.89 (.87)	1.85 (.96)
No. Unfamiliar	.85 (.75)	.08 (.16)	.81 (.56)	.19 (.47)
Perspective	1.03 (.07)	1.00 (.00)	1.09 (.17)	1.00 (.00)
Salience	-.12 (.61)	.37 (.70)	-.10 (.61)	.50 (.75)
Comprehensibility	-.52 (.57)	.12 (.59)	-.34 (.51)	.33 (.53)
Emotionality	-.08 (.64)	1.24 (.54)	.12 (.71)	1.45 (.53)
Surprise	.63 (.72)	-.31 (.79)	.18 (.68)	-.47 (.84)
DMQ	79.59 (12.15)		84.04 (10.99)	

At the point of recording the dreams and events, the rehearsal and control groups should not differ. This assumption was checked by conducting mixed model ANOVAs, whereby the

between subjects factor was group (rehearsal or control) and the within subjects factor was memory type (dream or event). No significant main effects of group were found for any of the characteristics listed in Table 5.2.1. In addition the DMQ scores did not significantly differ between rehearsal and control groups (T (53) = -1.42, n.s.). However significant main effects of memory were found for length, F (1, 53) =71.88, $p<0.01$; for episodic richness, F (1, 53) =31.73, $p<0.01$ (dreams longer and more episodically rich); for number of unfamiliar characters, F (1, 53) =45.18, $p<0.01$; for perspective, F (1, 42) =8.20, $p<0.01$; for salience, F (1, 49) =22.71, $p<0.01$; for emotionality, F (1, 49) = 55.75, $p<0.01$ (events more salient and emotional); and for surprise, F (1, 49) =31.63, $p<0.01$ (dreams more surprising). No significant main effect of memory was found for the number of familiar characters appearing in dreams and events (F (1, 53) =.65, n.s.) or for detail (F (1, 53) =5.79, $p<0.05$). No significant interactions were found. For all analyses the Bonferroni corrected alpha level of 0.005 was adopted.

The recall task involved a reality monitoring component, whereby participants had to identify whether the report title that was represented to them referred to a dream or event. All participants performed at ceiling level on this task, correctly reality monitoring every title that was presented to them.

Table 5.2.2 Mean (and SD) for dream and event recall task characteristics across groups

	Rehearsal (N=28)		Control (N=27)	
	Dream	Event	Dream	Event
How much detail	2.36 (.69)	2.02 (.67)	2.42 (.78)	2.19 (.61)
Word count	64.78 (32.21)	50.56 (35.81)	54.78 (23.65)	48.93 (34.34)
Detail	2.57 (.44)	2.61 (.45)	2.56 (.61)	2.59 (.36)
Episodic Richness	2.34 (.36)	2.10 (.37)	2.21 (.51)	2.18 (.36)

In addition, participants were asked indicate how much detail they could remember of the experience. A report of the recalled detail was written down, which was subsequently analysed for length (word count), detail and episodic richness (as described in Experiments 6 and 7). Table 5.2.2 shows the descriptive statistics across groups for these characteristics.

5.2.3.2 Analyses

Mixed model ANOVAs were conducted to ascertain whether there were any differences between the recall reports of the rehearsal and control groups (between subjects factor of group), and whether there were differences between the dreams and events (within subjects factor of memory) as previously described. There were no significant main effects of group or memory, however the main effect of memory for the amount of detail recalled by participants in their own ratings (responses to the question, "How much detail do you recall?") almost reached significance ($F(1, 53) = 7.51$, $p = 0.008$) when using the Bonferroni corrected alpha value of $p < 0.005$. In addition the only significant main effect of group was for the same variable of how much detail was recalled ($F(1, 53) = 851.67$, $p < 0.01$) whereby the control group had higher ratings than the rehearsal group. Figure 5.2.1 below illustrates how significantly more detail was rated to have been recalled for dreams than events. There were no significant interactions.

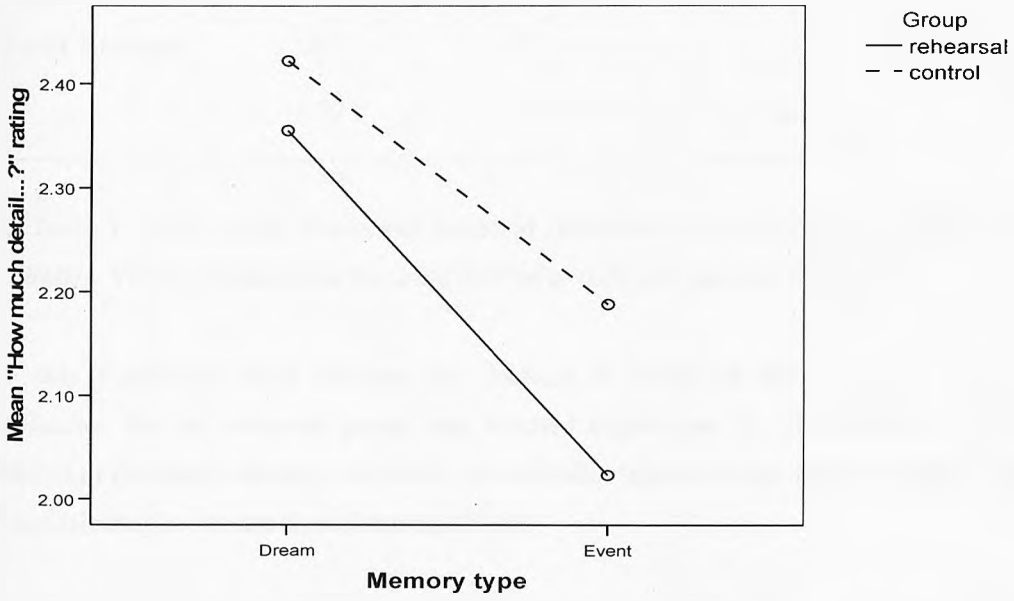

Figure 5.2.1 Mean ratings across groups in response to the question, "How much detail do you recall?" for dreams and events.

Word counts, detail and episodic richness ratings were also compared across original and recalled reports, as shown in Table 5.2.3.

Table 5.2.3 Mean differences in characteristic ratings between the original and recall task reports for rehearsal and control groups (T values below)

	Rehearsal (df=27)		Control (df=26)	
	Dream	Event	Dream	Event
Word count	-15.93	4.01	-20.67	-1.90
	-2.71	1.16	***-3.14***	-.43
Detail	-.18	.10	-.22	-.14
	-2.34	1.54	**-1.77**	-1.90
Episodic Richness	-.07	-.03	-.28	.03
	-1.32	-.57	**-2.37**	.68

Significant T values (at the Bonferroni corrected alpha level of $p<0.005$) are highlighted in ***bold and italics***. Values significant at the usual level of $p<0.05$ are shown in **bold** type.

The only significant effect concerns the decrease in length of dream reports. This neared significance for the rehearsal group, and reached significance in the controls. The general direction of the trends indicates that detail and episodic richness is also slightly reduced, although not significantly so, by the time of the recall task.

5.2.3.3 Relationships between the DMQ and attitude towards dreams

Attitudes towards dreams was measured at the beginning of the experiment, and after a two week interval, during the second session. Table 5.2.4 shows how these scores changed over this time.

Positive attitudes towards dreams slightly increased for controls, although slightly decreased in the rehearsal group.

Table 5.2.4 Means (and SDs) attitude towards dreams scores across groups

	Rehearsal (df=27)	Control (df=26)
Time 1	12.86 (3.17)	13.30 (3.14)
Time 2	12.54 (2.87)	14.00 (2.96)
Mean difference	-.32 (2.37)	.70 (2.46)
T test	T (27) =.72, n.s.	T (26) = -1.49, n.s.

In order to further assess the relationship between DMQ scores and attitude towards dreams, Pearson's correlations were conducted between the variables. Partial correlations were then conducted, controlling for "group", that is, rehearsal. The partial correlations actually reduced the size of the relationship between attitude towards dreams and DMQ scores, although this reduction was extremely small. Both correlations found the relationship between DMQ scores and the first attitude towards dreams scores to be $r=-.412$, $p<0.01$; and between DMQ scores and the second attitude towards dreams scores to be $r=-.409$, $p<0.01$.

5.2.4 Discussion

This experiment posited two main predictions: firstly, that rehearsal would increase the recallability of dreams and events. Characteristics of dreams and events did not significantly differ between the rehearsal and control groups, thus not upholding this prediction. Secondly, it was predicted that the mechanism of rehearsal could account for the variance in the relationship between DR, as measured by the DMQ, and attitude towards dreams. This prediction was not upheld, either, as reflected by partialling out the variance of "group", resulting in a smaller relationship between DMQ scores and attitude towards dreams than when not considering the effect of rehearsal.

The manipulation of rehearsal via the instruction of reading through dream and event reports may have been ineffective. Indeed, measurement of its effectiveness would have been reflected through improved recall, thus producing a circular methodology. The lack of improved recall in the rehearsal group as opposed to the control group may have resulted from a methodological problem (i.e. the manipulation not working) or a theoretical issue (i.e. that the rehearsal manipulation was effective, but did not increase recall). It may be more appropriate to consider that methodological problems were encountered for a number of reasons.

Firstly, DR during the course of this experiment was extremely different to recall in an everyday situation. Deliberately and effortfully recalling a dream (or event) in order to report it involves a degree of rehearsal at an early stage. Thus the control group would also have engaged in rehearsal. If the strength of the memory trace depends upon the depth of encoding, then the rehearsal and control groups would not have differed at all. Secondly, the instruction to read over the reports during the course of the experiment was assumed to have been followed. However a more stringent method of reinforcing this would have been desirable, such as asking participants to come into the lab on a daily basis to read over their reports. In addition, although dreams were encouraged to be recorded in the first week after session 1, and rehearsed (or not looked at for controls), some dreams were recorded that had occurred in the second week, thus being very close to the time of session 2. A recency effect may have confounded the effect of rehearsal.

The alternative explanation, that rehearsal did not improve subsequent recall, cannot be clearly supported, due to the methodological concerns described above. However important differences between the groups at recall were found. Specifically, when scoring the recall task, some reports seemed to be highly similar to the original dream and event reports. After recall scores had been compared across groups, this was investigated in more detail (prior to this point the experimenter was blind as to group membership, when scoring the recall task). On the whole the recall task reports, for both dreams and events, although especially so for dreams, corresponded much more closely with the original reports, than those of the control group. Some recall task reports were identical to original dream and event reports. Although no specific qualitative analyses were conducted to confirm this due to time restrictions, the findings were clear. Content analyses would further elucidate this discovery. This shows that the effect of rehearsal can limit what is later recalled, as well as enhance it. What is recalled is the report, rather than the original dream or event itself. Whilst it cannot be relied upon that this phenomenon was the result of rehearsal,

recording a dream or event encodes it in memory, providing further cues and details at recall. In the case of dreaming, this differs greatly to normal daily DR patterns. Thus rehearsing the material did seem to have an effect on the quality of the recalled reports, although not the quantity of them. This may not be surprising as the quantity of recalled reports was not especially varied; recall performance was reasonably high for both groups. Using a longer timeframe for the experiment may well have reduced this performance (see Experiment 6, for instance). In addition over time, between initially recording the memories and recalling them, dreams became shorter. This was especially (significantly) the case in the control group. That is rehearsal maintained some amount of detail in the dreams. The episodic richness of the control group's dreams also declined over time. This was not the case for events, which maintained their episodic richness[3]. This may reflect overall that dream memories are more susceptible to disruption than event memories, and that rehearsal does, indeed, maintain some degree of detail for those memories. The qualitative study of the reports indicated that rehearsal may well affect the phenomenology of subsequently recalled memories, thus altering dream detail rather than DRF.

The ratings concerning detail were both subjective (in the case of participants rating how much detail they felt they recalled) and objective (the detail ratings were scored along the same AMI criteria). Whilst the subjective ratings found that events were less detailed than the dreams at recall, and that the controls' reports were less detailed than those of the rehearsal group, the objective ratings did not find such differences. The objective detail ratings did not identify the extent of detail in the dream. Almost all original dreams and events were given a detail score of 3 (72%) and many (62%) were high in episodic richness, with a score of 2. As these reports have been treated as accounts of the original events or dreams themselves, it may be that more discerning scales would be appropriate, such as those referring to the amount of kinds of details that have been noted, such as a description of the environment or characters involved. Similarly, there was little variance at recall in both detail and episodic richness, although the full scale was used in response to the question, "How much detail do you recall?", as rated by the participants themselves. This subjective rating may thus be more appropriate as it also refers to the memory of the experience rather than its report.

The episodic richness scores were difficult to rate, as there are individual differences in writing styles. So someone may write in a detailed and descriptive way, although choose not to refer to

[3] It is worth remembering that events were significantly less episodically rich than the dreams at the initial time of recording, so there was less for the events to lose.

emotions, for instance, making the memory seem less episodically rich. In addition individual differences such as this may well affect the dream or memory content.

DR has been found to be consistently high in this study and the other diary studies (Experiments 6 and 7). Whilst keeping a dream diary seemed to increase DR in the participants recruited in these experiments, it also seemed to reduce its variance, that is, most participants seem able to recall dreams when they intend to do so. The dream diary method is therefore an insightful, although not particularly discerning, method of assessing DR.

The second hypothesis, concerning the mediating effect of rehearsal upon the relationship between attitude towards dreams and DR, may not have been upheld due to the methodological issues of the rehearsal manipulation, as described above. In addition, the influence of having a positive attitude towards dreams upon DR may affect how dreams are encoded as well as retrieved, whilst rehearsal acts upon retrieval processes only. This elucidates how having a positive attitude towards dreams does not affect how a dream memory trace is rehearsed. Rather, it seems as though the two issues are independent.

Despite this the qualities of the recalled memories did seem to differ between the groups with rehearsed reports corresponding more closely to the original report. This implies that dream detail and other characteristic measures of DR may be more indicative of memory processes than DRF measures.

Whilst retrospective events were more recallable than retrospective dreams (Horton, *in press*), the effect disappeared when current dreams and events were compared (Experiment 7). This experiment investigated dreams and events over a 2 week time interval, which was likely not long enough to see rehearsal experiences consolidated into LTM and self structures. Despite this rehearsal did affect the quality of recalled dreams and events, although not how recallable they were overall. The relationship between attitudes towards dreams and DR was not mediated by rehearsal, although this may have been the result of methodological inconsistencies throughout the rehearsal group. Altogether, whilst rehearsal may affect the phenomenology of recalled memories, factors affecting how they are encoded may well be more crucial in determining their subsequent recallability.

Summary

The present chapter has compared the retrieval of recently occurring dreams and events, finding that the recallability and recognisability of these experiences are comparable. There is evidence that events may be more frequently rehearsed than dreams, although it may well be that individual differences in this are widespread, as attitudes towards dreams predict such great variance in DR. The rehearsal of retrospective experiences seems to improve their recallability (Horton, *in press*), whilst the rehearsal of recent experiences seems to alter the qualities of remembered details. Rehearsal may well improve long term autobiographical memory although there is then concern that what is being recalled is a memory for the original experience, rather an enhanced, elaborated and perhaps semanticised depiction of that experience.

Chapter 6: Dream Content, Comprehensibility and the Self

Introduction: Content focused investigations of dreams and dream recall

A lot of recent research investigating the relationship between memory and dreams has been concerned with the content of dreams, rather than their recall. That is the focus has been upon how dreams are composed and whether or not they incorporate memories from daily life. This proposition is not new. Freud originally postulated the day residue hypothesis: the idea that dream content includes memories, experiences and events that had occurred the day prior to dreaming. Freud's ideas have been elaborated upon extensively, with theories existing concerning the consolidation of particular kinds of memories (for instance declarative versus procedural) in different phases of sleep (NREM versus REM, respectively; see Rauchs *et al.*, 2005 for a review). This chapter is interested in the content of dreams, and how the content may relate to autobiographical memory.

So far the thesis has presented how DR relates to sensations of autobiographical memory (see Experiment 1) but not episodic memory abilities (Experiments 3 and 4). Remembering dreams differs from remembering waking autobiographical memories in terms of characteristics (see Experiments 5 and 7) and retrievability (Experiments 5, 7 and 8) in many ways, although is similar to autobiographical remembering more generally. Whilst the difference in recallability of dreams compared to waking memories may well be a product of the original experience being encoded less thoroughly, thus resulting in lower characteristic ratings, the content of dreams specifically should be explored in relation to being recallable. The content of dreams has been proposed to relate to recallability in the salience hypothesis (Cohen & MacNeilage, 1974). Dream content will directly influence dream detail and other characteristic measures, although perhaps DRF to a lesser extent.

This chapter presents three studies. Firstly an exploratory case study was undertaken in which the comprehensibility of dreams recorded over a 6 month period was correlated with other characteristic ratings of the dreams, as well as being used as a cue for recall. Secondly a novel approach was employed in order to ascertain whether dream content changed alongside a change in self. Finally an alternative method was adopted, in which participants rated their own

incorporations of selves into their dreams, to see if dreams contain the self at all. These studies have collectively found that dream content relates to autobiographical memory. The results are positive in terms of encouraging a focus upon the content of dreams as well as DR measures in order to further investigate this relationship.

6.1 Experiment 9: Comprehensibility of Current Dreams: A Pilot Study

6.1.1 Introduction

Experiment 1 demonstrated that individuals who felt they could understand their dreams, as well as the sensations that they elicited, also recalled their dreams more frequently and in more detail. Comprehensibility of dreams was lower than comprehensibility of waking events, as demonstrated in Experiment 7. The variable can thus refer to both an individual differences trait as well as a dimension upon which each individual's dreams can vary. Whilst the characteristic may logically relate to having a positive attitude towards dreams and dream salience, it has not previously been investigated in detail. Comprehensibility ratings in previous experiments have required participants to rate their own dreams and memories according to the extent to which they feel they can understand the material in the report. The precise mechanism for such understanding could vary, depending upon theoretical outlook. For instance, a psychoanalyst may be more interested in underlying, disguised symbolisms than manifest images. A biological reductionist may give high comprehensibility ratings to many dreams due to material being viewed as overt and explicit. In the experiments described here, comprehensibility refers generally to the recognition of the source of a dream reference, such as dreaming of a person that was encountered on the previous day. In this respect, only manifest content is being considered and then the sources are being identified as an autobiographical memory.

Investigations involving the categorisation of dream content, whether in terms of their memory compositions, or relation to previous experiences more generally (as in the day residue or dream-lag hypotheses (Nielsen *et al.*, 2004) for instance), rely upon an implicit understanding of the trait of comprehensibility. Definitions of the trait and a strict methodology for its use and interpretation are therefore needed.

The present study was carried out in order to further explore the profile of comprehensibility. This pilot study aimed at establishing the extent to which dream material is related to memories

from waking life. Thus there should be a significant negative correlation between bizarreness scores and comprehensibility scores for recorded dreams.

6.1.2 Method

This pilot study used dreams recorded by the experimenter (aged 22 at the time of study) over a 23 week time period. 116 dreams were recorded as soon after waking as was feasible. Dreams were reported in as much detail as could be remembered. Along with the dream report itself, a number of ratings were noted down: the date and time of the dream, and scores on a 1-5 rating scale for overall comprehensibility, bizarreness, rehearsal of material between dreaming and reporting, emotionality (and the direction of the emotion; whether prominently positive, negative, both or none), personal salience, detail and episodic richness (the last two scores were taken from the Autobiographical Memory Interview and were scored on a 4 point scale from 0 to 3, as described in Experiments 7 and 8). In addition a general comprehensibility statement concerning the dream content was recorded, and a day residue comprehensibility statement, which charted down any links between events, thoughts or feelings from the previous waking day and the dream in question. The number of statements in each of these reports were totalled up and compared.

After the dreams had been recorded, and a 7 day retention interval in which no new dreams were recorded had passed, a recall and recognition task was undertaken. Approximately half (55) of the dreams were initially cued by the comprehensibility general information (G). 57 dreams were cued by the comprehensibility day residue (DR) reports. 3 dreams did not contain comprehensibility reports of either kind, so they were omitted from the recall task. Reports were randomly allocated to each of the cueing groups. However if, during the task, a report did not have some of the information required (such as nothing having been reported for the day residue report), then that report would be cued, instead, by the information that was available (the general comprehensibility report). This only happened in 8 cases. The participant (also the experimenter) tried to bring to mind as much as could be recalled about this dream, and the report was written down. Similarly the remaining half of the reports were cued by the day residue information. In each case the cue information was presented and read. Recalled reports were written down, taking as long as was required. After each recall task the dream in question would be presented, and a recognition style task completed. The participant reported whether the dream was remembered (R), known (K), familiar (F) or not recognised (N) as described in Experiment 4, using standard recollective experience responses. Order of presentation of each type of cue was random.

Once all dreams had been recalled and recognised, recall reports were scored for detail and episodic richness using the Autobiographical Memory Interview ratings, and length of reports (word counts) were recorded so DR was measured characteristically as well as objectively.

6.1.3 Results

A total of 116 dreams were recorded over 161 days. Just less than one dream (0.72) was recorded per day, on average. Table 6.1.1 details the descriptive trends for the characteristic ratings.

The general comprehensibility rating was significantly positively correlated with emotionality (.33), personal salience (.64), rehearsal (.24) and episodic richness (.27); in all cases $p<0.01$. In addition there was a negative correlation with bizarreness (-.45, $p<0.01$).

Table 6.1.1 Descriptive statistics for all ratings

Characteristic/Rating	Mean	SD
Days since dreamt	96.46	49.27
Time since dreamt (mins)	81.31	177.30
Comprehensibility	2.41	.87
Emotionality	2.86	.99
Bizarreness	3.01	.77
Personal Salience	2.65	.88
Rehearsal	1.98	.75
Detail	2.08	.66
Episodic Richness	2.10	.65
Dream Length	247.11	170.95
Length of comprehensibility (general) reports	12.8	13.49
Length of comprehensibility (day residue) reports	25.03	20.54
Number of units in the comprehensibility (general) reports	1.32	1.28
Number of units in the comprehensibility (day residue) reports	1.89	1.39

There were also similarly strong positive correlations (with the exception of bizarreness, which was negative) between the characteristics and all the comprehensibility individual scores, suggesting that the different ratings were measuring the latent construct of comprehensibility. The general rating correlated with the lengths of both of the comprehensibility scores (.25 for general and .46 for day residue, both $p<0.01$) as well as the counts of general (.32) and day residue (.42) units. In both cases the relationships were strongest with the day residue as opposed to the general scores. The length of the general comprehensibility reports, however, did not relate quite so well to the other ratings. The day residue comprehensibility ratings correlated more closely. See Table 6.1.2 for specific coefficients. Day residue ratings (both word count and number of units) correlated with emotionality (.24 and .18 respectively, both $p<0.05$) and rehearsal (.30 and .31 respectively, both $p<0.01$). The episodic richness ratings of the original dream report, however, correlated with all comprehensibility measures ($p<0.05$) except for the length of the day residue comprehensibility report. Table 6.1.2 portrays these relationships.

All comprehensibility measures positively correlated significantly ($p<0.05$) with personal salience, detail and dream length. In addition all measures (except for the general comprehensibility measure) were significantly negatively correlated with recollective experience ($p<0.05$). It is worth noting that a "remember" response was coded as 1, a "know" as 2, a "familiar" as 3, a "guess" as 4, and a "no recognition" response as 5. Thus the correlation in fact reflects a positive relationship between recollective experience and comprehensibility.

The time between dreaming and writing down the dream report was estimated and recorded in minutes. This variable only correlated significantly with one other; that of rehearsal, whereby a positive relationship was found ($r= .32$, $p<0.001$). However rehearsal was significantly correlated with a number of other variables: comprehensibility, emotionality, personal salience, detail, dream length, length of the day residue comprehensibility reports ($p<0.01$) and episodic richness ($p<0.05$). When partialling out rehearsal, time since dreamt remained uncorrelated with the other variables, and the relationship with personal salience disappeared.

Table 6.1.2 Correlation coefficients for all the comprehensibility ratings, with all the other ratings

	Com-prehen-sibility	Emotion-ality	Bizarre-ness	Personal Salience	Rehearsal	Detail	Episodic richness	Dream length	Length general	Length DR
Time since dreamt	0.13	0.02	-0.01	0.14	***0.32***	0.02	-0.06	0.06	0.08	0.05
Compre-hensibility		***0.33***	***-0.45***	***0.64***	***0.24***	0.17	***0.27***	0.07	***0.25***	***0.46***
Emotion-ality			0.15	***0.51***	***0.28***	***0.28***	***0.44***	***0.31***	0.16	**0.24**
Bizarre-ness				***-0.24***	0.05	0.00	0.02	**0.22**	0.09	-0.05
Personal salience					***0.24***	***0.32***	***0.40***	***0.24***	***0.31***	***0.34***
Rehearsal						***0.39***	**0.18**	***0.25***	0.06	***0.30***
Retail							***0.53***	***0.49***	**0.23**	***0.28***
Episodic richness								***0.34***	**0.23**	0.16
Dream length									***0.38***	***0.42***
Length general										**0.19**

Values in **bold** type reflect correlations significant at the $p<0.05$ alpha level.
Values in ***bold and italics*** indicate correlations significant at the $p<0.01$ alpha level.

6.1.3.1 Recall task

Overall recall was extremely poor. 3 reports could not be included in the recall task as they had neither a general nor a day residue comprehensibility report. Only 12 of the remaining 113 dreams were able to be recalled; 6 cued by the general comprehensibility reports and 6 cued by the day residue comprehensibility reports. The word counts, detail and episodic richness scores of these reports were compared.

The dreams cued by general comprehensibility (G) produced reports in the recall task that were 146.33 words long (SD = 103.63), whilst those cued by the day residue (R) information were longer, with the mean being 199.17 words (SD = 175.37). This did not differ significantly (F= (1, 10) .40, n.s.). Similarly the mean detail of the recalled reports by the G cues (2.17, SD = .75) was slightly lower than the mean for those cued by R information (2.50, SD = .55). These did not differ significantly (F= (1, 10) =.77, n.s.). The trend was in the same direction for the episodic richness ratings, with the mean for those cued by G information being 2.33 (SD = .82) compared to 2.50 (SD = .55) for the R cues. These did not significantly differ (F= (1, 10) =.17, n.s.). It can be seen in each case that the standard deviations are quite large, and that only 12 reports are being compared altogether. Thus the lack of significant effects is not surprising.

6.1.3.2 Recognition task:

In the recognition task, dream reports were re-read and the participant decided whether the dream was remembered (R), known (K), familiar in places (F), guessed (G) or not recognised at all (N). As Figure 6.1.1 shows, no "guess" judgements were made. The F response accounted for dreams in which only parts were recognisable. There were 49 R responses, 33 Ks, 18 Fs and 16 Ns.

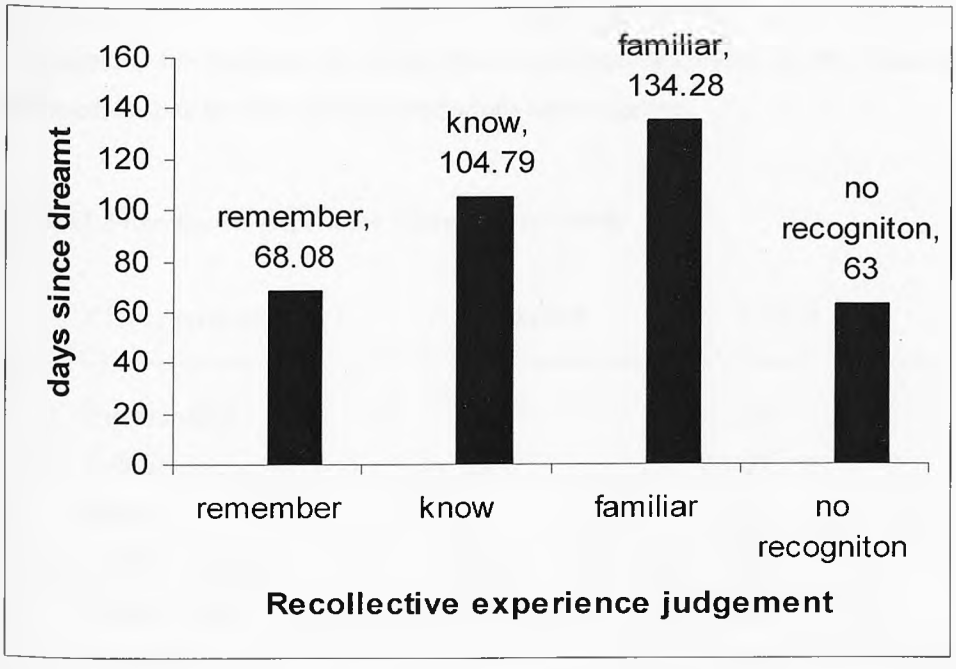

Figure 6.1.1 Recollective experience judgements for dreams over time

A significant correlation between recollective experience and days since dreamt was found (R= .44, $p<0.01$). Greater recollective experience was associated with a shorter time between dreaming and recognition (in days). Figure 6.1.1 reflects this clearly. There was a significant effect of recollective experience upon days since dreamt ($F(1, 112) = 14.81$, $p<0.001$). However the N responses did not match this trend in the same direction.

A series of one-way ANOVAs were conducted to see if the dreams that were recollectively experienced differed from those recognised with K, F or N responses. Recollective experience had a significant effect upon emotionality ($F(1, 112) = 3.05$, $p<0.05$), detail ($F(1, 112) = 11.11$, $p<0.01$), episodic richness ($F(1, 112) = 3.20$), $p<0.05$), dream length ($F(1, 112) = 19.11$, $p<0.01$), length of G report ($F(1, 112) = 4.02$), $p<0.01$), number of R units ($F(1, 112) = 3.80$, $p<0.05$), length of recall report ($F(1, 112) = 3.76$), $p<0.05$), and detail at recall ($F(1, 112) = 4.76$, $p<0.01$).

Table 6.1.3 shows the directions of these relationships, as recollective experience is correlated with emotionality, rehearsal, detail, episodic richness and length of the original report, length of the general and day residue comprehensibility reports, number of general and day residue comprehensibility units within those reports, and length and detail of the recalled report.

Specifically, these correlations were negative, as R responses were coded with a lower value than F responses, for instance. So recollective experience increased as the characteristic ratings increased, despite the fact that the correlations were negative.

Table 6.1.3 Recollective Experience Correlations (N=116)

Characteristic/Rating	Coefficient	P value
Emotionality	-.23	.01
Rehearsal	-.21	.03
Detail	-.46	.00
Episodic Richness	-.28	.00
Dream length	-.52	.00
G length	-.27	.00
DR length	-.23	.01
G units	-.20	.03
DR units	-.27	.00
Recall length	-.23	.01
Recall detail	-.27	.01

The variables that recollective experience did not have a significant effect upon were: comprehensibility ($F(1, 112) = 1.41$, n.s.), bizarreness ($F(1, 112) = 1.02$, n.s.), personal salience ($F(1, 112) = .93$, n.s.), rehearsal ($F(1, 112) = 1.68$, n.s.), length of R report ($F(1, 112) = 2.49$, n.s.), number of G units ($F(1, 112) = 1.96$), n.s.), or episodic richness at recall ($F(1, 112) = .68$, n.s.).

6.1.4 Discussion

The (general) comprehensibility rating seems to be as related to DR over time in terms of length and number of idea units contained in the dream, as the other ratings that typically increase recallability.

An important correlation is that between personal salience and comprehensibility. Although not surprising, it is well documented that salience is a great predictor of DR (Cohen and MacNeilage, 1974). It was the largest and most significant correlation found from the study. As the day residue ratings correlated slightly more closely to the other ratings, and the comprehensibility rating itself, than the general comprehensibility score, the day residue measure may be seen as a more accurate measure of comprehensibility than a vaguer, general component of dreams.

It would not be surprising for a more detailed and specific kind of cue to elicit a more specific and detailed report in a recall task. Thus, the vagueness of the general comprehensibility cues (e.g. "I have been feeling down lately") are not likely to act as an episodic memory retrieval cue. However no significant differences were found between the recall scores for the dreams cued by general comprehensibility reports and those cued by day residue comprehensibility reports. This may well be due to the extremely small number of dreams successfully recalled: just 6 for each cue. In addition these dreams tended to be more recent (the number of days since dreamt negatively correlated with length of the recalled reports, the detail of them and (positively) with recollective experience at recognition; all $p<0.01$).

The findings of this experiment could be interpreted in at least two different ways. Firstly, dreams comprise mostly day residues and it is these events that have occurred in the previous day that contribute to the comprehensibility of one's dreams. Secondly, it may be that because day residue aspects of a comprehensible dream seem to elicit more pronounced and detailed dream reports, researchers only seem to investigate a certain sample of dreams reports that are, potentially, unrepresentative. Those reports that are forgotten may be more general in nature and comprehensible in a more general way, too.

For now it would seem sensible to lean towards the first of those theoretical options, as the second is largely speculative. In addition, many reports have been collected using a number of different techniques, such as awakening a dreamer in the lab from different stages of sleep. The reports, although differing slightly in terms of event and memory-make up throughout these stages (e.g. Rauchs *et al.*, 2005) do not seem to differ in terms of detail or generality too much. Therefore we shall have to continue adopting these methods until a way of accessing forgotten dreams can be devised!

Methodologically, a number of different measures of comprehensibility were employed in this experiment. All measures correlated highly together, although the day residue measures reflected the strongest relationships with the other characteristic ratings. As the general "comprehensibility" measure did not correlate with recollective experience in the recognition task, and all other measures did, it seems that using a strict criterion for measuring comprehensibility, such as word count of the comprehensibility reports, or counts of the units of comprehensible items within the dream, may be more reliable methods. However there is evidence that the same latent construct of comprehensibility was being measured, due to the strong relationships between the different comprehensibility measures.

It should be mentioned that a relationship was found between "time since dreamt" and both the length and detail of the recalled reports; both $p<0.01$). Both these correlations were positive, suggesting that the more time between dreaming and reporting the dream, the lengthier the dream report would be. As the memory traces of dreams are known to decay extremely rapidly, this finding may seem surprising. However for those dreams to remain in memory for a long time, before they could be reported, the dreams were detailed with an especially strong memory trace. Thus it may be that a number of memory traces of dreams decay so rapidly that they cannot be remembered at all. However those detailed enough to be reported have essentially passed the first test; they have made it into consciousness and therefore are recallable for at least a few hours. When reporting dreams on a daily basis, it does seem that a previous day's dreams are difficult to recall. So it may be that the dreams that are recallable upon waking, and have not decayed immediately, are recallable until new dreams replace those memories. Thus, before dreams enter LTM, they may remain in consciousness for approximately 24 hours.

In conclusion this experiment has reinforced the findings from Experiment 1: that a new characteristic of dreams that should be further investigated, is comprehensibility. That is, the degree to which individuals can feel that they understand their own dreams. This experiment has further shown that using day residue measures of this are more methodologically appropriate than using more "general", speculative and subjective measurements of comprehensibility over time. The following two experiments, however, demonstrate that links between one's self and their dreams can, and indeed should, be measured systematically.

6.2 Experiment 10: Do Dreams Change When Selves Change? Introducing a Novel Methodology

6.2.1 Introduction

Experiment 9 found that comprehensibility was a key feature of recallable dreams. Experiment 1 demonstrated that it was also important as an individual differences trait. Comprehensibility may mediate the relationship between attitude towards dreams and DR, and may increase the likelihood of rehearsal or rumination.

Experiments 10 and 11 extend the focus of dream content in relation to the self. Whilst comprehensibility requires the dreamer to dwell actively upon their dreams, not all dreams are so reflective. The present experiment investigates the extent to which dream content contains information about the self in a larger sample.

There is a growing body of evidence illustrating the relationship between dreaming and memory. Nielson *et al.* (2004) have observed a dream lag effect whereby dreams contain references to events that have occurred approximately 5-7 days prior to the dream experience, as well as the effect of day residue whereby events from the previous day are also likely to be dreamed about. Fosse *et al.* (2003) argue against there being a relationship between dreaming and episodic memory; memories for specific events and experiences which can be accompanied by a feeling of pastness, or recollection, when remembered (Tulving, 1983). They suggest that the lack of replay implies a functional dissociation between episodic memory and dreaming, that is that the two functions are neurologically independent. However elements of episodic memories appeared in 65% of the dream reports in their study. It would therefore seem appropriate to conceptualise the relationship between dreaming and memory in a less stringent way than that adopted by Fosse *et al.* Indeed, the relative deactivation of the frontal lobes during dreaming, coupled with the deactivation of the dorsolateral prefrontal cortex (Hobson *et al.*, 2000), which is responsible for volition, implies that the actual replay of truly episodic memories which may be sensory-perceptual in nature and even accompanied by thoughts, would be difficult to experience whilst asleep in neurological terms. Instead aspects of those memories may appear in dreams in terms of specific characters, places or themes, without being replayed entirely in a controlled manner.

As has been demonstrated throughout this thesis, another interesting relationship between dreaming and memory concerns remembering dreams. Whilst DR is notoriously poor it does not seem to rely entirely upon waking memory processes (Cohen, 1974; Schredl *et al.*, 2003, also see Chapter 3). Despite this dreams can be recognised, if not recalled (Johnson, Kahan & Raye, 1984, also see chapters 4 and 5), indicating the overlap between dreaming and autobiographical memory. Autobiographical memory refers to memory for one's own experiences, and has an intricate relationship with the self (Conway, 2005; Conway & Pleydell-Pearce, 2000, Conway, Singer & Tagini, 2004). The Self-Memory System (Conway, 2005) was proposed to model this relationship between memory and the self. Specifically, the system consists of a conceptual self as well as an autobiographical knowledge base. Episodic memories form part of that base (Conway, 2001). The working self concept (Conway, 1995; Conway & Pleydell-Pearce, 2000) describes a short term store of goals, experiences, plans and thoughts, which is modulated by longer term conceptions of the self and autobiographical knowledge. Its name refers to how it could operate within the working memory system (Baddeley, 1986) in that its store and capacity is of a similar span, however its guidance by goals allows personality and other processes unique to an individual to exert influence within the self-memory system. This structure can be conceived of as being a present view of the self, which facilitates or inhibits access to certain kinds of autobiographical knowledge. The self is therefore active in some form at all times, even though this often does not necessarily reach consciousness.

Conway, Singer and Tagini (2004) updated the model to incorporate the long term self: a more stable conception of self. There is much evidence that such longer termed changes in the self are reflected in trends of autobiographical remembering. Freely recalled memories from the whole lifespan may be more accessible if they denote changes in the self (Rathbone, Moulin & Conway, in prep). The reminiscence bump refers to an increased likelihood of recalling memories from around the ages of 15 to 25. This "bump" coincides with a lifetime period in which many novel events are being experienced, and identity is vastly changing and being consolidated. It is argued that the more accessible memories from this period reflect the relationship between autobiographical remembering and the self.

Addis and Tippet (2004) exploited a change in self in individuals suffering from Alzheimer's disease relative to age-matched controls. As autobiographical memory functioning was generally impaired in the Alzheimer's patients, the authors argued that changes in memories in this group in accordance with changes in identity further reinforced the relationship between identity (self) and

memory. The patients performed less well than controls on autobiographical tasks concerning their more recent memories, whilst their earlier memories were not impaired. The lifetime period that signified identity change (early adulthood) was impaired in the Alzheimer's patients.

Very few studies have systematically compared dreaming with autobiographical remembering. Grenier and colleagues (2005) were interested in the comparison of these in terms of comparing the temporal references found in dreams and waking memories. That is, the units within a dream were identified by experimenters and the sources analysed by the dreamer in terms of their time since occurrence. Specifically the waking memory components of the dreams were plotted over time. There was a linear decrease in the number of references over time. The references in dreams of older participants (aged 60-77) were compared to autobiographical memories. A similar trend was found for dreams and autobiographical memories, with memories showing recency effects, childhood amnesia and a reminiscence bump, which was slightly more pronounced for the autobiographical memories than the dreams. It should be noted that whilst the dream references were being plotted over time in terms of when those references occurred in waking life, the autobiographical memories were generated according to a semantic cueing method. Thus only aspects of a dream that had appeared in waking life were being compared with whole episodic memories. Nevertheless the overlap between dreaming and autobiographical memory has been demonstrated, and the presence of the reminiscence bump implies that a period of self or identity change has a similar impact upon dreams as autobiographical memories.

Dreamers are aware of the presence of their self in the infrequent cases of lucid dreaming (Kahan & LaBerge, 1994) - an experience that can be conceived of as meta-awareness. Wolman and Kozmova (2007) argue that cognitions in dreams are largely similar to those in waking life. Through analyses of thought processes in dreams, they find evidence of a number of types of rational thinking whilst asleep. The authors consider this to be evidence of the coherent structure of dreams and cognitive continuation between dreaming and waking in terms of rational thought processes. The findings also imply that the self is active during dreams, as personal thought processes and reasoning were evident in relation to goal structures and autobiographical knowledge. There is a tendency for authors such as Wolman and Kozmova to defend the activity of waking cognitions and self-reflexivity in dreams, as it is assumed that such abilities are attenuated whilst asleep (e.g. Freud, 1900, Hobson *et al.*, 2000). However the evidence described above strongly suggests that there is continuity between dreaming and waking cognitions,

although meta-cognitions whilst asleep are generally only experienced in the case of lucid dreaming.

Although the dreamer may rarely be aware of themselves at the time of dreaming, dreams still reflect elements of the self in waking life. The overlap between the self in waking and dreaming is reflected by individual differences factors such as personality traits and gender that relate to dreaming behaviours, implying that physiological factors may not account for all the variance in records of the self being present in dreams. One such correlation concerns the likelihood of experiencing the sensation of déjà-vu and recalling dreams (Adachi, Adachi, Kimura, Akanuma, Takekawa & Kato, 2003; Zuger, 1966). Moulin, Conway, Thompson, James & Jones (2005) reported clinical instances whereby individuals experienced déjà-vécu: persistent sensations of déjà-vu that were so vivid the individuals felt that they had already lived through many of their present experiences before. This sensation can be alikened to the feeling of pastness present in recollective experience (Conway & Pleydell-Pearce, 2000). The sensations of déjà-vu experiences and dreaming may be considered similar in that they are both internal sensations, relating in some way to past memories (dreams) or feeling as if they are being remembered (déjà-vu). This continuity between dreaming and waking in terms of the self and autobiographical memory is extended in the following experiments.

Blagrove, Blakemore & Thayer (2006) note that abilities in monitoring one's own tickling behaviour from others', a behaviour that is usually extremely easy in waking life, are impaired throughout both REM and non-REM phases in the night. In addition this finding reflects the reality monitoring difficulty when dreaming, that is of ascertaining whether something that is occurring internally is perceived to be real. Studies such as this indicate that monitoring cognitive processes throughout different stages of sleep may be more insightful for the understanding of dreaming, than relying upon neuropsychological activation during certain stages of sleep. As dreaming occurs in both REM and NREM sleep, albeit being composed in slightly different ways (see Baylor & Cavallero, 2001 for a review), it would be unwise to assume that brain activity during particular stages of sleep predict dream content in a coherent way. Literature describing the relationship between the self and dreaming generally implies that cortical activity whilst asleep would not give rise to conscious awareness at all (Cicogna & Bosinelli, 2001), let alone an awareness of oneself in space and time. Freud believed that there was a suspension of ego control whilst dreaming, alongside a loss of self-reflexivity (1900). Whilst he was speaking in psychodynamic terms, the aforementioned deactivation of the dorsolateral prefrontal cortex

whilst dreaming may produce a lack of control over thoughts and processes whilst asleep. Solms (1997) argues that neuropsychological profiles of clinical cases support Freudian notions of dreaming. Specifically, damage to the ventromesial quadrant of the frontal lobe, which is involved in motivation, can lead to a cessation of dreaming. Thus underlying pertinent life themes may appear as dream imagery, but not in a particularly controlled manifestation. There is reason to believe, then, that the self would be present in dreams. In fact, it should be as present as autobiographical memories in dreams, seeing as the two concepts are interlinked. Further, whilst the self seems to be present in dreams, although without self-reflexive capabilities (with the exceptions of lucid dreamers), it may be that only the self in the present tense is active. That is, the working self concept is active and evident in dreams.

As many similarities between autobiographical remembering and dreaming have been outlined, it was necessary to identify whether dreams contained elements of the current self. As a result the relationship between memory and dreaming should acknowledge a number of things. Firstly, that a model of their relationship should be flexible enough to encapsulate the sensory-perceptual experiential nature of dreams and remembering. Secondly, the cognitive processes of the sleeping brain should be considered, acknowledging the presence of dreaming during a number of different sleep stages, so not relying upon, for instance, just REM sleep physiology. Thirdly, the autobiographical nature of dreams should be emphasised.

Experiment 10 argues that dreams reflect and relies upon the current self, much as autobiographical memory is dependent upon and defined by the self in the self-memory system. The methodology employed reflects a novel yet systematic way of studying dream content in the context of current selves. A longitudinal design was used whereby a change in "self" was examined over time. Such self (change) was assessed through the Twenty Statements Test (Kuhn & McPartland, 1954) at three different time points. In this task, participants completed "I am..." statements with items which they judged to reflect their identity, such as "I am a student", "I am a vegetarian" et cetera. By asking the participant to report recent dreams, as well as generating I am statements, it is possible to identify current features of the self present in dreams. In addition reports of up to five dreams were collected. Overall the study aimed to investigate whether there would be changes in the inclusion of I am statements from each time point, in the dreams reported at each time point. A high degree of inclusion would support the continuity hypothesis and implicate the self as an important feature of dreaming. Specifically, in line with the continuity hypothesis, there should be an overlap between dreaming and waking thoughts. So, the I ams

generated at a particular time point should be more highly incorporated in the dreams reported at that same time point, than the dreams generated at other time points.

Although the dreamer may rarely be aware of themselves at the time of dreaming, dreams arguably still reflect elements of the self in waking life, supporting not only the continuity hypothesis further, but also the idea that autobiographical memory is linked to dreaming, as opposed to merely episodes being consolidated in a way that is external to the consciousness of the individual. In addition the overlap between the self in waking and dreaming life seems to rely upon individual differences factors, such as personality traits and gender, implying that physiological factors may not account for the self rarely being recorded as being present in dreams. One such correlation concerns the likelihood of experiencing the sensation of déjà-vu and recalling dreams (Zuger, 1966; also see Experiment 1). This sensation can be alikened to the feeling of pastness present in recollective experience (Conway & Fthenaki, 2000). This continuity between dreaming and waking in terms of the self is investigated in the following experiments.

6.2.2 Method

6.2.2.1 Participants

Initially 151 individuals were contacted as part of this study. At this phase (Time 1) they were future students at the Institute of Psychological Sciences, University of Leeds. Twenty five participants (N=25, 22 females and 3 males) returned completed materials, whilst the remaining 126 individuals chose not to participate in the study. The same participants were then contacted 6 weeks later for the second phase once they had arrived at University (Time 2), and again 6 weeks later, once they had settled into University life a little more, at the beginning of their second semester (Time 3), producing three phases of the experiment. By the second phase, 20 participants returned completed materials, and 22 (of the 25) returned completed materials for the third phase. There were therefore 20 participants who completed all phases of the study (18 females and 2 males) in a repeated measures design. At the beginning of the study the median age was 19 years.

At the time of recruitment the participants were living with parents/guardians, having just completed their A-levels. Over the course of the study, it was anticipated that their "selves" changed to become more independent individuals, living alone and studying at University in a

new city. Thus the three phases of the study aimed to reflect a manipulation of self change through a repeated measures design.

6.2.2.2 Materials and design

Materials were distributed to participants at each phase of the study, including a brief questionnaire requesting information about DR patterns, sleeping routines and experiences of the sensation of déjà-vu. Participants were also required to complete the Twenty Statements test (Kuhn & McPartland, 1954) by listing I am statements (e.g. I am happy, I am a student etc) in response to the general question, "how would you describe yourself?" In addition, participants recorded 5 dreams that had occurred within a 2 week period (see 6.2.2.3 below).

In order to test the main hypothesis concerning incorporation of selves into dreams, the dreams were analysed by experimenters for inclusion of each I am statement. Repeated measures statistical analyses focused on changes over the three phases (Times 1, 2 and 3) for these constructs. Dream content was also measured, using the characteristic ratings of importance/salience, emotionality, comprehensibility and surprise included on the dream report templates.

The dream templates (see Appendix G) were administered in paper form so that participants could write down their dream report and record some characteristic details about that dream. Such details included reporting the characters present in the dream and their relationship to the dreamer (characters were people, animals or creatures, and the relationship indicated whether the character was familiar (had been encountered in everyday life, either experientially in person, or on television, for instance) or unfamiliar (unrecognisable or new) to the dreamer), where the dream took place, perspective when remembering the dream (first person (field) or observer) as well as personal salience, emotionality, comprehensibility and surprise ratings on 5 point scales).

6.2.2.3 Procedure

Materials were posted out to students at the initial phase of the study. Participants completed all dream templates and questionnaires in their own time. Instructions stipulated that the questionnaire was completed first, followed by the I am statements, and finally the dream templates. Participants were instructed to report any recent dream that they could remember that

had occurred in the past week. If participants could not recall any dreams they were asked to record dreams in a diary style until 5 templates had been completed, and to write them down as soon as was possible after waking. If, after 2 weeks, fewer than 5 dreams had been recorded, participants were asked to return materials. At Times 1 and 2 participants were not informed that the same materials were to be completed at a later date. At Times 2 and 3 participants were instructed to complete the materials with regard to how they were feeling at their current time in their life, so not to be concerned about completing materials in a way that was intentionally consistent with previous responses. In fact, participants were encouraged not to think about their previous responses at all.

6.2.3 Results

Analyses focused upon the incorporations of I ams into dreams at each phase. The experimenter conducted all analyses, although was blind to the phase from which the I ams and dreams has been generated at the time of counting incorporations. The procedure for this is described below. In order to further validate the method by which this was done, a second rater who was blind to the aims of the study (as well as the phases from which the I ams and dreams came) scored a random proportion (10%) of the reports for each participant. The mean inter-rater reliability correlation coefficient between the incorporation frequencies, the overall number of incorporations of I ams into dreams at each phase for each participant, was $r=0.78$ ($R^2 = .61$), significant at the $p<0.0001$ level). This did not reflect whether the exact same I ams had been rated to have been incorporated by both the experimenter and the second rater.

6.2.3.1 Generation of "I ams" and their dream incorporations

Each dream was analysed for the incorporation of each I am statement from the three phases. Incorporation was recorded using a simple yes/no response. For instance the dream that included the following extract:

"...I tell her I am moving to Leeds and am engaged. We compare rings and she is jealous of mine; I reassure her but I know I am lying" would demonstrate the incorporation of the "I am" statements: "*excited about going to university*"; "*quietly confident*" and "*happy about being engaged*" but not "*in love*" or "*a woman*", for instance, as these statements have not been directly reflected in the dream. Thus those former statements would receive a "yes" categorisation, reflecting their incorporation. The latter statements would receive a "no" rating as they were not

reflected in the dream in any way. Similarly "*I am sat with Lisa and my granddad is giving us gossip magazines to read*" reflects that the dreamer is "*...addicted to magazines*". The dream, "*I was having so much fun back at uni, that I forgot I had an exam the next day and was really stressed when I missed it*" incorporated the "I am" statements: "*I am getting a little worried about doing well in exams*", "*...loving uni*" and "*...on top of my work*".

The incorporations of some I am statements into the dreams sometimes appeared in their reverse form. For instance, the report described above, entitled, "exam stress", involving forgetting about an exam and not having revised for it, was scored as incorporating both "*getting a little worried about doing well in exams*" and also "*on top of my work*", as both the themes were clearly incorporated. Also, it has been documented in dream literature since the writings of Freud (1900) that fears as well as wishes present in dream content. For this reason, so long as a theme was clearly evident in a report, no account was taken of whether that theme (I am) was positive or negative.

Initially the number of consistent I ams, that is those that had not changed between the phases, were counted. There were more consistencies between the statements generated at times 2 and 3, rather than 1 and 2, and 1 and 3, although these counts are reasonably low (the maximum potential number of consistencies was 20). There were the most inconsistencies between phases 1 and 3. Due to the low number of consistencies across the phases, there appears to be evidence for a change in self. Specifically, the I ams changed over the three phases of the experiment, with the greatest changes occurring between Times 1 and 2, when the participants moved away from home and to university for the first time.

Table 6.2.1 Mean number of consistent "I ams" (SDs) between phases

Phases	Mean (SD)
1 and 2	4.00 (1.59)
2 and 3	6.05 (2.54)
1 and 3	3.50 (1.79)
All phases	2.65 (1.69)

A repeated measures ANOVA found there to be a significant effect of "time" on the number of consistent "I am" statements ($F(1.54, 29.31) = 25.87$, $p<0.0001$, Greenhouse-Geisser corrected).

6.2.3.2 Incorporation of "I am"s

The mean inter-rater reliability correlation coefficient between the incorporation frequencies was $r=0.78$ ($R^2 = .61$), significant at the $p<0.0001$ level).

As can be seen from Table 6.2.2 the only time there was a mean of more than 1 incorporation of an I am statement into a dream report was for the I ams generated at time 1 in the dreams at time one, similarly for the I ams generated at time 2 in dreams at Time 2, and for Time 3's I ams in Time 3's dreams. Thus the cases when incorporations of I ams were highest were when I ams from a particular phase were incorporated into the dreams of that same, current phase. The grand mean for number of I am incorporations was .81.

Repeated measures ANOVAs were conducted to see whether the incorporation of I ams differed over the different time periods. The time at which the I ams were generated did not have an effect on the mean incorporation rates as although the means differed (the means were .76, .83 and .83 respectively for I ams generated at Times 1, 2 and 3) the Repeated Measures ANOVA was not significant ($F(2,37) = .25$, $p=.78$). Similarly there was no main effect of time ($F(2,36) = 1.26$, $p=.30$). Means were .71, .82 and .88 respectively. However a significant interaction between I ams and time was found ($F(4,72) = 16.19$, $p<0.0001$). Table 6.2.2 shows the direction of this.

Table 6.2.2 Mean number of "I am" incorporations over the 3 phases

	Time		
	1	2	3
"I am"s Time 1	1.05	0.61	0.41
"I am"s Time 2	0.56	1.10	0.85
"I am"s Time 3	0.63	0.88	1.21

The trends are illustrated through Table 6.2.2, whereby the mean number of incorporations was highest at each time point for the I ams that were consistent with that time point. So, at Time 1 the I ams from Time 1 had the highest mean (1.05), whilst these were much lower for Times 2 and 3, although the third time point was slightly higher than the second. For the I ams generated at the Time 2, there were the most incorporations at Time 2 (1.10) and the least at Time 1, and there were considerable differences between each of these means. For the I ams generated at time 3, there is a steep increase in the mean number of incorporations between phases 1, 2 and 3, at similar increments. That is, the increase in the number of I am incorporations into the dreams of Time 1, 2 and 3, is approximately linear.

The I ams generated at a particular phase, were most likely to be incorporated into the dreams from that same, current phase. This is also illustrated in Figure 6.2.1, whereby the incorporations of I ams from each phase have been divided into congruous (current) and incongruous (past/future) dream reports. The number of incorporations into current dreams are significantly higher than the incorporations into past/future dreams at each phase (Time 1: $T(20) = 3.79$, $p<0.001$; Time 2: $T(19) = 2.61$, $p<0.05$, $T(20) = 3.75$, $p<0.001$).

Current dreams refer to dreams reported at the same time as the "I am"s being generated. For instance, at time 1, the Figure shows the mean number of incorporations of Time 1's "I am"s into Time 1's dreams being higher than the incorporation of Time 1's "I am"s into dreams generated from other phases (past/future dreams). Past/future dreams refer to the "I am"s from each phase being incorporated into the dreams generated at different phases. That is, those "I am"s generated at Time 1 were counted if they had been incorporated into the dreams from Times 2 and 3 (but not Time 1). Similarly, Time 2's "I am"s were counted if they had been incorporated into dreams from Times 1 and 3 and Time 3's "I am"s were counted if incorporated into dreams from Times 1 and 2.

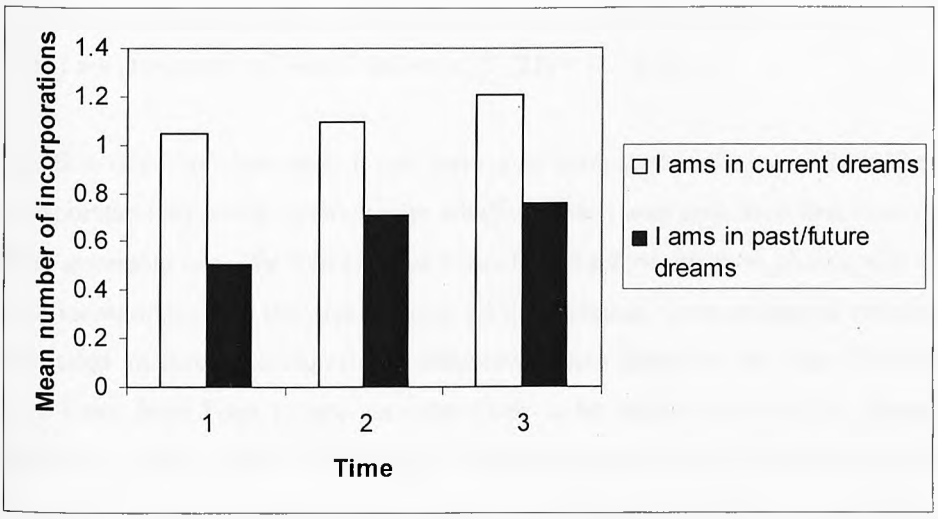

Figure 6.2.1 Comparison of mean number of incorporations of "I am"s into current dreams, and mean number of incorporations in dreams from different phases

Planned contrasts in the form of several T-tests confirmed the directions of these interactive trends. All the paired variables have been found to differ significantly apart from the number of incorporations of Time 2's I ams in the dreams generated at Times 2 and 3, and Time 3's I ams in dream reports 2 and 3. In order to reduce familywise error the Bonferroni corrected p value of .0083 was adopted (the original p value of 0.05 divided by the number of comparisons made; 6). Comparisons were also made between the I ams at each time point across time points. All differences were significant apart from the incorporations of I ams from time 2 into dreams generated at Times 1 and 2. Also the mean incorporations of time 3's I ams into Time 1 and Time 2's dreams did not differ significantly.

I am statements were judged to be either concrete or abstract, based upon distinctions outlined by Kuhn (1954). In order to ascertain whether the first generated I ams were more salient, and therefore more likely to be incorporated into dreams, than the finally generated I ams, the first three and last three statements were compared overall. The majority of statements were judged to be abstract, with a mean number of abstract references in the first three generated I ams being 1.73 (SD 1.01), and for the final three I ams, 2.51 (SD .78).

The final three I am statements were significantly more likely to contain abstract references (as opposed to concrete references, Kuhn & McPartland, 1954) compared to the first three I am statements, at Times 1 and 2 ($T(23) = -4.80$, $p<0.001$; $T(18) = -3.62$, $p<0.005$, respectively. No

significant differences were found in the number of abstract references between the first and last three I am statements at Time 3, however (T (21) = -1.16, n.s.).

The first three and last three I ams were also compared in terms of their likelihood of being incorporated into dream reports to see whether those I ams generated first were more salient than those generated last. The first and last I ams from each of the three phases, and whether they had been incorporated into the dreams from all three phases, were compared, resulting in 9 separate two-tailed analyses. No significant differences were found in any case. For instance, the first three I ams from Time 1 were not more likely to be incorporated into the dreams from Time 1, than the last three I ams. The summary statistics for these analyses are outlined in Table 6.2.3.

Table 6.2.3 Comparisons of the number of first and last three "I am"s being incorporated into dream reports at each phase

	Mean (SD)		
Time	First	Last	T test
Time1 "I am"s 1	0.13 (.23)	0.14 (.16)	T (21) =-.17, n.s.
Time1 "I am"s 2	0.07 (.14)	0.06 (.15)	T (18) =.20, n.s.
Time1 "I am"s 3	0.05 (.09)	0.08 (.16)	T (19) =-.90, n.s.
Time2 "I am"s 1	0.10 (.14)	0.07 (.12)	T (19) =.77, n.s.
Time2 "I am"s 2	0.09 (.13)	0.19 (.26)	T (17) =-1.29, n.s.
Time2 "I am"s 3	0.13 (.25)	0.11 (.17)	T (17) =.29), n.s.
Time3 "I am"s 1	0.12 (.20)	0.14 (.19)	T (17) =-.24, n.s.
Time3 "I am"s 2	0.14 (.19)	0.13 (.17)	T (17) =.18, n.s.
Time3 "I am"s 3	0.15 (.17)	0.13 (.21)	T (19) =.27, n.s.

6.2.3.3 Dream recall frequency (DRF)

The questionnaire (see Appendix J) consisted of 8 items concerning frequency of DR, sleep routines and frequency of experiencing the sensation of déjà-vu. Repeated measures ANOVAs determined whether each of the 8 dimensions differed over the 3 time points. The Bonferroni corrected p value of 0.005 was used. Sleep routines changed over time, however (question 2). The sleep pattern was significantly more inconsistent at Time 2 than before the participants had gone to University or once they had been there for a semester ($F= (2, 38) 7.23$, $p<0.002$).

Participants remembered significantly less detail from their dreams (question 4) at Time 2, when they were settling into University, compared to at the other two phases, where they were closer to recalling "some of what has been dreamt" as opposed to "very little of what has been dreamt" ($F= (2, 38) 9.15$, $p=0.001$).

The number of dreams reported in the dream diary at each phase did not differ significantly ($F (1.37, 26.10) = .22$, n.s.). The same participants tended to report all 5 required dreams at each stage, and similarly the same participants who would tend not to report many dreams at all. However the mean number reported at each stage was high, indicating that on the whole participants were able to report all the 5 required dreams. Thus due to these ceiling effects this was not an additional valid measure of DRF.

6.2.3.4 Dream reports

The quantitative data was recorded and analysed using repeated measures ANOVAs as described above. The frequencies of familiar and unfamiliar dream characters were recorded. Familiar characters included family members, friends, or anyone referred to by name. Participants were instructed to describe how the character was known to them, if at all. Characters from television and film, or other celebrities, were also considered "familiar". Unfamiliar characters, however, were defined as being people (or animals and monsters) that the participant did not recognise. If a description excluded a name, for instance "*the policeman*", this would be classified as unfamiliar. In almost all cases the participant clearly labelled the familiarity of the characters involved.

The dream reports were collected, and characteristics of the dreams were rated and compared over the three time periods. These were the length of the dream report (word count), the number

of familiar and unfamiliar characters appearing in the dream, perspective (field or observer) of the dreamer when recalling the dream, salience, emotionality, comprehensibility and surprise. These final characteristics were scored by the participant on a 1-5 scale. Emotionality ranged from -2 (extremely negatively emotional) to +2 (extremely positively emotional) with 0 reflecting no emotion in the dream. Characters (animate creatures, people or otherwise) were considered familiar if the participant had encountered them in everyday life. Recognising a character from a TV show or book, for instance, was considered familiar. Table 6.2.4 shows the descriptive statistics for these. There were no significant changes in these ratings over the different phases of the experiment. At time 1 N=20, at time 2 N=15 and at time 3 N = 17.

Table 6.2.4 Descriptive statistics for the report ratings over the phases

	Time 1		Time 2		Time 3		
	Mean	SD	Mean	SD	Mean	SD	Sig.?
Report length (word count)	83.42	51.13	60.47	22.49	55.80	25.93	F (1.4, 18.39) = 1.15, n.s
Familiar characters	2.18	.75	1.96	.66	1.71	.58	F (1.4, 18.50) = .87, n.s
Unfamiliar characters	.73	.73	.36	.45	.49	.68	F (1.37, 17.84) = .94, n.s
Perspective	1.11	.23	1.03	.07	1.04	.08	F (2, 26) = 1.26, n.s.
Salience	- .01	.61	-.145	.72	-.05	.84	F (2, 26) = .51, n.s.
Emotionality	- .49	.71	-.45	.82	-.42	.64	F (2, 26) = .05, n.s.
Comprehensibility	.05	.72	-.20	.58	.09	.68	F (2, 26) = 2.48, n.s.
Surprise	.06	.68	.21	.67	.29	.73	F (2, 26) = 2.63, n.s.

6.2.4 Discussion

Overall this experiment has demonstrated that there was a change in self for each of the participants over time. Whilst the characteristics of the dreams did not significantly alter over

time, the self change was accompanied by a change in dream content, The self, which was measured by the Twenty Statements Test (Kuhn & McPartland, 1954), was incorporated into current dreams but was significantly less likely to have been incorporated into past or future dreams.

Inter-rater reliability was acceptable for the ratings of incorporations of I ams into dreams. However the experimenters were distanced from personal meanings of the dreams, as only written reports were analysed. In order to ascertain whether the low incorporations of I ams into dream reports were the result of stringent methodologies, a sample of participants were recruited to generate I ams and recall 3 recent dreams. They then rated the incorporations of I ams into their dreams themselves. Participants had greater insight into the personal meanings of their own dreams, as well as their I ams, than a rater. As the dreams and I ams used for analysis were just taken from one phase per participant, this experiment was purely undertaken to assess the extent to which the self is present in dreams whilst investigating the reliability of the methodology described in Experiment 11.

Characteristic and questionnaire measures of DR did not generally change over time periods, reflecting stability in the dream reports. This reinforces the validity of the findings; only the self descriptions and the dream content changed over time, as the self manipulation had anticipated. In addition the manipulation can be said to have been effective due to there being significant changes of the "I am" statements over the three time periods, despite there being similar numbers of such statements generated. As predicted, there were more consistencies between the "I am"s of phases 2 and 3 (when the participants were at university) than any other combination (1 and 2, 1 and 3) with there being an especially low number of consistencies between the statements made at Time 1 and Time 3, and over all 3 phases. Few consistencies were found over the phases, reflecting a highly successful manipulation of the independent variable.

The two dimensions upon which scores did differ over time related to sleep pattern and the amount of detail remembered from dreams. The change of sleep routine is unsurprising, considering that the participants underwent a major life change over the course of the study. This has been related to DRF in the past (e.g. Schredl *et al.*, 2003) so the significant changes in amount of recalled dream detail is, also, unsurprising. As this study employed a matched design whereby similar numbers of dreams were requested at each phase of the study, the characteristics of these

dreams were more able to be reliably assessed as means were calculated from similar numbers of reports throughout.

The differences in the profile of numbers of dreams recalled and detail of dreams, both assumedly measures of DRF, have been cited as accounting for the conflicting results regarding the correlates of DR (e.g. Wolcott & Strapp, 2002). In this case, whilst dream detail differed over time and self-reported recall frequency did not, this provides evidence for the fact that these two measures are distinct, and therefore encourages studies in this area to utilise both measures as dependent variables.

Despite these minor methodological challenges faced with this new paradigm, the results seem to be robust enough to reflect continuity between the self in waking and dreaming life. So, as dreams are composed of, among other things, events from our waking lives (Nielson *et al.*, 2004; Rauchs *et al.*, 2005), the autobiographical self (Conway, 2005) seems to feature, too. This strongly implicates the role of autobiographical memory in dreaming behaviours.

6.3 Experiment 11: Validation of the Self-Incorporation Methodology

6.3.1 Introduction

The paradigm developed and employed in Experiment 10 was, to a degree, subjective. Whilst adequate inter-rater reliability coefficients were demonstrated, methodological reliability needed to be established given the insight that the dreamer would have into their dreams and self statements, compared to an independent rater.

In order to ascertain whether the low incorporations of "I am"s into dream reports were the result of stringent methodologies, a sample of participants was recruited to generate "I am"s and recall 3 recent dreams. They then rated the incorporations of "I am"s into their dreams themselves. Participants had greater insight into the personal meanings of their own dreams, as well as their "I am"s, than a rater. As the dreams and "I am"s used for analysis were just taken from one phase per participant, this experiment was purely undertaken to assess the extent to which the self is

present in dreams whilst investigating the reliability of the methodology described in Experiment 11.

6.3.2 Method

Undergraduate students were recruited to take part in a study on dream memory. 55 participants (49 females, 6 males, with a median age of 18) recorded 3 to 5 dreams in a diary fashion over a week using the standard template. After a week's interval, 2 weeks from the beginning of the experiment and being asked to record their dreams, participants came to the lab for testing. They completed the Twenty Statements Test and were then asked to look through 3 of their dreams that they had recalled. If more than 3 dreams had been recalled, the experimenter selected 3 dreams of reasonable length (i.e. more than 1 or 2 sentences) for analysis. The experimenter firstly rated the incorporation of I ams into those dreams using the same procedure as has been described in the above experiment, unbeknown to the participant, whilst the participants engaged in another task. Participants were then asked to assess whether they felt their own I ams had been incorporated into their dreams. If they felt they had, they should tick which I ams had been incorporated into each dream. Participants were particularly instructed to tick the I ams that they had clearly dreamed about. For instance if they had written the I am statement that they were "*...a woman*", although they would likely be a woman in their dream, they should only tick that I am if they had dreamt about being a woman, specifically.

6.3.3 Results

The dream reports had a mean length of 59.87 words (SD = 28.52). A higher number of "I am"s were judged to have been incorporated by the participants, than the experimenter. This is reflected in Table 6.3.1.

Table 6.3.1 Mean ratings (and SDs) for the number of "I am" statements incorporated into dreams, by the experimenter and participants (mean)

Incorporation	Experimenter	Participant (mean)	Correlation
Dream 1	1.38 (1.55)	2.41 (2.48)	.70
Dream 2	1.67 (1.54)	2.54 (2.10)	.40
Dream 3	1.42 (1.39)	1.95 (2.09)	.65
Mean	1.47 (.99)	2.28 (1.78)	.61

Table 6.3.1 illustrates the mean ratings by the experimenter and the participants. The mean values correlated highly ($R = .61$, $p<0.001$, $R^2 = .37$) showing a great level of agreement between experimenter's ratings and those of the participants. Ratings by the experimenter and the participant for each of the three individual dream's incorporations were also significantly correlated, as shown in Table 6.3.1. Correlations were conducted between the experimenter's and the participants' ratings in each case. All correlations were significant at the $p<0.001$ level.

Regression analyses indicated that the experimenter's ratings significantly predicted the participant's own ratings ($F(1, 50) = 29.33$, $p<0.001$).

6.3.4 Discussion

Correlations indicated that there was a high level of agreement between the experimenter and participants regarding rating the number of "I am"s that had been incorporated into dreams. The scoring methodology for such incorporations therefore seems to be clear and systematic.

The grand mean of incorporations of "I am"s into current dreams was higher that that found in Experiment 10; in fact it was more than twice the value. Participants were able to follow guidelines for assessing the incorporations of "I am"s. Furthermore there was great agreement between participants' own ratings, and those of an independent experimenter.

The higher mean number of incorporations indicates two things. Firstly, the findings from this experiment confirm that the self appears in dreams, through the incorporations of "I am" statements into dream reports. Secondly individuals may have more insight into their own dream content, thus applying a slightly less stringent methodology when rating whether measures of their self (i.e. "I am" statements) are incorporated into their dreams. Specifically personal dream memories may well have contained more sensory-perceptual imagery, thus providing a rich and elaborate detail for the "I am"s to be assimilated into. A certain amount of (perhaps assumed) knowledge would have been lost when writing down dreams on the required template, as some characters were mentioned in the reports, but their relationships were not detailed in the "characters" section. This meant that some vital information was lost. For instance when participants dreamt about a family member, and referred to them by name only, the result was that an experimenter would not recognise an "I am" relating to family as being incorporated into that particular dream.

Despite this the high level of agreement between different raters indicates that the method by which "I am"s were rated for their dream incorporations, was useful and reliable. Experiment 10 also found there to be a high level of agreement between two independent raters. It may be more reliable for incorporations to be analysed by independent raters only in future experiments, so to withhold an experiments' true aims from its participants. It is worth remembering, however, that whilst independent raters may pick up overall trends in relationships between the self and dreams, they may not accurately identify the absolute number of "I am"s in a dream report, due to the lack of information that they are able to access when relying upon relatively short dream reports.

Summary

Experiment 9 demonstrated how comprehensibility; a measure of self-understanding of dream material, positively influenced DR. Both Experiments 10 and 11 have supported the prediction that the self would be present in dreams. Kuhn and McPartland's (1954) Twenty Statements Test, as a measure of the conceptual self, produced statements that were incorporated into current dreams, and was a reliable and novel methodology. Characteristic ratings of dreams did not change over the three phases of the experiment, reflecting that the only thing that did change was the self, which in turn produced changes in dream content. This demonstrates that there is continuity between one's descriptions of their self at a particular point in time and dreams from that same time. Specifically, the predictions were supported that significantly more incorporations of I am statements into dreams would be found whereby the time at which the I ams were reported, and the dreams generated, matched.

As predicted in Experiment 10, there were more consistencies between the I ams of phases 2 and 3 (when the participants were at university) than any other combination (1 and 2, 1 and 3) with there being an especially low number of consistencies between the statements made at Time 1 and Time 3, and over all 3 phases. Few consistencies were found over the phases, reflecting a highly successful manipulation of the independent variable.

As only the current self was found to be present in dreams, it seems that the working self is active whilst asleep, due to dream content reflecting current concerns, wishes and goals. The long term self was found to change, whilst dreams reflected only the current conception of the self. The Twenty Statements Test may be conceived as a measure of the long term self as it requires

general trait-like statements to be generated. The working self may be comparable to a shorter term conception of the self, in which goals are a motivator (Conway & Pleydell-Pearce, 2000). Whilst the present study has established a link between the conceptual self and dreaming for the first time, and therefore a link between autobiographical memory and dreaming, it is proposed that the working self could be found to be reflected in dreams even more, if an appropriate measure of the working self could be devised. Difficulties with devising such a measure concern the confound of mood, which should not be confused with the working self. Whilst dreams relate to goals and life changes, the more stable measurement of the self (I ams) do not capture the transience of the working self fully.

There may also be reason to believe that the current self extends beyond just the notion of the working self. As dreams incorporate memories from at least the past week (dream lag effect) as well as the previous day (day residue; Nielsen *et al.*, 2004), the self over the space of at least a week may well also be incorporated into dreams. Studies aiming to replicate day residue and dream lag effects in terms of the self would further support and illustrate the relationship between dreaming and autobiographical memory.

The self being incorporated into dreams reflects current concerns, wishes and goals. The presence of these things may be insightful as to the function of dreaming. Revonsuo (2000) proposes a function of dreaming that encompasses the relationships between dream content and the adaptation of the self. He argues that dreaming has evolved to allow people to simulate threatening situations, which accounts for the similarities between peoples' dreams as well as the general negative tone of dream content, with the function being to prepare the self for possible negative consequences of daily life. Zadra, Desjardins and Marcotte (2006) and Desjardins and Zadra (2006) argue that not all dreams reflect threatening situations and those that do, do not always seem to contain situations that are pertinent to survival - an important feature for an evolutionary account of dreaming. This criticism also notes how threat simulation theory is "silent" about how dream content may reflect psychological adaptation to current life situations (Valli & Revonsuo, 2006). Rather, dream content consists of and actively reflects current lifetime issues, as opposed to them being repressed, thus opposing early psychodynamic notions of the function of dreaming. Revonsuo's theory, then, takes a biological evolutionary stance as opposed to analysing specific dream content in the content of an individual's specific life context, or self.

Despite this Revonsuo has bravely acknowledged dream content when formulating a theory of the functionality of dreaming, something that dream researchers explicitly seem to avoid, given the methodological issues encountered in dream research (see Schredl & Fulda, 2005; Valli & Revonsuo, 2006) perhaps because of the highly subjective nature of interpretation. In the methodology described in the present paper we demonstrate that there are ways to analyze and manipulate dream content and that this impacts in interesting ways on current theorizing.

An alternative proposed function of dreaming that has been widely investigated is that of memory consolidation. A number of studies have postulated that REM sleep may be involved in the consolidation of procedural memory whilst NREM sleep enhances performance in declarative memory tasks (see Rauchs *et al.*, 2005, for a review). Further, it may be that episodic memories, in particular, are consolidated during NREM sleep. This may partly account for Fosse *et al.*'s (2003) findings that episodic memories were not replayed in dreams, as their participants kept dream diaries, which may well have consisted of dreams from REM sleep (REM dreams are more memorable than NREM dreams; Foulkes and Schmidt, 1983). It is worth emphasising the concern over correlating dreaming with the functioning of a particular stage, or stages, or sleep, however, as dreams occur throughout most sleep stages. The findings of the present studies propose a link between dreaming and autobiographical memory, which consists of declarative knowledge, episodic memories and the self. Thus the different processes involved in the self-memory system are not restricted to activity that is typical of particular sleep stages, thus reflecting the transience of the composition of dreams over the sleep cycle.

Baylor and Cavallero found that REM dreams contain more self-referential information, a finding mirroring Purcell *et al.*'s (1986) result that REM dreams were more likely than dreams from sleep stages 2 and 4 to contain self-reflective behaviours for the dreamer. As REM dreams are more likely to be remembered than non-REM dreams (e.g. Foulkes & Schmidt, 1983), it follows that dreams generated in a diary style out of the laboratory would also contain self references. This implies two things for the interpretation of the present findings: firstly the composition of the dreams recorded in the diary style may not reflect the composition of all dreams (see below), but secondly that, given the relationship between autobiographical memory and dreaming, the self may be being consolidated in some way whilst dreaming. Thus it is proposed that a function of dreaming is to consolidate autobiographical memories, an offshoot of which results in the consolidation of the self.

Johnson, Kahan and Raye (1984) mention in the discussion of their reality monitoring paper that dreams were rated as relevant to current life situations, and were more revealing about participants themselves, in comparison to the dreams of their partners (which were read as part of the paradigm). Indeed, such self-knowledge about the dreams and the memories that they trigger can act as powerful cues in reality monitoring decisions. As the characteristics of dreams and waking events differ considerably, with dreams being less detailed along a host of ratings (Burt, Kemp & Sheen 2003) any additional information about the memory itself, such as recognition that the self was active in a dream, may facilitate reality monitoring decisions.

A potential methodological complication in dream research concerns measuring DR. That is, any investigation of dreams should work with a representative sample of dream reports. Laboratory elicited dreams may be highly unnatural, influencing dream content, although potentially improving DR. Diary style collections, similar to those adopted in Experiment 10, potentially suffer from low recall and therefore only the most salient dreams being recalled. Questionnaire data indicated that sleep routines were significantly affected by phase, and participants remembered significantly less detail from their dreams at Time 2, when they were settling into University, compared to at the other two phases. The changes in routine were likely to have affected sleep routine and subsequently DRF. Despite this participants were able to recall an adequate number of diary dreams throughout the study, thus the change in dream content can be attributed to this change in long term self as opposed to reflecting themes from an unrepresentatively salient sample of dreams.

Some attempts have been made at devising schemes assessing the relationships between waking life and dreams. Barcaro, Cavallero and Navona (2005) describe two dreams that have been analysed to find the links between different dream sources. Their method involves recalling a dream, and the "sources" of that dream being identified by the dreamers themselves. In this case the source refers to an aspect of waking life that the dreamer feels is reflected in the dream. Semantic similarities between the sources of the dream, based upon grammatical analyses of the links between the sources, qualitative identification of context changes (between sources), and structured analyses of graphical representations of the structure of the dreams' sources are then identified.

The components of a dream may be conceptualised qualitatively or quantitatively. In the method described in the present experiments, both qualitative and quantitative methods are adopted, as

dreamers identify meaning to their own dreams, and then these are analysed quantitatively using semantic networks. Whilst participants counted more incorporations of I am statements into their dreams than an independent experimenter, the methodology was reliable. Thus dream content based paradigms offer hope for dream researchers as a measure of the relationships between dreaming and memory.

Experiments 9, 10 and 11 show that dreams reflect the self, albeit in a stream-of-unconsciousness (i.e. when asleep). Experiments 10 and 11 presented a novel and reliable methodology for investigating the relationship between autobiographical memory and dreaming, in terms of the incorporation of the working self into dreams. The findings clearly demonstrate that dreams reflect the current self, supporting the idea that dreams are not entirely randomly generated. Singer (2003) claimed that whilst the self can be investigated via conscious thought, "...cognitive unconscious processes [are] for studying clinical phenomena, personality, and even the metaphors of dreams..." (p. 461). However the present paper has demonstrated that the self is processed during dreams, which operate to a large extent out of conscious control. Thus, observing the self and memories through a stream-of-unconsciousness may be illuminating.

Chapter 7: Discussion

7.1 Summary of aims

This thesis aimed to quantify, categorise and effectively measure DR in relation to current conceptions of waking memory. A review of the contemporary widely adopted measures of DR (see 1.8) ascertained that a non-invasive technique for assessing dream recallability through conceptualising memory experiences that could be easily administered out of the laboratory (in order to facilitate ecological validity) was certainly required. Experiment 1 developed, psychometrically validated and proposed the Dream Memory Questionnaire as fulfilling these requirements. In addition, it emphasised the overlap between dreaming and the sensations of waking memory experiences. Other studies described in the present thesis involved the re-administration of the DMQ in relation to a host of other measurements of personality, dreaming and waking memory. Experiment 2 explored the profile of the DMQ and subsequently DR, by correlating its scores with a host of individual differences (personality) variables. A clear profile emerged implying that the tendency to recall dreams is related to a general personality that is open to experiences and able to recognise and welcome those experiences. The DMQ was not related to non-autobiographical episodic recognition memory.

Remembering dreams was directly compared with normal waking autobiographical remembering in a number of experiments. In addition these studies directly compared the factors contributing to successful and unsuccessful recall of dreams and waking memories, in terms of memory characteristics and retrievability. As a result of this the effect of rehearsal was considered as an example of a feature of long term waking autobiographical memory that could potentially influence DR. The summary findings of these studies are discussed below in 7.2.

The relationship between dreaming and autobiographical remembering was extended to include a key feature of autobiographical memory: the self. As the self represents an aspect of autobiographical memory, DR in comparison to the self (and a change in self) was not the main focus of chapter 6, instead the relationship between dream content and the self was investigated, and found to be intricately linked for the first time.

The aims of the thesis have been achieved. However some difficulties in researching DR have become apparent, and are described below (see 7.8).

7.2 Summary of findings

Experiment 1 developed new measure of DR and memory experiences, which was significantly correlated with aspects of earliest and recent dreams (detail of early dreams, detail and clarity of recent dreams). The measure was psychometrically valid and subsequently used in Experiments 2, 3, 4, 9 and 10.

Experiment 2 supported the claims that the DMQ relates to certain individual differences traits. These are openness to experience, fantasy proneness, absorption, thin boundaries and dissociative experiences. These traits all seem to be measuring some kind of propensity towards being aware of experiences relating to sensory perception, or dwelling upon internal states. This reinforces findings from Experiment 1 in which DMQ items concerning sensory experiences (such as comprehensibility of sensations and déjà-states) map onto DR.

Following this the relationship between memory abilities and a likelihood of recalling dreams was explored. Experiments 3 and 4 found no evidence to support the idea that memory for dreams relates to either visual or verbal LTM abilities in either recognition or recall tasks.

It seemed necessary to then focus on the relationship between autobiographical memory and dream memories, as the sensory-perceptual episodic nature of these are much more comparable. Experiment 5 discovered that dreams are more difficult to recall in an autobiographical fluency task, and that dream memories are less detailed and vivid compared to memories for episodic events, across a range of modalities.

Studying dreams across time allowed dream characteristics to be further explored, as well as memory to be tested and compared to original dream reports. Experiment 6 allowed a diary methodology to be piloted in a single-case design. Dreams were reported over an 8 month period, and memory was subsequently tested for 102 dreams in free recall and recognition tasks. Recognition performance was higher than recall performance, indicating that dream memories may be difficult to access, but the memory traces are not lost altogether.

Subsequent experiments refined the diary method, and compared dreams with waking episodic events (Experiment 7). Current dreams and events were similarly recallable and recogniseable. It was speculated that older events would be rehearsed over time, thus improving their recallability.

Experiment 8 compared a group of participants who rehearsed their recorded current dreams, with a group of controls who did not look at their dreams after recording them, in a recall task. Whilst significant group differences were not found in terms of DRF, qualitative examination found that those in the rehearsal group did seem to remember the details of their dream reports more precisely than the control group, who seemed to simply remember the gist of the dream.

The final experimental chapter was concerned with dream content in relation to dream memory. Specifically this investigated the role of the self and the comprehensibility of one's dream content. Experiment 9 utilised another single case design, and found that dreams recorded over an 8 month period were most comprehensible in terms of day residue, rather than general life themes being incorporated into dreams. Thus as dreams tend to reflect current thoughts and concerns, Experiment 10 manipulated a change in "self" and found that dreams reflected this change. Current depictions of the self were incorporated into dreams reported at that same time. Experiment 11 reinforced that dreams do reflect the current self, using an enhanced reliability-checking methodology.

Taken altogether, whilst dream memory does not seem to rely upon general LTM abilities, it shares a profile similar to autobiographical memory generally. Dreams recalled over time show childhood amnesia (experiments 1 and 5) and a recency effect (experiments 1, 5, and 6). There is reason to believe that dreams may also show a reminiscence bump (Experiment 5) just as in autobiographical memory, as dreaming has been shown to relate to changes in the self (experiment 10). Further, whilst dream memories that have reached waking consciousness seem to decay rapidly upon waking, their memories are not lost. Performance in recognition tasks (experiments 6 and 7) has been consistently high and, crucially, higher than performance in recall tasks. Thus dream memories are difficult to access, although those that are recallable upon waking reamin stored in autobiographical LTM.

7.3 The profile of dreams

One of the major aims of the thesis was to understand the profile of dreams in terms of their similarity to waking memories, both autobiographical and non-autobiographical.

7.3.1 Dreaming and visual memory

DR has been hypothesised to relate to waking memory processes. In particular, as dreaming is a highly visual process, and damage to the visual cortex can lead to a cessation of dreaming (Solms, 1997) a number of researchers (Cory *et al.*, 1975; Lloyd, 1976; Schredl, *et al.*, 1995; Schredl, 2003; Simmel & Dainoff, 1975) have proposed that there exists a relationship between visual memory abilities and DR. However Experiments 3 and 4 did not replicate the proposed relationship between DR and visual memory. There is a tendency to rely upon inherently verbal measures when assessing this relationship. Whilst the methodology of these experiments highlights this, images of scenes were also presented that could not be easily verbally labelled. There is therefore strong evidence to suggest that dream recallability as an individual differences trait does not rely upon generic episodic memory processes. The relationship between the visual cortex and DR may instead be conceived of in terms of dreams being highly visual, so removing the ability to see their images would lessen the salience of dreams substantially, thus reducing their recallability.

7.3.2 Dreaming and non-autobiographical memory

The memories assessed in Experiments 3 and 4 have been termed non-autobiographical memories as they were both, to a degree, semantic and episodic. Presentations of pictorial and word stimuli were episodic in nature, although non-autobiographical as they did not necessarily involve the self when being recalled. This conception of certain memories being both episodic and semantic challenges classical notions of memories as being strictly either episodic or semantic. DR was not related to non-autobiographical memory processes or abilities in any way. The relationship between dreaming and memory may therefore be considered to be almost entirely autobiographical in nature.

7.3.3 Short term memory

As a relationship between long term non-autobiographical memory and DR was not found, this does not necessarily eliminate the idea that DR may relate to non-autobiographical memory completely. Some researchers have posited that STM plays a crucial role in determining whether dreams are recalled or forgotten (e.g. Cohen, 1971). Indeed, arousal-retrieval and functional state-

shift models of DR both rely upon there being sufficient activity upon awakening for a dream to be held in memory long enough for it to be consolidated, rehearsed or transformed into LTM. Working memory is a specific term for STM whereby more than one process occurs simultaneously (Baddeley and Hitch, 1974), for instance holding an item in memory whilst preparing to retrieve that information ("working" with it). Working memory abilities may therefore account for some of the variance of DR, if upon awakening an individual is able to hold a dream memory trace sufficiently long enough, whilst transforming that experience into a consolidatable memory. The latter process may well be the function of the episodic buffer (Baddeley, 2000). The extent to which working memory is involved in storing and processing dream memories upon awakening is questionable. Whilst it is assumed from modal models of memory (e.g. Atkinson & Shiffrin, 1968) that perceptions must pass through a short term store before entering LTM, the process of awakening may be more lengthy than a couple of seconds, the approximate proposed timeframe within which working memory operates (e.g. Towse, Hitch and Hutton, 2000). Thus DR may well rely at large upon LTM systems more than working memory systems.

Despite this discrepancy over the involvement of STM, memory abilities and functioning cannot account for an especially great deal of variance in DR as the characteristics (salience) of a dream partly determines its subsequent recallability and, as has been demonstrated, specific autobiographical memory processes allow for more transient concepts such as the self to be acknowledged as being actively involved in shaping DR at encoding, storage (rehearsal) and retrieval.

The potential relationship between DR and STM is assumedly a non-autobiographical one. Whilst autobiographical information is likely to be perceived and pass through a short term store before being consolidated into a more long term structure, autobiographical memories are assimilated into existing memory and self-related knowledge structures. As a result STM measures are difficult to be entirely autobiographical. Thus any relationship between dream memory processing and STM abilities implies that autobiographical memory processing cannot entirely account for the variance in DR. Indeed, any one influence upon dream recallability is unlikely given its vast variability.

7.3.4 Dreaming over the lifespan

Robbins and Tanck (1978) and Schredl, Morlock and Bozzer (1996) demonstrated a significant, positive correlation between DR and earliest memories. This may reflect an early cognitive development of the processes and skills required for the successful encoding of memories (e.g. Domhoff, 2001; Foulkes, 1979). Alternatively it may reflect constructive processes involved at the recall stage rather than at encoding.

Experiment 1 found that earliest dreams were significantly longer and more clear (clarity scores), although less detailed, than recent dreams. Some measures of earliest dreams significantly predicted the overall DMQ score and the Factor 1 scores, indicating that earliest dreams do indeed relate to DRF and dream detail. This further supports cognitive-developmental accounts of the emergence of dreaming as a cognitive process, such as those put forward by Foulkes (1999) and Domhoff (2001; 2002).

Comparisons between retrospective dreams (Horton, *in press*) and recent dreams (Experiment 7) revealed differences in terms of recallability and characteristics. Recently occurring dreams were as recallable (68%) and recognisable (76%) as recently occurring waking events. However retrospective dreams were less recallable than events (83%), whilst recognition performance was again comparable to that of waking events (83%). Performance overall was notably higher for recent dreams (and events) than retrospective dreams (and events). This may demonstrate a recency effect for dreams and events, as has also been demonstrated for dreams over the night (Meier, 1968). The difference in recallability of retrospectively occurring dreams and events was explained in terms of rehearsal, whereby events would likely have been rehearsed to a greater degree than dreams, which are less likely to be ruminated upon. Rehearsing recently occurring dreams also seems to alter the quality of the memories that are subsequently recalled (see Experiment 8). Reporting current dreams in a diary style is highly atypical of normal daily DR behaviours, and so comparing retrospective and recent dreams cannot easily be done.

Overall, whilst some early dreams may be particularly emotional or vivid (Bulkeley *et al.*, 2005), it may be this characteristic that improves their subsequent recallability, and perhaps leads to the increased likelihood of that particular dream memory being rehearsed. The mediating cognitive variables leading to increased likelihood of DR therefore seem to remain the same across the lifespan, hence the relationships between earliest dreams and DRF, even though childhood

dreams may be more emotional or vivid than dreams of adulthood (Siegel, 2005). Foulkes and Domhoff interpret that finding as reflecting changes in the cognitive development of children. However changes in the self may also bring about particularly salient dreams, thus increasing the likilhood of dreams from a period of self-change, consolidation or development to be especially memorable.

7.4 Dreaming and the self

7.4.1 Self and autobiographical memory

The self has been conceptualised throughout this thesis as being a fundamental aspect of autobiographical memory (Conway, 2000). That is, memories for one's own experiences cannot be appropriately referenced without a stable and enduring self. Likewise, a self cannot be either stable or enduring without a bank of experiences to draw upon. Chapter 3's finding that DMQ scores were unrelated to non-autobiographical memory processes required more ecologically valid and experiential episodic waking events to be compared to dreams. Their similarities in terms of characteristics that would determine their subsequent recallability and recogniseability strongly implied the overlap between remembering dreams and autobiographical remembering, and that dreams do not differ from waking memories as much as had previously been proposed (Cipolli *et al.*, 1993; Hartmann, 2000; Kahan *et al.*, 1997)).

As a result of this the self was explicitly investigated in relation to dreaming. This was done in three ways. Firstly, Experiment 1 produced a factor of "comprehensibility" as accounting for variance in DMQ scores. This was further investigated in Experiment 7 as a characteristic of dreams and events as well as in Experiment 9, which was dedicated to investigating the specific role of comprehensibility within DR. Comprehensibility reflects the proximity of the self in dreams, as a dreamer cannot be distanced from their dream content if a dream is comprehensible. Secondly, the self was investigated as affecting DR in Experiment 10. Whilst a change in self did not alter perceived DRF in terms of how many dreams were remembered over a given period, significantly less detail was recalled from dreams whilst participants were settling into university compared to the other time points, at which their selves were more stable and unchanging. A change in sleep routine was also noted, so this may well have mediated the relationship between self and dream recallability. Thirdly, the self as a variable was measured directly in terms of its effect upon dream content in Experiment 10 (this methodology was repeated in Experiment 11

and the same ideas replicated, although this experiment concentrated mainly upon the methodology of the novel approach). A change in self brought about a change in dream content, which was found to be exactly in line with this change in self. Dreams therefore seemed to be reflecting the self. This idea is not an entirely novel one. Psychodynamic approaches (e.g. Freud, 1900; Jung, 2002) have focused upon the content of dreams as opposed to their quantitative features and characteristics, emphasising the influence of an individual's experience and personality upon dreams - so much so in fact that dreams are deemed a more accurate reflection of the self ("true" wishes and fears) than waking consciousness would allow. Contemporary accounts of the function of dreaming such as Revonsuo's (2000) threat simulation hypothesis relies upon dream content in relation to an individual's discovery of situations that may potentially harm the self. Whilst Revonsuo's theory focuses upon the universality of dream content, it can be criticised for ignoring the varied and complex nature of dreams in relation to personality and the self.

7.4.2 A new theory of dream function: consolidation of autobiographical memories

Memory consolidation experiments often adopt a content-based approach to dream research in a similar way to that outlined in Experiments 10 and 11. That is elements of waking life are listed and the dreams are analysed for the incorporation of that particular waking event. As has been discussed, dreams have been found to reflect elements of waking life although not necessarily by replaying them (cf. Fosse *et al.*, 2003). If dreams are deemed to reflect particular elements of memories from the preceding day, for instance, this may reflect processing of those memories, likely as part of some consolidatory function (Cipolli *et al.*, 2003). It may be considered then, that dreaming performs a self-consolidatory function. Taken together, that dreams reflect autobiographical waking experiences and the self and so have an intricate relationship with autobiographical memory, dreams may well consolidate autobiographical memories, a by-product of which is that the self is also consolidated, strengthened and stabilised.

Previous research suggests that information from waking life reflecting the self appears in REM sleep more than in NREM sleep (Baylor & Cavallero, 2001; Purcell *et al.*, 1986). This implies two things. Firstly, as REM dreams tend to be better remembered than NREM dreams (e.g. Foulkes & Schmidt, 1983), perhaps due to the quality and thus salience of the dreams resulting from brain activity influencing arousal-retrieval notions of recall, it may be that the dreams

recorded in a diary task have largely been collected from REM sleep. As a result the dreams analysed throughout this thesis may well be more likely to contain self-referential information than dreams collected in a laboratory, when participants are woken from NREM, for example. Secondly, as NREM sleep tends to consolidate episodic memories (see Rauchs *et al.*, 2005, for a review) and REM sleep, semantic aspects (and procedural memories), autobiographical memories may well be consolidated throughout all stages of sleep, thus featuring in dreams collected from both REM and NREM sleep. This is because autobiographical memory contains the self (present in REM dreams) as well as episodic elements (present in NREM dreams).

In order to test this hypothesis, the consolidation of autobiographical memories after sleep, compared to a similar amount of time spent awake, should be investigated. This could be measured both in terms of scores on autobiographical memory tasks, which would be hypothesised to improve after sleep significantly more than after a waking period, if autobiographical memory was being consolidated during sleep, as well as in terms of the composition of autobiographical memories being reflected in dreams. It is worth mentioning that this thesis has not specifically assessed the consolidation of autobiographical memories in dreams for a number of reasons. There has been much research conducted upon the memory-based elements on dreams, the findings of which have been useful in formulating the autobiographical approach novel in this thesis. Further replications of clear effects were considered unnecessary when devising methodologies of the studies outlined here. The experiments in this thesis covered much new ground in terms of comparing the DR to waking events, thus time constraints limited the number of studies able to be conducted. Finally, the assumption that dreaming relates to autobiographical memory processes has been suggested by a number of findings in the present experiments. Correlating scores on an autobiographical memory task with DR performance would further support this assumption. However the only main measure of specific autobiographical memory performance that is currently in use is the AMI (Kopelman *et al.*, 1989)[4], which was devised in order to identify disorders of memory as a diagnostic tool. High performance on the interview is therefore not particularly discriminatory, and would be unwise as a potential correlate of a DR variable in which there is a large amount of variance. In addition the interview is lengthy and required qualitative analysis. The characteristics of dreams and memories have been systematically and adequately compared in other studies (Experiments 5, 7 and 8) thus providing similar kinds of data to that which the AMI could elicit.

[4] Many autobiographical memory measures request information on memory detail and characteristics, such as Sutin and Robins' (2007) Memory Experiences Questionnaire.

It should be noted that this proposition is not being extended to assume that self relevant information or autobiographical memories are necessarily being consolidated in particular stages or types of sleep (e.g. REM, SWS etc).

It may be argued that all autobiographical memories are, by definition, self-relevant in some way. However some memories may be more crucial to the maintenance or change of the self than others. This may account for why some memories (or aspects of the self) appear in dreams at any one time, and others do not. That is, rather than considering dreams to be generated by the processing of consolidated memories, they may be the by-product: the final stage in the process of consolidation (cf Fosse *et al.*, 2003). In addition the neurological context of dreaming does not lend itself towards experiences from the day being replayed in their precise forms during sleep. Indeed any experience is not necessarily encoded exactly as it happened. The act of remembering is constructive rather than replaying an episode like a film (see 1.4.4). Therefore it would be illogical to assume that dreams would contain replays of episodic memories in order to imply that dreaming consolidates episodic memory. Elaboration of the methods by which consolidation processing is reflected in dream mentation is required, as it is not clear as to whether the selection process of consolidated memories may either be taking place during the dream, in which case or whether the selection has already begun and dreams are reflecting only the relevant aspects of our autobiographical memories, or whether the selection process is reflected through the dreaming self.

Traditional accounts of memory consolidation theory state that information is susceptible to interference effects during the consolidation process (Stickgold & Walker, 2005). It is also in the process of "maturation" that effective processing can lead to subsequent improved memory and the assimilation of that information into a more stable, LTM structure. If autobiographical memories and autobiographical knowledge (including information concerning the self) are being consolidated during sleep, in particular as evidenced through the process of dreaming, it follows that dream material would also be particularly vulnerable and easily lost if interrupted prior to successful and complete consolidation. Dreams, then, are in many ways between stores. After being experienced they briefly pass through a sensory memory store to be then held in STM although likely without processing (Koulack & Goodenough, 1976), rendering dreams difficult to be transformed into long term memories. In addition to dream memories being difficult to recall as a result of the physiological and cognitive activity over the sleep-wake cycle (Koukkou &

Lehmann, 1983; Koulack & Goodenough, 1976) they reflect the processing characteristic of consolidation, largely presumed to be autobiographical as outlined above, leading to especially vulnerable and transient experiences. In essence, dreams are difficult to recall as a result of their resulting transient nature, which are subsequently difficult to be encoded (Koulack & Goodenough, 1976) and retrieved (Koukkou & Lehmann, 1983).

This transience has been described by Tulving (1983), who refers to such unanchored memories as "free radicals". Dreams are comparable to free radicals in that they are therefore unreferenced to other autobiographical memories or knowledge (pre-consolidation), not yet having reached a LTM store. Dream memories are also unstable, even those that are recallable upon waking. Most dreams are not recallable, yet the few that are retrievable upon waking decay rapidly. Subsequent dream memories may displace previous dream memories, rendering dreams from over 24 hours ago especially difficult to recall. Evidence for such a circadian-structured memory store comes from day residue theories of dreaming (Freud, 1900; see also Nielsen *et al.*, 2004); referring to the incorporation of memories from the previous day into dream mentation.

A theory proposed by Zhang (2004) extends this notion by proposing a temporary memory store between STM and LTM. The temporary store supposedly has a limited capacity and so material within it can be displaced until it is consolidated in LTM, which occurs during sleep. As information cannot pass directly from STM to LTM, the LTM store is in "retrieval-only" mode whilst awake. During sleep information can be assimilated into it as well. However Zhang proposes that the temporary store adopts a retrieval-only mode at this time, in order to ensure that relevant memories are consolidated appropriately. The result in terms of dreams is that any mentation occurring during sleep remains in STM, as it cannot be transferred into the temporary memory store. This produces dream memories that decay extremely rapidly. Zhang's theory, whilst in need of elaboration in terms of neurological plausibility and empirical support, provides a theoretical framework for Koulack and Goodenough's (1974) arousal-retrieval model in which dream memory traces being unable to reach LTM stores.

7.4.3 Continuity hypothesis: a word of warning

The neurological context of dreaming does not easily give rise to higher order cognition, as implied by the attenuated frontal lobes during sleep (REM sleep in particular). This does not account for the relatively high instances of self references appearing in mentation during this

time. Perhaps only a marginal overlap between dreaming and waking can be expected. Many models of dreaming emphasise the discontinuities between the dreaming and waking brain (Hobson, 1988, Hobson *et al.*, 1998, 2000; Domhoff 2000, Solms 1997, 2000); many of these being physiologically-focused. A great many scholarly articles are however dedicated to the continuity in terms of cognition, consciousness and content of dreaming and waking. Indeed, this thesis emphasises the overlap between dreaming and waking autobiographical memory processes. However a number of factors prevent dreams from being experienced, and thus encoded, in the same way as waking memories. (Retrieval processes, on the other hand, may well be largely similar, with the exception of the lack of cues present in waking life that would facilitate the recall of a specific dream, due to context and state dependency effects).

Firstly dream salience is significantly lower than the salience of waking memories. This has been found by Kemp and Burt (2006), Kemp, Burt and Sheen (2003) and Johnson, Kahan and Raye (1984) as well as from the data from Experiments 5-8 in the present thesis, whereby dreams and waking events were directly compared along a host of criteria. Secondly the aforementioned lack of awareness (frontal attenuation) at the time of the dream experience means that dream cannot be encoded easily. This is especially important considering the nature of dreams, in that they are transient, difficult to verbalise and highly visual. This idea has been reinforced by Koukkou and Lehmann's (1983) functional state-shift hypothesis in which dreams could not be transferred from working-memory to LTM. This lack of awareness renders meta-awareness almost impossible in the majority of people, with the exception of lucid dreamers. Thirdly this physiological state-shift (perhaps cholinergic to aminergic activation of the brain) emphasises the state dependency problems (Koulack and Goodenough, 1974), whereby a waking state, where much retrieval occurs (both in daily life and especially in non-sleep laboratory based studies of DR) differs greatly from the state in which the dream was generated and encoded. This presents little overlap between the memory cues from encoding and retrieval thus making recall difficult. Context dependency may also exaggerate this effect, as dreams are encoded whilst asleep, so likely at night in the quiet in a bed. If elements of this environment and context were also encoded along with the dream (presumably when encoding occurs upon waking as opposed to during the sleep experience itself), recall would be especially poor as it is not likely to occur under these conditions. Another context dependency effect could concern the longer-term trait of self (Experiments 10 and 11).

7.5 Characteristics of dreams and waking episodic memories

Whilst the differences between the dreaming and waking brains can elicit differences in the recallability of dreams and waking autobiographical events, the characteristic differences between dreams and events are profound. This may not necessarily reduce the recallability of dreams. In fact, their unique transience and sensory-perceptual experiential nature can facilitate reality monitoring decisions (e.g. Johnson *et al.*, 1984) and can even provide valuable cues for subsequent recall in rare circumstances (for instance taking off in an aeroplane may cue the memory of a dream involving flying). A number of experiments described in this thesis (Experiments 5, 7 and 9) have extended the well documented finding that dreams are less detailed upon a range of characteristics, than waking events (Kemp and Burt, 2006; Kemp, Burt & Sheen, 2003, Johnson et al,. 1984). The implications of these upon theories of DR (and failure) are described below.

7.5.1 Salience

The salience model of DR (Cohen & MacNeilage, 1974) offers an explanation as to why some dreams are more recallable than others. In addition, it is assumed that some individuals tend to experience more salient dreams than others, thus accounting for individual differences in DR. Specifically, the more salient the dream, the more memorable it is. Salience can be conceived of in at least two ways. Traditionally, salience refers to self important information or experiences. Indeed, Cohen and MacNeilage considered salience in this way, and measured it in terms of subjective impact of the dream. As a result the diary studies (Experiment 7) also referred to this variable as "salience/personal importance". On the other hand, salience may also refer to the strength of the memory trace of the dream experience. That is, a dream may be distinctive or significant as based upon its characteristic features. If, for instance, a dream is especially sensory-perceptual, its content may be judged to be salient as the content is highlighted. It may leave a lingering sensation, thus increasing the chances of being held in memory and therefore subsequently recalled. Increased recallability of an experience may well improve the chances of that experience being considered to be significant, thus the salience effect is circular. Generally, the findings that dreams are less detailed along a host of characteristic ratings than waking memories, may well account for their impaired recallability, according to the salience hypothesis.

It has been noted that the salience hypothesis can account for the recallability of dreams at the stage of generation. However individual differences in DR may result from variation in retrieval processes. The interference of new stimuli upon waking can interfere with the late encoding process (Cohen & Wolfe, 1973) however the arousal-retrieval model (Koulack & Goodenough, 1974) can account for effects of both salience and interference in a more comprehensive way. Traits such as adopting a positive attitude towards dreaming may well reduce effects of interference through attending to dream material rather than external stimuli upon awakening. Taken altogether then, Koulack & Goodenough's model seems able to account for trends in much of the data described in this thesis; in terms of both individual differences and cognitive effects, and (with regard to interference effects) the interaction of these two.

The model was criticised (see 1.3.5) for ignoring state-dependent memory effects, largely because, despite the name, encoding rather than retrieval processes are emphasised in it. That is due to decreased levels of cortical arousal whilst asleep, dreams cannot transfer from short to LTM stores. Koukkou & Lehmann's (1983) functional-state shift model is largely similar in that it describes the attenuation of structures of the sleeping brain, however accounts for state-dependent memory effects of DR. Whilst Koulack and Goodenough imply that dream encoding is largely difficult whilst asleep, Koukkou and Lehmann's model suggests that successful encoding is more likely for dreams occurring close to waking, or when the brain is more active and aroused. Thus a fusion of these two models could account for the aforementioned trends of interference, salience, decreased DR compared to waking recall (due to encoding), state-dependent recall effects as well as the interaction of these effects with individual differences and the recency effect whereby dreams generated and experiences later in the night are most likely to be recalled.

7.5.2 Reality monitoring

As a result of the aforementioned finding that dreams are less detailed than waking events, reality monitoring decisions should be relatively easy (Johnson *et al.*, 1984). Johnson *et al.* proposed that when characteristic details do not differ, differences in the quantity of cognitive operations remembered to be involved at the time of the experience can facilitate accurate reality monitoring judgements. Taken altogether the lack of characteristic detail and the cognitive operations typical of an internally generated experience should ensure that deciding whether a memory referred to a thought, dream or fantasy, as opposed to an actually perceived event, should be easy. However as

cognitive operations are lacking whilst dreaming, likely due to the relative deactivation of the frontal systems whilst asleep (in REM sleep in particular; Hobson *et al.*, 2000) successful reality monitoring decisions rely upon the characteristic differences between dreams and waking memories. In this view these characteristic differences are functional, insofar as discriminating between dreams and waking reality.

7.6 Dream recall

The majority of the experiments in this thesis have focused upon DR especially in comparison to the recall of waking autobiographical memories. The previous section has described the relevance of the findings for the proposed function of dreaming, in terms of autobiographical memory consolidation. Taken altogether the thesis has found a number of cognitive characteristics accounting for some of the widespread variance in remembering dreams. These are described and modelled below.

7.6.1 Individual differences and dream recall

Experiment 2 aimed to classify the trait variables relating to DR. It was clear that those individual differences correlating with DMQ scores were, on the whole, measuring highly similar traits that had simply been operationalised with differing terms. This was reinforced with the finding that DES scores correlated with DMQ scores. As dreaming is not a dissociative experience (although successful reality monitoring decisions do require that dreams be discerned from reality), individuals who scored highly on the DES also seemed to score highly on the other trait measures, thus perhaps indicating their tendency to be observant and analytical of their sensory-perceptual experiences.

Schonbar (1965) proposed that DR formed part of a person's lifestyle. Whilst her interpretation of these effects was psychodynamic, findings from Experiment 2 did imply that traits related to DR and memory experiences were largely similar, therefore possibly measuring the same underlying construct. Whilst these findings strongly indicated that individual differences relate to DR, they were unable to suggest a direction for the relationship. That is, whilst being openness to experience, for instance, could lead to a heightened ability to recall dreams, recalling dreams could equally likely lead to being open to new experiences. With this in mind, individual differences trends do not suffice in attempting to account for variance in DR. Rather, cognitive

models of memory may well offer explanations as to the processes involved in the recalling or forgetting of dreams, and the mediation of these relationships.

It should be noted that individual differences and cognitive based accounts of DR are not necessarily independent. The huge variation in DRF far exceeds the variation in memory abilities, therefore memory processes are likely to interact with other factors, also. Experiment 1 demonstrated that sensations of autobiographical remembering varied between individuals, and that this trait accounts for dream recallability. Thus a sophisticated style of autobiographical remembering may well comprise the observational and interpretative skills characteristic of the traits found to relate to DR, such as openness to experience, fantasy proneness and even scoring highly on the DES.

7.6.2 Cognitive explanations

A number of experiments in this thesis have demonstrated that dreaming is similar to autobiographical remembering (Experiments 1, 5, 7 and 8), but that it is unrelated to non-autobiographical memory processes (Experiments 3 and 4). As a result a number of processes typical of autobiographical remembering may well be responsible for the successful recall of dreams. Rehearsing material, for example, was not found to increase DRF (which was found to be high anyway; Experiment 8), but instead it altered the quality of remembered dreams and events. Rehearsed experiences were recalled in almost exactly the same way as they had initially been recorded, whilst non-rehearsed memories were more speculative, ordered differently to the original report and containing slightly different kinds of details (fewer rather than more, compared to the original memory). This effect of rehearsal upon the quality rather than the quantity of recalled memories (both dreams and events) implies that the cognitive strategy for improving the characteristics, and thus salience, of a dream memory is a facet of LTM. Working memory rehearsal involves mere repetition (Baddeley & Hitch, 1974) whilst LTM rehearsal can involve a more meaningful consideration of the original memory trace in the context of other experiences in an autobiographical knowledge base. Considering this, whilst it is unknown as to whether working memory processes facilitate DR (see 7.3.3), LTM strategies can influence the phenomenology of recalled dreams.

Table 7.1 Physiological and cognitive influences upon dream memory over time

During experience	Encoding (waking)	Retrieval
1) Cortisol		
Dopamine		
Cholinergic-aminergic neuro-modulation	Cholinergic-aminergic neuro-modulation	
	State-dependency	State dependency – context
		State dependency – self
2) Content – comprehensibility (closeness to self)	Comprehensibility of dream sensations[5]	Comprehensibility
Content – salience of dream		
3) Frontal activation (cognitive operations)[6]	Deliberate encoding strategies	
4)	Attitude towards dreams	Attitude towards dreams
	Rehearsal	Rehearsal
		Rumination – fantasy proneness
		Rumination – daydreaming
		Rumination – déjà-states
5)		Time

[5] As found, specifically, in Experiment 1
[6] Johnson, Kahan and Raye, 1984; Johnson *et al.*, 1988

Table 7.1 notes the cognitive and physiological influences upon DR, as well as how the two may interact. It can be seen that whilst the physiological factors largely affect DR in terms of dream generation and experiential nature of the event, memory-based factors alter recall at the retrieval stage (upon awakening) and over a longer time-frame. Figure 7.1 further details how these relationships may operate.

Cholinergic-aminergic neuro-modulation described in Table 7.1 and detailed by Hobson (Hobson and McCarley, 1977; Hobson, Pace-Schott and Stickgold, 2000) may give rise to effects of state-dependency, whereby maintaining or creating a dream-like state can improve recall, such as in Green's (1999) hypnosis study on autobiographical memory. Over time state-dependency in terms of context can produce an overlapping of cues present at both encoding and retrieval, leading to a successful recollection. The self may also add to this[7]. A particular self may also facilitate comprehensibility of dream material[8], as detailed in the second level of the Table. The dream salience[9] is likely to affect all levels of the encoding and retrieval process, as sufficient details need to be dreamt about and encoded, in order to render clear retrieval possible. The trait behaviours of rumination (considered to relate to fantasy proneness and daydreaming), rehearsal, holding a positive attitude towards dreams and experiencing déjà-states are all postulated to be mediated by autobiographical memory habits. Thus this thesis has posed a cognitive explanation for the individual differences correlates of DR for the first time.

Figure 7.1 illustrates a summary model of the cognitive characteristics of remembering dreams, as based upon findings within this thesis (separated into "individual differences" and "memory" aspects) as well as more general physiological influences outlined in the literature on dreaming.

The individual differences relationships with DR (those of openness to experience, absorption in imaginings, dissociative experiences, fantasy proneness, thin boundaries, experiencing déjà-states and having a positive attitude towards dreams) have been found from the results of Experiment 2. Comprehensibility has been postulated to relate to DR as a result of data from Experiments 1 and 10-12. Experiment 8 found that rehearsal affects the phenomenology of recalled dreams, which may be increased if dream comprehensibility is high. The thesis has, altogether, implicated the importance of autobiographical remembering in accounting for DR, especially in terms of

[7] Taken from results from Experiments 11 and 12
[8] Results from Experiments 1 and 10
[9] Results from Experiments 4-8

salience (Experiments 5-8) and self (Experiment 10-11), which itself facilitates dream comprehensibility. The model as a whole emphasises the dependent nature of these factors by detailing how individual differences correlates of DR and autobiographical memory processing may interact. That is, traits such as comprehensibility, experiencing déjà-states and having a positive attitude towards dreams are the result of autobiographical memory habits and processes, and influence other individual differences behaviour as well.

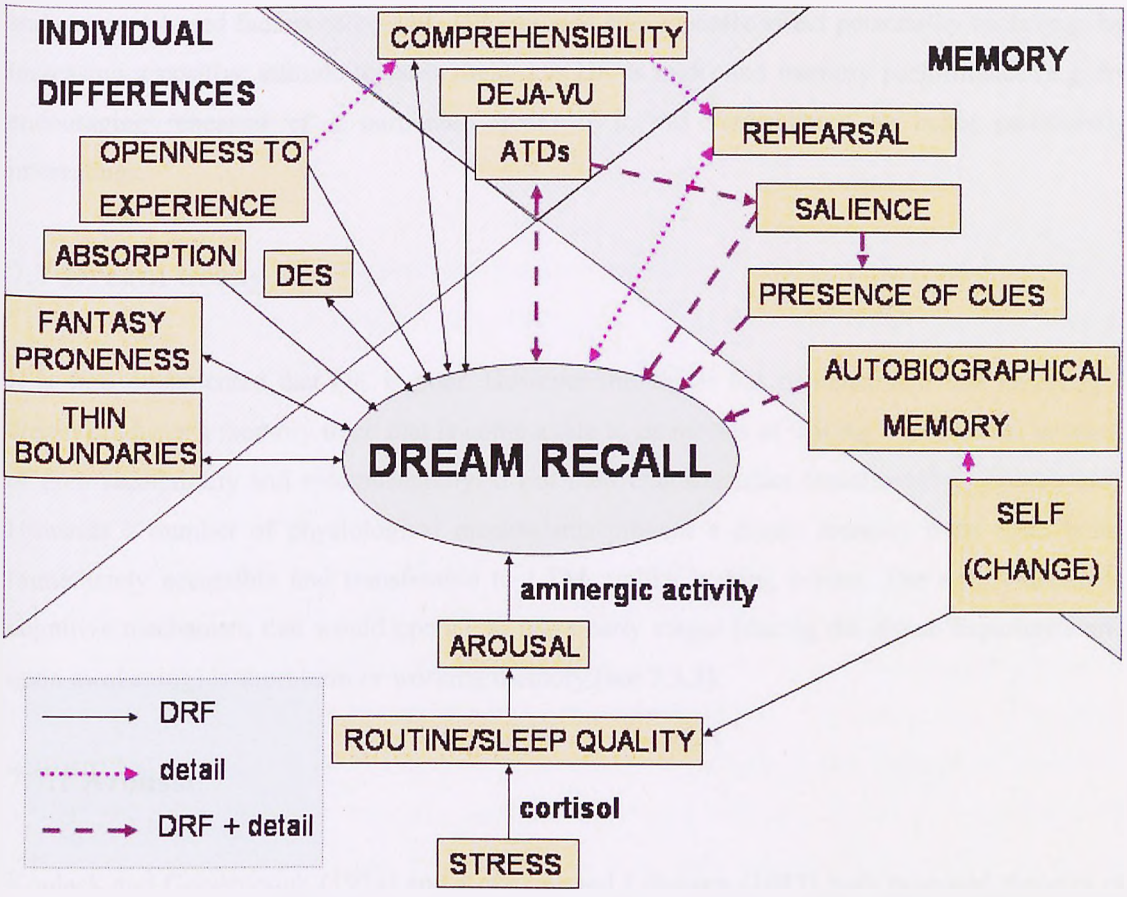

Figure 7.1 Model of dream recall

The model also emphasises how DRF and dream detail are independent, insofar as they have unique profiles to individual differences and memory-based influences. Specifically, rehearsal affects the quality of recalled dreams (dream detail) but not their quantity (DRF). Having a positive attitude towards dreams may increase the likelihood of deliberate encoding strategies upon awakening, thus increasing DRF as well as dream detail. Physiological and individual differences correlated of DR are postulated to affect DRF, as they would affect whether or not a

dream was initially encoded. However longer term rehearsal or other memory strategies would likely serve to maintain or elaborate an otherwise decaying weak memory trace, thus autobiographical memory processes may be more likely to influence dream detail as opposed to DRF values. The partly-dependent variables of DRF and dream detail may correspond to the ability for a dream to be encoded and retrieved, respectively.

A number of bi-directional relationships are shown in Figure 7.1. That is, not only do personality and memory-based factors affect DR, DR can also subsequently affect personality traits (e.g. by increasing a positive attitude towards dreams is DR is high) and memory performance (e.g. by encouraging rehearsal of a particular dream if it was remembered as being particularly interesting).

7.7 Dream decay

It is well documented that DR is poor. However this thesis has demonstrated that reporting a dream produces a memory trace that is comparable to memories of waking experiences, in terms of their recallability and recogniseabilty, if not their characteristics (emotionality, salience etc). However a number of physiological mechanisms prevent a dream memory trace from being immediately accessible and transferable to LTM, unlike waking events. The only considered cognitive mechanism that would operate at these early stages (during the dream experience and upon awakening) is short term or working memory (see 7.3.3).

7.7.1 Arousal

Koulack and Goodenough (1974) and Koukkou and Lehmann (1983) both proposed theories of DR that centred upon the differences between brain activity in dreaming and waking states. As the dreaming or sleeping brain is deemed to be less active, on the whole, than the waking brain, frontal regions associated with the implementation and control of actions prevent the conscious encoding of certain memories. In addition whilst the dream is being experienced the dreamer may not have the reflective or meta-cognitive capacities that would encourage deep encoding. That is, the deactivation of the dorsolateral prefrontal cortex results in a confused sense of time within dreams. This may well account for a feeling of the present whilst in dreams, and may also prevent the encoding of particular experiences, as considering future plans would be difficult at this time. Nielson and Stenstrom (2005) acknowledge that it is this lack of temporal awareness that makes a

link between dreaming and episodic memory difficult to account for. As episodic memories are in part defined by their recognition of time (they are characterised by a feeling of "pastness", for instance; Tulving, 1987) an episodic memory of a dream would be difficult to remember. This also means that during dreaming individuals are unable to acknowledge whether they remember a waking episode whilst it appears in the dream. Episodic richness scores from the diary studies (Experiment 7) indicated that individuals could have episodic memories for dreams. They would likely be unable to identify exactly when these dreams had occurred, however this may well also be the case for waking memories. In addition the dorsolateral prefrontal cortex has been proposed to be responsible for volition (Hobson *et al.*, 2000), thus being unable to control ones dreams or actions generally whilst asleep, reinforces the idea that conscious encoding plans would be problematic.

Solms (1997; 1999) claimed that the occipito-temporo-parietal junction is essential for dreaming to occur. This region, according to Luria (1973), is involved with the conversion of perceptions into abstract thought. That is, the encoding of an experience would likely involve this region. Its activity and its crucial role in dreaming is therefore incongruent with the difficulty of encoding dreams. However, frontal regions that may well concern conscious and more effortful encoding in waking life are attenuated during sleep, leading to a difficulty of encoding regardless of the activity of the occipto-temporo-parietal junction. Solms (1999) argues that this region is responsible for the reversed nature of dreaming. That is, in waking perceptions are converted into thoughts and stored as memories, whilst in dreaming the memories and thoughts are converted into perceptions. Whilst it is not specified as to how this is exactly the case, it may be assumed that the brain resorts to producing internally generated stimuli in the absence of externally perceptible experiences. Alternatively, aspects of memories may be activated as a result of their processing during consolidation. This explanation may well account for the activation of just elements of episodic memories as opposed to them being replayed (Fosse *et al.*, 2003) as the hippocampus is active during dreaming, although less active than when in its waking state. In addition perhaps just the self-relevant aspects of memories are consolidated during dreaming, resulting in the processing thus activation of features of memories, which subsequently trigger the activation of other memories via the association cortex (occipito-temporo-parietal junction). Coupled with the attenuation of the controlling frontal lobes, aspects of memories may be fused and appear bizarre in some memorable dreams. On the whole, however, the mish-mash of images seen in a dream are themselves difficult to encode, thus resulting in dreams that are largely

difficult to encode due to their characteristic nature as well as the physiological activation of the dreaming brain.

7.7.2 Cortisol

A number of neurotransmitters have been implicated as being involved in the shifts of sleep and wake stage in the brain. Serotonin, norepinephrine, acetylcholine and cortisol are the most described in literature on the physiology of sleep and dreaming. Payne and Nadel (2006) describe how cortisol, involved in the exertion of control over hippocampal functioning, may be involved in the consolidation of different types of memories (episodic/procedural) over the sleep-wake cycle. As cortisol is also known to be released in times of stress, cortisol levels may increase during particularly negatively emotional dreams, thus increasing their likelihood of being encoded and subsequently recalled. Experiment 2 did not find a relationship between stress and DR, directly. However such a relationship would oversimplify the complex interactions of cortisol in the hippocampus over the sleep-wake cycle. Payne and Nadel also emphasise the rising levels of cortisol in the early hours as opposed to at the beginning of a night's sleep, which may well account for the increased dream recallability, irrespective of sleep state (REM/NREM) of dreams occurring later in the night.

7.7.3 Cholinergic-aminergic activation

Hobson (Hobson, 1988; Hobson & McCarley, 1977; Hobson, Stickgold & Pace-Schott, 1998; Hobsons, Pace-Schott & Stickgold, 2000) noted that aminergic brain activation, typical of the waking state, changed to cholinergic activation during REM sleep. Thus the neuromodulation of the brain across the sleep wake state may relate to effects of state-dependency in terms of DR. Koukkou and Lehmann (1983) claimed that differences in the irretrievability of dreams may demonstrate effects of state-dependency. As has been discussed already, assuming that dreaming is equivalent to REM states is misleading. A state-dependency or functional state-shift (Koukkou & Lehmann, 1983) model should therefore also take into account the more experiential differences between dreaming and waking states, as well as physiological ones. That is, DR may be facilitated by recall in one's bed upon waking as opposed to when completing a dream diary at a desk, where the dream did not occur.

7.7.4 Dopamine

According to Solms (1997, 1999) one of the two essential brain regions involved in dreaming is the ventromedial quadrant of the frontal lobe, the fibre pathway of which transmits dopamine from the middle of the brain upwards to higher regions. Dopamine is involved in reward and motivation, and disorders of dopamine can lead to problems of memory. Dopaminergic transmission whilst dreaming may, therefore, help elucidate the processes of memory active and possible during sleep states. PET scan studies may offer a promising way of doing this. Hartmann (1980) found that l-DOPA; a drug able to increase levels of dopamine, led to an increase in the vividness of dreams. Whilst it is not known whether this was the result of individuals dreaming more salient material or that their memories had been improved, dopamine levels may account for some of the variation in dream recallability. Dopamine levels have been proposed to account for a number of personality variables, including psychotic tendencies (excessive dopamine) or withdrawal (lack of dopamine), thus the widespread variance in DR as measured by correlations with individual differences traits may have their roots in biochemical functioning.

7.8 Methodology

The profile of remembering dreams has been clarified in terms of the characteristics that predict recall, and traits that correlate with the successful recall of a dream. A theme that has emerged from the present findings is that an effective way of conceptualising these notions is by emphasising the comparability between dreams and autobiographical waking remembering. However there are a few obstacles preventing absolute comparability between these two types of memories. First and foremost, brain activity whilst asleep, although researchers cannot agree as to its profile (over the sleep cycle), certainly differs from the waking brain. Secondly, the original memory trace of a dream can never be totally accessed. At best a dream report can be collected upon awakening, but this is such a personal experience that it can never be validated by anyone other than the dreamer. And the memory for that dream evidently decays quite rapidly! Thirdly, and a consequence of the second point, measuring DR and recognition can be problematic as far as re-presenting cues to the original memory trace is concerned. The cues may be especially distinctive (a result of the occasionally unique content of dreams) thus providing a great hint as to what the memory was. The cues may make up the majority of the dream memory, depending upon how much of the original experience was recorded. For these reasons the cues may not facilitate comparisons to waking memory tasks.

As has been mentioned above and described in detail in Experiment 2, there is great variance in DR. Dream studies seem appealing for students to participate in, however it is likely that the samples upon which the present experiments were conducted consisted of those who were higher than average on scores of positive attitudes towards dreams. In addition, whilst it was encouraged that participants did not necessarily have to believe that they had particularly impressive DR, indeed forgotten dreams were also of interest, some dream report had to be initially collected. So in fact participants who failed to report dreams at all were unable to participate. The resulting samples, then, may not be entirely representative of the dreaming population at large. It is worth remembering that the majority of dream studies make use of students (especially of dream studies!). Whilst this may be the norm, it is still less than desirable. It can be defended insofar as dream reports have to be collected for a subsequent memory of that dream to be compared to something. Also, many people find that their DR improves once they begin keeping a dream diary. Thus it is worth trying to obtain a representative sample by encouraging participation from individuals who do not necessarily normally report or remember their dreams. Hopefully, throughout a study, DR would improve and the sample would therefore be representative. There appears, then, to be a representativeness-validity trade-off. The best sample for the study should depend upon the particulars of that study on a case by case basis.

In addition some dream content is especially personal or apparently revealing about an individual. Diary studies attempted to overcome this by reminding participants that their diaries would be treated confidentially and anonymously, and that only one experimenter would see them. If they felt that they would prefer not to reveal particular content, they should either refer to it in a manner that only they would understand, that is in some code, or that they should explicitly state that they recalled the content but that they chose not to report it. No participants chose this latter option, and it was not recorded as to how many participants opted for the formed, for ethical reasons. At debriefing sessions no participants, when asked, felt that they had had to hold back when reporting their dreams, although dealing with personal material may well have affected the amount of or type of material that was recorded and therefore subsequently recalled.

Evidently ethical issues play an especially great role when working with dreams. Whilst some individuals seem especially keen to take part in a dream study, it is often necessary (especially with memory research involving surprise recall or recognition tasks) to withhold information as to the true nature of the study from participants. This has never been at all problematic in any of the experiments described in this thesis. However the content of dreams may, as described above,

give rise to especially sensitive information being dealt with. Recall tasks (both for the original dream report and the recalled dream, at a later date) have required participants to write down their dreams in order to maintain some privacy. Verbal skills may confound the detail reported in such tasks, so reporting them orally into a private tape recorder (with the experimenter out of the room) may overcome this problem. Here they may be a problem with embarrassment interfering with a clear report of dream material. Further methodological investigation is required in order to understand the best possible means of gathering dream data in a valid manner that is as sensitive as possible to the possibility of personal data being discussed.

A final serious methodological issue in dream research concerns the dependent variable of interest. Whilst some studies quantify DRF from laboratory- or questionnaire-based reports, other studies are interested in the quality of the dreams in terms of dream detail. This thesis has tried to use both dependent variables, and has also discovered that the two measures relate to similar features of autobiographical memory (see Experiment 1), although they have slightly differing memory profiles overall. Despite this the findings from Experiment 9 demonstrated that some cognitive processes have differential effects upon these variables. Specifically, rehearsing dream and event memories altered dream detail, but not DRF. Thus studies in this area should ensure that the variable of interest in specified, clearly defined and not extrapolated to a generic conception of DR. There is also a need to establish whether DRF may refer to the likelihood that a dream memory has been encoded, whilst dream detail refers to the amount of that memory that is retrieved.

7.9 Conclusions

The findings of the present thesis broadly indicate that whilst brain physiology may prevent dreams from being easily encoded, dreams are memory experiences and thus any encoded dream memory operates in the same way as would a waking experience, after considering the less-salient nature of dreams compared to waking memories. As dream memories share a profile with autobiographical memories, it may be more appropriate to conceive of the declarative memory system as containing an autobiographical (rather than an episodic) and a semantic system. Alternatively, adopting Tulving's conceptualisation of episodic and semantic memories render dreams similar to "free radicals", neither truly episodic nor semantic. Cognitive strategies such as rehearsal of old or current experiences alter the phenomenology of the memory, and dwelling upon dream material may increase the likelihood of subsequent recall. In addition the inclusion of

the self within dreams may imply a function of dreaming: to consolidate autobiographical memories.

Despite this continuity between the sleeping and waking autobiographical systems, dreams are generally very difficult to recall. As Botman and Crovitz (1989-90) conclude, there are many reasons as to why DR is poor, and that autobiographical memory functioning should not be one of them. Explanations include dreams being characteristically less detailed than waking memories (salience) thus rendering them more difficult to encode; the deactivation of frontal brain regions whilst asleep lessen the abilities of controlled encoding of dream experiences; state- and context-dependent memory effects leading also to fewer cues being present for successful DR; and intentions to recall varying greatly across individuals.

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Appendices

APPENDIX A: CONSTRUCTS UNDERLYING THE DMQ

Demographics:

Please state your gender Male / Female

Age: Years ..... Months .....

How often remember dreams:

How often do you feel you dream?

How often are you aware that you have been dreaming?

How often do you remember your dreams?

How often do you forget your dreams?

How rapidly do you typically forget the dream?

How much detail remembered from dreams:

How much detail do you typically remember from each dream?

How much detail do you typically forget from each dream?

Do you remember detail in terms of a story/theme?

Do you remember details of places and people as well as what you're doing in your dreams?

Sleeping patterns:

Do you, on average, have a regular sleep pattern? (i.e. go to bed and wake at similar times each day?

If you replied "YES" to question __, do you feel that you are more likely to remember your dreams if you deviate from that pattern? (If you did not respond "YES", please leave blank).

On average, for how many hours do you sleep each night?

Routine of dreaming/recall:

Do you feel that you remember your dreams routinely (i.e. do you consistently dream daily/monthly, as has been indicated above, or do you dream frequently for a few days and then not for months, for example)?

Do you feel that you forget your dreams routinely (i.e. do you consistently forget your dreams daily/monthly, as has been indicated above, or do you forget dream frequently for a few days and then not for months, for example)?

Do you think that you dream more depending upon how much sleep you have?

Control:

Do you feel in control of what you are dreaming?

Do you ever feel out of control of what you are dreaming?

Do you ever try to control what you are dreaming?

Emotions in dreams:

Do you ever feel scared by your dreams' content?

Do you have particularly emotional dreams?

Do you enjoy your dreams?

Do you tend to dream particularly emotionally negative dreams?
Do you tend to dream particularly emotionally positive dreams?

Do you tend to dream emotionally neutral dreams?

Senses:

Do you think you dream in colour?

Are you ever aware of being able to use the sense of smell in your dreams?

Are you ever aware of being able to use the sense of touching in your dreams?

Are you ever aware of being able to use the sense of hearing in your dreams?

Are you ever aware of being able to use the sense of taste in your dreams?

Deja-vu:

Have you experienced the sensation of déjà vu (i.e. having already seen/felt something before)?

If you answered, "yes" to question... (deja-vu), have you ever experienced the sensation of having already heard something before ("deja entendu")?

If you answered, "yes" to question... (deja-vu), have you ever experienced the sensation of having already felt something before, so much so that it has previously been experienced? ("deja vecu")?

If you answered, "yes" to question... (deja-vu), have you ever experienced the sensation of having already done something before ("deja fait")?

If you answered, "yes" to question... (deja-vu), have you ever experienced the sensation of having already dreamt something before ("deja reve")?

If you answered, "yes" to question... (deja-vu), have you ever experienced the sensation of knowing that something would happen (a presentiment; "deja pressenti")?

If you answered, "yes" to question... (deja-vu), have you ever experienced the sensation of having already thought something before ("deja pense")?

If you answered, "yes" to question... (deja-vu), have you ever experienced the sensation of having already known something (intellectually) before ("deja su")?

If you answered, "yes" to question... (deja-vu), have you ever experienced the sensation of something having already happened before ("deja arrive")?

If you answered, "yes" to question... (deja-vu), have you ever experienced the sensation of having already met someone before ("deja rencontre")?

Post-dream experiences:

How frequently do you experience the sensation whereby you wake up after a dream and cannot understand the dream at all?

How frequently do you experience the sensation whereby you wake up after a dream and feel you have insights into the meaning of the dream?

How frequently do you wake up after dreaming and are left with a lingering sensation or thought of bizarreness?

How frequently do you wake up after dreaming and are left with a lingering sensation or thought of clarity or understanding?

How often do you experience a sense of revelation upon waking?

How often do you experience a sense of revelation upon waking, despite the dream not being clear or sensical?

If you are familiar with the sensations described in questions …and..., for how long on average do these sensations remain with you?

Understanding of material (comprehensibility factor):

Do you feel that you often understand why you dream the material that you dream?

Do you think that it is important to understand dream material?

How often do you experience a sensation of profound incomprehension when waking from a dream?

How often do you experience a sensation of profound incomprehension whilst dreaming?

Attitudes towards dreaming:

Would you like to remember more of your dreams?

Would you like to forget more of your dreams?

Do you think that dreams should be forgotten?

Do you feel that you have a generally accepting attitude towards dreaming?

Do you think that dream content can be analysed?

Continuity between dreaming and waking:

Do you feel that your feelings in your dreams mirror those from waking life?

Do you feel that dream material is unrelated to experiences in your waking life?

Do you feel continuity between experiences in your dreams and in your waking life?

How frequently do you dream about events/memories from the previous day?

How frequently do you dream about events/memories from the previous week?

How often do your dreams contain replays of experiences from waking life?

How often do your dreams contain material that relates to events from your waking life, without replaying the events?

Dream material throughout life:

Do you think you dreamt similar things when you were younger to those that you dream now?

Do you feel that your dream content has changed as you have grown older?

Do you think that your dream content has changed as you have gone through different periods of your life?

Earliest dreams:

How old do you feel you were when you started dreaming at night?

How old do you feel you were when you started remembering your dreams?

How old do you feel you were when you started daydreaming?

Daydreaming:

How often do you experience the sensation of daydreaming?

How frequently do you find your mind has wandered from your usual thoughts, and you find yourself ruminating (i.e. speculating/thinking deeply about something)?

How frequently do you find yourself ruminating and unable to return to the task at hand?
How often do you experience the sensation of having involuntary memories interrupt your train of thought?

How often would you find yourself to be easily distracted by daydreaming?

If you daydream to what extent to you find you lose awareness of the external environment/activities taking place?

How intense are your daydreams?

Perspectives:

How often do you have dreams whereby you can see yourself?

How often do you have dreams whereby you take on the view of somebody other than yourself?
Do you tend to remain in the perspective of yourself, as you are in waking life, when dreaming?

Clear/vivid/intense dreams:

Do you dream especially intense or clear dreams?

Do you dream especially vivid dreams?

Have you experienced an awareness that you are dreaming, whilst dreaming?

Are you able to control what happens in a dream?

Individual differences in dreams:

Do you feel that there are differences between people in the way they dream?

Do you feel that there are differences between people in the way they remember their dreams?

Do you think that everybody dreams?

If you replied "NO" or "ONLY SOME PEOPLE DREAM" to question 14), why do you think that there would be differences between the ways in which people dream? E.g. personality, memory abilities, how creative that person is, whether they want to remember their dreams etc.

Returning/involuntary memories:

How often do you confuse memories for actual events with memories for dreams?

How often does a memory of a dream involuntarily return to mind?

How often does a feeling of a dream, though not necessarily alongside a detailed memory of that dream, involuntarily return to mind?

APPENDIX B

DREAM MEMORY QUESTIONNAIRE

This questionnaire requires you to report behaviours related to dreaming. Please complete as honestly as you can.

If you have any questions relating to this questionnaire, please contact Caroline Horton.

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Demographics:

Please state your age _____

Please indicate your gender Male ☐ Female ☐

Are you, or have you ever been, a student of Psychology? Yes ☐ No ☐

Are you currently a student (either an undergraduate or a postgraduate)? Yes ☐ No ☐

Do you, on average, have a regular sleep pattern?

☐ **Yes – every day is the same**
☐ **Yes – most days are the same**
☐ **Some days are the same, but the routine isn't strict**
☐ **Not a regular routine, but probably sleep for a similar amount most nights**
☐ **No – routine varies considerably**

1. How often do you feel you dream?
   - ☐ **Daily**
   - ☐ **Once/twice a week**
   - ☐ **A few times a month**
   - ☐ **Once a month**
   - ☐ **A few times a year/never**

2. How often do you experience the sensation of daydreaming?
   - ☐ **Daily**
   - ☐ **Once/twice a week**
   - ☐ **A few times a month**
   - ☐ **Once a month**
   - ☐ **A few times a year/never**

3. How frequently do you find yourself ruminating (mulling things over)?
   - ☐ **Daily**
   - ☐ **Once/twice a week**
   - ☐ **A few times a month**
   - ☐ **Once a month**
   - ☐ **A few times a year/never**

4. How often do you remember your dreams?
   - ☐ **Daily**
   - ☐ **Once/twice a week**
   - ☐ **A few times a month**
   - ☐ **Once a month**
   - ☐ **A few times a year/never**

5. How frequently do you find yourself ruminating and unable to return to a task?
   - ☐ **Daily**
   - ☐ **Once/twice a week**
   - ☐ **A few times a month**
   - ☐ **Once a month**
   - ☐ **A few times a year/never**

6. How often are you aware that you have been dreaming?
   - ☐ **Daily**
   - ☐ **Once/twice a week**
   - ☐ **A few times a month**
   - ☐ **Once a month**
   - ☐ **A few times a year/never**

7. How often do you experience the sensation of involuntary memories interrupting you?

- ☐ **Daily**
- ☐ **Once/twice a week**
- ☐ **A few times a month**
- ☐ **Once a month**
- ☐ **A few times a year/never**

8. How often do you experience a sense of revelation upon waking?

- ☐ **Daily**
- ☐ **Once/twice a week**
- ☐ **A few times a month**
- ☐ **Once a month**
- ☐ **A few times a year/never**

9. How often are you distracted by daydreaming?

- ☐ **Daily**
- ☐ **Once/twice a week**
- ☐ **A few times a month**
- ☐ **Once a month**
- ☐ **A few times a year/never**

10. How often do you feel you understand why you dreamt particular material?

- ☐ **Daily**
- ☐ **Once/twice a week**
- ☐ **A few times a month**
- ☐ **Once a month**
- ☐ **A few times a year/never**

11. How often do you dream emotionally positive dreams?

- ☐ **Daily**
- ☐ **Once/twice a week**
- ☐ **A few times a month**
- ☐ **Once a month**
- ☐ **A few times a year/never**

12. How frequently do you wake with a lingering sensation of bizarreness?

- ☐ **Daily**
- ☐ **Once/twice a week**
- ☐ **A few times a month**
- ☐ **Once a month**
- ☐ **A few times a year/never**

13. How frequently do you wake with sensation of clarity or understanding?

- ☐ **Daily**
- ☐ **Once/twice a week**
- ☐ **A few times a month**
- ☐ **Once a month**
- ☐ **A few times a year/never**

14. How often do you experience a sense of revelation upon waking, despite having dreamt a confusing dream?

- ☐ **Daily**
- ☐ **Once/twice a week**
- ☐ **A few times a month**
- ☐ **Once a month**
- ☐ **A few times a year/never**

15. How frequently do you wake with insights into the meaning of the dream?

- ☐ **Daily**
- ☐ **Once/twice a week**
- ☐ **A few times a month**
- ☐ **Once a month**
- ☐ **A few times a year/never**

16. How often do you feel you understand why you dream the material you dream?

- ☐ **Daily**
- ☐ **Once/twice a week**
- ☐ **A few times a month**
- ☐ **Once a month**
- ☐ **A few times a year/never**

17. How often does a memory of a dream involuntarily return to mind?

- ☐ **Daily**
- ☐ **Once/twice a week**
- ☐ **A few times a month**
- ☐ **Once a month**
- ☐ **A few times a year/never**

18. How frequently does a feeling of a dream, although not a specific memory for it, involuntarily return to mind?

- ☐ **Daily**
- ☐ **Once/twice a week**
- ☐ **A few times a month**
- ☐ **Once a month**
- ☐ **A few times a year/never**

19. Do you have particularly emotional dreams?
- ☐ **Usually**
- ☐ **For some of my dreams but not for others**
- ☐ **Sometimes**
- ☐ **For some parts of my dreams but not for others**
- ☐ **Never**

20. Do you feel that you remember your dreams routinely?
- ☐ **Extremely consistently**
- ☐ **Pretty consistently**
- ☐ **Not sure**
- ☐ **Pretty inconsistently**
- ☐ **Extremely inconsistently**

21. Are you ever aware of being able to use the sense of smell in your dreams?
- ☐ **(Yes) frequently**
- ☐ **(Yes) occasionally**
- ☐ **I have been aware of this**
- ☐ **(No) but I probably could**
- ☐ **(No) – I doubt I am able to use that sense**

22. Do you dream especially intense or clear dreams?
- ☐ **(Yes) frequently**
- ☐ **(Yes) occasionally**
- ☐ **I have been aware of this**
- ☐ **(No) but I probably could**
- ☐ **(No) – I doubt I am able to use that sense**

23. Do you dream especially vivid dreams?
- ☐ **(Yes) frequently**
- ☐ **(Yes) occasionally**
- ☐ **I have been aware of this**
- ☐ **(No) but I probably could**
- ☐ **(No) – I doubt I am able to use that sense**

24. Are you ever aware of being able to use the sense of taste in your dreams?
- ☐ **(Yes) frequently**
- ☐ **(Yes) occasionally**
- ☐ **I have been aware of this**
- ☐ **(No) but I probably could**
- ☐ **(No) – I doubt I am able to use that sense**

25. Have you ever experienced the sensation of déjà-vu?

- ☐ **(Yes) frequently**
- ☐ **(Yes) occasionally**
- ☐ **I have been aware of this**
- ☐ **(No) but I probably could**
- ☐ **(No) – I doubt I am able to use that sense**

26. Have you ever experienced the sensation of déjà-entendu (having already heard something before)?

- ☐ **(Yes) frequently**
- ☐ **(Yes) occasionally**
- ☐ **I have been aware of this**
- ☐ **(No) but I probably could**
- ☐ **(No) – I doubt I am able to use that sense**

27. Have you ever experienced the sensation of déjà-fait (having already done something before)?

- ☐ **(Yes) frequently**
- ☐ **(Yes) occasionally**
- ☐ **I have been aware of this**
- ☐ **(No) but I probably could**
- ☐ **(No) – I doubt I am able to use that sense**

28. Have you ever experienced the sensation of déjà-arrive (something having already happened before)?

- ☐ **(Yes) frequently**
- ☐ **(Yes) occasionally**
- ☐ **I have been aware of this**
- ☐ **(No) but I probably could**
- ☐ **(No) – I doubt I am able to use that sense**

29. How intense are your daydreams?

- ☐ **Extremely vivid and sensory-perceptual in nature**
- ☐ **Usually vivid and sensory-perceptual in nature**
- ☐ **Not vivid, but clear**
- ☐ **Occasionally vivid, but usually more vague**
- ☐ **If I daydream at all, they are vague**

30. How intense are your dreams?

- ☐ **Extremely vivid and sensory-perceptual in nature**
- ☐ **Usually vivid and sensory-perceptual in nature**
- ☐ **Not vivid, but clear**
- ☐ **Occasionally vivid, but usually more vague**
- ☐ **If I dream at all, they are vague**

THANKYOU

APPENDIX C: STIMULI FOR EXPERIMENTS 3 AND 4

The same stimuli (targets and foils) were used for experiments 3 and 4.

Session 1 Session 2

Practise stimuli:

Pictures	words	scenes	nonwords
Dress	literal	wt11	perbick
Hoof	neuter	wt10	luntarl
Bomb	ornate	wt9	paggiel
Cross	gender	wt8	temcktik

Experimental stimuli:

Pictures:

Targets	Foils	new foils	new new foils
Airplane	bike	bus	car
Apple	banana	carrot	pear
Book	newspaper	computer	cassette player
Pig	lion	duck	elephant
Table	chair	bed	rug
Shoe	glove	socks	t shirt
Telephone	lamp	money	candle
Windmill	house	church	bricks
Key	comb	clock	watch
Drum	piano	banjo	xylophone
Skateboard	tennis racket	baseball	rollerskates
Cake	cheese	egg	pizza
Squirrel	tiger	snail	fish
Rope	chain	fork	lawnmower
Legs	thumb	toe	face-tear

Words:

Targets	Foils	New foils	New new foils
Adverb	appraise	audition	ambition
Blunder	buffoon	botany	burrow
Chaotic	clamour	clumsy	condemn
Desolate	discord	dynasty	deliver
Equality	evaluate	exposure	elegant
Fertile	figment	finite	forecast
Harmony	hoarse	hybrid	hypnotic
Imitate	incise	ignore	import
Misuse	mortgage	mutiny	mister
Paradox	perish	pledge	portray
Ration	refresh	retain	retreat
Sanctity	sequel	slovenly	sluggish
Spangle	stingy	suffix	swayed
Tenure	thwart	tolerant	truism
Unrest	wander	yonder	zenith

Scenes (file names):

Targets	Foils	New foils	New new foils
W11	b2	w1	w3
W12	b5	w2	w17
W14	b7	w4	w5
W19	b10	w7	wb2
Wb1	b11	w8	w9
B1	m1	w18	wb4
B3	b4	wb3	wbt1
B6	b8	wb8	wt2
B9	bt7	wbt2	wbt5
Bt1	bt5	wbt4	wbt8
Bt2	bt4	w6	wbt7
Bt3	bt6	wb5	wb6
M3	w10	wb7	wt6
M060	m061	M062	m063
wb9	wbt1	wbt3	wbt6

Nonwords:

Targets	Foils	New foils	New new foils
bodhen	maplint	tengret	nuglend
dergar	snylyre	polstin	defnond
cakith	gruvvelt	bennon	saftopp
gritheth	cerntern	serligg	krernfol
hirnstet	swollops	lapmel	bifhuns
quifren	zentext	pavvel	ventilt
trubstem	feddelts	struffle	snaggult
barnsteg	goffam	gundbegg	grikons
flikket	srerter	jerging	plymone
crarding	bagwog	murlheb	sansails
wertener	biltoing	poilnin	berfnitt
jikbing	crugbit	snerdig	tessgrum
hurlspit	invernt	mowswin	wallspog
attnail	goysbob	tukkleys	flimsbits
triblem	koysgrubs	dellilay	topsbays

APPENDIX D: Correlations between DMQ scores and recollective experience judgements for all stimuli (pictures, words, scenes, nonwords) split by target (Tar) and foil

	Session 1	Session 2 part 1	Session 2 part 2
Pictures Tar "R"	0.10	-0.15	0.01
Pictures Tar "K"	-0.05	0.23	0.00
Pictures Tar "F"	-0.01	0.19	0.10
Pictures Tar "G"	0.13	-0.14	0.02
Pictures Tar "N"	-0.21	0.05	-0.09
Pictures Foil "R"	-0.07	-0.04	0.01
Pictures Foil "K"	-0.06	0.09	0.09
Pictures Foil F	-0.08	0.22	-0.08
Pictures Foil "G"	0.03	0.06	0.14
Pictures Foil "N"	0.05	-0.21	-0.05
Words Tar "R"	-0.10	**-0.35**	-0.02
Words Tar "K"	0.29	**0.34**	0.15
Words Tar "F"	-0.18	0.03	-0.08
Words Tar "G"	0.05	**0.38**	-0.05
Words Tar "N"	-0.03	-0.04	0.04
Words Foil "R"	-0.12	-0.26	0.07
Words Foil "K"	0.13	-0.02	0.23
Words Foil "F"	0.00	0.06	0.17
Words Foil "G"	**0.32**	0.17	0.04
Words Foil "N"	-0.23	-0.01	-0.24
	N=34	N=34	N=35

	Session 1	Session 2 part 1	Session 2 part 2
Scenes Tar "K"	**0.31**	0.17	0.09
Scenes Tar "F"	-0.06	0.28	0.21
Scenes Tar "G"	0.01	-0.06	0.26
Scenes Tar "N"	-0.13	-0.28	**-0.36**
Scenes Foil "R"	**-0.29**	-0.25	-0.03
Scenes Foil "K"	0.04	-0.01	0.25
Scenes Foil "F"	0.08	0.08	0.06
Scenes Foil "G"	-0.03	0.21	**0.29**
Scenes Foil "N"	0.02	-0.11	-0.23
Nonwords Tar "R"	0.07	**-0.31**	-0.27
Nonwords Tar "K"	0.01	0.12	0.26
Nonwords Tar "F"	**-0.36**	0.01	0.09
Nonwords Tar "G"	0.26	0.21	0.23
Nonwords Tar "N"	0.05	0.00	-0.07
Nonwords Foil "R"	-0.20	**-0.29**	**-0.31**
Nonwords Foil "K"	0.05	-0.08	0.12
Nonwords Foil "F"	-0.15	0.10	-0.09
Nonwords Foil "G"	-0.01	-0.05	0.05
Nonwords Foil "N"	0.16	0.07	0.14
Pictures	0.10	-0.16	-0.08
Words	-0.21	0.00	**0.31**
Scenes	0.21	0.12	-0.02
Nonwords	0.01	0.09	0.10
Targets	0.18	0.11	0.21
Foils	-0.11	-0.08	0.19
	N=34	N=34	N=35

Bold type indicates correlation significant at alpha level $p<0.05$
Bold and italic type indicates correlation significant at alpha level $p<0.01$.

APPENDIX E: QUESTIONNAIRE FOR CHARACTERISTICS OF AUTOBIOGRAPHICAL MEMORIES

Please circle the most appropriate rating for this memory.

My memory for this event:

1. is 1 = dim, 5 = clear 1 2 3 4 5
2. is 1 = black and white, 5 = entirely colour 1 2 3 4 5
3. involves visual detail 1 = little or none, 5 = a lot 1 2 3 4 5
4. involves sound 1 = little or none, 5 = a lot 1 2 3 4 5
5. involves smell 1 = little or none, 5 = a lot 1 2 3 4 5
6. involves touch 1 = little or none, 5 = a lot 1 2 3 4 5
7. involves taste 1 = little or none, 5 = a lot 1 2 3 4 5
8. overall vividness is 1 = vague, 5 = very vivid 1 2 3 4 5
9. my memory for this event is 1 – sketchy, 5 = very detailed 1 2 3 4 5
10. order of events is 1 = confusing, 5 = comprehensible 1 2 3 4 5
11. story line is 1 = simple, 5 = complex 1 2 3 4 5
12. storyline is 1 = bizarre, 5 = realistic 1 2 3 4 5
13. my memory for the location where the event takes place is 1 = vague, 5 = clear/distinct 1 2 3 4 5
14. general setting is 1 = unfamiliar, 5 = familiar 1 2 3 4 5
15. the event seems 1 = short, 5 = long 1 2 3 4 5
16. at the time the event seemed like it would have serious implications 1= not at all, 5 = definitely 1 2 3 4 5

17. Looking back, this event did have serious implications 1 = not at all, 5 = definitely 1 2 3 4 5

18. I remember how I felt at the time when the event took place: 1 = not at all, 5 = definitely 1 2 3 4 5

19. Feelings at the time were 1 = negative, 5 = positive
1 2 3 4 5

20. feelings at the time were 1 = not intense, 5 = very intense
1 2 3 4 5

21. As I am remembering now, my feelings are 1 = not intense, 5 = very intense
1 2 3 4 5

22. I remember what I thought at the time: 1 = not at all, 5 = clearly
1 2 3 4 5

23. This memory reveals or says about me 1 = not much, 5 = a lot
1 2 3 4 5

24. Overall, I remember this event: 1 = hardly, 5 = very well
1 2 3 4 5

25. Do you have any doubts about the accuracy of your memory for this event? 1 = a great deal of doubt, 7 = no doubt whatsoever 1 2 3 4 5

26. Would you be confident enough to testify in court? 1 = not at all, 5 = definitely
1 2 3 4 5

27. Since it happened, I have thought about this event: 1 = not at all, 5 = many times
1 2 3 4 5

28. The event in my memory is 1 = a merging of different events, 5 = an extended event 1 2 3 4 5

29. How intense are your emotions concerning the event? 1 = not intense, 5 = very intense 1 2 3 4 5

30. How much effort did it take for you to recall this event? 1 = much effort, 5 = little or no effort 1 2 3 4 5

31. Is your image seen from your usual perspective? 1 = field (first person), 2 = image perspective 1 2

Please indicate the extent to which these statements are characteristic of your memory, when you are recalling the memory, using the scale:
1 = not at all, 5 = totally characteristic

32. I am reliving the original event	1	2	3	4	5
33. I travel back to the time when it happened	1	2	3	4	5
34. I remember it rather than just knowing it happened	1	2	3	4	5
35. I can hear it in my mind	1	2	3	4	5
36. It comes to me in words	1	2	3	4	5
37. It comes to me as a coherent story	1	2	3	4	5
38. I can feel now the emotions that I felt then	1	2	3	4	5
39. It is significant for my life	1	2	3	4	5
40. It occurred once at one particular time	1	2	3	4	5
41. Overall, how much of the event do you remember? 1 = a little, 5 = a lot/all	1	2	3	4	5
42. This event is: 1 = not at all typical, 5 = very typical of my child hood behaviours	1	2	3	4	5

APPENDIX F: CHARACTERISTICS OF DREAMS AND EVENTS FROM EXPERIMENT 5

	Early		Other		Recent	
	Events	Dreams	Events	Dreams	Events	Dreams
Dim/clear	4.15 (.86)	2.90 (1.33)	4.10 (.79)	2.40 (1.27)	4.50 (.76)	3.06 (1.36)
Black and white/colour	4.20 (1.20)	3.10 (1.48)	4.50 (.69)	2.80 (1.36)	4.45 (1.00)	3.55 (1.28)
Visual detail	3.75 (1.21)	2.90 (1.02)	4.25 (.85)	2.90 (1.17)	4.35 (.93)	3.50 (1.32)
Sound	3.05 (1.47)	2.10 (1.25)	3.20 (1.47)	2.30 (1.46)	3.15 (1.50)	2.05 (1.36)
Smell	1.90 (1.21)	1.25 (.64)	2.00 (1.26)	1.15 (.37)	1.70 (.92)	1.25 (.91)
Touch	2.40 (1.73)	1.65 (1.23)	2.40 (1.31)	2.35 (1.46)	2.25 (1.41)	2.25 (1.33)
Taste	1.50 (1.05)	1.10 (.31)	1.55 (1.00)	1.20 (.70)	1.85 (1.23)	1.10 (.45)
Vividness	3.90 (1.07)	3.25 (1.07)	3.85 (.81)	2.90 (1.02)	4.30 (.66)	3.25 (1.29)
Sketchy/detailed	3.55 (1.10)	2.65 (1.31)	3.70 (.98)	2.40 (1.47)	4.00 (1.31)	2.50 (1.32)
Order confusing/ comprehensible	4.10 (.97)	2.25 (1.45)	4.20 (.89)	2.30 (1.22)	4.25 (1.07)	2.60 (1.39)
Storyline simple/complex	1.90 (1.02)	2.70 (1.42)	2.50 (1.47)	3.05 (1.64)	2.30 (1.17)	2.75 (1.33)
Storyline bizarre/realistic	4.60 (.75)	1.55 (1.23)	4.55 (1.00)	1.95 (.95)	4.70 (.47)	2.40 (1.23)
Location vague/clear	4.35 (.75)	2.15 (1.60)	4.25 (1.16)	2.30 (1.42)	4.45 (1.00)	2.20 (1.44)
Setting unfamiliar/familiar	4.25 (1.16)	2.40 (1.57)	3.75 (1.41)	2.30 (1.56)	3.80 (1.36)	2.15 (1.60)
Short/long	3.10 (1.48)	2.40 (1.27)	3.30 (1.42)	2.75 (1.55)	3.60 (1.35)	2.40 (1.43)
Implications felt at time	3.70 (1.34)	3.25 (1.45)	2.85 (1.73)	3.30 (1.84)	3.20 (1.61)	2.45 (1.64)
Actual serious implications	2.80 (1.47)	1.30 (.66)	2.60 (1.54)	1.90 (1.29)	3.20 (1.61)	1.40 (.94)
Remember how felt at time	3.95 (1.28)	3.50 (1.10)	3.90 (1.12)	3.65 (1.31)	3.85 (1.14)	3.10 (1.29)
Feelings negative/positive	2.80 (1.58)	2.20 (1.54)	3.55 (1.64)	2.15 (1.27)	3.80 (1.11)	2.35 (1.35)
Feelings not intense/intense	4.35 (.93)	4.25 (.79)	3.80 (1.15)	3.90 (1.02)	3.80 (1.28)	3.55 (1.23)
Now feelings are not intense/intense	2.60 (1.23)	2.40 (1.00)	2.75 (1.33)	2.15 (1.14)	2.75 (1.12)	2.20 (1.11)

	Early		Other		Recent	
	Events	Dreams	Events	Dreams	Events	Dreams
Remember thoughts	3.40 (1.23)	3.25 (1.16)	3.40 (1.27)	3.15 (1.16)	3.55 (1.00)	3.00 (1.30)
Memory reveals lot/little about me	3.10 (1.07)	2.35 (1.14)	3.15 (1.35)	2.65 (1.42)	3.45 (1.19)	2.30 (1.03)
Recall hardly/very well	3.95 (1.10)	2.65 (1.18)	3.90 (1.02)	2.55 (1.10)	4.25 (.79)	2.80 (1.32)
Doubt accuracy of memory	3.50 (1.24)	2.60 (1.23)	3.80 (1.11)	2.70 (1.17)	4.05 (1.00)	2.60 (1.35)
Confidence in memory	3.50 (1.10)	1.90 (1.21)	3.65 (1.31)	2.65 (1.27)	3.95 (1.36)	2.20 (1.36)
Thought about event since	3.65 (1.04)	3.00 (1.12)	3.10 (1.02)	2.60 (1.00)	3.15 (1.18)	2.75 (1.25)
Merging of events/extended	3.85 (1.23)	3.20 (1.32)	4.10 (.72)	3.25 (1.29)	3.55 (1.28)	3.35 (1.39)
Emotions now not intense/intense	2.90 (1.37)	2.65 (1.27)	2.90 (1.29)	2.45 (1.23)	3.05 (1.19)	2.35 (1.27)
Effort to recall	3.60 (1.35)	3.65 (1.31)	3.90 (1.07)	3.15 (1.09)	4.15 (1.18)	3.10 (1.59)
Field/image perspective	1.30 (.47)	1.45 (.51)	1.40 (.50)	1.35 (.49)	1.35 (.49)	1.25 (.44)
Reliving	3.50 (1.05)	2.35 (1.18)	3.40 (1.31)	3.10 (1.12)	3.70 (1.26)	2.80 (1.36)
Travel back	3.70 (1.17)	3.05 (1.61)	3.40 (1.23)	2.90 (1.37)	3.85 (1.23)	2.70 (1.38)
Remember/know	4.15 (1.09)	3.35 (1.27)	4.05 (1.05)	3.40 (1.05)	4.15 (1.04)	3.10 (1.45)
Hear memory	2.60 (1.54)	2.20 (1.32)	2.85 (1.35)	1.80 (1.06)	3.05 (1.64)	1.75 (1.12)
Memory in words	1.65 (1.08)	1.55 (1.00)	1.95 (1.28)	1.60 (1.14)	2.25 (1.41)	1.85 (1.04)
Coherence of story of memory	3.75 (1.07)	2.05 (1.36)	3.85 (.86)	2.60 (1.14)	4.15 (1.14)	2.65 (1.35)
Feel emotions now as then	3.00 (1.34)	2.85 (1.14)	3.10 (1.37)	2.75 (1.12)	3.25 (1.21)	2.30 (1.30)
Significance	2.65 (1.57)	1.75 (.97)	3.05 (1.43)	1.70 (1.17)	3.10 (1.48)	1.70 (1.22)
Episodic nature (it happened once)	4.50 (1.10)	3.10 (1.59)	4.40 (1.23)	3.85 (1.27)	4.20 (1.24)	4.00 (1.30)
Remembered little/lot	3.65 (1.18)	2.35 (1.23)	3.50 (.83)	2.65 (1.14)	3.95 (.95)	2.50 (1.28)
Typical/atypical of childhood	2.85 (1.42)	2.60 (1.14)	2.30 (1.42)	2.40 (1.39)	2.20 (1.28)	1.90 (1.21)

APPENDIX G: DIARY TEMPLATE FOR EXPERIMENTS 7, 8 AND 9

Date of occurrence: Date_____Month_____Year_____

Hour (time) of occurrence:_____Time of writing:_____

Title:_____

Report of event/dream:

Please continue overleaf if necessary.

Please list characters involved, and their relationship to you:

Character_____Relationship_____
Character_____Relationship_____
Character_____Relationship_____
Character_____Relationship_____

Detail of the setting: _____

Perspective: first person (field) _____observer perspective_____

What was the main activity_____

What was the most distinctive feature of this memory?_____

_____

Rating for personal importance/salience (-2 = extremely unimportant; 2 = extremely important) -2 -1 0 1 2

Emotional intensity (-2 = extreme negative; 0 = not emotional; 2 = extreme positive)
-2 -1 0 1 2

Comprehensibility (-2 = totally incomprehensible, 2 = totally comprehensible)
-2 -1 0 1 2

How surprising was this event? (-2 = not at all surprising, 2 = very surprising)
-2 -1 0 1 2

APPENDIX H: UNRELATED LURE SENTENCES FOR RECOGNITION TASKS

For retrospective dreams and events (Experiment 7)

Dreams

- I was waiting for a train to arrive in an old quiet station.
- I went off to University and I met three boys from my course.
- I was at home with my family who were having a party and I had worn my best outfit for the occasion.
- I was with my friend and we were late for a meeting, so we ran and ran, although it felt like we weren't moving at all.
- There was a lot of fighting. Things were flying about everywhere. I couldn't see.

Events

- I couldn't believe I'd left my wallet in there – I was so annoyed.
- When we found her I was really upset, I couldn't stop crying.
- My friend had been told not to go, but we went anyway.
- We went to see a band that I really like, and we had a great time.
- I had passed the test – I couldn't believe it!

For current dreams and events (Experiment 8)

Dreams

- Later we were at a party with the people I live with.
- My friend told us she was pregnant and we didn't know what to say, so we nervously congratulated her.
- At a Spanish themed bar, having some drinks with friends.
- I was rushing to get ready in time and suddenly I was changed and ready to go.
- I saw what was on the exam paper before I had sat the exam!

Events

- I had just nipped out to the shop to buy some milk and I bumped into an old friend.
- I watched TV with some friends and ate pizza.
- I went for a walk as I was feeling so stressed about it.
- We went out for something to eat, ended up staying out until 1am.
- I went to the lecture, fell asleep through most of it and then left with my friends.

APPENDIX I: ATTITUDES TOWARDS DREAMS QUESTIONS

(a) How often do you discuss your dreams with family or friends?
(b) How much attention do you usually pay towards your dreams?
(c) How much significance do you usually attach to your dreams?

The scores from these three items were averaged to form a single composite measure of Attitude Towards Dreams.

APPENDIX J: DREAM RECALL QUESTIONNAIRE FOR EXPERIMENT 11

Please complete this initial brief questionnaire, which shall provide me with some basic details about you. Please respond by placing a tick in the appropriate box, or by writing in the grey space.

Are you male ☐ female ☐ Please state your age _____

Approximately for how many hours do you sleep each night?

(i) <5 ☐
(ii) 5 – 7 ☐
(iii) >7 – 9 ☐
(iv) >9 ☐
(v) Varies from night to night ☐

Do you tend to have a routine sleep pattern?

(i) Extremely consistent ☐
(ii) Pretty consistent ☐
(iii) Not sure ☐
(iv) Pretty inconsistent ☐
(v) Extremely inconsistent ☐

How often do you tend to remember your dreams?

(i) Daily ☐
(ii) Once/twice a week ☐
(iii) A few times a month ☐
(iv) Once a month ☐
(v) A few times a year/never ☐

How much detail do you tend to remember from your dreams?

(i) Everything that has been dreamt ☐
(ii) Most of what has been dreamt ☐
(iii) Some of what has been dreamt ☐
(iv) Very little of what has been dreamt ☐
(v) None of what has been dreamt ☐

How frequently do you experience the sensation of deja-vu?

(i) Daily ☐
(ii) Once/twice a week ☐
(iii) A few times a month ☐
(iv) Once a month ☐
(v) A few times a year/never ☐

How many times in the past 2 weeks have you experience the sensation of deja-vu?

(i) Never ☐
(ii) Never, but I often do experience this ☐
(iii) Once ☐
(iv) Two or three times ☐
(v) More than three times ☐

How many times in the past 2 weeks have you been able to remember your dreams?

(vi) Never ☐
(vii) Never, but I often do experience this ☐
(viii) Once ☐
(ix) Two or three times ☐
(x) More than three times ☐

How many times in the past 2 weeks have you, upon waking, not been aware that you have been dreaming?

(xi) Never ☐
(xii) Never, but I often do experience this ☐
(xiii) Once ☐
(xiv) Two or three times ☐
(xv) More than three times ☐

Thankyou for completing this questionnaire. Please return this and the other materials in the Freepost envelope provided.

If you have any questions regarding this study, please contact me (Caroline Horton – psccIh@leeds.ac.uk). Also, if you are interested in this research, or in participating in any other similar studies, please do not hesitate to let me know.

Would you be willing to be contacted to participate in future studies?

Yes ☐ No ☐

If you would like to leave any more contact details, please feel free to do so on the back on this questionnaire.