

Chapter 1 INTRODUCTION

1.1 INTRODUCTION

Many researchers have suggested a possible link between memory recall and its distortion, and a person's degree of fantasy proneness (Merckelbach, Muris, Horselenberg & Stougie, 1999; Merckelbach, Horselenberg & Muris, 2001; Aleman & Haan, 2003). Although fantasy is generally hard to access, it has been reported that roughly 96 percent of people have had daydreams or reveries at some point in their lives (Singer, 1996, cited in Person, 2003). It has been for some time a matter of speculation about the differences between imagining, hallucinating, fantasizing and remembering (Casey, 2003). Memory and imagining have also been considered to be psychical partners, that many psychologists have even suggested that the two states are actually one state or psychological process (Casey, 2003). Fantasy being almost indistinguishable from imagination may be considered to share many of the cognitive and neuropsychological processes of memory (Casey, 2003).

Fantasy proneness has often been used as a construct to investigate a person's capacity for experiencing dissociation (Merckelbach et al., 1999, Geraerts, Merckelbach, Jelicic, Smeets & Heerden, 2006). Dissociation may be regarded as the process whereby an interconnected set of activities, thoughts, attitudes, and feelings become separated from an individual's personality and functions separately (Reber, 1995). It may prove useful to investigate whether visual memory is a part of this process or is affected by this process in its relationship with fantasy proneness. This may provide valuable clinical and theoretical information, as visual memory distortion may shed light on the processes involved in fantasy proneness and a person's capacity for dissociation (Merckelbach et al., 1999). Fantasy proneness and its link with visual memory may also shed light on the memory dimensions of eyewitness testimony, where memory is important in the process of reporting and recalling forensic events (Loftus & Pickrell, 1995). The examination of the link between fantasy proneness and visual memory distortion may also provide valuable theoretical information about the cognitive and neuropsychological processes of both visual memory functioning and fantasy proneness and its functioning.

The link between visual memory and visual memory distortion, with fantasy proneness has emerged in this research through a discussion of various cognitive theories and some neuropsychological evidence. Some of the theories have linked visual memory directly with fantasy proneness, such as the theory that they share the same cognitive process involved in imagery (Alemam & Haan, 2003). Other theories discussed have explored more indirect connections between visual memory distortion and fantasy proneness, for example the executive processing theories relating to frontal lobe functioning (Merckelbach et al., 2001; Kolb & Wishaw, 2003; Hirstein, 2005).

The literature review has defined and provided an explanation of visual memory. Visual memory processing has been explained, which has elaborated on some important contemporary cognitive models useful in understanding visual memory, specifically for this study. The neuropsychology of visual memory has been elaborated on, which has also been connected to the cognitive theories discussed, and has enriched those explanations. Understandings of the neuropsychology of visual memory have broadened the theory needed to understand some of the links between visual memory and fantasy proneness. Visual memory distortion has then been discussed; in this section some other cognitive models of visual memory have been introduced to help understand visual memory distortion. Imagery and its processing has then be elaborated on, first with regard to its relationship with imagination and then with memory, in order to establish theoretical links. Imagery is an important construct, as it appears to be the most direct link between visual memory distortion and fantasy proneness. Imagery was discussed with regard to fantasy so that its theoretical links are established. From imagery the literature review moved into defining and discussing the construct of fantasy proneness. The theory of fantasy proneness relevant to this study was explored. Finally, fantasy proneness was linked back with visual memory distortion in the last section of the literature review. Here the major theoretical links between visual memory distortion and fantasy proneness have been established. The literature review expressed and elaborated the various theoretical links between fantasy proneness and visual memory distortion.

A non-experimental within subjects research design was chosen for this study and has been explained further in the methodology section. The study was performed on students of the University of the Witwatersrand. The students were selected by a nonrandomized sampling procedure. The sampling methodology as well as its' characteristics have been further elaborated on in the methodology section. The exclusion criteria of the sample have also been elaborated on. Data collection and analysis are also discussed in detail in this section.

The results section has provided a detailed description of all the statistics computed for the study. It has included descriptive statistics for the sample. It also described the inferential statistics, which has included correlations of the measures of fantasy proneness and visual memory distortion. Analyses of variance have also been computed for *groups* divided by 'strategy use' in the measure of visual memory distortion and students 'area of study', for comparing the *groups*' differences between scores on visual memory distortion and fantasy proneness. No significant correlations were found between visual memory distortion and fantasy proneness. However some significant correlations were found between the various aspects of visual memory distortion. Some significant correlations were also found in the divided groups of students, by 'area of study' and 'strategy use' in visual memory. The correlations have been explored in more detail in the results and discussion section.

Lastly the discussion section has provided detailed arguments and reflections on the statistical results and the theory explaining the links between visual memory distortion and fantasy proneness. In this section the absence of a statistically significant relationship between visual memory distortion and fantasy proneness has been explored. However significant correlations have also been explored, specifically between strategy use, visual memory distortion and fantasy proneness. The study concludes that fantasy proneness and visual memory distortion appear to be governed by their own unique cognitive and neuropsychological processes. Visual memory distortion and fantasy proneness are mostly separate, yet they appear to share some related cognitive processes, specifically in strategy, which is most likely an aspect of executive functioning.

In terms of the neuropsychological processes of visual memory distortion, visual memory may be distorted either due to strategy and planning difficulties or directly by memory processing difficulties. A person's use of strategy appeared to be a good indicator of their performance in visual memory, with more strategy use indicating better visual memory performance. Symbolic, meaningful and verbal cognitive aspects don't appear to have any affect on visual memory distortion; particularly measured in this study.

Fantasy proneness also appeared to be a good indicator of mental imagery processing, with higher scores on fantasy proneness more likely indicating poorer mental imagery ability. The study has also provided normative data for visual memory distortion and fantasy proneness, in University students in a South African context.

Chapter 2 LITERATURE REVIEW

2.1.1. VISUAL MEMORY

Studies of visual imagery preceded investigations into visual memory. For example, one of the first experiments on imagery was Galton's 1883 study on the vividness of imagery (cited in Baddeley, 1990). In his study of visual imagery he found considerable differences in his subject's reported vividness. From research on imagery, psychologists then began to examine and perform research on memory for visual experiences (Baddeley, 1990). Early research into memory for visual experiences first distinguished between short term and long term visual memory.

It is important to distinguish short term memory (STM) from long term memory (LTM) when discussing visual memory and its processes; as STM and LTM systems have separate cognitive and neuropsychological components, yet link in the formation of a memory (Baddeley, 1990; Kolb & Wishaw, 2003). STM refers to an individual's average capacity for minimal information processing and interpretation. This includes a memory store capacity for about, plus or minus, seven items and an average half life memory storage (un-rehearsed) of about no more than 10-15 seconds (Reber, 1995). Baddeley (1986, 2000) distinguishes two types of STM or more specifically working memory, that of the visual spatial sketch pad, in which object forms are located spatially, and the phonological scratch pad, that holds verbal information. The nonverbal working memory component of the visual spatial sketch pad makes up the cognitive and neuropsychological processes of visual STM. Non-verbal visual STM generally concerns memory for objects, drawings, faces and geometric drawings (Baddeley, 1990; Kolb & Wishaw 2003). According to the visual spatial sketch pad hypothesis of visual memory, the visual spatial sketch pad has a passive cache and scribe that is a supportive spatial rehearsal system (Logie & Pearson, 1997 cited in Neath & Surprenant, 2003). If there is no rehearsal of information stored in the cache by the scribe, there will be slow information decay (Neath & Surprenant, 2003).

Very early research on visual STM storage developed in a series of experiments by Posner, Boies, Eichelman, and Taylor (1969). Their first study concerned presenting subjects with two letters, where the subjects had to guess whether the two letters shared the same name. For example with the identical letters 'AA' or 'Aa' the subject would respond 'yes'. However with 'AB' or 'Ab' the subject should respond 'no'. Subjects were much faster at identification when the letters were identical (for example 'AA' or 'aa' rather than 'Aa' or 'aA'). The subjects were timed on their responses. Posner et al. (1969) found that their experiment suggested a visual trace with a two second decay rate; some evidence for STM. However later studies by Phillips and Baddeley (1971), suggest that the two second decay rate may be too short, that short term visual storage may be much longer than originally suggested by Posner et al. (1969). Thus the now commonly accepted decay rate half-life is 10 to 15 seconds (Reber, 1995). The idea that visual STM is a distinct memory system was made clear, by determining that interference effects of other memory systems, such as iconic memory, had little effect to no effect on visual STM processing (Doost & Turvey, 1971; Phillips & Christie, 1977). Although visual memory is also distinct from LTM memory, it appears to be connected in the formation of a memory (Baddeley, 1990).

Long term visual memory involves the store of events of particular points of time, and usually contains information of when and where the event took place, or remembering specific facts or knowledge (Lieberman, 2004). Tulving (1972) calls these two types of LTM, episodic and semantic respectively. LTM also does not seem to have the same temporal restrictions of STM. It has a different rate of decay and the storage of information is less unstable (Lieberman, 2004).

Early research on long-term visual memory processing concerned the identification of objects and shapes over extended periods of time (Nickerson, 1965; Engelstein, 1959, cited in Baddeley, 1990). For example Engelstein (1959 cited in Baddeley, 1990) examined memory for a single meaningless shape for up to a month after the initial perception. Accuracy in identification of the objects and shapes decreased over time. Further experiments revealed that although we may store a great deal of visual information over extended periods of time, our capacity for storage is more for particular visual details or aspects of visual percepts, rather than for detailed visual

information (Goldstein & Chance, 1971; Siewert, 2002; Noe, 2002). For instance, we only store very specific aspects of an experience, rather than a detailed account of that experience in memory. This is often observed in studies on eyewitness testimony (Loftus, Miller & Burns, 1978) and change blindness (Brooks, 1991; Dennett, 1991; see also Stroud, 1955; Gibson, 1986; O'Regan, 1992; Levin, 2002; Noe, 2002), where subjects are only able to recall very few details of their original memory or experience with accuracy.

2.1.2. VISUAL MEMORY PROCESSING

The idea that particular aspects and not detailed percepts of an experience are stored appears to be expressed in the process of memory formation (Noe, 2002). The process of memory formation first begins with the perception of an event, then encoding, through to storage, and lastly retrieval of the original percept of the event (Sternberg, 1999; Baddeley, 2005). Encoding is the process where information moves from STM into LTM, where it is stored. Visual encoding concerns the specific coding of perceptual information into a visual store of that information. However there appears to be some semantic information or 'residue' when storing visual percepts (Frost, 1972; Sternberg, 1999). This semantic 'residue' appears to relate to the form in which the information is stored cognitively, it may also relate to the cognitive processes involved in the production of meaning – of the visual perceptual information (Sternberg, 1999).

The cognitive systems of encoding a percept or image from STM into long term visual memory storage may be considered to be either analogue or propositional (Baddeley, 1990). Each of these forms of information storage is different from the other. For instance, in an analogue system the mode of representation in memory is continuous (Baddeley, 1990). In other words the representation is continuous from the sensory experience through to perception and encoding, in the form of the percept's cognitive representation. However in a propositional memory system, visual memory processing would be discontinuous and discrete in its memory representation. It would be altered as it moves from perception into storage, and then again in the retrieval process (Baddeley, 1990; Baddeley, 2005). The form of the cognitive

representation of the percept changes from the sensory aspects to the memory aspects of the percept. For instance in an analogue system, imagery is continuous in its memory processes whereas in a propositional system imagery is an epiphenomenon; a series of processes that are stored in LTM that operate on discrete spatial information or symbolic verbal code (Baddeley, 1990; Sternberg, 1999). However most modern cognitive psychologists (Peterson, Kihlstrom, Rose & Glisky 1992) believe that the system operating in terms of visual imagery may have some propositional aspects, which is having a symbolic verbal code, and yet may also at the same time have imaginal aspects. The idea is that visual information may be stored as discrete analogues of visual perception, yet also have a symbolic component that may affect or play a role in visual perceptual storage such as the semantic residue described above. This is called the *dual-code hypothesis* (Paivio, 1971; Sternberg, 1999; Brown & Craik, 2005).

There are many shortcomings to the *dual-code hypothesis*, for instance it only seems to cover focal memory and not memory for contextual visual experiences (Brown, & Craik, 2005). An example of contextually based memory would be memory for the source of the original experience (Schacter, Harbluk, & McLachlan, 1984; Brown, & Craik, 2005). For instance a person may remember a fact about something, but forget about where the fact was acquired. It is believed that contextual information is of a different memory code than what the *dual-code hypothesis* proposes in terms of visual memory. The reason for this is that contextual code appears to be represented differently to both the analogue and propositional forms of memory, in encoding (Brown, & Craik, 2005).

2.1.3 NEUROPSYCHOLOGY OF VISUAL MEMORY

The encoding of visual memory from STM into LTM may be further understood by examining the various neuroanatomical and neuropsychological correlates of the various processes of visual memory formation. The cognitive aspects of visual memory processing, from perception to storage, are governed by particular aspects of brain functioning. These aspects will now be elaborated and linked back to the cognitive processes of visual memory.

The neuropsychological structures of visual STM and long term visual memory are different, yet importantly linked in the processes of visual memory formation and the long term storage of percepts (Kolb & Whishaw, 2003; Walsh, 1990). Visual STM may be understood in terms of its neuropsychological structures by understanding the functioning of the visual spatial sketch pad. The visual spatial sketch pad operates to represent both spatial and visual imagery in processing visual STM (Kolb & Whishaw 2003). The neuropsychological structures of the visual spatial sketch pad are the ventral object recognition system of the posterior neocortex and the frontal neocortex. The visual spatial sketch pad is also synonymous with the dorsal spatial visual system. These systems relate to the dorsal stream of visual information processing of the parietal cortex (Kolb & Whishaw 2003). However the neural basis if imagery and its LTM processing appears to take place in higher cortical areas in a number of cortical brain regions, in the occipital and temporal lobes (Kolb & Whishaw, 2003).

Although neuropsychological evidence suggests that visual STM, such as the visual spatial sketch pad is part of the frontal and posterior neocortex, Farah (1988) has found evidence to suggest that visual imagery may be represented differently to that of spatial imagery. Similar hypotheses have emerged with regard to the visual spatial sketch pad model; that the cache represents visual imagery, whilst the scribe aspect represents sequences of spatial movement, and that visual imagery and spatial imagery may be represented differently by these neuropsychological systems (Neath & Surprenant, 2003). This appears to support the *dual-code hypothesis* (Sternberg, 1999; Brown, & Craik, 2005), that visual information may be processed both analogically and propositionally. Perception is broken down into an imaginal representation and a spatial representation; the propositional component in STM being situated in the spatial organization of the percept and the analogical in the imaginal aspect. It therefore appears that aspects of visual perception are broken down in the neuropsychological processing of memory into both imaginal components and symbolic components. This is further supported by Baddeley (1986) and Wilson, O'Scalaidhe, and Goldman-Rakic (1993) who explored evidence which suggests that spatial memory and object working memory are a part of different neuropsychological structures. For example single cell recording studies in non-human primates have indicated a ventral-dorsal segregation in the prefrontal cortex, with ventral neurons demonstrating sustained activity during object working memory delays and dorsal

neurons demonstrating sustained activity during spatial working memory delays (Wilson et al., 1993; Schacter, Wagner, and Buckner, 2005).

Another neuropsychological structure that may be important in recall from LTM, specifically the reconstruction of non-verbal visual memory is the frontal neocortex. The frontal neocortex concerns planning and problem solving (as a function of the frontal lobe) rather than direct non-verbal memory capacity or storage. Thus the frontal neocortex plays a role in the reconstruction of non-verbal memory recall (Luria & Tsvetkova, 1964; Kolb & Whishaw, 2003). The executive processing of the frontal neocortex helps both order and allows for appropriate re-engagement of task performance and the temporal and planned selection of appropriate strategy implementation, in order to complete the task of visual memory recall with accuracy in its re-representation (Kolb & Whishaw, 2003). The recall and specifically reconstruction of visual memory therefore requires procedural ability, which is governed particularly by the frontal neocortex (Kolb & Whishaw, 2003). Frontal neocortical hypothesis of visual memory, appear to focus predominantly on the reconstructive and constructive aspects of memory retrieval (Brown & Craik, 2005; Mitchell & Johnson, 2005; Tulving & Craik, 2005).

2.1.4. VISUAL MEMORY DISTORTION

Bartlett introduced the idea that memory is a reconstructive process (1932 cited in McClelland and Schacter, 1997). He believed that recall was not retrieval, but rather a reconstruction of a past experiences, based on previous memories and current experiences weaved into a coherent whole (Schacter, 1997).

Therefore memory recall is not static but a dynamic process. Memory recall does not concern merely the movement of information from storage to consciousness, it is rather a process of reconstruction (Schacter, Norman, & Koutsaal, 1998; Loftus and Pickrell, 1995). The reconstructive nature of memory may be explained further in terms of constructive aspects and reconstructive aspects. It is reconstructive, for example, searching for cues and drawing inferences in the retrieval process, to rebuild an experience. It may also be constructive, in that previous experiences may largely

determine the content and interpretation of the memory recall of a specific event or experience (Sternberg, 1999).

It appears that the constructive component of memory retrieval is a greater source of memory bias and distortion than the reconstructive component (Sternberg, 1999). Constructive memory distortion may best be explained by examining research by Elizabeth Loftus' experiments on eyewitness testimony (Loftus, et al., 1978). In these studies it was shown that a person's memory recall might be distorted, due to constructive memory. A person may be led to construct a memory that is quite different from what actually happened (Sternberg, 1999).

The process of recollection and re-construction of experience also utilizes the executive systems of frontal lobe functioning. As we do not store discrete episodes of memory experience, but rather a collection of representations that executive processes must control in the reconstruction process that takes place when we remember (Hirstein, 2005).

Therefore when considering short term and long term visual memory, it becomes clear that visual memory may not only be reconstructive, in terms of rebuilding past experiences, but also constructive, as there is an 'interpretational element'- based on other 'similar' past experiences (Sternberg, 1999).

Aside from the constructive and reconstructive aspects of visual memory distortion, there may be difficulty distinguishing real memory from imagined memory, which may also cause visual memory distortion. This process is called a reality monitoring error or failure (Perner, 2005). Reality monitoring refers to a person's ability to monitor whether the contents of their memory are real or imagined (Johnson & Raye, 1981; Perner, 2005). By about the age of three a person is generally able to determine fact from fiction, through their capacity to reality monitor (Woolley & Bruell, 1996). There are some developmental considerations in terms of reality monitoring, as children up to the age of six may be able to determine whether a fact was stated by another person or themselves, but have difficulty remembering whether they themselves just said it or just thought it (Johnson & Raye, 1983; Perner, 2005). The capacity of a person to reality monitor appears to have some major effects on the accuracy of memory recall (Perner, 2005).

It has been suggested that reality monitoring failures produce powerful illusory memories; these powerful illusory memories have often been called confabulations (Merckelbach, et al., 1999). Confabulation as a specific type of memory bias examined by Merckelbach et al. (1999), was found to be a type of memory failure referring specifically to a person endorsing logically plausible responses to a particular memory recall test, when the items in the responses were mostly false positives. This meant that an individual was able to recall items in a particular memory test, although the items did not accurately represent those of the original test items.

It has been suggested that confabulations due to reality monitoring errors as an executive functioning deficit, may even make distinguishing between hallucinations from real perceptions difficult (Marcia, Hayes, D'Esposito & Raye, 2000, cited in Hirstein, 2005). It appears that many retrieval theories focus more on the capacity to access memories, rather than the executive process that focus on correction failure (Hirstein, 2005).

However the executive process theories discussed which are responsible for correction failure may not be the only responsible factor for memory distortion and constructive memory failure. Some theorists believe that the difficulty is not in executive neocortical failures, but rather with the actual retrieval and storage difficulties and failures (Roediger & McDermott, 2005). For instance Muller and Pilzecker (1900, cited in Roediger & McDermott, 2005) showed that interference effects could be a potent source failure in the retrieval of information. The effects of interference may occur at either the point of encoding into storage or retrieval. An interference event competes with the original memory, so that the original memory becomes distorted with the inferring event. This is believed to be a strong source of false memories. This also appears to be a potent source of memory distortion in visual memory processing (Loftus et al, 1978; Roediger & McDermott, 2005). The constructive nature of visual memory and visual memory distortion may have significant effects in terms of the original percept. The memory of our perceptions may not be as accurate as we believe them to be. Therefore the inner world of our minds and imaginings, which is made up of our perceptions, may not be the accurate reflections of the outer world we often believe them to be (Noe, 2002).

2.1.5. VISUAL IMAGERY AND IMAGINATION

Imagery and perception are considered to be functionally equivalent (Sternberg, 1999). It has been suggested that imagination may be the product of mental imagery and not necessarily the symbolic contents of mental processing (Nigel, 1999). In a paper by Nigel (1999) on the 'active perception approaches' to imagination, it is expressed that imagination emerges not from the 'traditional' symbolic computational model's view, but rather through active perception. Thus imagination is a process of 'seeing as'; it is a very similar process to active perception, that it is grounded in visual information processing (Nigel, 1999). Therefore we may view imagination as containing mostly visual percepts and images or depictive representations. This may be because imagination is more of an analogical process than a propositional process or epiphenomenal process (Baddeley, 1990). However it may appear that analogical components predominate whilst there is some propositional residue (Brown & Craik, 2005; Sternberg, 1999), which appears common to both imagery and perception.

There is also strong evidence in neuroscience to further support the idea that mental images share more depictive representations with perception; yet at the same time have some aspects that are spatial in nature. The evidence mostly comes from metanalytical studies of brain imaging, in the primary visual cortex of areas V1 and V2 of the occipital lobe, during mental imagery tasks (Kosslyn & Thompson, 2003). Imagination may therefore be constituted by visual imagery that is similar in nature to perceptual and visual experience. However there is also evidence to suggest that the neuropsychological processes of imagining and visual perception are different. For instance Behrman, Winocur, and Moscovitch (1992) in their case of C.K. showed that the neural systems dealing with object perception are different from those dealing with the generation of images. Yet Farah (1988) has expressed that there are cortical areas involved in both mental imagery ability and visual perception, which are commonly related, even if the two may be affected differently by brain injury. The common area identified for both mental imagery and visual perception appears to be the left-temporo-occipital region (Kolb & Wishaw, 2003).

Marzi, Mancini, Metitieri and Savazzi (2006) examined retinal eccentricity effects, which are observed changes in the retina from visual stimuli, which appears to occur during the perception of 'real visual stimuli' and also occurs during the imagining of visual experience. Their study expressed that if imagined stimuli yield the same eccentricity-related effect as perceived stimuli then the neural substrates for imagery and perception would either be the same or very similar (Marzi, et al., 2006). This means a lot in terms of the nature of imagination and whether visual perceptual retrieval may be related to the same processes. If imagery and imagination have a predominantly non-symbolic, but rather perceptual representational property with some added spatial information such as described by the *dual-code hypothesis* (Sternberg, 1999), then it would be interesting to investigate the effects of memory on imagery in terms of memory for visual perceptual information.

2.1.6. IMAGINING AND VISUAL MEMORY DISTORTION

If imagery and perception are functionally equivalent (Sternberg, 1999) and if imagination and visual perception share similar representational qualities, then memory for visual perception may share similar processes and qualities, as the effects that memory may have on imagination. Imagination and memory may be intimately linked. For example memory for specific events or occurrences may be distorted through the process of imagination inflation (Roediger & McDermott, 2005). Imagination causes an inflation of the contents of the memory recollection process. When recalling a specific event our imaginations affect the content, by either distorting or confabulating memories of or for that event respectively. Therefore we may even imagine events that did not really occur and treat those events as real memories (Garry, Manning, Loftus & Sherman, 1996). For example people who imagine having performed an action, are more likely to falsely recognize a statement in having completed that action, which in fact they only imagined completing (Roediger & McDermott, 2005).

However although imagination appears to affect visual memory of particular events or experiences, it may not always have such a direct effect on the retrieval processes of visual memory. For instance memory for events may be affected prior to the effects of imagination inflation, such as by interference effects or reality monitoring errors, which occur in the encoding process of memory formation (Roediger & McDermott, 2005). This may mean that imagination may have less of an effect on visual memory distortion, or it may rather be affected by memory distortion itself.

On recalling events, we often displace them in time and we may also mistake memory for dreamed events for real events, and sometimes memory of real events for memory of dreamed events (Hirstein 2005). We often also only remember the things we intended or wished to say or do, rather than the things we actually said or did. Our imaginations and memory appear to deeply affect each other, especially in terms of our visual experiential world (Hirstein 2005). Johnson, Hayes, D'Esposito and Raye say that: "a vivid imagination can exceed the threshold and be taken to be a memory of an actual event, for example, when one believes they said or did something that they only thought or imagined saying or doing" (2000, pg. 361). Imagination and visual memory often affect each other. The effects of imagination on memory appear to affect mostly the storage and retrieval processes of long term visual memory.

There are a few methods a person may use to monitor the static of imaginary feedback in LTM retrieval. One method employed when engaging in memory retrieval is heuristic checking. Here some similar candidate memories are used in comparison of the retrieved memory (Hirstein 2005). So that a person may use a host of other similar memories in the process of aiding the retrieval of a specific memory, as a means of decreasing retrieval time and simplifying cognitive performance. However this process is mostly unconstrained and may let in more imaginary feedback that would distort the memory retrieval process. This may happen because there may be more interference from candidate memories. Then there is systematic checking of memory, which concerns an active, deliberate and more consciously engaged process, of perceptual details, cognitive schemas and even other past candidate memories. Systematic memory processing decreases the chances of imaginary interference, however it is a more conscious and an active process, that takes place much less of the time than heuristic memory processing (Hirstein 2005). This may be because it is

more time consuming and cognitively demanding. Most memory retrieval is heuristic in nature and therefore more prone to the effects of distortion or bias by imagining (Hirstein, 2005). Our imaginations are therefore more likely to filter into our memory retrieval processes. Perception, imagination and LTM seem to filter into each other through the similarly connected and overlapping cognitive processing of visual experience.

2.1.7. FANTASY AND IMAGINATION

Fantasy may be thought of, as being constituted by imagination (Person, 1995). It has been considered that imagination is our capacity to think of possibilities that go beyond our ordinary or everyday perceptions. Our ability then, to contemplate alternatives to the real world of people, places, time and things, is very much linked to our capacity for creativity of novel ‘internal experiences’ of which constitute the lives of our fantasies (Person, 1995).

Although fantasies are generally hard to access, it has been estimated from an American sample, that about 96 percent of people “report having daydreams or reveries at one time or another” (Person, 1995, p31). Fantasy and imagination are an important part of our everyday experiences and mental processes.

The mind is often thought of as the ‘organ of reason’, that its primary roles are analysis, logic, planning and other forms of intellectual and abstract thought. However the mind performs many other activities, although abstract, they are generally further from the logical and reasoning roles its thought to play. These other activities involve the capacity to generate stories and internal mental worlds. These mental conjurations include fantasies, myths and tales, and imaginings informed by the cultures that surround us (Person, 1995).

Fantasy being intimately connected with imagination, may share similar characteristics in the effects that imagination has on memory. In order to understand the effects that fantasy has on memory processing and distortion, the construct fantasy proneness will be elaborated, as a particular aspect of fantasy that appears to affect visual memory.

2.1.8. FANTASY PRONENESS

It has been suggested that the construct fantasy proneness relates to a number of experiences of an individual's deep involvement in fantasy (Wilson & Barber, 1983). The concept of fantasy proneness was developed by Wilson and Barber (1983) in order to express a specific set of characteristics relating to a small group of people who may be labeled fantasizers (Merckelbach et al., 2001). Wilson and Barber's (1983) original study explicated various components of fantasy proneness such as spending a large portion of one's time fantasizing, having fantasies that are hallucinatory (for example appear 'real as real') in intensity, strong bodily experiences relating to fantasies, vivid childhood memories and fantasies, having paranormal or parapsychological experiences (e.g. precognitive ability), out-of-body experiences and also intense religious experiences (Merckelbach, et al., 2001).

It has been suggested that there are many commonalities between fantasy prone individuals (Merckelbach, et al., 2001). They share common developmental pathways, for example most fantasy prone individuals reported that when they were children they were given strong encouragement by their parents to indulge in their fantasies, and many also have used their engagement in fantasy as a means of coping with their emotional difficulties (Rhue and Lynn, 1988).

People who are fantasy prone also appear to spend larger portions of their time daydreaming and fantasizing, they are more easily able to pretend to be someone else and feel more different than other people when doing so. They also generally experience strong physical symptoms when fantasizing about illness (Merckelbach, 2004).

It has been suggested that fantasy proneness is strongly associated with mental imagery ability (Aleman & Haan, 2003). Fantasy proneness appears to affect the degree of vividness of mental imagery that a person experiences; with increased vividness usually corresponding to fantasy proneness. However some researchers believe that perception may be more vivid than mental imagery itself in relation to fantasy proneness (Kosslyn, Sukel, & Bly, 1999; Aleman & Haan, 2003). This appears to correspond with the idea that imagery and perception may share the same cognitive processes (Sternberg, 1999; Nigel, 1999).

In fantasy prone individuals it appears that mental images and percepts are less distinctive from each other with regard to their sensory characteristics (Johnson & Raye, 1981; Johnson, Hashtroudi, & Lindsay 1993). The meta-cognitive processes associated with mental images and percepts are also less distinctive. This may mean that fantasy prone individuals may have more vivid mental imagery and may find it easier to generate mental imagery (Johnson & Raye, 1981; Johnson, et al., 1993).

2.1.9. FANTASY PRONENESS AND VISUAL MEMORY DISTORTION

Of particular interest in this study is the association that fantasy proneness has with visual memory distortion (Aleman & Haan, 2003). Although memory is generally thought to be quite accurate, distortions in memory recall are almost unavoidable and people generally accept illusory memories as true without generally questioning them, unless they actually encounter contradictory evidence (Dodson, Koutsaal & Schacter, 2000). Re-experience based on false memory recall may be an element of fantasy proneness, and many researchers have suggested a link between memory recall distortions with fantasy proneness. (Merckelbach, et al., 1999; Merckelbach, et al., 2001). There is speculation that memory recall distortion may also be related through mental imagery performance, to ones degree of fantasy proneness. The higher the individual scores on fantasy proneness the higher their degree of mental imagery vividness and potentially visual memory distortion (Aleman & Haan, 2003).

Aleman and Haan's (2003) research examined the link between fantasy proneness and mental imagery ability and the meta-cognitive process of distinguishing between internal and external sources of information, in memory distortion. These aspects of cognition concern the capacity for reality monitoring. The concept of reality monitoring refers to a person's capacity to discriminate between memories of events that have really happened from memories of events that the person has only imagined (Merckelbach et al.,1999). Reality monitoring has been found to be a largely associated with memory distortions in fantasy proneness (Merckelbach, et al., 1999). Merckelbach et al. (1999) also found a strong link between reality monitoring errors and confabulation, which strongly supports the idea that fantasy proneness, may have significant effects on visual memory distortion. The idea that reality monitoring errors

are the link between visual memory distortion and fantasy proneness, suggests that the cognitive and neuropsychological processes involved are predominantly executive and frontal neocortical processes respectively (Mitchell & Johnson, 2005; Tulving & Craik, 2005).

However other cognitive factors have been raised with regard to memory recall, which may also be involved in the process of fantasy proneness, such as the encoding and retrieval characteristics of memory processing. These cognitive processes are not executive processes, and may even provide an alternative explanation to the executive process theories, of the link between fantasy proneness and visual memory distortion. They are posterior neocortical and specifically the visual information processing and storage aspects of the visual dorsal stream (Kolb & Whishaw, 2003). The non-executive processing of visual memory may also be observed in the cognitive forms in which visual memory is encoded and stored.

If visual information is encoded in memory predominantly as an analogue representation and less propositionally, then it may be more likely to be effected by fantasy proneness. This may be because it would support the idea that perception and imagery are similar processes, and that fantasy proneness affects these processes similarly (Aleman & Haan, 2003). Also if visual memory retrieval is predominantly constructive there may also be more distortions. However the potential retrieval effects that fantasy proneness may have on visual memory or the effects that retrieval of visual memory might have on fantasy proneness have not been studied specifically. The study by Aleman and Haan (2003) suggest that mental imagery ability may better predict memory bias than reality monitoring errors.

Aleman and Haan (2003) found that individual differences in fantasy proneness and the vividness of a person's mental imagery were possibly related directly to memory confusions and retrieval processes. They also examined reality monitoring errors in conjunction with object imagery and fantasy proneness and found that reality monitoring errors had a non significant association with fantasy proneness. Therefore according to Aleman and Haan (2003) high fantasy proneness may be related directly to memory biases and distortions, rather than leading to reality monitoring errors. The relationship between reality monitoring and fantasy proneness was weak in their study (Aleman & Haan, 2003). This theoretical link is counter to Merckelbach et al. (1999;

Merckelbach, 2004), who express that the link between memory distortion and fantasy proneness is in the executive processes of reality monitoring errors.

It appears that mental imagery processing may be the most significant cognitive factor in how fantasy proneness and visual memory distortion are linked. The cognitive processes of perception and imagery appear to be closely linked (Sternberg, 1999), especially if percepts are encoded predominantly in analogue form, as mental images (Nigel 1999). If percepts are encoded as mental analogues, then memory distortion may occur as fantasy prone individuals are more likely to distort their perceptions and mental images. They also find it even harder to distinguish between the two after encoding (Aleman & Haan, 2003), which may link back to difficulties in reality monitoring. However it is difficult to determine whether visual memory processing in terms of encoding and reconstruction affects fantasy proneness, or an ability to determine whether coded information is a percept or imagined mental image, in fantasy proneness affects visual memory.

However visual memory and fantasy proneness may not share the same cognitive processes, in terms of mental imagery ability. This may be because the neuropsychological structures involved in imagining and visual memory may be more different than the same; for instance neuropsychological evidence that suggests that imagery processing is different to visual perceptual and memory processing (Behrman, et al., 1992). This would limit the suggestion that mental imagery ability is the link between fantasy proneness and visual memory distortion (Aleman & Haan, 2003). However the link may not be in the shared processes of mental imagery ability, but more in the executive processes involved in coordinating the reconstruction of visual memory and imagery, suggested in theories of reality monitoring (Merckelbach et al., 2004).

The various relationships between visual memory distortion and fantasy proneness now appear more distinct. One suggestion is that visual memory distortion may relate specifically to fantasy proneness through mental imagery processing (Aleman & Haan, 2003). This suggests a non-verbal element to the type of visual memory distortion that may be implicated in high scores of fantasy proneness, or the degrees of fantasy proneness implicated in visual memory distortion. Other links may be in the executive processes involved in both visual memory distortion and fantasy proneness, such as in reality monitoring (Merckelbach et al., 1999; Merckelbach, 2004). It is also possible that the link is neither in the executive organizational

processes nor in mental imagery ability. But rather in other types of encoding taking place in the process of visual memory and fantasy proneness, such as contextual and semantic coding that is neither propositional nor analogical, which may be a part of an experience of acquiring a memory in specific surroundings or contexts (Brown & Craik, 2005). The source and meaning of the memory may therefore be the potential link between visual memory distortion and fantasy proneness. Each of these theories provides either a direct or indirect link between visual memory distortion and fantasy proneness.

2.1.10 CONCLUSION

It appears that fantasy proneness and visual memory may affect each other. The literature indicates various possible links that fantasy proneness and visual memory distortion may have. The strongest and most direct link appears to be in the processing of mental imagery, as the cognitive processes would be similar. Mental imagery may directly affect memory processing and fantasy proneness, as mental images as analogues may be exaggerated through cognitive errors associated with processing perception into mental images. This may occur if percepts and mental images appear the same cognitively, which are both evident in fantasy proneness and visual memory distortion (Aleman & Haan, 2003). The link may also be executive and organizational, in that there may be difficulties or biases in the capacity to monitor memory for real perceptual experiences from imagined perceptual experiences, this process being the errors in reality monitoring.

The link between visual memory distortion and fantasy proneness may be useful in determining the efficacy of certain eyewitness testimonies. Fantasy proneness measures may be used to determine whether a person's memory may be easily distorted, thus providing a potentially less accurate eyewitness testimony. The fantasy proneness construct, together with theory and empirical enquiry into visual memory, may also provide theoretical insights for future research in eyewitness testimony. Fantasy proneness has been used to determine a person's potential for dissociation (Merckelbach et al., 1999, Geraerts, et al., 2006), so that if there is a significant link between visual memory and fantasy proneness, further research in visual memory

may provide interesting theoretical and empirical insights for research on dissociation and dissociative experiences. This may also provide certain clinical insights, about dissociation and dissociative experiences and their relationship with a patient's visual memory and fantasy proneness.

2.2 RATIONALE

A clearer understanding of the relationship between visual memory distortion and fantasy proneness will reveal further theoretical insights for both the processes of fantasy and visual memory. This study was developed in order to provide a greater understanding of the cognitive and neuropsychological processes of the relationship between visual memory and fantasy proneness. It will provide some insights around some of the current debates around the cognitive processes involved in fantasy proneness, for example whether fantasy proneness is predominantly linked with reality monitoring difficulties or visual and imagery processing difficulties (Merckelbach et al, 1999; Almena & Haan, 2003). It will supplement existing research and provide a basis for further research involving elements of fantasy proneness- with empirical insights of the neuropsychological visual memory mechanisms involved. It will also provide some theoretical insights about the role of visual memory and the debates about its cognitive processing, for example whether visual memory is predominantly an analogue or a propositional process (Sternberg, 1999; Badelley, 1990; Noe 2002; Brown, & Craik, 2005). It may also provide theoretical insights useful in the research of confabulation or eye-witness testimony, which relies on sound understandings of visual memory processing and the effects of memory recall distortion (Loftus, et al., 1978; Sternberg, 1999). The link between visual memory distortion and fantasy proneness may also provide a unique perspective for eye-witness testimony research. This study will also elaborate on the possible clinical implications of the relationship between visual memory distortion and fantasy proneness. This may be in areas where dissociative experiences or dissociation is studied with regard to its relationship with fantasy proneness and visual imagery, were it may provide a new means of examining or even understanding these psychological processes (Merckelbach et al., 1999; Aleman & Haan, 2003).

2.3 RESEARCH AIMS

The aim of this study was to investigate the relationship between visual memory recall, and specifically visual memory recall distortion and fantasy proneness. It examined aspects of an individual's visual memory recall in terms of accuracy of recall and degree of visual memory distortion, according to the Rey-Osterrieth Complex Figure Test [Appendix E], as well as strategy used in visual memory, and the relationship that this had with fantasy proneness; according to the creative experiences questionnaire (Merckelbach, et al., 2001). [Appendix D].

2.4 RESEARCH QUESTIONS

- Is there relationship between immediate visual memory recall and fantasy proneness?
- Is there relationship between delayed visual memory recall and fantasy proneness?
- What is the relationship between visual construction, immediate visual memory recall and delayed visual memory recall?

Chapter 3 METHODOLOGY

3.1 INTRODUCTION TO METHODOLOGY

The study will answer the first three research questions by correlating the Creative Experiences Questionnaire (CEQ) and the Rey Osterrieth Complex Figure Test (ROCFT). The last question will involve examining the relationship between the various aspects of visual construction and memory assessed by the ROCFT, described further below.

3.2 RESEARCH DESIGN

This study is structured within a non-experimental, within subjects design (Neuman, 1997). It is comprised predominantly of quantitative data, although some qualitative data was collected. There was no randomization of the sample and the participants were tested once off. The data obtained from the participants was then subjected to a series of correlations and analyses of variance.

The objective of the correlations was to determine whether a significant relationship exists between the variables under investigation and the degree of any significant relationships. Variables of fantasy proneness in the CEQ were correlated with variables in visual memory recall and distortion in the ROCFT. The analysis of variance was used to determine whether there was any significance between the variance of particular groups in the study.

The variable pertaining to fantasy proneness was a single score of the CEQ, which concerns the sum of the *yes* responses to the 25 items on the questionnaire [Appendix D].

The variables of visual memory distortion determined by the ROCFT were: 1) copy task or visual construction; 2) immediate visual memory recall; 3) delayed visual memory recall. They all had a possible total score of 36. [Appendix E]. There was also a qualitative component, which represented three categories of strategy: 1) strategy used; 2) some strategy used 3) no strategy used.

3.3 SAMPLE

The sampling method used for this study consisted of non-probability convenience and snowball sampling procedures. Non-probability convenience sampling, which is based on the participant's availability (Neuman, 1997), was used to obtain a sample of undergraduate and graduate students from the University of the Witwatersrand. The sample was selected from University of Witwatersrand due to ethical considerations and limitations with regard to drawing a sample from an identifiable and accessible population group. Sciences and humanities students were approached to participate. The sample was therefore not randomly selected, affecting its degree of representation (Neuman, 1997). Snowball sampling was used as a method to expand the participants volunteering in the convenience sampling procedure. The participants selected in the convenience sampling procedure recommend other potential participants who, when willing and volunteering to participate, then recommend further participants in a snowballing procedure (Neuman, 1997).

Suitability criteria of participants in the sample included an absence of a previous incident of head injury with loss of consciousness, and not currently using any psychoactive medication. These suitability criteria eliminate any extraneous effects that a head injury with loss of consciousness or psychoactive medication might have, on the visual memory recall instrument (Tombaugh & Hubley, 1991). A maximum age of 35 was chosen and a minimum age of 20, as the age ranges before 20 and after 35 generally have quite different ROCFT mean scores (Lezak, 1995).

The sample size-target for the study was approximately 50 students. The reason for selecting this number for the sample size was to be able to work manageably with data collection, whilst still being able to generate results that would be more generalizable, and share a greater degree of normality with regards to the target population (Howell, 2004).

3.4 INSTRUMENTS AND QUESTIONNAIRES

The test instruments used in this study were the Creative Experiences Questionnaire (CEQ) for fantasy proneness and the Rey-Osterrieth Complex Figure Test (ROCFT) for visual memory distortion. The CEQ is a forced choice self-report inventory of 25 items. The ROCFT is an administered neuropsychological test of visual memory. A biographical questionnaire was given in order to determine descriptive information of the sample.

- Biographical Questionnaire [appendix C]
- Rey-Osterrieth Complex Figure Test [appendix E]
- Creative Experiences Questionnaire [appendix D]

3.4.1 BIOGRAPHICAL QUESTIONNAIRE

The biographical questionnaire was used to gather information about the participant's age, gender, area of study and information on suitability criteria (listed above). These all form the descriptive statistics and were used in the statistical analysis. The participant's names were not required on the biographical information sheets, in order to maintain confidentiality.

3.4.2 REY-OSTERRIETH COMPLEX FIGURE TEST (ROCFT)

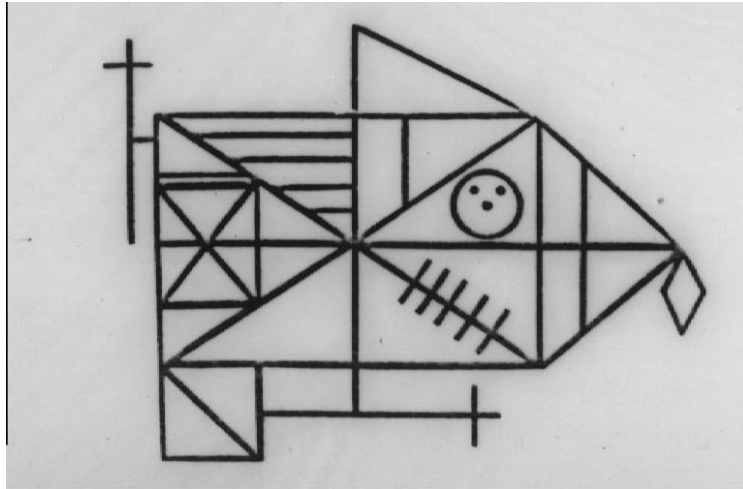


Fig. 3.1 Rey-Osterrieth Complex Figure (<http://www.scielo.br/img/>, 2007)

The ROCFT has been developed for neuropsychological assessment in testing an individual's perceptual organizational skill and visual memory recall ability (Lezak, 1995; Peirson & Jansen, 1997; Osterrieth, 1944 and Rey, 1941; Rey & Osterrieth, 1993). The test was originally conceptualized and developed by Rey (1941) and then subsequently normed by Osterrieth (1944). The most common administration procedure of the ROCFT consists of a copy trial, immediate recall, and a 20 to 60 minute delayed recall trial. Comparisons amongst the various trials help to differentiate between visual perceptual and constructional difficulties from memory performance difficulties (Woodrome & Fastenau, 2004).

Various dimensions of visual memory may be examined by the ROCFT, such as the executive aspects of the re-constructional component of memory processing, and the degree of distortion and omission in the memory retrieval process, particularly around visual representation (Westervelt, Somerville, Tremont & Stern, 2000). The ROCFT may also be used to evaluate a person's degree of strategy and planning, during the performance of any of the copy or recall tasks; this is predominantly around organizational strategy (Westervelt et al., 2000). It is also important to note that a person's organizational ability, which is an executive frontal lobe function, is important in a person's degree of accuracy in their reconstruction, during recall (Westervelt et al., 2000).

Visual memory distortion may be examined by the ROCFT. The ROCFT may be used to determine whether the particular memory distortion is due to constructional difficulties, executive difficulties or particularly a storage or retrieval difficulty. However the standard testing procedure of the ROCFT does not distinguish specifically from a storage or retrieval difficulty in visual memory recall (Woodrome & Fastenau, 2004). The standard testing procedure was utilized in this study, due to time constraints and the available normative and standardized data available for the standardized scoring procedure (Lezak, 1995).

The standard scoring procedure (Lezak, 1995) most often employed in the ROCFT, is used to express the degree of memory difficulty. The scoring, for the entire figure, is out of 36, and each component of the drawing is worth either 0; 1; 0.5 or 2 points per aspect. Two points are given if a component or detail is correct and positioned properly. One point is given if the component or detail is distorted or altered, but placed correctly. 0.5 point is given if the component or detail of the figure is distorted and incorrectly placed. Lastly no points are given if a component or detail is omitted or is completely unrecognizable (Ferraro, Grossman, Bren & Hoverson, 2002). This method of scoring the ROCFT has some subjective biases, in terms of the researcher being the rater. It may also be considered to be a qualitative method, even though the categories represent quantitative information (Loring, Martin, & Meador, 1990).

The participant is instructed to copy a complex geometrical figure as accurately as they possibly can. This geometric figure is essentially the Rey-Osterrieth Complex Figure (*Fig. 3.1*). The participant is then asked to redraw the figure without the aid of the drawing. The individual is then asked to retrieve and redraw the figure after a certain interval of time; the time lapse used in this study was approximately 25 to 30 minutes (Lezak, 1995). At the end there should be three drawings of the ROCFT: a copy, immediate recall and delayed recall drawing (Bennett-Levy, 1984).

The figure is drawn with colored pencils. The participant alters between the colors, using each color once per drawing and switching between the colored pencils every thirty seconds. The researcher times each period of colored pencil use and tells the participant when to switch, and also records the order in which the pencils were used. This is done to track the constructional aspects of the ROCFT, in order to later examine the individual's qualitative strategy score.

The results of the ROCFT are in the form of the degree of accuracy in re-representation of the geometrical figure presented in the ROCFT; which is analyzed qualitatively by the researcher based on the accuracy of the re-representation but given a quantitative score. Therefore the scores that will be obtained by the ROCFT, specifically for this study, will be quantitative scores of copy or figure representation before memory recall, figure representation of short term memory recall and of delayed, long term memory recall. The general scoring procedure and norms used for the ROCFT will be the original 'Osterrieth methods and norms' (Lezak 1995); which considers the qualitative appraisal of the figure and the quantitative scoring method provided.

In terms of the quantitative statistics of the ROCFT, the reliability of the ROCFT indicated by the Boston Qualitative Scoring System (BQSS) found excellent interater reliability coefficients for a series of tests of the ROCFT; on average the scores were 0.90 or higher (Psychological Assessment Resources, 2005). Lezak (1995) records good interscorer reliability (0.91 to 0.98) and average to good test-retest reliability scores (0.60 to 0.76).

A normative data set was developed by Loring, Martin, and Meador (1990) from comparing the differences and the effects between the immediate and delayed recall trials (N = 87). This data set comprises percentile ranks of their sample, as a population norm group [Appendix J]. The mean copy score of the ROCFT was also provided by their study (M = 35.7, SD = 0.8).

A comparison study was done between the ROCFT and another test designed to measure the same neuropsychological constructs of visual memory, the Taylor Complex Figure Test (TCFT) (Strauss & Spreen, 1990). They found very similar mean scores in university students (N = 20) between the two figures in terms of the copy task (Rey- 31.83, SD 2.14; Taylor 31.78, SD 1.80), yet different mean scores in the delayed recall task (Rey- 20.58, SD 6.47; Taylor 25.68, SD 3.60). They estimate that the delayed recall of the ROCFT is slightly harder than the delayed recall of the TCFT. However they suggest as one of the most important findings, the similar difficulty in the copying task of both figures (Strauss & Spreen, 1990).

Spreeen and Straus (1998) reported in an age group from 20–29 (which is very similar to participant’s age in the present study), a mean copy performance of 33.70 ($SD=1.59$) and mean 30-min delayed recall performance of 21.80 ($SD=6.56$). In another study by Ferraro, et al., (2002) on undergraduate students ($N = 48$) they report similar findings with a mean copy performance of 32.51 ($SD=3.05$) and mean recall performance of 23.69 ($SD=5.76$). In a much older study, King (1981) found on a study on frontal lobe focal lesions, the following data in his control group, which represented a norm population sample: mean scores for ages 20 to 30 years: copy trial performance of 33.0 ($SD = 2.8$).

Not many studies give the normative or descriptive statistics for the immediate recall trial of the ROCFT. However in a study by Tombaugh and Hubley (1991) on the similarities between the ROCFT and the TCFT, they give some descriptive data for the immediate recall trial ($M = 23.5$, $SD = 5.1$) for undergraduate students ($N = 33$) enrolled in third year psychology courses. There was no published normative data found for the ROCFT for any South African populations.

Lastly a qualitative analysis of strategy based on colour pencil use was performed. The qualitative scoring method has been designed by the researcher for the purposes of this study. It provides some information on the participant’s basic level strategy and is based on the order and pattern of colored pencils used to produce the ROCFT. The researcher examined the three drawings of the figure (copy, immediate recall and delayed recall) of a single trial. The order of the parts drawn was examined, based on whether the smaller components or the larger components of the ROCFT were drawn first to last. The sequencing of parts and the movement from one part to the next, based on the change in colour pencil use to track this, was also examined. So for example drawing aspects of the figure from the left to the right or from the outside to the inside, or randomly were noted. The more random the parts were drawn the less likely strategy was used.

This qualitative method was based on some of the evaluative aspects used in the Developmental Scoring System for the ROCFT (Psychological Assessment Resources, 1996), where for example the scoring of the organization of the figure examines the alignments and intersections of the major lines of the figure. For the

method used in this study to examine strategy specifically, the lines were examined in terms of their alignments and intersections, but specifically for their consistency and order. This was based on the hypothesis that strategy may be observed in the order of the figures replication (Lezak, 1995).

The three categorical and qualitative scores for strategy in this study were: 1) some strategy used, where there was consistency in all three figure drawings, in the order and arrangement of their parts. 2) Alternating consistency between the three figures, with parts of the figure being produced, observed to be disordered. 3) No consistency observed between the figures, with regards to their construction, and poor arrangement and ordering of the various parts of each figure.

3.4.3 CREATIVE EXPERIENCES QUESTIONNAIRE (CEQ)

The CEQ [Appendix D] comprises 25 items that measure various components of fantasy proneness. It was originally developed on the principles of fantasy proneness proposed by Wilson and Barber (1983). The various components include the developmental antecedents of fantasy proneness, intense elaborations and profound involvement in fantasy and daydreaming and the concomitants and consequences of fantasizing (Merckelbach, et al. 2001).

The CEQ contains forced choice yes/no categories that determine capacity for fantasy proneness. The test may be answered in one sitting. The score obtained on the fantasy proneness questionnaire, represents the degree of fantasy proneness of the specific individual.

Test re-test reliability was found to be excellent ($r= 0.95$) in a sample of 17 undergraduate students (14 women; mean age: 22.6 years) re-tested after a six week period. The mean CEQ scores on both occasions was 7.7 (S.D.=4.7) and 7.1 (S.D.=4.5), respectively. Also internal consistency was measured in a separate sample of 99 undergraduate students (79 women; mean age: 21.2 years) and appeared good: Cronbach's $\alpha=0.72$ (Merckelbach, et al. 2001).

A correlation was conducted between the CEQ and Wilson and Barber's (1981) measure of fantasy proneness, the Inventory of Childhood Memories and Imaginings (ICMI). A strong (0.77) and significant correlation was found, (Merckelbach, et al., 2001).

Participants reporting paranormal experiences have been correlated with high scores on the CEQ. For instance participants with high scores on reported paranormal experiences (N = 28) also achieved higher scores on the CEQ, than participants who did not report high scores (N = 71). Validity in the CEQ was measured by comparing results of individuals (n=18) intense experiences of paranormal phenomena with that of an outside independent judge who rated the eccentricity of the paranormal experiences on a 10-point scale (anchors: 0=*quite normal*; 10=*extremely bizarre*) (Merckelbach, et al. 2001). A positive significant relationship appeared ($r = 0.37$, $p = 0.07$)

One study compared scores on the CEQ with scores on the 44-item ICMI, on a sample of 52 undergraduate women. The study yielded a Pearson product-moment correlation of 0.77 ($p < 0.001$) between the two test instruments (Myers, 1983, cited in Merckelbach et al, 2001).

3.5 PROCEDURE AND DATA COLLECTION

Between one to four students were approached for one administration of the ROCFT and CEQ with the biographical questions, to collect data. The students were approached during breaks and between classes and lectures. The researcher also scheduled times with students to meet, so that enough time would be available to administer the ROCFT and CEQ with the biographical information. At least 90 minutes was put aside for an administration, for either one to four students. Participation was voluntary, and consent forms had to be signed before participation. The students had the opportunity to voluntarily withdraw at any time.

The students who were approached and who gave consent to be tested, were given subject information sheets and the test administration protocol was discussed [Appendix A]. They also had to sign a consent form to participate [Appendix B]. The test protocol expresses the time for testing, a brief description of the study and the instruments and the order of test administration. It also included the instructions for the individual test instruments.

The order of administration was first the biographical questionnaire, then the copy task of the ROCFT, then the immediate recall task of the ROCFT, this is where they were asked to redraw the figure almost immediately without the visual aid of the geometric figure (approximately within 3 minutes after copy task [Lezak 1995]); this was the test for short term memory recall and working memory of the ROCFT. The CEQ was given after this, and lastly the Delayed recall task after 25 to 30 minutes (Lezak, 1995).

The testing took place in lecture rooms in the offices of the psychology department, Umthombo building at the University of the Witwatersrand. The testing took place from February 2007 until April 2007. There were approximately 32 administration sessions of the full study test battery (Biographical questionnaire, CEQ and ROCFT), with a total of 56 students participating.

3.6 DATA ANALYSIS

Data was collected and filed immediately after each test administration. After the complete administration of all the tests to the participants the data was scored and analyzed. A standardized scoring procedure was used for the ROCFT that was adapted from scoring procedures described by Lezak (1995) and the BQSS (Psychological Assessment Resources, 2005). The system used for scoring the ROCFT has been described above in the section describing the ROCFT. The CEQ was scored by the same methods described by Merckelbach et al. (2001), also described above.

A research assistant helped code the first ten ROCFT's, this included the copy, immediate and delayed recall trials. This was done in order to increase the interator reliability of the data analysis for the ROCFT. Interator reliability between the scorers for the copy trail was 0.97, for the immediate recall trial 0.93 and for the delayed recall trial it was 0.94. The interator reliability was high for all the trials of the ROCFT [Appendix K].

After all the data had been scored, the data was entered into excel spread sheets in Microsoft Office and statistical analyses were performed using Statistical Analysis Systems (version 9.1). The computer analysis provided correlations, nonparametric analysis of variance and various graphs, descriptive and summary statistics.

A qualitative scoring procedure was used for the ROCFT, to assess broad categories of the participant's strategy. The scoring methodology was developed by the researcher and focused on the order in which the ROCFT was completed. This was done by assessing the order in which the participant completed the figure by using the colored pencils [Appendix F]. Three broad categories were developed. They express the potential degree of basic strategy of the participant. The categories examine the aspects of the figure the participant drew first and the way the participant chose to reconstruct the figure from the first aspects onward. This was examined and compared across the copy design, immediate and delayed recall trials. The three qualitative categories used to describe the participants levels of basic strategy are: 1) Strategy used in figure (represented by a score of 1); 2) Some strategy used in figure (represented by a score of 2); 3) No strategy used in figure (represented by a score of 3).

3.7 ETHICAL CONSIDERATIONS

The nature of the research study, testing and administration of tests and questionnaires was explained to the participants by providing a participant information sheet and answering questions about the research study. Participants were first asked to complete a consent form, before they participated in the study; participation was completely voluntary. The confidentiality of all participants will be maintained, this

has been done by excluding their identifying details, such as their name, address or telephone numbers in the consent forms [Appendix B], and the biographical questionnaires [Appendix C]. The participants were made aware of this in the participant information sheets. Anonymity could not be guaranteed in this study, because of the nature of testing and collection of data. The only means of identifying the participant is a participant number; this however will be explained to the participant in the participant information sheet.

It was explained to the participants that there will be no benefits for participating in this research study, nor would any participants be given incentives to participate. The participants had the right to withdraw from the research study at any time, without disadvantaging themselves in any way. The participants were told that they may request feedback on their participation; in the form of the completed research report, which will provide an overview of scores and results, rather than any particular results of any individual participant.

There were no adverse effects due to the administration of the questionnaires and tests, however, telephone numbers for the Depression and Anxiety Support group and Life Line were made available to participants at the time of consent and after completing the questionnaires and tests.

Chapter 4 RESULTS

4.1 SAMPLE PROFILE

The sample consisted of 56 participants. Five participants were eliminated from the sample due to not having fulfilled the suitability criteria. The suitability criteria of participants in the sample included an absence of a previous incident of head injury with loss of consciousness, and not currently using any psychoactive medication. Another two participants were eliminated as outliers. The reason they were eliminated as outliers, was because both participants were unable to complete the ROCFT. They were also above the age requirement cut off for the study, which was 35 years old. Therefore a total of 49 participants were used in the statistical analysis. Descriptive statistics given below provide further details of the sample.

4.2 DATA ANALYSIS

SAS (Statistical Analysis System version 9.1) was used to analyse the data. Distribution plots for age, the CEQ scores and the various ROCFT trials, expressed mostly skewed and abnormal distributions and all the ROCFT trials were asymptotic (Howel, 2004). Tests for normality of the distributions for age, CEQ scores and the ROCFT were performed. The tests for normality included the Kolmogorov-Smirnov and the Anderson Darling tests. Both tests for normality produced non-significant results for normality, for all the distributions for the CEQ scores and the ROCFT trials [Appendix L]. Therefore the various distributions for the CEQ scores and the ROCFT trials are not normal and therefore non-parametric measures have been used to analyse the data.

The following statistical procedures were computed: All biographical, nominal data was graphed. Inferential data, which includes the age of all participants, CEQ scores and all ROCFT trial scores were correlated. Spearman correlations were performed as the data distributions were nonparametric (Howell, 2004). Two nonparametric analyses of variance were performed for educational background- divided between

sciences and humanities students. The second analysis of variance was done for the qualitative data from the ROCFT trials. The level of significance chosen for the various statistical analysis was $p = 0.05$.

4.3 DESCRIPTIVE STATISTICS

The descriptive statistics include the biographical features of the participants, including age, gender, and area of study. Bar-graphs elaborate the proportions for the samples age, gender and area of study:

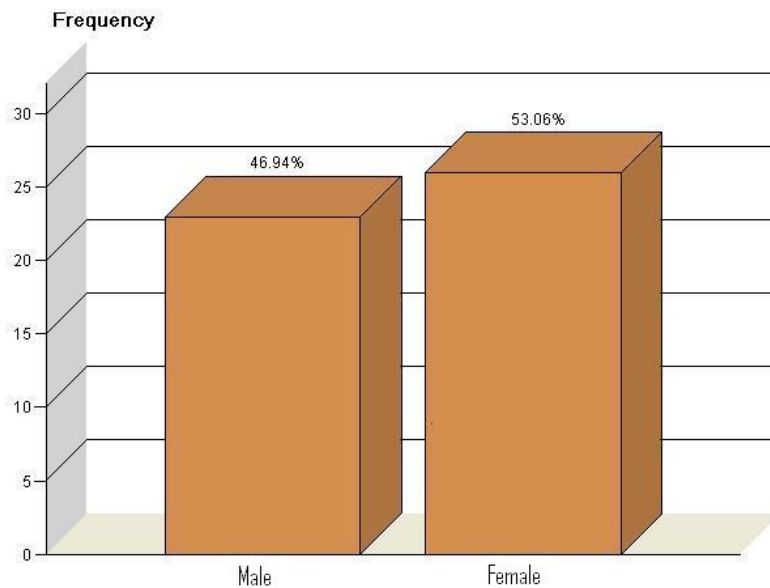


Fig.4.1 Frequency distribution of gender

Fig.4.1 represents the proportion of female and male students. There were 23 males and 26 females. In terms of the sample $n = 49$, the proportion of males was 47% and the proportion of females was 53% for the sample in this study.

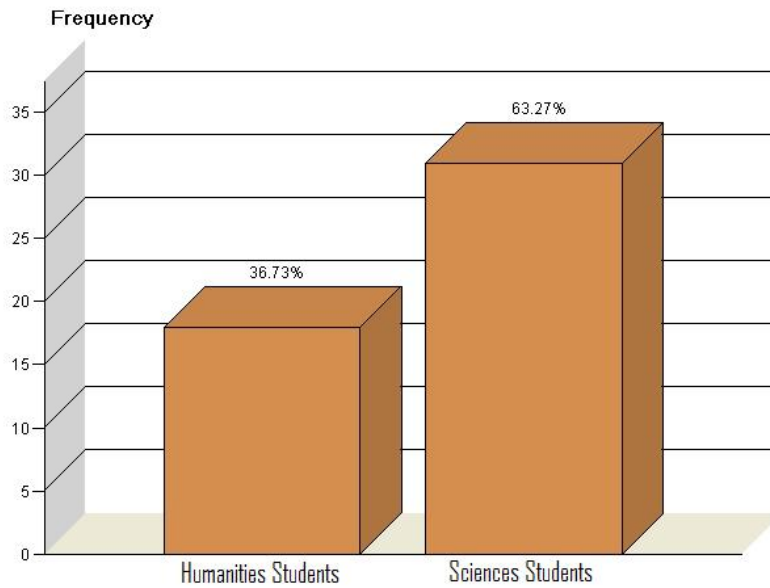


Fig.4.2 Frequency distribution of humanities and sciences students

Fig.4.2 represents the proportion of humanities and sciences students. There were 18 humanities students and 31 sciences students. In terms of the sample $n = 49$, the proportion of humanities students was 36.7% and the proportion of sciences students was 63.3%.

The number of postgraduate students in the sample ($n = 49$) was 42. The number of postgraduate students who have completed more than two years of postgraduate studies, and were either in their masters or doctoral studies was 29. The number of undergraduate students in the sample was 7. The proportions in the sample therefore predominantly represented postgraduate students.

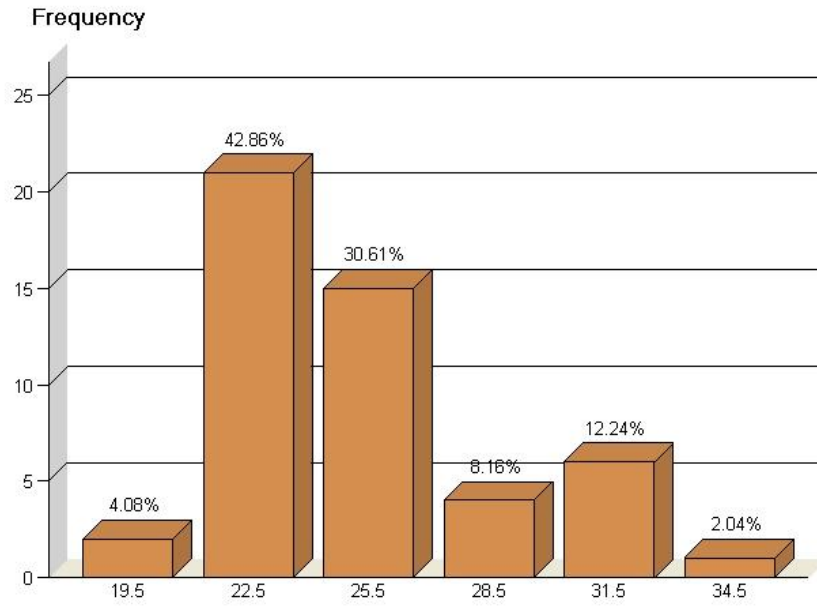


Fig.4.3 Frequency distribution of age ranges

Fig.4.3 represents the proportion of the various age ranges of the sample. The majority of students were in the 22.5 year old category (42.9%), which included the age ranges from 20 to 24 years of age. Summary statistics for the age category of the sample will be described below.

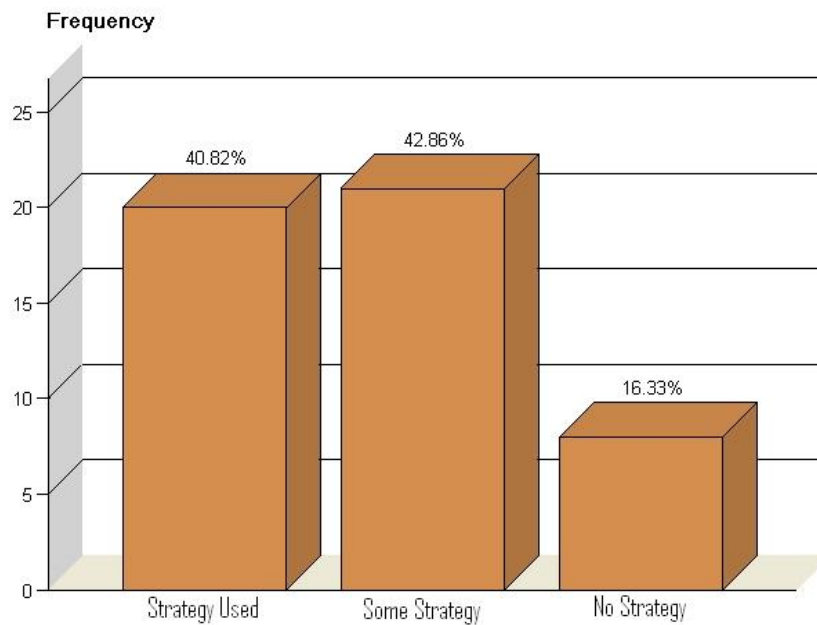


Fig.4.4 Frequency distribution of Qualitative Strategy categories of the ROCFT

Fig.4.4 represents the frequency of scores the participants received on their overall or total qualitative score for strategy in their ROCFT trials. The highest frequencies were between the categories some strategy (42.9%) and strategy used (40.8%). This indicated that most of the participants employed strategy to a varying degree in the ROCFT trials, whilst a small minority did not (16.3%).

4.4 SUMMARY STATISTICS

Summary statistics include the mean, standard deviations and variance of the inferential data for the participant's age, CEQ scores, ROCFT copy trial scores, ROCFT immediate recall scores, and ROCFT delayed trial scores (Table 4.1).

Table 4.1
Summary Statistics for Age, CEQ scores and ROCFT trials

Variable	Mean	SD	Variance	Minimum score	Maximum score	Total possible score	N
Age	24.59	3.59	12.91	19	35	-	49
CEQ	11.14	4.50	20.21	3	24	25	49
ROCFT Copy	35.43	1.02	1.04	32	36	36	49
ROCFT Immediate	26.33	5.47	29.1	10	35	36	49
ROCFT Delayed	26.45	4.74	22.49	13	34	36	49

The mean for the age of the sample (n = 49) was 24.6 years, with a standard deviation (SD) of 3.6 years. The CEQ had a mean of 11.14 with a SD of 4.50. The ROCFT trials differed in their mean scores, with the ROCFT immediate and delayed recall having similar mean scores (26.33 and 26.45 respectively). There was also greater variance in the immediate and delayed recall trials of the ROCFT, than compared with the copy trial.

4.5 INFERENCE STATISTICS

4.5.1 CRONBACH COEFFICIENT ALPHA

A measure of internal consistency of the ROCFT was performed; this was the Cronbach Coefficient Alpha (Huysamen, 1994). The Cronbach Coefficient Alpha for all the trials of the ROCFT was 0.79, indicating that the ROCFT has high internal consistency and high reliability, in these testing situations. The Cronbach Coefficient Alpha for the CEQ in the ROCFT trials was 0.76, indicating that the CEQ has high internal consistency and reliability, in these testing situations.

4.5.2 CORRELATIONS

A Spearman correlation was chosen because the data distributions were nonparametric. Age was also correlated with the scores on the ROCFT trials and the CEQ scores, as it was thought to possibly have a significant relationship with either the CEQ or the ROCFT trials.

Table 4.2
Spearman Correlation of Age, CEQ, ROCFT trials and Qualitative Strategy (N = 49)

	Age	CEQ	ROCFT Copy	ROCFT Immediate	ROCFT Delayed	Qualitative Strategy
Age	1.00					
CEQ	-0.26	1.00				
ROCFT Copy	0.029	-0.21	1.00			
ROCFT Immediate	0.12	-0.20	0.21	1.00		
ROCFT Delayed	0.15	-0.16	0.26	0.89***	1.00	
Qualitative Strategy	-0.09	0.35*	-0.09	-0.5***	-0.42**	1.00

Note: * p < .05, ** p < .01, *** p < .001

All the correlations for the ROCFT trials were one-tailed, as the various trials are theoretically all positively related (Spren & Straus, 1998).

The ROCFT correlations therefore all produce positive correlations between the trials (Spren & Straus, 1998), which have been generated between the ROCFT trials in this study. The significance values were therefore halved, when comparing the ROCFT trials with each other.

Some statistically significant correlations emerged and can be seen in the correlation matrix. There was a statistically significant strong positive relationship between the ROCFT immediate recall trial and the ROCFT delayed recall trial ($r = 0.89$, $p < 0.0001$). There was also a statistically significant relationship between the ROCFT copy and the ROCFT delayed recall trials, with weak positive relationship ($r = 0.26$, $p = 0.035$). CEQ and age just fall short of correlating significantly. No statistically significant relationships were found between the CEQ and any of the ROCFT trials.

A few significant correlations emerged with regard to the qualitative scores of strategy. Correlations with Qualitative Strategy were computed using a total base score, representing the most common type of strategy used by the person (3 = no strategy used, 2 = some strategy used and 1 = strategy used). CEQ correlated significantly with Qualitative Strategy ($p = 0.014$), the relationship was weak to moderate and positive ($r = 0.35$). Therefore the higher the scores in the CEQ, the higher the scores in Qualitative Strategy, indicating less to no strategy used. The ROCFT immediate and delayed recall trials also correlated significantly with Qualitative Strategy ($p = 0.0003$ and $p = 0.003$ respectively). Both relationships were negative and moderate ($r = -0.5$ and $r = -0.42$ respectively). Therefore as the ROCFT immediate and delayed recall scores increased the Qualitative strategy score decreased, more likely indicating more strategy used.

Independent correlations were performed on the sciences and humanities students. A spearman correlation was performed to determine whether a significant relationship exists between the scores on the ROCFT trials, the CEQ scores and age, specifically in the *sciences* students ($n = 31$).

Table 4.3
Spearman Correlation of Age, CEQ, ROCFT trials and Qualitative Strategy in
Sciences Students (n = 31)

	Age	CEQ	ROCFT Copy	ROCFT Immediate	ROCFT Delayed	Qualitative Strategy
Age	1.00					
CEQ	-0.48**	1.00				
ROCFT Copy	0.13	0.057	1.00			
ROCFT Immediate	0.26	-0.23	0.01	1.00		
ROCFT Delayed	0.27	-0.19	-0.007	0.92***	1.00	
Qualitative Strategy	-0.27	0.38*	0.17	-0.58**	-0.53**	1.00

Note: * p < .05, ** p < .01, *** p < .001

The correlation between the ROCFT immediate and delayed recall trials was statistically significant in the sciences students ($r = 0.92$, $p < 0.0001$, one-tailed). The relationship was also very strong. The correlation between age and the CEQ scores was also statistically significant in the sciences students ($r = -0.48$, $p < 0.006$), with a moderate negative relationship. There were also some statistically significant relationships with Qualitative Strategy. For instance CEQ correlated significantly with Qualitative Strategy ($p = 0.027$), the relationship was positive and weak to moderate ($r = 0.38$). Also the ROCFT immediate and delayed recall trials correlated significantly with Qualitative Strategy ($p = 0.006$ and $p = 0.002$ respectively). Both relationships were negative and moderate ($r = -0.58$ and $r = -0.53$ respectively).

A spearman correlation was then performed to determine whether a significant relationship exists between the scores on the ROCFT trials, the CEQ scores and age, specifically in the *humanities* students.

Table 4.4
Spearman Correlation of Age, CEQ and ROCFT and Qualitative Strategy in
Humanities Students (n = 18)

	Age	CEQ	ROCFT Copy	ROCFT Immediate	ROCFT Delayed	Qualitative Strategy
Age	1.00					
CEQ	0.067	1.00				
ROCFT Copy	0.10	-0.59**	1.00			
ROCFT Immediate	0.08	-0.23	0.45*	1.00		
ROCFT Delayed	0.17	-0.26	0.66**	0.87***	1.00	
Qualitative Strategy	0.16	0.32	-0.43	-0.31	-0.20	1.00

Note: * p < .05, ** p < .01, *** p < .001

The following statistically significant correlations have emerged in the humanities students: First between the ROCFT immediate and ROCFT delayed recall trials ($r = 0.87$, $p < 0.0001$). Where there was a strong positive relationship. Secondly CEQ was correlated significantly with the ROCFT copy trial ($p = 0.009$). There was a moderate negative relationship ($r = -0.59$). The ROCFT copy trial correlated significantly with the ROCFT immediate recall trial (one sided $p < 0.034$), where there was a moderate positive relationship ($r = 0.45$). The ROCFT copy trial also correlated significantly with the ROCFT delayed recall trial ($p < 0.003$). The correlation was also a moderate to strong positive relationship ($r = 0.66$).

It appears that the correlation between the ROCFT immediate and ROCFT delayed recall trials was slightly stronger amongst the sciences students than the humanities students. However many more correlations have emerged in the humanities students than the sciences students. The small sample size ($N = 18$) needs to be taken into consideration with regards to these correlations.

3.5.3 NONPARAMETRIC ANALYSIS OF VARIANCE [ONE WAY ANOVA]

Because the data distributions are not-normal a nonparametric analysis of variance (one way ANOVA) was used to determine the differences in variance in the different academic groups. The Wilcoxin Two Sample Test was used, as there were only two categories in the academic groups: sciences and humanities students (Howell, 2004). The IV was academic degree: humanities students (N= 18) and sciences students (N = 31). The dependant variables were the CEQ score and the various ROCFT trial scores. No significant differences based on degree were found (see Appendix I)

4.5.4 QUALITATIVE CATEGORIES OF STRATEGY IN THE ROCFT TRIALS USED TO CLASSIFY CEQ AND ROCFT TRIAL SCORES

Statistics were performed to determine whether qualitative categories derived from the ROCFT analysis may provide further information about the relationship between the CEQ scores and the various ROCFT Trial scores. The three qualitative categories were: 1) *Strategy Used*; 2) *Some Strategy Used* 3) *No Strategy Used*

The following graph reveals the percent of scores that participants received in the Qualitative categories in the ROCFT for strategy, across the copy, immediate and delayed recall trials:

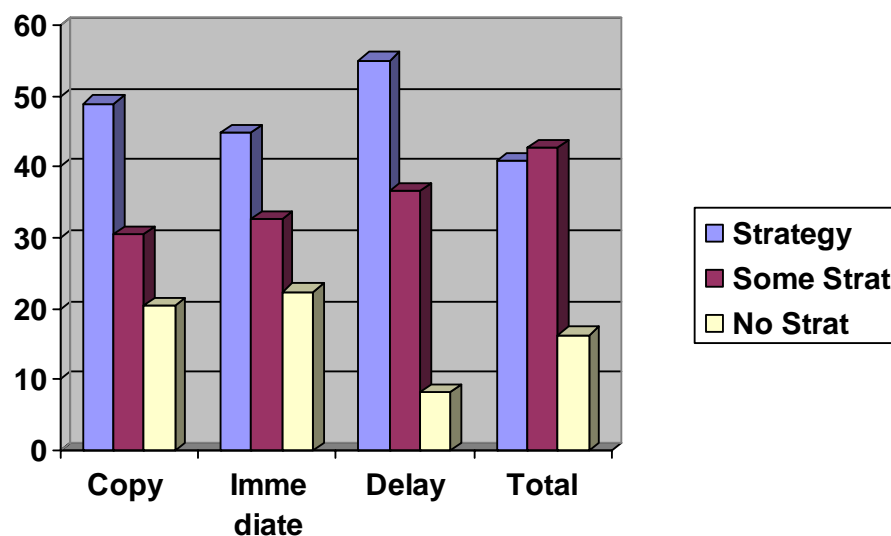


Fig.4.5 Graph of qualitative scores of strategy in the ROCFT

The graph illustrates the trend in strategy use across the various ROCFT trials. The first sequence is the ROCFT copy trial, then the ROCFT immediate recall trial and thirdly the ROCFT delayed recall trial. The last sequence or group of bars represents the overall strategy used by the sample. These totals were analysed using Spearman correlations and a nonparametric one-way ANOVA, which is further detailed just below. Only the ‘Total’ strategy category was used to generate further statistics. The reason for this is that the ‘Total’ strategy category incorporates the overall strategy used by the participants in the copy, immediate and delayed recall trials of the ROCFT.

4.5.5 CORRELATIONS WITHIN QUALITATIVE CATEGORIES

The qualitative categories formed three groups: *strategy used (1)*, *some strategy used (2)* and *no strategy used (3)*. Each had their own individual Spearman correlations for the variables. So that Spearman correlations were then performed in each qualitative group for: age, CEQ scores and ROCFT trial scores.

4.5.5.1 STRATEGY USED CATEGORY

Table 4.5

Spearman Correlation of Age, CEQ and ROCFT in Strategy Used Category (n = 20)

	Age	CEQ	ROCFT Copy	ROCFT Immediate	ROCFT Delayed
Age	1.00				
CEQ	-0.16	1.00			
ROCFT Copy	0.07	-0.24	1.00		
ROCFT Immediate	0.13	-0.02	0.09	1.00	
ROCFT Delayed	-0.07	0.25	-0.06	0.75***	1.00

Note: * p < .05, ** p < .01, *** p < .001

The only statistically significant correlation that emerged in the *strategy used* category and can be seen in the correlation matrix is the relationship between the ROCFT immediate recall trial and the ROCFT delayed recall trial ($p < 0.0001$). There is also a strong positive relationship ($r = 0.75$). All other correlations in this matrix are statistically non-significant.

4.5.5.2 SOME STRATEGY USED CATEGORY

Table 4.6

Spearman Correlation of Age, CEQ and ROCFT in *Some Strategy Used Category* (n = 21)

	Age	CEQ	ROCFT Copy	ROCFT Immediate	ROCFT Delayed
Age	1.00				
CEQ	-0.45*	1.00			
ROCFT Copy	0.03	-0.23	1.00		
ROCFT Immediate	0.05	-0.16	0.11	1.00	
ROCFT Delayed	0.22	-0.28	0.35	0.89***	1.00

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

The Spearman correlation revealed the following statistically significant correlations in the *some strategy used* category: First between the ROCFT immediate and ROCFT delayed recall trials ($r = 0.89$ $p < 0.0001$). Secondly CEQ is correlated significantly with age ($p < 0.043$). There is also a moderate negative relationship ($r = -0.45$).

4.5.5.3 NO STRATEGY USED CATEGORY

Table 4.7

Spearman Correlation of Age, CEQ and ROCFT in *No Strategy Used Category* (n = 8)

	Age	CEQ	ROCFT Copy	ROCFT Immediate	ROCFT Delayed
Age	1.00				
CEQ	-0.27	1.00			
ROCFT Copy	0.06	0.23	1.00		
ROCFT Immediate	0.06	0.22	0.46	1.00	
ROCFT Delayed	0.43	0.22	0.41	0.79**	1.00

Note: * p < .05, ** p < .01, *** p < .001

The Spearman correlation revealed the following statistically significant correlation in the *some strategy used* category: The ROCFT immediate and ROCFT delayed recall trials scores correlated significantly, with a strong positive relationship ($r = 0.79$ $p < 0.0195$).

4.6 ANALYSIS OF VARIANCE FOR QUALITATIVE DATA AND PERFORMANCE IN THE ROCFT [ONE-WAY ANOVA]

A nonparametric One-Way ANOVA was performed using the qualitative categories as independent variables classified by the scores the students received for age and on the ROCFT trials and on the CEQ. Kurskal-Wallace statistics have been provided, as there were more than two categories in the independent variable (Howell, 2004). No significant differences on the CEQ, ROCFT copy or immediate recall were found (see Appendix H).

ROCFT delayed recall trial classified by qualitative categories.

The Kurskal Wallace Test was statistically significant: Chi-Square = 8.63, $p = 0.013$
($p > \text{Chi-Square}$)

Table 4.8

**Kruskal-Wallis Nonparametric one-way ANOVA of ROCFT Delayed recall
classified by Strategy**

CHI-SQAURE	8.6248
DF	2
$p > \text{Chi-Square}$	0.0134

The Qualitative Strategy categories determine the delayed recall of the ROCFT.

Chapter 5 DISCUSSION

5.1 INTRODUCTION TO DISCUSSION

The study's aim was to examine the relationship between visual memory distortion and fantasy proneness. It examined aspects of visual memory recall in terms of accuracy of recall and the degree of visual memory distortion, according to the ROCFT, as well as strategy used in visual memory recall, and related this to fantasy proneness, according to the CEQ. The discussion has examined these aims, by comparing the study's statistical findings and the theoretical arguments.

The various statistical results have been discussed, in this section, with regards to the theory that suggests there is a link between visual memory processing and distortion with fantasy proneness. The discussion has first examined the various relationships between visual memory distortion in the ROCFT, such as immediate and delayed memory recall distortions and their relationship with fantasy proneness in the CEQ. It has also examined strategy in the ROCFT and how it relates to the relationship between visual memory distortion and fantasy proneness. It has then examined the fantasy proneness construct in the South African context. The ROCFT and visual memory distortion have then been discussed specifically. Lastly the ROCFT has been discussed with regards to the specific sample of university students used in this study compared with overseas studies, in an attempt to provide various aspects of normative data for future research.

5.2 RELATIONSHIP BETWEEN FANTASY PRONENESS AND VISUAL MEMORY DISTORTION

No significant relationships in this study's sample of university students $N = 49$, were found in the Spearman correlations between fantasy proneness and visual memory distortion as measured by the CEQ and ROCFT respectively. The data therefore suggest that the link between visual memory distortion and fantasy proneness is not as specific or clear as suggested by the literature. However when the sample was split

between the academic groups of the sciences ($N = 31$) and humanities students ($N = 18$), there was one significant negative relationship between the CEQ and the ROCFT copy trial in the humanities students ($r = -0.59$, $p = 0.009$). However this relationship has not been previously conceptualised by any of the literature.

The literature expresses that the most direct link between visual memory distortion and fantasy proneness is in the cognitive processing of imagery (Aleman & Haan, 2003; Merckelbach et al., 2001). If this link between fantasy proneness and visual memory distortion is in the cognitive processing of imagery (Aleman & Haan, 2003), then the methods of examination and the tools used to correlate visual memory distortion and fantasy proneness may not have been adequate. There may have been many aspects of imagery not conceptualised to be measured by the ROCFT or the CEQ. The ROCFT only measures memory for object vision and object reconstruction (Woodrome & Fastenau, 2004). Semantic aspects of imagery or the other possible symbolic aspects of imagery (Sternberg, 1999), are not measured by the ROCFT. These would be the propositional components of imagery that would not be assessed by the ROCFT, as it measures visual perceptual and visual memory difficulties specifically (Woodrome & Fastenau, 2004). For example the ROCFT task is focused on an individual's ability to redraw the figure, which is an abstract geometrical construction (Lezak, 1995). The process of forming a memory of the ROCFT lacks many of the contextual features relevant to a richer semantic and symbolic memory (Brown & Craik, 2005); the individual is told to only remember the figure and to only concentrate on recalling and redrawing the figure. Also the CEQ as a construct may not have enough representative questions to assess the memory aspects of fantasy proneness that are purely visual or analogical in nature. For example there are only three questions in the CEQ that focus directly on memory [Questions, 13; 16; and 17, Appendix C].

5.2.1 IMMEDIATE AND DELAYED RECALL AND FANTASY PRONENESS

In terms of visual memory processing, the immediate recall aspect of the ROCFT did not correlate with the CEQ scores. This indicates that there is no apparent significant relationship between STM and fantasy proneness measured by the CEQ. This means

that the cognitive processes involved in the movement of a percept from perception to storage are either not clearly linked or are not linked at all to fantasy proneness. Therefore a person who is fantasy prone does not have an advantage or disadvantage in the immediate recall and construction of a visual object. Because STM here has been dealing primarily with visual perceptions, it may also suggest that the forms of representation that perceptions have cognitively, are different to that of imagery. This is counter to Nigel's (1999) view that perception and imagery are alike. In a paper by Nigel (1999) on the 'active perception approaches' to imagination, it is expressed that imagination emerges not from the 'traditional' symbolic computational model's view, but rather through active perception and its processing. However the data and relationship between fantasy proneness and STM suggests rather that the processing of perception in short term memory appears to be different to imagined visual experience. It may also support neuropsychological evidence that imagery and perceptions are processed separately in the brain. As indicated by Behrman, et al. (1992) in their case of C.K., which showed that the neural systems dealing with object perception are different from those dealing with the generation of images.

In terms of the LTM processing, the delayed recall on the ROCFT also did not correlate significantly with the CEQ scores (N = 49). There may therefore be no relationship between LTM processing as measured by the ROCFT with aspects of fantasy proneness, measured by the CEQ. Therefore the data suggests that the storage of imagery may not be the same as the imagining of imagery. So that imagination and fantasy may not have the same components or type of cognitive characteristics that visual LTM would have with regards to the processing of imagery. Fantasy and imagination may in fact have a more propositional and symbolic content, than an analogical content. Perception may also either be stored as images or as propositions (Nigel, 1999). If perceptions and imagery have different cognitive content, then the CEQ and the ROCFT may be measuring different aspects of cognition that are not linked. This may appear to further remove fantasy and imagination from being connected to visual memory processing and distortion. The reason for this is that they may be structured more differently cognitively, in terms of their storage characteristics and processing features. This suggests that the *dual code hypothesis* (Paivio, 1971; Sternberg, 1999; Brown & Craik, 2005), which describes how visual memory shares characteristics of both forms of cognitive processing, that is both

analogical and propositional processing, fails to provide a link between visual memory distortion and fantasy proneness. However the absence of a relationship between perceptions in LTM and imagery, with regards to discrepancies in their cognitive content, may also be due to the methods of measurement used in this study. The ROCFT is an abstract object, and imagination, imagery and fantasy may be linked or may overlap more with meaningful objects that have predominantly contextual and semantic features or aspects to them (Brown & Craik, 2005).

5.2.2 COPY ASPECT OF THE ROCFT, VISUAL CONTRUCTION AND FANTASY PRONENESS

The copy aspect of the ROCFT did not correlate with the CEQ scores either. This suggests that the constructional and spatial aspects of visual processing do not correlate with fantasy proneness. However the correlation between the CEQ scores and the ROCFT copy trial scores in the humanities student's group (N = 18) was significant, when the sample was split between the humanities and sciences students. The relationship was a moderate negative correlation ($r = -0.59$, $p < 0.0094$). This indicates that increases in fantasy proneness correlate with lowered copy ability, which means that art students, who score high in fantasy proneness will perform more poorly on visual construction tasks than art students who score low in fantasy proneness. Some of the humanities students, who scored high on fantasy proneness, may support the hypothesis that in fantasy prone individuals, mental images and percepts are less distinctive from each other with regard to their sensory characteristics (Johnson & Raye, 1981; Johnson, et al., 1993).

Therefore humanities student's who are high in fantasy proneness are likely to have affected mental imagery ability (Aleman & Haan, 2003). They may perceive the ROCFT object, yet because discriminating between a mental image and a percept is more difficult, they perform poorly in copying the figure. The copy task also needs precision, and high fantasy proneness scores may indicate high scores in imaginal ability (Aleman & Haan, 2003) which would be likely to interfere with a capacity to be precise in the copy task of the ROCFT. The relationship, in the humanities students, between the CEQ scores and the copy task of the ROCFT may be because

many of the humanities students performed the tasks in a particular way, which has not been assessed in this study, and which was different to the way the sciences students performed on the same tasks. The small sample size of the humanities student group may also have contributed to these results, as the smaller the sample size the greater the possibility for statistical anomalies (Howell, 2004).

Therefore visual memory distortion measured by the ROCFT, from the copy trial, immediate recall trial and the delayed recall trial do not correlate with the fantasy proneness measured by the CEQ. The cognitive processing of perception has been established to be different to that of mental imagery.

5.2.3 EXECUTIVE PROCESSES IN VISUAL MEMORY DISTORTION AND FANTASY PRONENESS

Another point of departure that may account for the absence of a link between visual memory distortion and fantasy proneness measured in this study, are the executive processes that are not measured in this study and not specific to visual memory. These processes may involve the cognitive mechanisms described in the role of reality monitoring errors. Reality monitoring errors refers to a person's endorsing imaginary events for real events or failing to discriminate between real and imagined events (Johnson & Raye, 1981; Perner, 2005). This may often happen with visual information, but the processes responsible are largely executive processes (Marcia, et al., 2000 cited in Hirstein, 2005). For example reality monitoring errors have little to do with retrieval failures or problems accessing visual memory, but rather with the executive process that focus on correction failure (Hirstein, 2005). The processes of recollection and re-construction of perceptual experience also utilize the executive systems of frontal lobe functioning (Brown & Craik, 2005). As we do not store discrete episodes of visual memory experience, but rather a collection of representations that executive processes must control in the reconstruction process that takes place when we remember (Hirstein, 2005). This hypothesis is more in line with Merckelbach et al.'s (2001) view, that reality monitoring errors play a significant role in fantasy proneness, rather than Aleman and Haan's (2003) view, that fantasy proneness has more to do with processing object imagery and therefore visual memory.

The ROCFT does not detect reality monitoring errors or the executive processes that may contribute to reality monitoring. The ROCFT testing procedure also lacks many of the semantic and contextual features that appear important in the process of reality monitoring and for the effects it can have on memory distortion (Perner, 2005). The contextual and semantic features that would be necessary for visual memory, and the executive processes involved in reality monitoring, would include a full experience of a situation that includes many visual features that have relevance to previous experience and are meaningful (Schacter, Harbluk, & McLachlan, 1984; Brown & Craik, 2005). The CEQ measures fantasy proneness and not necessarily all the specific aspects of reality monitoring, as it does not explicitly distinguish between imagined and real events (Merckelbach, et al., 2001 Aleman & Haan, 2003). Therefore the ROCFT and the CEQ may not be measuring the right executive constructs that necessarily link fantasy proneness with visual memory distortion.

Although some executive processes involved in the reconstruction and retrieval of memory may be assessed by the ROCFT, it may not be an appropriate measure of reality monitoring errors, and it may only be able to assess the executive processes that control for the reconstruction of visual memory specifically. The ROCFT has only a limited ability to measure executive processes and is mostly used to measure organizational ability (Westervelt et al., 2000), and this may not reflect on its ability to represent all the cognitive errors involved in reality monitoring errors or reconstruction errors that entail the executive processing that may link fantasy proneness with visual memory distortion.

5.2.4 OTHER COGNITIVE PROCESSING DIFFICULTIES IN VISUAL MEMORY DISTORTION AND FANTASY PRONENESS

There are other aspects of the cognitive processing of memory besides the executive processes, which may be responsible for fantasy proneness, which would also contribute to the non-significant relationship it has with visual memory in this study. It is possible that visual memory is encoded as semantic information, in propositional information processing (Sternberg, 1999), and it may be this type of visually encoded

and stored memory that is linked with fantasy proneness. Because the ROCFT does not measure the semantic aspects of visual memory, it fails to reveal a link. It may be that the CEQ does not access the semantic aspects of visual information either. The relationship between fantasy proneness and visual memory may lie only in the semantic link which was not measured in this study, which would incorporate the symbolic meanings that either imagined or visual information has for the person (Sternberg, 1999). The semantic aspects of fantasy and visual memory appear to relate to the conscious experience and vividness of fantasy experiences (Aleman & Haan, 2003) and the detailed reports of fantasy material (Merckelbach, 2003).

Horselenberg, Merckelbach, Muris, Sijnsenaar and Spaan (2000), examined the connection between the CEQ and a person's capacity to endorse socially desirable responses in a 33 item Social Disability Scale (Crown & Marlow, 1964, in Merckelbach et al., 2001), as a measure of imagination inflation in a group of students ($n = 79$). They found no correlation between the CEQ and scores on the Social Desirability Scale ($r = 0.03$). Therefore the CEQ does not appear to correlate with either memory illusions or memory distortions, which have been considered to be linked (Roediger & McDermott, 2005). Memory illusion occurs when memory for specific events or occurrences are distorted through the process of imagination inflation (Roediger & McDermott, 2005). Imagination causes an inflation of the contents of the memory recollection process. When recalling a specific event our imaginations affect the content, by either distorting or confabulating memories of or for that event respectively. Therefore we may even imagine events that did not really occur and treat those events as real memories (Garry, et al., 1996). This does not appear to happen with regards to fantasy proneness and therefore may be one of the reasons for it not having a link with visual memory distortion, as there are no correlations with either construct with fantasy proneness, even though, theoretically, visual memory distortion and imagination inflation are linked (Roediger & McDermott, 2005).

5.2.5 QUALITATIVE STRATEGY IN THE ROCFT AND FANTASY PRONENESS

There was a significant moderate correlation between the CEQ and the Qualitative Strategy scores of the ROCFT in both the entire sample of students ($n = 49$, $r = 0.35$, $p = 0.014$) and the sciences students in the sample ($n = 31$, $r = 0.38$, $p = 0.027$). Qualitative Strategy represents the organisation and strategy used by the students and therefore represents executive aspects of the ROCFT performance. However there was no direct correlations between the CEQ and the ROCFT and the corresponding theory discussed suggests that the link may only be in the executive processes that are not directly part of visual memory or visual and imaginal processing (Aleman & Haan, 2003; Merckelbach et al., 1999). This relationship between Qualitative Strategy and fantasy proneness, may therefore suggest that the link is indirect and in the executive processing, which may overlap with both visual memory and fantasy proneness. Although this relationship between Qualitative Strategy and the CEQ may confirm a link between fantasy proneness and visual memory in the executive processes of strategy and organisational ability, it appears to be contrary to the findings that the ROCFT and the CEQ are related. It therefore may only suggest that there is an indirect link between the strategy involved in visual memory processing and fantasy proneness.

The relationship between Qualitative Strategy and the CEQ was a moderate positive correlation. Because higher scores in qualitative strategy indicate less to no strategy used, it may be reasonable to expect such a correlation between Qualitative Strategy and the CEQ. So that increases in fantasy proneness lead to decreases in strategy performance. This would tie in with the theoretical suggestions that have described how fantasy proneness affects executive processes. For example most theory suggests there is generally a decrease in ability to reality monitor and there are more cognitive errors with higher scores of fantasy proneness, which supports the inverse effect that fantasy proneness has on executive functioning (Merckelbach et al, 1999, Merckelbach, Muris, & Rasin, 1999).

There was no significant relationship in the humanities students ($n = 18$, $p = 0.199$) between the CEQ and Qualitative Strategy scores of the ROCFT. This may suggest that the link between the CEQ and Qualitative Strategy has something to do with the way in which the sciences students completed the ROCFT in terms of strategy, where the humanities students did not. However the difference in the significance of the correlations in the CEQ and Qualitative Strategy in the sciences and humanities students may also have something to do with the different sample sizes of the two groups and possible factors not controlled for in this research, for example some of the characteristics of the compositions of each group of students. LTM measured by the ROCFT did not correlate significantly with the CEQ, where the Qualitative Strategy component correlated significantly with the CEQ, which supports the hypothesis that fantasy proneness and visual memory are not linked directly, but are affected by the executive processes involved in both (Merckelbach et al., 1999; Merckelbach, 2004)

Although there is a relationship between Qualitative Strategy and the CEQ in the sciences students and the total sample group, it appears that the link may have little to do with visual memory performance and more to do with the strategic processes involved in the reconstruction or construction of images or perception, than actual memory processing itself.

The Qualitative Strategy aspect of the ROCFT consisted of only three dimensions of measurement. A more sensitive analysis may be needed between the CEQ and various areas of strategy that are more specifically defined, that were not accurately detected or analyzed by the particular Qualitative Strategy construct used in this study.

These relationships also support the idea that the link may lie more with processes of construction, rather than with the cognitive processes involved in memory formation. So that the ability to reconstruct an event through the active selection of information (Hirstein, 2005) governed by executive processes or the ability to discriminate

between visual memory and imaginative material as a function of executive processes may be inversely linked to fantasy proneness (Merckelbach et al., 1999; Merckelbach et al., 2001), rather than memory or visual memory itself (Aleman & Haan, 2003).

However there was a significant relationship in the Kruskal-Wallis one-way ANOVA in the ROCFT delayed recall scores classified by Qualitative Strategy ($p = 0.013$). This suggests that there is a link between the strategy and executive processes measured in this study and the ROCFT. So that although the link between fantasy proneness appears to be with the more executive aspects, such as strategy, strategy still has an effect on delayed visual memory recall performance. This may suggest that although visual memory distortion and fantasy proneness are not directly linked, both are affected by executive processes, most likely involved in strategy and planning. This executive process may be somewhat interdependent to both visual memory and fantasy proneness, responsible for aspects of each of their processing, yet not directly linked or related in the same way to either fantasy proneness or visual memory and its distortion.

The data also suggests that it is possible that there is no link between visual memory distortions specifically and fantasy proneness. The instruments may have adequately indicated this, at least between the CEQ and the ROCFT. There has been no direct, significant link or relationship indicated throughout this study between the ROCFT as a measure of visual memory distortion and the CEQ, to indicate that visual memory distortion in either STM or LTM processing is related with fantasy proneness.

5.3 FANTASY PRONENESS

There is no normative data available or published in South Africa on fantasy proneness, specifically in terms of the CEQ. This study may provide some normative data on South African university students.

The prevalence of fantasy proneness appears to indicate some differences compared with the previous study performed by Merckelbach et al, (2001) to provide a normative sample group on Dutch Students (N = 14). The mean score in the Merckelbach et al. (2001) study for re-test reliability was 7.7 (S.D.=4.7) and 7.1 (S.D.=4.5), respectively. A mean score of 8.3 (S.D. = 3.9) was also found in another sample of students (N = 116). The mean score for the students in this study (N = 49) was 11.1, with similar standard deviation (S.D.=4.5) to the previous study by Merckelbach et al, (2001). Compared with the Merckelbach et al. (2001), there is a significant difference in the levels of fantasy proneness found in this study. The data suggests that South African students in general score higher on fantasy proneness than overseas student populations. However various variables need to be taken into consideration, such as the cultural validity of the CEQ measure, how representative the sample was in the Merckelbach et al. study (2001) and in this study, and the size of the samples in both the studies, which may all have affected the scores obtained in the CEQ measures.

It is interesting to note, that when the sample was split between the sciences and humanities students, the correlation between age and the CEQ scores was statistically significant in the sciences students (n = 31, < 0.006), with an average negative relationship (r = -0.48 p). This indicates that the younger the science student the higher the CEQ score, which would mean that the younger sciences students were more fantasy prone. Age as a factor is not discussed with regards to the CEQ, in other studies, in terms of data or literature to substantiate any theoretical understanding behind this relationship.

A similar result was found in the *some strategy used* correlation category, where CEQ was correlated significantly with age (p < 0.043). There was also a moderate negative relationship (r = -0.45). Both the correlations between age and the CEQ, in strategy use and in the sciences students indicate that the younger the participant the higher the score on the CEQ.

These two findings have produced similar negative relationships between age and CEQ scores, and both are statistically significant for the relationship between fantasy proneness and age. Further research may be useful in exploring various hypotheses around types of strategy used, with regard to age and fantasy proneness or those students studying the sciences and the relationship between age and fantasy proneness. It may also be interesting to consider that there may even be a relationship between the strategy used and sciences students with regards to age and fantasy proneness, given the similarity in the strength of the relationship. However the significance of the relationship was marginally different, suggesting that there may be more differences than similarities to aspects of the sciences students and the type of strategy the students used, that are being measured and correlated between age and the CEQ.

5.4 THE ROCFT TRIALS AND VISUAL MEMORY DISTORTION

Many significant correlations emerged with regards to the immediate and delayed recall trials of the ROCFT. For instance on the correlation matrix with the total sample, the relationship between the ROCFT Immediate Recall Trial and the ROCFT Delayed Recall Trial was significant and the relationship was both positive and very strong ($r = 0.89$, $p < 0.0001$). The relationship between the immediate and delayed recall throughout the statistical analysis remained significant and all the correlations were strong positive relationships. This was observed in all the Qualitative Strategy and Academic (sciences and humanities) groups. The results between the immediate recall and the delayed recall suggest that the ROCFT accurately measured visual memory as a construct between the STM and LTM visual processes of the test. The ROCFT was therefore accurate in this study for both picking up memory distortion and for providing normative statistics for the immediate and delayed recall trial correlations for future studies.

In the humanities students ($n = 18$) the ROCFT Copy trial correlated significantly with the ROCFT Immediate recall trial (one sided $p < 0.034$), with a moderate positive relationship ($r = 0.45$). The ROCFT Copy Trial also correlated significantly with the ROCFT Delayed Recall Trial ($p < 0.0031$), in the humanities students.

The correlation was also a moderate to strong positive relationship ($r = 0.66$). This indicates that the copy trial in the humanities students represented and was related to the same cognitive processes responsible for visual memory in the immediate and delayed recall trials. The ROCFT trials appeared to measure visual memory processing and distortion most consistently compared with the sciences students ($n = 31$) and the total sample ($n = 49$).

In terms of the one-way ANOVA's, only one significant difference was found between the groups of the ROCFT classified by Qualitative Strategy. The significant difference was found in the delayed recall trial ($p = 0.013$). This indicates that Qualitative Strategy measured in this study affects the performance on the delayed recall of memory on the ROCFT. This may indicate that Qualitative strategy is essential in the ROCFT delayed recall performance and is an important component in completing the delayed recall of the ROCFT.

5.5 THE ROCFT IN A SOUTH AFRICAN POPULATION OF UNIVERSITY STUDENTS

Most studies examining visual memory using the ROCFT use clinical populations where there is a presence of neuropsychological impairment (Lezak, 1995). The normative data comes from control groups in these clinical studies. There is no published normative population data available for South African populations. This data may therefore be useful as representing normative data for a non-clinical population of university students in South Africa. However the sample size in this study is small ($N = 49$), which may affect the validity of the samples contribution to normative data for a non-clinical population of university students. The reason for this is that a sample size approaching less than 50 generally starts to affect the distribution and the normality of the sample (Howell, 2004), where in the case of this study the distribution was not normal. However nonparametric statistical analyses should correct for not-normal distributions (Howell, 2004).

The most significant ($p < 0.0001$) and very strong correlation ($r = 0.89$) in the sample $n = 49$ produced by this study, was between the immediate and delayed recall of the ROCFT. This suggests that both these aspects of the ROCFT were very strongly linked in measuring visual memory. It also suggests that a good reproduction of the immediate recall trial will lead to a good reproduction on the delayed recall trial.

Other correlations in the sample $n = 49$ that emerged were between the copy trial and the delayed recall trial (0.035 , $r = 0.26$). The relationship was significant but was not as strong as the relationship between the immediate and delayed recall trials. The relationship between the copy trial and the delayed recall trial suggest that the better the figure was copied, the better the person was able to recall the figure later on, after a 25 minute period of delay. However the copy trial did not correlate with the immediate recall trial, which may suggest that they are not linked in terms of measuring the same aspects of visual memory and visual cognition. This would suggest that copying the figure did not relate to the immediate reproduction of the figure from memory. However immediate recall was more strongly linked with delayed recall, in terms of the strength of the relationship that emerged in the correlation, which would suggest that the immediate recall may better predict delayed recall in terms of visual LTM performance than the copy task of the ROCFT. This data would be useful, as the correlations produced by this study may be used as normative data for future studies that may use the ROCFT in a correlation; specifically with South African student groups.

The study produced various mean and standard deviation scores for the various aspects of the ROCFT trials, which may be used as normative data for South African student populations. In terms of the means and standard deviations of the ROCFT trial scores in this study ($n = 49$), there was some differences with regard to the data produced in other studies. For example in Spreen and Strauss' (1998) study in the age group of students 20-29, they found a mean of 33.7 ($SD=1.59$) for copy performance and 21.8 for delayed recall performance ($SD=6.56$). In this study ages 19-35, with a mean age of 25 years, the mean for the copy trial was 35.4 ($SD 1.02$) and the delayed recall trial was 26.45 ($SD 4.74$). The results differ significantly from each other. The Ferraro et al., (2002) study on a similar number of undergraduate students ($N = 48$) also report significantly different findings, with a mean copy performance of 32.51

($SD=3.05$) and mean recall performance of 23.69 ($SD=5.76$). There may be many reasons for the difference in means. One of the differences may be the variability of the age of the students in this study. There may also be the effects of the differences in the type of students, as those used in the Spreen & Straus (1998) and Ferraro et al., (2002) study were undergraduates, whereas those in this study were mostly post graduates.

The copy task and the delayed recall task are generally the only trial aspects of the ROCFT needed to measure visual memory recall and its distortion (Lezak, 1995). Therefore in terms of the immediate recall trial's means and standard deviations, there was limited data, as the immediate recall trial is often not used as a standard procedure of the ROCFT (Lezak, 1995). However the results on the immediate recall in this study have been compared with studies by Tombaugh and Hubley (1991) on the similarities between the ROCFT and the TCFT (1991), were they obtained a mean score for the immediate recall trial of 23.5 ($SD = 5.1$), for undergraduate students ($N = 33$) enrolled in third year psychology courses. This is different from the immediate recall mean score of 26.3 ($SD = 5.5$), obtained in this study. Again the students in this study outperformed the students in the Tombaugh and Hubley study (1991). The reason for the differences may come in the differences between the samples, in terms of the size of this sample and the difference between the samples level of study.

It was interesting to find that no relationships between ROCFT scores on the various trials correlated with age. This appears to be contrary to the theory that suggests that age has a negative relationship or even negative direct effect on ROCFT performance (Lezak, 1995).

From the data on the means and standard deviations of this studies sample compared with a few other studies means and standard deviations for overseas students, the South African students generally performed better. The reasons for the higher scores achieved by the South African students merits further investigation, as there may be many variables contributing to these differences.

5.6 LIMITATIONS OF THE STUDY

The small sample size of this study may have had an effect on the statistical results of the data analysis (Howell, 2004). It also limits the generalizability of the findings (Vadum & Rankin, 1998). The sample was drawn from a population of students, which also limits the generalizability of the findings, as the student population is different to other populations, in terms of educational level. Especially considering that the majority of the students assessed in this study were at a postgraduate level.

Non-probability convenience sampling was the method used to acquire the students for testing. The students, who participated, also chose to participate. Many of the participants were colleagues and friends of those who had already participated (through a snowball sampling process). There was therefore no randomization in the sampling process, which may also have affected the generalizability of the findings, as the sample may contain selection biases, in terms of students who willingly choose to participate in research (Neuman, 1997).

The sample also consisted mostly of postgraduate students, whereas most of the available research only provided norms for the CEQ (Merckelbach, et al., 2001) and the ROCFT (Spren & Struas, 1998; Lezak, 1995), which focused predominantly on undergraduate students. This may have affected the comparisons between this study and others that have a different sample profile. It may also have contributed to some of the differences obtained in the results in the ROCFT and the CEQ (described above in discussion section).

The research design was non-experimental, which although suited the methods of investigation and data collection, it has limited the strength of the study, in terms of the investigation of the relationship between fantasy proneness and visual memory distortion, as only relationships may be discussed and not whether there are any causal links.

Nonparametric statistical analyses were done because most of the data distributions were not normal. Nonparametric statistical analyses are generally weaker than parametric analysis, and may not have been as sensitive or powerful in computing the various statistics (Howell, 2004).

There was no standardization of the qualitative scoring method used in this study. The procedure for determining the qualitative aspects of each ROCFT trial was structured by the researcher, but relied more on subjective interpretations of the patterns and order of color use, rather than a standardized and tested procedure. There may therefore be poor validity with regards to this procedure's capacity to adequately evaluate the strategy of the participants visual memory recall.

Although the ROCFT measures visual memory recall and distortion, it does not measure the symbolic, contextual (Brown & Craik, 2005) and the propositional (Baddeley, 1990) aspects of memory. The instruments may therefore not have adequately been able to establish a link in the data between visual memory distortion and fantasy proneness.

The CEQ has not been normed or used in South Africa and the literature and current data describing this scale of measurement for fantasy proneness, is limited (Merckelbach, et al., 2001).

The relationship between fantasy proneness and visual memory distortion was examined broadly. The relationship appears to be far more complicated than conceptualized by this study. The CEQ and the ROCFT only measure specific constructs that are not related. The more specific aspects or features that may connect the two constructs were not examined. For example the imaginal processing aspects of each (Roediger & McDermott, 2005; Aleman & Haan, 2003) or the executive processes that may relate to both, such as in reality monitoring errors (Merckelbach et al., 1999) or other cognitive errors not necessarily part of memory processing (Merckelbach et al., 1999b.).

The study has limited clinical implications. The sample was a 'normal' group of students, with no head injuries. The absence of psychoactive medication, as an exclusion criterion, has been assumed to exclude most of the participants from psychiatric illness. The study added little to research on dissociation and the clinical understandings of visual memory distortion and fantasy proneness.

5.7 FURTHER RESEARCH

It appears that further research is needed to investigate the executive processes that appear to overlap, and which have been suggested by the literature (Aleman & Haan, 2003; Merckelbach et al., 1999), between visual memory distortion and fantasy proneness.

Future research may also focus more specifically on other areas of the cognitive and neuropsychological processes of memory that may link with fantasy proneness. Some of these points of exploration may be the areas that are primarily not visual or a focus on the verbal memory systems (Baddeley, 1990). Future research may also examine more broadly a whole array of memory constructs and processes and attempt to correlate these with fantasy proneness.

Further research should consider using a larger sample size. A more systematic research design is also required in order to increase the strength of the study in determining the possible relationships or links between the constructs of fantasy proneness and visual memory distortion. These designs might be more experimental (Neuman, 1997).

Also the results obtained between the sciences and humanities students, needs further investigation. Future research may incorporate theory and design features into their study to further investigate the differences, similarities and unique findings each of these groups achieved in this study. For example the following merits further investigation: in the sciences students a significant positive strong correlation was achieved between the ROCFT immediate and delayed recall trials; a moderate negative relationship between their age and CEQ scores; a positive moderate relationship between their CEQ scores and Qualitative Strategy; and lastly the ROCFT immediate and delayed recall trials which also correlated negatively and moderately with Qualitative Strategy. In the humanities students the following was observed and merits further investigation: first a significant positive strong correlation was achieved between the ROCFT immediate and delayed recall trials; secondly there was a moderate negative relationship between the CEQ and the ROCFT copy trial; the ROCFT copy trial also correlated significantly with the ROCFT immediate recall

trial, where there was a moderate positive relationship; lastly the ROCFT copy trial also correlated significantly with the ROCFT delayed recall trial. The correlation was also a moderate to strong positive relationship.

The Qualitative Strategy category may be further tested and evaluated in other studies, especially to determine its validity and reliability.

5.8 IMPLICATIONS OF THE STUDY

The study has provided evidence to suggest that there is no direct relationship between visual memory distortion and fantasy proneness. This study may therefore bring more clarity to some of the debates around visual memory distortion and fantasy proneness. For example it suggests that executive process may play a much larger role in the processes of fantasy proneness. It also suggests that visual memory distortions alone are not affected by fantasy proneness or seem to affect fantasy proneness.

Theoretically it has introduced certain propositions with regards to visual memory distortion and fantasy proneness. In terms of visual memory distortion, the study suggests that visual memory is affected by executive processes such as strategy and organizational ability, that the visual memory distortion that is detected by the ROCFT is analogical and non-symbolic. In terms of the CEQ it suggests that fantasy proneness is also affected by executive processes. It proposes that the CEQ may have a stronger connection to cognitive processes that are more symbolic and propositional in form, especially with regards to its related visual and imaginal aspects. The implication of these propositions is that they will guide future research and add to the debates around both constructs.

Humanities and sciences students differed with regard to some of their measurements, which pose an interesting hypothesis about differences in information processing between these two groups of students.

The study has also provided normative data for the CEQ and the ROCFT for University students in a South African context. It has specifically contributed to normative data on postgraduate students, as they formed the majority of the sample.

A person's use of strategy appears to be a good indicator of their performance on the ROCFT. More strategy use generally indicates better performance on the ROCFT. This may indicate that performance on the ROCFT is not only an indication of visual memory but also of the specific executive processes of planning and organization.

However the study has also introduced some clarity with regards to the limits of the ROCFT and the specific aspects of visual memory distortion that it measures. That it has limitations with regards to evaluating aspects of visual memory that are more executive, symbolic, propositional and contextually based (Sternberg, 1999; Brown & Craik, 2005).

The ROCFT appears to have limited use in establishing neuropsychological findings that are relevant to visual memory impairments that are more symbolic and meaningful. The findings of this study support the ROCFT as tool used to measure nonverbal memory only (Lezak, 1995; Kolb & Wishaw, 2003).

Therefore in terms of neuropsychological assessments, the ROCFT may be limited in the detection of many of the executive processes involved in visual memory. However the ROCFT may be used to evaluate strategy and planning, as aspects of the executive processes of visual memory distortion. This study may have provided a possible means of evaluating planning and strategy in visual memory distortion, through the evaluation of Qualitative Strategy in the ROCFT; which has been developed in this study.

In terms of neuropsychological evaluations of perceptual impairments, it appears that the ROCFT may have limited ability, on its own as an assessment tool, to determine the cognitive nature or neuroanatomical locations of particular perceptual impairments. This is because there may be executive processes - in planning and strategy during an administration, that are often not considered (Kolb & Wishaw, 2003). This is counter to those who suggest that it may determine the particular neuropsychological locations of impairments; such as right temporal lobe damage (Kolb & Wishaw, 2003).

Because the ROCFT was performed on a non-clinical population of university students, it would be difficult to determine whether the Qualitative Strategy component may be useful in assessing strategy as an aspect in particular visual spatial constructional abilities and constructional apraxias. However the data on strategy collected in this study may be useful as a normative data set or a starting point for future studies examining a possible link or the clinical aspects relating to visual spatial construction and strategy.

Visual memory distortion measured by the ROCFT, does not appear to play a role in dissociative experiences; especially considering that the CEQ is often used as a means to assess an individual's propensity for dissociative experiences (Merckelbach, 1999).

Fantasy proneness appears to be a good indicator of impaired mental imagery ability; particularly with the humanities students in this study. This supports Aleman and Haan's (2003) position, that high scores in the CEQ may indicate impaired mental imagery ability. Clinically the CEQ may therefore be used as an indicator for this. However this needs further investigation.

Chapter 6 SUMMARY AND CONCLUSION

6.1 SUMMARY AND CONCLUSION

This study explored the relationship between visual memory distortion and fantasy proneness, in a sample of university students (n = 49). The Creative Experiences Questionnaire (CEQ) was used as the measure of fantasy proneness and the Rey-Osterrieth Complex Figure Test (ROCFT) was used as the measure of visual memory distortion.

The findings indicated that there was no direct relationship between visual memory distortion and fantasy proneness measured by the ROCFT and CEQ respectively. Immediate and delayed visual memory recall did not relate to fantasy proneness. It however appears that there is a link between strategy, as an executive process measured in this study by Qualitative Strategy in the subjective analysis by the researcher of the ROCFT data, and the ROCFT and CEQ. This may suggest that although visual memory distortion and fantasy proneness are not directly linked, both are affected by executive processes, most likely involved in strategy and planning. These executive processes appear to be interdependent to both visual memory and fantasy proneness, and are responsible for aspects of each of their processing, yet not directly linked or related in the same way to either fantasy proneness or visual memory distortion. The instruments appear to have been limited in their capacity to assess these executive processes.

Both instrument's dimensions of measurement were limited in assessing the appropriate constructs that may be common to both aspects of visual memory distortion and fantasy proneness. It appears that the symbolic processing and meaningful dimension of memory and fantasy were not appropriately assessed in this study by the CEQ and the ROCFT.

Students in this study appeared to perform better on the ROCFT, than overseas students. The students in this study also on average scored higher on Fantasy Proneness in the CEQ. The high scores obtained in this study may be because of the small sample size of students, most of whom were at a postgraduate level, most were sciences students and all had volunteered and chose to participate in the study.

In conclusion both fantasy proneness and visual memory distortion are governed by their own unique cognitive and neuropsychological processes. These processes are largely independent of each other. They function separately in an individual, and appear to be influenced differently by contextual features. The visual memory distortion measured in this study was influenced specifically by an abstract geometrical object, and fantasy proneness by potentially more meaningful and symbolic experiences, that may be more context based. Although visual memory distortion and fantasy proneness are mostly separate, they may share some related features, through interdependent cognitive constructs most likely of executive functioning.

APPENDIX

APPENDIX A

Subject Information Form Participation in the Interview Process

Hello,

Our names are **Zureida Garda**, **Shantall Tryon** and **David Rosenstein**; we are students studying for a master's degree in clinical psychology which requires us to complete a research study. Our individual research studies all fall under one larger project. The larger project consists of collecting data on: a person's degree of fantasy proneness, your anticipatory anxiety, visual memory recall ability, level of depression, suicidal ideation and personality. Each of us will be focusing on one or two of these aspects:

- 1) **Zureida Garda: Title** - 'It's just your imagination': Fantasy proneness and social anxiety.
Research aspects: Fantasy proneness and social anxiety
Social anxiety is a form of anxiety where an individual becomes nervous as they think about a social event; such as giving a speech. Fantasy proneness refers to an individual's ability to imagine, visualise or daydream, in other words, their ability to fantasise.
- 2) **Shantall Tryon: Title** - The relationship between suicidal ideation and the five factor model of personality in young adults.
Research aspects: Depression, suicidal ideation and personality
Personality traits have been described as relatively enduring dispositions in individuals, characteristic ways of thinking, feeling, and acting; they are basic emotional, interpersonal, experiential, attitudinal, and motivational styles. Suicidal ideation refers to the thoughts or act of taking one's own life. Suicidal ideation has been viewed to precede attempted and completed suicide. It is important to stress that not all suicide ideation leads to attempted and completed suicide. Depression can be characterized by a disturbance of mood, such as feeling sad, empty or hopeless.
- 3) **David Rosenstein: Title** – Visual memory distortion and fantasy proneness
Research aspects: Fantasy proneness and visual memory recall ability
Visual memory recall ability relates to the capacity or ability to remember an object/s a person has previously seen or drawn and then to re-draw the object about an hour later. Fantasy proneness refers to an individual's ability to imagine, visualise or daydream.

You are invited to participate in the overall study. Should you consent to participate in the study, you will be required to complete some questionnaires and a visual recall assessment, the duration of which will take approximately two hours. All information disclosed will remain confidential. No names or identifying information will be used in reporting the results of any of the three studies. If you agree to participate it will mean completing a full batch of assessment measures, which will then be used in different combinations in the three separate studies described above.

Any questions you have or additional information you may require will be answered before, during and after the administration of the questionnaires. Although we do not anticipate that filling in the assessment battery will be upsetting, as you have read some of the measures are designed to assess problems in living, such as social anxiety and suicidal thoughts. Should you require further support with emotional issues after completion of the questionnaires; telephonic counselling will be available to you. The required helpline telephone numbers will be made available before the administration of the questionnaires. The university student counselling centre also offers a counselling service free of charge to registered students.

Participation in the study is voluntary if you agree to take part and then if you chose to no longer participate; you may withdraw at any time. Non-participation will in no way influence or affect your academic record. If you agree to participate, please sign the consent form; which will be provided.

The results of the study will be published in the final research reports once the study has been completed and may also be published in a journal article form. Only group trends will be reported. If you are interested in receiving a copy of a summary of the results of any of the studies you are welcome to approach one of us. The research reports based on the three studies will be available in the Cullen Library once we have completed our degrees.

Thank you for your time.

Zureida Garda – 082 322 7073

Shantall Tryon – 082 902 2485

David Rosenstein – 083 923 2585

APPENDIX B

Consent Form

I understand the purpose and procedures of the research projects which are titled:

Visual memory distortion and fantasy proneness

'It's just your imagination': Fantasy proneness and social anxiety

The relationship between suicidal ideation and the five factor model of personality in young adults

I understand that I may withdraw at anytime from participation in this group study, without any negative consequences. I also understand that all information I shall have given will be treated as confidential and that I will remain anonymous in the research report. I also understand that I have the right to refuse to answer any question. I may also request a copy of a summary of the results of this research project.

I (Name in block letters) _____ agree to participate in this research project conducted by David Rosenstein, Zureida Garda and Shantall Tryon; masters students studying clinical psychology at the University of Witwatersrand.

Signature (Participant): _____

Researcher (Zureida Garda): _____

Researcher (Shantall Tryon): _____

Researcher (David Rosenstein): _____

Date: _____

APPENDIX C

BIOGRAPHICAL INFORMATION SHEET

Please fill in and mark appropriately on this biographical information sheet after completing the consent form- thank you.

Participant number: _____

Sex: _____

Area of study: _____

Date of Birth: _____

Home language: _____

Have you ever had a previous episode of head injury with loss of consciousness? :

YES / NO

Are you currently using any psychiatric/psychoactive medication/s (for example antidepressants)? : YES / NO

APPENDIX D

CREATIVE EXPERIENCES QUESTIONNAIRE (CEQ)

1] As a child I thought that the dolls, teddy bears and stuffed animals that I played with were living creatures	<input type="checkbox"/> YES	<input type="checkbox"/> NO
2] As a child I strongly believed in the existence of dwarves, elves and fairytale figures	<input type="checkbox"/> YES	<input type="checkbox"/> NO
3] As a child I had my own make believe friend or animal	<input type="checkbox"/> YES	<input type="checkbox"/> NO
4] As a child I could very easily identify with the main character of a story and/or movie.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
5] As a child I sometimes had the feeling I was someone else (e.g. a princess, orphan, etc.)	<input type="checkbox"/> YES	<input type="checkbox"/> NO
6] As a child I was encouraged by adults to (parents, grandparents, brothers, sisters) to fully indulge myself in my fantasies and daydreams	<input type="checkbox"/> YES	<input type="checkbox"/> NO
7] As a child I often felt lonely	<input type="checkbox"/> YES	<input type="checkbox"/> NO
8] As a child I devoted my time to playing a musical instrument, dancing, acting and/or drawing.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
9] I spend more than half the day (daytime) fantasizing or daydreaming.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
10] Many of my friends and/or relatives do not know that I have such detailed fantasies.	<input type="checkbox"/> YES	<input type="checkbox"/> NO

11] Many of my fantasies have a realistic intensity	<input type="checkbox"/> YES	<input type="checkbox"/> NO
12] Many of my fantasies are just as lively as a good movie.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
13] I often confuse fantasies with real memories	<input type="checkbox"/> YES	<input type="checkbox"/> NO
14] I am never bored, because I start fantasizing when things get boring.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
15] Sometimes I act as if I am somebody else and I completely identify myself with that role.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
16] When I recall my childhood, I have very vivid and lively memories.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
17] I can recall many occurrences before the age of three.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
18] When I perceive violence on television, I get so into it that I really get upset.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
19] When I think of something cold, I actually get cold.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
20] When I imagine I have eaten rotten food, I really get nauseous.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
21] I often get the feeling that I can predict things that are bound to happen in the future.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
22] I often have the experience of thinking of someone and soon afterwards that particular person calls or shows up.	<input type="checkbox"/> YES	<input type="checkbox"/> NO

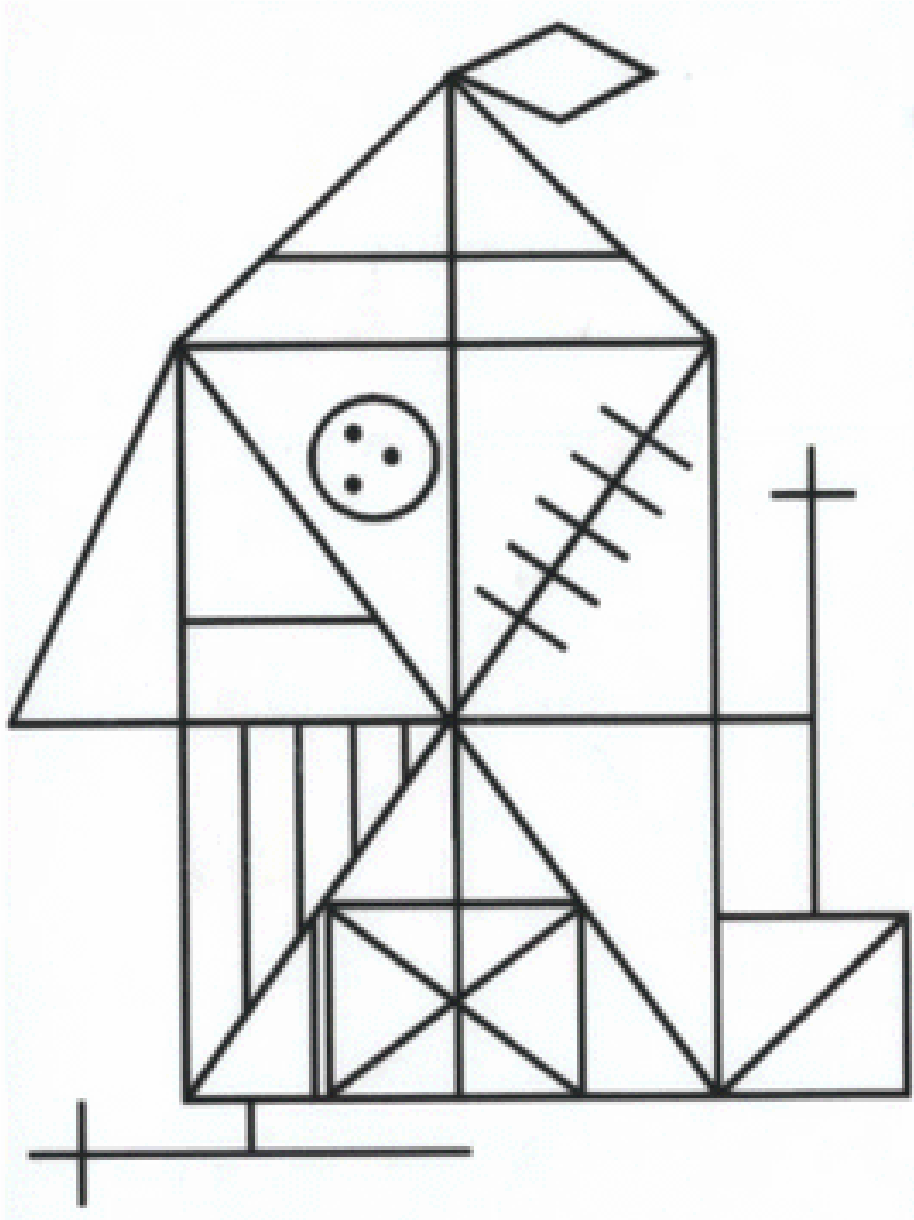
23] I sometimes feel that I have had an out of body
experience **YES** **NO**

24] When I sing or write something, I sometimes have the
feeling, that someone or something outside my self directs me. **YES** **NO**

25] During my life I have had intense religious experiences
which influenced me in a very strong manner **YES** **NO**

APPENDIX E

REY-OSTERRIETH COMPLEX FIGURE



APPENDIX F

ROCFT ADMINISTRATION PROTOCOL

COMPLEX FIGURE TEST

Requirements: Copy of Figure

A4 paper (blank, unlined)

6 coloured pencils (green, blue, black, orange, red, purple)

Place a blank unlined A4 piece of paper (short end facing them) and the first coloured pencil in front of the subject. Then place the figure in front of the subject.

Copy task:

“I am going to show you a card on which there is a design that I would like you to copy on this piece of paper. Please copy the figure as carefully as you can. I am going to ask you to switch coloured pencils every thirty seconds”.

When the subject changes coloured pencils, hand the pencils in the following order: green, blue, black, orange, red, & purple. Try allow the subject to finish with the purple pen.

Do not allow the subject to rotate the figure or their paper. If they do so, reposition it and say: “No it needs to stay like this”.

For immediate recall (after 2-3 minutes):

“Remember a short time ago I had you copy a figure. I would like you to draw that figure again”.

For delayed recall (after 25-30 minutes):

“Do you remember that design I had you copy a while ago? Now I would like you to redraw the figure from memory as carefully and completely as you can on this sheet of paper.

APPENDIX G

CORRELATIONS (SAS v9.1)

TOTAL SAMPLE CORRELATION MATRIX

Spearman Correlation Coefficients, N = 49						
Prob > r under H0: Rho=0						
	Column2	Column6	Column7	Column8	Column9	Column13
Column2	1.00000	-0.25617	0.02860	0.12418	0.15467	-0.09220
Column2		0.0756	0.8453	0.3953	0.2886	0.5286
Column6	-0.25617	1.00000	-0.20847	-0.19819	-0.15994	0.34978
Column6	0.0756		0.1506	0.1722	0.2723	0.0138
Column7	0.02860	-0.20847	1.00000	0.21154	0.25960	-0.08905
Column7	0.8453	0.1506		0.1445	0.0716	0.5429
Column8	0.12418	-0.19819	0.21154	1.00000	0.88711	-0.50017
Column8	0.3953	0.1722	0.1445		<.0001	0.0003
Column9	0.15467	-0.15994	0.25960	0.88711	1.00000	-0.42241
Column9	0.2886	0.2723	0.0716	<.0001		0.0025
Column13	-0.09220	0.34978	-0.08905	-0.50017	-0.42241	1.00000
Column13	0.5286	0.0138	0.5429	0.0003	0.0025	

NO STRATEGY USED CORRELATION MATRIX

SPEARMAN CORRELATION COEFFICIENTS, N = 8					
PROB > R UNDER H0: RHO=0					
	Column2	Column6	Column7	Column8	Column9
Column2	1.00000	-0.27163	0.05940	0.06025	0.43031
Column2		0.5152	0.8889	0.8873	0.2872
Column6	-0.27163	1.00000	0.22717	0.21958	0.22090
Column6	0.5152		0.5885	0.6013	0.5991
Column7	0.05940	0.22717	1.00000	0.45644	0.41326
Column7	0.8889	0.5885		0.2556	0.3088
Column8	0.06025	0.21958	0.45644	1.00000	0.79043
Column8	0.8873	0.6013	0.2556		0.0195
Column9	0.43031	0.22090	0.41326	0.79043	1.00000
Column9	0.2872	0.5991	0.3088	0.0195	

SOME STRATEGY USED CORRELATION MATRIX

SPEARMAN CORRELATION COEFFICIENTS, N = 21					
PROB > R UNDER H0: RHO=0					
	Column2	Column6	Column7	Column8	Column9
Column2	1.00000	-0.44648	0.02698	0.05382	0.21585
Column2		0.0425	0.9076	0.8168	0.3474
Column6	-0.44648	1.00000	-0.23134	-0.16261	-0.27990
Column6	0.0425		0.3130	0.4813	0.2191
Column7	0.02698	-0.23134	1.00000	0.11125	0.34712
Column7	0.9076	0.3130		0.6312	0.1231
Column8	0.05382	-0.16261	0.11125	1.00000	0.89276
Column8	0.8168	0.4813	0.6312		<.0001
Column9	0.21585	-0.27990	0.34712	0.89276	1.00000
Column9	0.3474	0.2191	0.1231	<.0001	

STRATEGY USED CORRELATION MATRIX

Spearman Correlation Coefficients, N = 20					
Prob > r under H0: Rho=0					
	Column2	Column6	Column7	Column8	Column9
Column2	1.00000	-0.15637	0.07052	0.12686	-0.07258
Column2		0.5103	0.7677	0.5940	0.7611
Column6	-0.15637	1.00000	-0.24244	-0.02153	0.24735
Column6	0.5103		0.3031	0.9282	0.2931
Column7	0.07052	-0.24244	1.00000	0.09267	-0.06257
Column7	0.7677	0.3031		0.6976	0.7933
Column8	0.12686	-0.02153	0.09267	1.00000	0.75066
Column8	0.5940	0.9282	0.6976		0.0001
Column9	-0.07258	0.24735	-0.06257	0.75066	1.00000
Column9	0.7611	0.2931	0.7933	0.0001	

HUMANITIES STUDENTS CORRELATION MATRIX

SPEARMAN CORRELATION COEFFICIENTS, N = 18					
PROB > R UNDER H0: RHO=0					
	Column2	Column6	Column7	Column8	Column9
Column2	1.00000	0.06733	0.10425	0.07568	0.16902
Column2		0.7907	0.6806	0.7654	0.5026
Column6	0.06733	1.00000	-0.59362	-0.22713	-0.26026
Column6	0.7907		0.0094	0.3647	0.2969
Column7	0.10425	-0.59362	1.00000	0.44450	0.65694
Column7	0.6806	0.0094		0.0646	0.0031
Column8	0.07568	-0.22713	0.44450	1.00000	0.86649
Column8	0.7654	0.3647	0.0646		<.0001
Column9	0.16902	-0.26026	0.65694	0.86649	1.00000
Column9	0.5026	0.2969	0.0031	<.0001	

SCIENCES STUDENTS CORRELATION MATRIX

Spearman Correlation Coefficients, N = 31					
Prob > r under H0: Rho=0					
	Column2	Column6	Column7	Column8	Column9
Column2	1.00000	-0.48367	0.12756	0.25760	0.27073
Column2		0.0058	0.4941	0.1618	0.1407
Column6	-0.48367	1.00000	0.05706	-0.23206	-0.18587
Column6	0.0058		0.7605	0.2091	0.3168
Column7	0.12756	0.05706	1.00000	0.01175	-0.00701
Column7	0.4941	0.7605		0.9500	0.9701
Column8	0.25760	-0.23206	0.01175	1.00000	0.91581
Column8	0.1618	0.2091	0.9500		<.0001
Column9	0.27073	-0.18587	-0.00701	0.91581	1.00000
Column9	0.1407	0.3168	0.9701	<.0001	

APPENDIX H

ANOVAS – BY QUALITATIVE STRATEGY

CEQ by Qualitative Strategy

KRUSKAL-WALLIS TEST	
Chi-Square	5.8818
DF	2
Pr > Chi-Square	0.0528

Copy by Qualitative Strategy

Kruskal-Wallis Test	
Chi-Square	1.1552
DF	2
Pr > Chi-Square	0.5613

Immediate Recall by Qualitative Strategy

Kruskal-Wallis Test	
Chi-Square	12.3321
DF	2
Pr > Chi-Square	0.0021

Delayed Recall by Qualitative Strategy

KRUSKAL-WALLIS TEST	
Chi-Square	8.6248
DF	2
Pr > Chi-Square	0.0134

APPENDIX I

ANOVA's BY AREA OF STUDY

CEQ by Area of Study

KRUSKAL-WALLIS TEST	
Chi-Square	1.6081
DF	1
Pr > Chi-Square	0.2048

Copy by Area of Study

KRUSKAL-WALLIS TEST	
Chi-Square	0.0732
DF	1
Pr > Chi-Square	0.7868

Immediate Recall by Area of Study

Kruskal-Wallis Test	
Chi-Square	2.4500
DF	1
Pr > Chi-Square	0.1175

Delayed Recall by Area of Study

Kruskal-Wallis Test	
Chi-Square	0.1812
DF	1
Pr > Chi-Square	0.6703

APPENDIX J

ROCFT Percentiles, Loring et al. 1990 (N =87)

COPY	CENTILE	<5	10	20	30	40	50	60	70	80	90	99
	Score	33	34	35	36	36	36	36	36	36	36	36
Immediate Recall	Centile	<5	10	20	30	40	50	60	70	80	90	99
	Score	15	21	24	26	28	29	29.5	30.5	32	33	36
Delayed Recall	Centile	<5	10	20	30	40	50	60	70	80	90	99
	Score	16	22.5	25	28	29	30.5	31	32	33	35	36

APPENDIX K

INTERATOR RELIABILITY

Pearson Correlation Coefficients, N = 10						
Prob > r under H0: Rho=0						
	David C	Zureida C	David I	Zureida I	David D	Zureid D
David Copy	1.00000 0.97567 <.0001	0.97567 <.0001	0.44669 0.1956	0.12541 0.7299	0.77413 0.0086	0.68958 0.0274
Zureida Copy	0.97567 <.0001	1.00000	0.31363 0.3775	-0.01205 0.9736	0.68776 0.0279	0.57279 0.0835
David Immediate	0.44669 0.1956	0.31363 0.3775	1.00000	0.93328 <.0001	0.65077 0.0416	0.62971 0.0510
Zureida Immediate	0.12541 0.7299	-0.01205 0.9736	0.93328 <.0001	1.00000	0.40347 0.2476	0.44358 0.1991
David Delayed	0.77413 0.0086	0.68776 0.0279	0.65077 0.0416	0.40347 0.2476	1.00000	0.94059 <.0001
Zureida Delayed	0.68958 0.0274	0.57279 0.0835	0.62971 0.0510	0.44358 0.1991	0.94059 <.0001	1.00000

APPENDIX L

NORMATIVE DATA

Age

TESTS FOR NORMALITY				
Test	Statistic		p Value	
Shapiro-Wilk	W	0.916794	Pr < W	0.0020
Kolmogorov-Smirnov	D	0.140496	Pr > D	0.0167
Cramer-von Mises	W-Sq	0.220541	Pr > W-Sq	<0.0050
Anderson-Darling	A-Sq	1.407909	Pr > A-Sq	<0.0050

CEQ

TESTS FOR NORMALITY				
Test	Statistic		p Value	
Shapiro-Wilk	W	0.974027	Pr < W	0.3474
Kolmogorov-Smirnov	D	0.093398	Pr > D	>0.1500
Cramer-von Mises	W-Sq	0.062104	Pr > W-Sq	>0.2500
Anderson-Darling	A-Sq	0.391119	Pr > A-Sq	>0.2500

Copy Task

Tests for Normality				
Test	Statistic		p Value	
Shapiro-Wilk	W	0.616106	Pr < W	<0.0001
Kolmogorov-Smirnov	D	0.38569	Pr > D	<0.0100
Cramer-von Mises	W-Sq	1.502718	Pr > W-Sq	<0.0050
Anderson-Darling	A-Sq	8.064807	Pr > A-Sq	<0.0050

Immediate Recall Task

TESTS FOR NORMALITY				
Test	Statistic		p Value	
Shapiro-Wilk	W	0.949288	Pr < W	0.0346
Kolmogorov-Smirnov	D	0.099215	Pr > D	>0.1500
Cramer-von Mises	W-Sq	0.072615	Pr > W-Sq	>0.2500
Anderson-Darling	A-Sq	0.589503	Pr > A-Sq	0.1228

Delayed Recall Task

TESTS FOR NORMALITY				
Test	Statistic		p Value	
Shapiro-Wilk	W	0.949573	Pr < W	0.0355
Kolmogorov-Smirnov	D	0.079119	Pr > D	>0.1500
Cramer-von Mises	W-Sq	0.070335	Pr > W-Sq	>0.2500
Anderson-Darling	A-Sq	0.586828	Pr > A-Sq	0.1247

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