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# Examining the Relationship between Executive Function and Superstitious and Paranormal Beliefs

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University of the Witwatersrand, Johannesburg,
in partial fulfilment of the requirements for the Degree Master of Arts
in Research Psychology By Coursework and Research Report

December 2011

**DECLARATION**

I, Candice Schneider, know and accept that plagiarism (i.e., to use another‘s work and present it as one‘s own) is wrong. Consequently, I declare that:

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- I have correctly acknowledged all direct quotations and paraphrased ideas/content. In addition I have provided a complete, alphabetised reference list, as required by the APA method of referencing.
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.....
Candice Schneider

.....
Date

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## ABSTRACT

Recent research has suggested possible relationships between neuropsychological functioning and belief in superstitious and paranormal phenomena. The prefrontal cortex is of particular interest in this regard, as executive function and the mechanisms associated with faulty reasoning ability may maintain superstitious and supernatural beliefs. The present study investigated the relationship between executive function and superstitious and paranormal beliefs, in order to examine the extent to which the executive function abilities of individuals who subscribe to such beliefs differs from that of individuals who do not believe in such phenomena. The sample consisted of 43 male and female university students, between the ages of 21 and 28, from various ethnic groups. A non-experimental, cross-sectional, between-subjects, correlational mixed methods design was employed. Quantitative data was collected using a demographic questionnaire, a Modified Paranormal Beliefs Scale, the Neuroticism subscale of the NEO PI-R and an executive function and logical reasoning test battery. Qualitative data was collected by means of interviews. Few significant correlations were found between demographic variables and superstitious and paranormal beliefs, Neuroticism and executive function scores respectively. Relationships between Neuroticism and superstitious and paranormal beliefs were minimal. Both positive and negative correlations were found between superstitious and paranormal beliefs and executive function scores, suggesting that other neuropsychological factors may underlie illogical beliefs. Qualitative data revealed that superstitious and paranormal beliefs were perpetuated because of their links to familial environment and culture and beliefs assisted individuals in managing anxiety about the unknown by instilling a sense of control over the future. These results suggest that other neuropsychological mechanisms, such as emotion, may play a more significant role than executive function in superstitious and paranormal beliefs.

**Keywords:** executive function; superstitious beliefs; paranormal beliefs; personality

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# CHAPTER ONE

## 1 INTRODUCTION TO THE STUDY

Various superstitious beliefs exist in cultures around the world and are diverse in both their nature and origins. Many superstitions continue to affect the daily lives of modern individuals, centuries after the formation of such beliefs (Wiseman & Watt, 2004). South African society presents an interesting and diverse combination of superstitions, because of the country's multicultural nature and the influence of both Western and a traditional African superstition, but very little research has explored the nature of the seemingly irrational beliefs which exist in the various South African cultures (Peltzer, 2002; Peltzer, 2003).

Psychological research pertaining to this area has traditionally focussed on the association between certain personality traits and characteristics and tendencies towards superstitious and paranormal beliefs (Peltzer, 2002; Thalbourne, Dunbar & Delin, 1995; Wolfradt, 1997). More recent research, however, has begun to investigate possible links which may exist between neuropsychological functioning and belief in superstitious and paranormal phenomena (Brugger & Mohr, 2008; Wain & Spinella, 2007). Of particular interest to neuropsychologists is the prefrontal cortex, as executive function and the mechanisms associated with faulty reasoning ability may play a role in maintaining superstitious and supernatural beliefs (Einstein & Menzies, 2004).

The prefrontal cortex has been the subject of a great deal of neurological and neuropsychological interest, based on the significant role which this area of the brain plays in the broad range of "cognitive processes and behavioural competencies" (Chan, Shum, Toulopoulou & Chen, 2008, p.201) which are collectively referred to as executive functions. This area of the brain is thus responsible for monitoring, adapting and controlling behaviours (Chan et al., 2008). Much of the research which has been conducted in this area has focussed on gaining an understanding of the various executive function mechanisms and the effect which damage to the frontal and prefrontal cortices has on behaviour, attention, planning and other cognitive processes, especially due to the severe consequences which dysfunction within and damage to these areas has on

everyday social and cognitive functioning (Bechara, Damasio, Damasio & Anderson, 1994).

By studying the formation and maintenance of irrational beliefs, neuropsychologists hope to gain a better understanding of how other types of beliefs arise in neuropsychologically healthy individuals. The conclusions drawn from such research may help to inform understandings of pathological thought patterns and beliefs and serve to explain certain adaptive mechanisms of cognition, such as creativity (Brugger & Mohr, 2008). This study therefore investigated the nature of the relationship between executive function and superstitious and paranormal beliefs.

# CHAPTER TWO
# LITERATURE REVIEW

## 2.1 The Prefrontal Cortex

The cerebral cortex accounts for 80% of the human brain's volume, and comprises two cerebral hemispheres, each of which is divided into four areas, known as the parietal, occipital, temporal, and frontal lobes respectively. Composed of numerous sulci and gyri, the cerebral cortex controls higher cognitive processes, receiving and analyzing information from the sensory system and then processing, categorizing, assimilating, storing and utilizing this input as necessary (Zillmer, Spiers & Culbertson, 2008). The cortex as a whole is arranged hierarchically, with higher levels representing functions which are increasingly directed towards integrating information (Fuster, 2001). Thus, particular areas of the cortex are specialized for processing certain types of information – for example, the anterior parietal lobes process somatosensory input, while the temporal lobes are responsible for dealing with auditory information. Broadly, the processing of sensory information is carried out by the occipital, parietal and temporal lobes, while the frontal lobes are generally responsible for motor activity and further subdivided into the motor, premotor and prefrontal cortices (Kolb & Whishaw, 2009). The prefrontal cortex represents the uppermost level of the cortical function hierarchy, "dedicated to the representation and execution of actions" (Fuster, 2001, p.319), and consists of the dorsolateral, orbital and medial frontal cortices. The orbital and medial cortices are concerned with emotional behavioural responses (Kolb & Whishaw, 2009), while the dorsolateral region is involved in the cognitive processes associated with "the temporal organization of behaviour, speech, and reasoning" (Fuster, 2001, p.319).

## 2.2 Executive Function

Executive function is the broad term used to collectively refer to both the emotional and logical components of the activities of the prefrontal cortex (Chan et al., 2008). Executive functioning is a multidimensional neuropsychological concept (Suchy, 2009) and consists of a number of behaviours and mental processes, including "verbal reasoning, problem-

solving, planning, sequencing, the ability to sustain attention, resistance to interference, utilization of feedback, multitasking, cognitive flexibility, and the ability to deal with novelty" (Chan et al., 2008, p.201). These abilities function "only when the novelty and/or complexity of a given situation precludes an automatic, routine response" (Suchy, 2009, p.106) and therefore require a certain quantity of energy when they are engaged. Executive function abilities mature over time, as the prefrontal cortex develops, with studies revealing that the prefrontal areas of the brain do not achieve "full maturity until adolescence" (Fuster, 2001, p.319), as individuals develop increased competence in their ability to plan, ignore distracting stimuli and exert a level of control over impulses (Bunge & Wright, 2007). The "maturation of adult-level cognition involves first an integration of childhood compensatory network with that of the more mature performance enhancing regions, and next an increase in localization within those necessary regions" (Bunge & Wright, 2007, p.243), as the strength and intricacy of connections within the brain increase, while myelination and pruning continue as the individual develops (Zillmer et al., 2008). Thus, the executive function capabilities of children are very different to those of adults, because of the developmental pattern of improvement of executive function.

Theories of neural plasticity suggest that changes in the organisation of the brain are possible, however, even in adulthood. Research has predominantly investigated the mechanisms of plasticity by studying the effects of plasticity on lesions in patients recovering from strokes. A number of potential mechanisms have been examined in this regard. Decreases in the activity of inhibitory interneurons between cortical and peripheral neuronal connections may allow for activation to occur along previously unused neuronal circuits. Synaptic strengthening, axonal sprouting, formation of new synapses and dendritic sprouting may also allow for neural plasticity and the potential to change or recover functioning. Experience dependant plasticity has also been investigated and represents "the ability of the *adult* brain to adjust itself to changes in environmental conditions" (Huttenlocher, 2002, p.176). Environmental enrichment may therefore result in organisational changes within the brain, in response to stimuli. Higher cortical functions, such as those associated with the prefrontal cortex, are dependant on

environmental stimuli and this suggests that these areas may be especially capable of plasticity. Little research has been conducted into the mechanisms of neural plasticity associated with the prefrontal cortex, however (Huttenlocher, 2002).

A number of models of executive function have been suggested, with the majority of these theories based on the premises suggested by Luria, who asserted that the frontal lobes are responsible for "programming, controlling and verifying activity" (Ardila, 2008, p.92). According to Luria, the prefrontal cortex is specifically involved in directing and adjusting cognitive processes and behaviour, and it is from this theory that the concept of executive function originated (Zillmer et al., 2008). A great deal of research has been conducted on executive function and its numerous individual components, such as memory, attention, and goal-directed behaviour. Theorists have also extended Luria's original model, providing more complex explanations of the mechanisms associated with executive function. Fuster (1997) proposed a temporal integration framework, asserting that the three primary tasks performed by executive function relate to inhibition, working memory and set attainment, while Stuss, Shallice, Alexander & Picton (1995) and Stuss et al. (2005) expanded existing theories regarding attention, positing seven anterior attentional functions, maintained by the reticular activating system and certain areas of the thalamus.

A cognitive neuropsychology model of executive functioning, in the form of the supervisory attentional system model was posited by Shallice and Burgess in 1991. This theory proposes that executive function is responsible for "working memory; monitoring; rejection of schema; spontaneous schema generation; adoption of processing mode; goal setting; delayed intention marker realization; and episodic memory retrieval" (Burgess & Alderman, 2004, p.192). The supervisory attentional system model has subsequently been expanded by Burgess (2000) to explain both multitasking and the motivational aspects which affect the performance of behaviours associated with executive function.

Despite involvement in the maintenance and control of executive functions, the prefrontal cortex it is not singularly responsible for these activities, as other areas of the brain,

including both cortical and subcortical regions, also play a role in directing and regulating behaviour and cognitive processes (Ardila, 2008; Gazziniga, Ivry & Mangun, 1998; Heyder, Suchan & Daum, 2004). Alexander, DeLong & Strick (1986) proposed a theory of dorsolateral prefrontal circuits, which involve pathways between the prefrontal cortex and both the basal ganglia and thalamocortical areas (Alexander et al., 1986; Alexander & Crutcher, 1990). Further research has implicated a more complicated network, which involves circuits connecting structures such as the cortex, globus pallidus, striatum and thalamus, in sustaining activity in the prefrontal cortical regions (Miller & Cohen, 2001). These circuits play a significant role in executive functions such as inhibition, task management, multitasking and set shifting (Heyder et al., 2004).

Executive function allows individuals "to make choices and to engage in purposeful, goal-directed, and future-oriented behavior" (Suchy, 2009, p.106), which are distinct from the "innate, hard-wired drives and reflexes, as well as from over-practiced, overlearned, and prepotent responses" (Suchy, 2009, p.106) characteristic of individuals who have suffered damage to the complex executive function systems. Damage to the prefrontal cortex frequently impairs executive function more than any other mental activity, influencing a diverse range of behaviours. Individuals who have suffered frontal cortex damage are often found to be "disinhibited, socially inappropriate, misinterpreting others moods, impulsive, unconcerned with the consequences of their actions, irresponsible in everyday life, underestimating the seriousness of their condition (lack of insight), and showing a poor sense of initiative" (Séguin, 2004, p.185). These symptoms are generally described as indicative of a "frontal syndrome." The existence of a frontal syndrome has been supported by a number of studies - most frequently conducted on individuals who have suffered some form of brain damage (Ardila, 2008) - which have assisted in further defining the association between executive function and the prefrontal cortex. Research has illustrated that individuals who have suffered prefrontal cortex injuries experience difficulty in making decisions which are based on estimations, especially in cases where "an exact calculation of the future outcomes is not possible" (Bechara et al., 1994, p.13). Thus, while these individuals can hypothesize about the potential outcomes and consequences of their actions, they struggle to translate these

strategies into action – a phenomenon which remained stable over time, as retesting both one month and six months later revealed similar results. These findings support theories about the role which the prefrontal cortex plays in planning and executing appropriate behaviours and decision-making processes (Bechara et al., 1994). Research conducted by Stuss, Floden, Alexander, Levine & Katz (2001) on individuals with frontal lobe lesions illustrates that the frontal cortex plays a significant role in maintaining goal-oriented behaviour, working memory, the inhibition of responses and behavioural selection processes and cognitive flexibility, illustrating the diversity of the responsibilities of executive function. Recent research by Duffau (2011), however, suggests that the symptoms associated with frontal syndrome can also occur as a result of disruptions within the cortical and subcortical areas of the frontal-occipital fascicle, as well as the frontal lobes. Cases of left or right frontal lobectomies which did not result in "frontal syndrome" have also been reported. These results suggest that the functions typically associated with the prefrontal and frontal cortices may not be as localised as initially thought (Duffau, 2011).

### 2.3 Assessment of Executive Function

Executive function may be measured by a number of processes, including "the clinical interview, assessment through questionnaire administration, neuropsychological tests, and behavioural and functional assessment" (Burgess & Alderman, 2004, p.185). The assessment used will depend on both the individual conducting the investigation and the aims of the evaluation, whether they are for research purposes, to gain clinical information about an individual or to assess the nature or extent of potential brain damage. Different tests typically evaluate one or more aspects of executive function, such as working memory, attention or behavioural inhibition, and are designed to test the capabilities of the individual undergoing the assessment. Additionally, assessments may be designed for use with individuals who have either an executive function impairment, disability or handicap (Chan et al., 2008). Neuroimaging techniques may also be used simultaneously, in order to monitor cognitive activity while the assessment task is being completed (Ardila, 2008; Krain, Wilson, Arbuckle, Castellanos & Milham, 2006).

Numerous neuropsychological tests have been developed to assess executive function. Research suggests that the majority of neuropsychologists favour the Wisconsin Card Sorting Test (Baddeley, 1996; Barcelo & Knight, 2002; Butler, Retzlaff & Vanderploeg, 1991; Rabin, Barr & Burton, 2005; Reitan & Wolfson, 1994; Strauss, Sherman & Spreen, 2006; Stuss & Benson, 1986; Stuss and Levine, 2002). A number of other neuropsychological measures of executive function, including the Rey-Osterrieth Complex Figure Test, the Cambridge Neuropsychological Test Automated Battery, the Cognitive Estimation Test, the Halstead Category Test, the Delis-Kaplan Executive Function System, the Design Fluency test, the Five-Point Test, the Hayling & Brixton test, the Ruff Figural Fluency test, the Self-Ordered Pointing Test, the Stroop test and the Verbal Fluency test, are commonly utilised by neuropsychologists (Rabin, Barr & Burton, 2005; Strauss et al., 2006). The diverse nature of tests has, however, lead to uncertainty regarding the assessment of executive function. Concerns have been raised regarding the construct validity of executive function tests (Miyake, Emerson & Friedman, 2000a; Strauss et al., 2006). Tasks assessing executive function do not measure this variable in isolation from other cognitive abilities (Miyake et al., 2000a), and problems related to "task impurity" (Strauss et al., 2006, p.405) may emerge. Results obtained from measures of executive function may therefore be influenced by other cognitive abilities, which may themselves be impaired (Miyake et al., 2000a). Failure to select executive function measures on the basis of psychometric properties also presents a significant construct validity problem, as clinicians have instead been found to favour face validity (Kafer & Hunter, 1997; Miyake et al., 2000a; Miyake et al., 2000b).

Problems regarding the reliability of measures of executive function have also emerged (Lowe & Rabbitt, 1998; Rabbitt, Lowe & Shilling, 2001). This may be due to the reliance of these tests on "novelty and high attentional demands" (Strauss et al., 2006, p.406). Lowe & Rabbitt (1998) argue that low reliabilities on measures of executive function may be related to the extent to which individuals develop a suitable approach to achieve success in the tasks presented to them. Failure to achieve a successful approach – or the absence of an approach altogether – may impair performance on subsequent tests.

A number of suggestions have been made regarding ways of improving both the construct validity and reliability of measures of executive function. Executive function consists of a diverse range of abilities (Chan et al., 2008; Miyake et al., 2000b), and this must be taken into account within the assessment process (Miyake et al., 2000a; Strauss et al., 2006). With regard to construct validity, it is essential that clinicians select instruments which will assess specific executive function abilities. Additionally, diagnosis of dysexecutive syndromes should not be made based on performance on a single task. Using a number of measures of the same ability in the assessment process will also address the reliability issues associated with executive function tests, to some degree (Miyake et al., 2000a; Strauss et al., 2006).

### 2.4 Superstitions and Paranormal Beliefs

Superstitious beliefs and practices occur in most cultures (Campbell, 1996; Jahoda, 1969) and may be defined as beliefs in "paranormal or anomalous phenomena that are incompatible with scientific explanation" (Wain & Spinella, 2007, p.137). Paranormal refers to "phenomena, which, if true, violate basic limiting principles of science" (Dudley, 1999, p.1058). Superstitions generally take one of two forms, being either negative or positive in nature. Negative superstitions are those beliefs that reflect the idea that "certain behaviours (e.g., breaking a mirror) or omens (e.g., seeing a black cat) are magically associated with unlucky and potentially harmful consequences" (Wiseman & Watt, 2004, p.1534), while positive superstitions are those beliefs which involve behaviours which are thought to encourage good luck and deter misfortune (Wiseman & Watt, 2004). Furthermore, it is important to note that what makes superstitious behaviours different from other actions is "the individual's belief that the cathartic activity is directly linked in some manner with the desired outcome, in other words the presence of a belief that what the individual is doing will influence that outcome in a desired fashion" (Campbell, 1996, p.155). Little difference appears to exist between superstitious and religious beliefs, with some researchers defining them in almost

identical manners (Wain & Spinella, 2007). Religion, however, may be defined as a way of forming meaning in the face of uncertainty (Barnes, 1997), consisting of

> stories of transcendence; of another realm of reality; of superhuman/supernatural being(s) that have the power to help (or to harm), humankind. The recognition of human limitation—of finitude—in face of the inexorable processes of nature that eventuate in death, and the transcending of those limitations by postulating (recognizing/assuming) the existence of a superhuman source of power on which humans can draw, is what religion is essentially all about. (Barnes, 1997, p.377).

It is evident that understanding the basis of superstitions and the tendencies of individuals to engage in such beliefs and behaviours has presented an area of interest within the field of psychology and a number of different theories have been suggested in an effort to explain superstitious thought. Both Freud and Jung posited hypotheses for the existence and practice of superstitions, while Skinner asserted that such beliefs occurred as the result of an erroneous learning process (Campbell, 1996).

Despite the spread of secularism and empiricism in modern society, these seemingly irrational beliefs have remained and continue to influence the thoughts and behaviour of individuals in their everyday lives (Campbell, 1996). It is important to note that, although superstitions are culture-specific, “not all individuals in a given culture subscribe to the same beliefs” (Wain & Spinella, 2007, p.136). Between and within-group variations thus exist, and the presence of such differences has raised questions regarding the factors which might influence superstitious and paranormal beliefs. Thus, for example, the effects of age on superstitious and paranormal beliefs have been investigated. Research by Wolfradt (1997) and Aarnio & Lindeman (2005) revealed no significant differences in belief with regard to age. Other studies, however, have found that these beliefs are influenced by age, with younger individuals being more likely to subscribe to beliefs of a superstitious or paranormal nature (Irwin, 2000; Tobacyk, Pritchett & Mitchell, 1988b; Torgler, 2007; Vyse, 1997). This may be because younger individuals are more likely to engage with beliefs of alternative and eccentric natures, as their lives are more likely to be characterised by feelings of unpredictability regarding the future. Superstitious and paranormal beliefs thus represent a way of mediating the unease which might be linked to

the absence of control over the future (Malinowski, 1927 and 1948, cited in Torgler, 2007). Younger individuals may also be more inclined towards such beliefs because they possess less life experience, scepticism and responsibility than their older counterparts (Vyse, 1997). Additionally, superstitious and paranormal beliefs may help to provide a sense of meaning in the seemingly erratic world which young people may encounter (MacDonald, 1995).

Research into the effects of gender on superstitious beliefs has yielded mixed evidence, with some studies arguing that women are more likely to believe and act in accordance with superstitious and paranormal beliefs (Aarnio & Lindeman, 2005; Clarke, 1991; Irwin, 1993; Wolfradt, 1997). Wiseman & Watt (2004) found that this trend was reflected with regard to both positive and negative superstitions, as women subscribed to both types of superstition significantly more strongly than men. Other research, however, has found that men are more likely than women to report experiences of a paranormal nature (Houran, 1997; Vitulli & Luper, 1998). In two studies conducted in South Africa by Peltzer (2002 and 2003), no significant differences existed between males and females with regard to superstitious and paranormal beliefs.

Ethnicity represents another factor which has been investigated with regard to superstitious and paranormal beliefs. Some studies have found that differences in the extent to which these beliefs are held do exist along ethnic lines (Emmons & Sobal, 1981; Tobacyk, Miller, Murphy & Mitchell, 1988a). Other research by Rogers, Qualter, Phelps & Gardner (2006), however, has failed to find such differences between ethnic groups. The relationship between religion and superstitious and paranormal beliefs has proved to be similarly complicated. Research has shown that individuals who hold strong religious beliefs may hold few superstitious and paranormal beliefs, while those who are less religious may be more superstitious (Emmons & Sobal 1981; Tobacyk & Wilkinson, 1990). Other research however, suggests that individuals who are more religious may also be more inclined to hold superstitious and paranormal beliefs (Orenstein, 2002), while some studies have failed to find any relationship between religious and superstitious and paranormal beliefs (Rice, 2003). The nature of the relationship between

beliefs in superstitious and paranormal phenomena and religious beliefs represents an area which requires further attention, in order to establish whether the types of beliefs which underlie superstitious and paranormal beliefs and religious beliefs are similar or distinct (Emmons & Sobal 1981; Orenstein, 2002; Rice, 2003; Tobacyk & Wilkinson, 1990).

A number of other factors have been found to influence individual belief in superstitious and paranormal phenomena. Beliefs may be maintained by personal and situational variables which alter logical thought patterns. For example the extent to which one's culture subscribes to such beliefs has been found to be influential with regard to individual beliefs. Beliefs may be accepted as legitimate and justifiable because they are held by other members of one's culture and because they are intricately related to day to day activities. Similarly, beliefs held by families tend to be passed on to younger generations, who may readily accept these beliefs as part of their family's outlook on reality (Akande, 2010; Jahoda, 1969; Rudski, 2003; Tobacyk & Milford, 1982; Williams & Irwin, 1991). A lack of awareness regarding one's superstitious and paranormal beliefs has also been found to occur, whereby individuals have internalized these beliefs to such an extent that they do not engage in reasoning activities to attempt to disprove their beliefs and therefore may perform behaviours related to superstitious beliefs as a matter of routine (Gmelch & Felson, 1980; Keinan, 2002).

Research also suggests that individuals may attribute positive occurrences to luck and believe that later successes are also the result of luck, even when later events are unconnected and unrelated to the first event (Darke & Freedman, 1997; Kramer & Block, 2008). Belief in superstitious and paranormal phenomena as capable of fostering good or bad luck can perpetuate a self-fulfilling prophecy, whereby positive or negative results are achieved as a result of an individual's beliefs, as these beliefs may influence self-belief, motivation and influence performance on tasks (Keinan, 2002). The reduction of anxiety levels may also foster positive results, as individuals may rely on superstitious and paranormal beliefs and rituals to reduce anxieties about the future, as these beliefs and actions may suggest to the individual that they possess a certain level of control over

future outcomes (Irwin, 2000; Wiseman & Watt, 2004). Successes or failures may be attributed to certain superstitious and paranormal phenomena, such as good or bad luck. The individual may therefore be able to conceive of events in a particular way, and in cases of misfortune or failure, they may be absolved of responsibility (Case, Fitness, Cairns & Stevenson 2004).

### 2.4.1 The relationship between superstitious and paranormal beliefs and personality

Research has investigated the extent to which personality traits influence the degree of superstitious beliefs and behaviours which individuals engage in. Neuroticism has thus been found to correlate positively with superstitious and paranormal beliefs (Thalbourne et al., 1995; Windholz & Diament, 1974; Wiseman, 2003; Wiseman & Watt, 2004; Wolfradt, 1997). Research has also shown that personality traits may influence the extent to which individuals believe themselves to be lucky or unlucky. Thus, for example, individuals who considered themselves to be lucky were more likely to score highly the dimensions of Openness to Experience and Extraversion than individuals who believed themselves to be unlucky (Wiseman, 2003). Other research has suggested that "paranormal and superstitious beliefs may develop in anxious individuals with a strong need for control, in an attempt to overcome perceived uncertainty in their surroundings" (Wiseman & Watt, 2004, p.1534), while dissociation - the "structured separation of mental processes (e.g. thoughts, emotions, conation, memory, and identity) that are ordinarily integrated" (Spiegal & Cardena, 1991, p.367) – has been found to play a significant part in the extent to which individuals experience paranormal beliefs, with high levels of dissociation having been found to correlate with increased levels of paranormal beliefs (Irwin, 1994; Wolfradt, 1997). The area of research which has proved to be the most conclusive relates to the role of superstitious behaviours in obsessive-compulsive disorder. Superstitious thought patterns and behaviours are common in individuals who meet the diagnostic criteria for this disorder (Einstein & Menzies, 2004), possibly because "superstitious beliefs and behaviors may represent attempts to control circumstances and situations that are perceived to be beyond one's control" (Wain & Spinella, 2007, p.137).

## 2.5 Superstitious and Paranormal Beliefs in South Africa

South Africa is an extremely culturally diverse country, with multiple cultural and ethnic groups (Elion & Strieman, 2001). Consequently, a wide variety of superstitious and paranormal beliefs exist. Notable differences exist between those superstitions which are inherent to African cultures and those which are Western in origin (Akande, 2010). While traditional Western superstitions, such as bad luck being associated with black cats or breaking a mirror, continue to be practiced in South Africa (Peltzer, 2003), African superstitions continue to exist alongside these Western superstitions. As a result,

> The supernatural seems to be part and parcel of everyday life amongst blacks in South Africa, which is in contrast to the belief in the Western world that supernatural is irrational and naïve superstitions that inhibits scientific processing. Belief in magic and the so-called irrational thinking is still being held in high esteem in some parts of the African continent. People still believe in the use of traditional healers who perform religious rituals with substances such as roots, herbs, bark, stems, stalks and other plant and animal materials (Akande, 2010, p.8).

Little research has been conducted into the role of traditional South African superstitions and paranormal beliefs, despite the significant part which beliefs in the paranormal play in both the broad arena of everyday life and in more specific contexts, such as explanations of psychopathology (Lebakeng, Sedumedi & Eagle, 2002). Research has indicated, however, that “fear of unknown and supernatural phenomena seem to be greater amongst black South Africans” (Akande, 2010, p.8) and superstitious practices continue to be prevalent, especially in rural areas (Lebakeng et al., 2002). Interestingly, some research regarding the relationship between personality factors and superstitious beliefs in a South African sample has found that, contrary to Western populations, high levels of superstitious and paranormal beliefs were associated with high levels of Extraversion and negative associations existed between superstitious and paranormal beliefs and Neuroticism (Peltzer, 2002).

## 2.6 Neuropsychological Explanations of Superstitious and Paranormal Beliefs

Neuropsychological research has begun to investigate potential links which may exist between superstitious beliefs and behaviours and neurobiological processes, with the prefrontal cortex having presented an area of particular interest (Wain & Spinella, 2007). Neuroimaging research has shown that the prefrontal cortex plays a significant role in logical reasoning, and as a result of this, the impact which this area has on cognitive processes - particularly those related to both logical and abstract reasoning – has begun to be explored (Bunge, Wendelken, Badre & Wagner, 2005; Noveck, Goel & Smith, 2004). The study of superstitious and paranormal beliefs may help to inform explanations of how everyday beliefs and ideas are formed in neuropsychologically healthy individuals. It is particularly important to note that healthy, non-patient individuals have become the focus of this area of research, due to "the cognitive-neuropsychiatric approach to belief formation [which] has directed the spotlight of attention in too focused a manner on a particular subset of delusional beliefs that have no correspondence in the healthy mind" (Brugger & Mohr, p.1291, 2008). Through this change in focus, research hopes to explain the ways in which both maladaptive thought processes – such as faulty reasoning - and adaptive cognitive mechanisms - such as creativity – work, in neuropsychologically healthy individuals (Brugger & Mohr, 2008).

Research investigating the relationship between superstitious and paranormal beliefs and reasoning ability has presented mixed results. Wierzbicki (1985) found a significant relationship between belief in paranormal phenomena and syllogistic reasoning ability. Thus, higher levels of belief in the paranormal were associated with a higher error rate on the reasoning test presented to participants (Wierzbicki, 1985). Hergovich & Arendasy (2005) found that scores on tests measuring critical thinking ability did not correlate with paranormal beliefs. Reasoning ability, however, was found to correlate with paranormal beliefs, especially with regard to those variables associated with traditional paranormal beliefs and New Age philosophies (Hergovich & Arendasy, 2005). The distinction between critical thinking and reasoning ability is important as research has found that differences in levels of paranormal beliefs in individuals may be associated with general

critical thinking ability, rather than reasoning ability (Hergovich & Arendasy, 2005; Musch & Ehrenberg, 2002).

Education has been shown to play a significant role in moderating superstitious and paranormal beliefs. Higher levels of education are often associated with less extensive belief in superstitious and paranormal phenomena (Otis & Alcock, 1982; Torgler, 2007). Research thus suggests that "university students have less paranormal beliefs than students of lower educational levels because their education provides them with critical thinking abilities" (Aarnio & Lindeman, 2005, p.1228).

With regard to specifically investigating the effect of executive function on superstitious and paranormal beliefs, Wain & Spinella (2007) found inverse correlations between superstitious and paranormal beliefs - as measured by the Paranormal Beliefs Scale - and scores on the Executive Function Index. These results suggest that a relationship may exist between increased belief in superstitious and paranormal phenomena and poor cognitive organisation, restricted cognitive flexibility and increased impulsive tendencies (Wain & Spinella, 2007).

Hemispheric differences have also been found to exist with regard to executive function. The right prefrontal cortex has also been found to be especially sensitive to disturbances in expectations created by associative learning (Fletcher et al., 2001), a process which is associated with cognitive flexibility. Thus, given the role which executive function plays in logical and abstract reasoning, organisation, dealing with novel stimuli, adjusting behaviour to feedback and problem-solving (Chan et al., 2008), superstitious and paranormal beliefs may be the result of faulty cognitions associated with these processes. Research also suggests that executive dysfunction may play a significant role in accounting for delusional beliefs involving confabulation (Papagno & Baddeley, 1997; Cunningham, Pliskin, Cassissi, Tsang, & Rao, 1997).

## 2.7 Rationale

Given the results presented above and the debate which has arisen with regard to the distinction between general critical thinking ability and reasoning ability (Hergovich & Arendasy, 2005; Musch & Ehrenberg, 2002), the present study sought to investigate potential links between neuropsychological functioning - with particular reference to those reasoning abilities associated with executive function - and superstitious and paranormal beliefs, in a neuropsychologically healthy sample. The influence of personality on superstitious and paranormal beliefs was also taken into account. The research was innovative in that it aimed to investigate the neuropsychological underpinnings of superstitious and paranormal beliefs in a country which is culturally diverse and influenced by both Western and traditional African viewpoints. Furthermore, the research aimed to explore the meaning which these superstitious beliefs hold for individuals and the underlying rationalisations which individuals utilise to support their beliefs, in order to gain an understanding of the relevance and significance which they hold and the manner in which individuals comprehend these seemingly irrational beliefs.

## 2.8 Research Aims

This study aimed to examine the extent to which the neuropsychological profile of individuals who subscribe to superstitious and paranormal beliefs differs from that of individuals who do not believe in paranormal phenomena or do not practice common superstitious behaviours, in a South African context. Specifically, this research aimed to investigate potential relationships which may exist between cognitive ability, in the form of executive function, as a function of the prefrontal cortex, personality factors and superstitious and paranormal beliefs, in a sample of neurologically intact South African adults, to determine whether differences in neuropsychological profiles and personality are associated with varying levels of superstitious and paranormal beliefs. While primarily a replication study, based on the methods used by Wain & Spinella (2007), the study also aimed to examine the meaning which superstitious and paranormal beliefs hold for individuals and the underlying reasoning which maintains these seemingly beliefs

## 2.9 Research Questions

1. Is there a relationship between the prefrontal cortex executive function of individuals and superstitious and paranormal beliefs in a sample of non brain-damaged South African adults from various cultural backgrounds?
2. Does personality affect the extent to which individuals believe in and behave in accordance with superstitious and paranormal beliefs?
3. What are the underlying meanings which superstitious and paranormal beliefs hold for individuals and how do they rationalise their belief in these phenomena?

# CHAPTER THREE
# METHOD

## 3.1 Research Design

The study took the form of a non-experimental, cross-sectional, between-subjects, correlational design, employed both quantitative and qualitative data gathering and data analysis techniques in the form of a mixed methods study utilising an explanatory sequential strategy (Greene, Caracelli & Graham, 1989; Tashakkori & Teddlie, 2003; Whitley, 2002).

## 3.2 Sample and Sampling

The sample consisted of 43 adults, between the ages of 21 and 30 years, who were studying at the University of the Witwatersrand at the time at which the study was conducted. The age criterion was important because of developmental issues associated with executive function (Fuster, 2001; Bunge & Wright, 2007). An adult sample thus avoided any extraneous variables associated with executive control development which might be present in a sample composed of younger individuals.

Individuals were selected for the study by means of a convenience sampling process (Whitley, 2002). Undergraduate and postgraduate students from the University of the Witwatersrand were invited to participate in the research by means of emails which were forwarded to students by course co-ordinators. Included in the email was a subject information sheet (Appendix A) which detailed the aims of the research and what would be required of individuals should they wish to participate in the study. Further participants were recruited by visiting a number of undergraduate lectures, where the researcher was given permission by lecturers to invite students to participate in the study. Individuals who volunteered contacted the researcher via email and a suitable time was arranged with each participant for testing to take place.

It was important that the individuals who participated in the study had not suffered any form of severe brain damage, particularly in terms of frontal and prefrontal cortex injuries, as the study aimed to investigate executive function in a group of non-brain damaged individuals. By using a sample of this composition, a standard level of executive function could be established for healthy, non-brain damaged individuals within this sample. This exclusion criterion was utilized in order to rule out possibly extraneous variables which might affect behaviour in some way during the study. There were no other demographic exclusion criteria for individuals who wished to participate in the study.

The educational background of participants was taken into account, as performance on tests of executive function has been shown to be influenced by levels of education, improving in accordance with the number of years of study which an individual has engaged in (Heinrichs, 1990; Strauss et al., 2006). Because the sample consisted of university students, who have at least 12 years of education, levels of executive function were expected to be quite high in nature.

## 3.3 Variables

### 3.3.1 Executive function

a) Theoretical definition: The emotional and logical components of the activities of the prefrontal cortex, consisting of a number of behaviours and mental processes, including “verbal reasoning, problem-solving, planning, sequencing, the ability to sustain attention, resistance to interference, utilization of feedback, multitasking, cognitive flexibility, and the ability to deal with novelty” (Chan et al., 2008, p.201).
b) Operational definition: An individual’s scores on the Wisconsin Card Sorting Test, Raven’s Progressive Matrices and Behavioural Assessment of the Dysexecutive Syndrome.

3.3.2 Superstitious and paranormal beliefs

a) Theoretical definition: “Anomalous phenomena that are incompatible with scientific explanation” (Wain & Spinella, 2007, p.137).
b) Operational definition: Self-reported belief in superstitious and paranormal phenomena, as measured by the Modified Paranormal Beliefs Scale.

3.3.3 Neuroticism

a) Theoretical definition: A lack of emotional stability and potential maladjustment, with a tendency towards anxiety, aggression and sadness. Individuals with low Neuroticism scores are generally composed, serene and unperturbed by events and are capable of dealing with demanding events without becoming distressed (Costa & McCrae, 1995).
b) Operational definition: Self-reported scores on the Neuroticism subscale of the NEO PI-R. and the facets associated with Neuroticism, including Anxiety, Angry Hostility, Depression, Self-consciousness, Impulsiveness and Vulnerability.

3.3.4 Demographic variables

a) Demographic variables within the study were operationalised as follows:
    - Gender (whether the participant is male or female)
    - Age (in years)
    - Level of education (number of years in primary, secondary and tertiary education settings combined)
    - Population group (racial group, as specified by Statistics South Africa [2001]).
    - Religious affiliation (the religious group to which an individual belongs, either by birth or by choice)
    - Socioeconomic status, as measured by a number of sub-variables including parental employment status, parental occupation group, parental education level, participant employment status and household socioeconomic status.

## 3.4 Measures

### 3.4.1 Demographic Questionnaire

Participants in the study were required to complete a demographic questionnaire (Appendix B), specifying their gender, age, level of education, population group (specified according to the main population groups recommended by Statistics South Africa; 2001) and religious affiliation, for statistical purposes. Socioeconomic status was also investigated - using criteria specified by Higgs (2002) - by means of a number of questions concerning parental employment status, parental occupational group, parental level of education, participant employment status and household socioeconomic status. Parental occupational group was classified according to the recommendations made by Schlemmer & Stopforth (1979). While a more recent classification system for gauging employment status would have been preferable, no system appropriate to the South African context could be found. In order to avoid problems which might be associated with the manner in which career classification systems may have changed, only the broadest classification system, in the form of occupational category was used to classify data obtained from participants (Schlemmer & Stopforth, 1979).

Participants were not required to include their name on the questionnaire, nor on any of the instruments used, as a numerical coding system was utilized, whereby each participant was assigned a unique code (for example, 001) which was subsequently used to identify that participant's data and demographic information in order to maintain the anonymity of the participants. By signing the demographic questionnaire, volunteers consented to participating in the study.

### 3.4.2 Modified Paranormal Beliefs Scale (MPBS)

Paranormal beliefs and superstitions were measured using a modified version of Tobacyk & Milford (1983) and Tobacyk's (2004) Revised Paranormal Belief Scale (RPBS). The RPBS consists of a 26-item scale, which "represents seven distinct types of beliefs,

namely, traditional religious belief, psi, witchcraft, superstition, spiritualism, extraordinary life forms, and precognition" (Peltzer, 2003, p.1420), each of which represents a subscale of the overall scale. It is a five-point Likert-type scale, with responses ranging from "1) strongly disagree with this item" through to "5) strongly agree with this item" (Tobacyk & Milford, 1983), and internal consistency values of as high as 0.92 have been reported (Dagnall, Parker & Munley, 2007).

Given that the instrument was developed for use with an American sample and focuses on Western superstitions, the scale needed to be adapted for use in a South African sample, by including appropriate and common South African superstitions. Peltzer (2002; 2003) created a modified version of the scale for use in his research and indicated that it has good internal reliability coefficients of between 0.72 and 0.75. This version of the scale includes a number of traditional African superstitions which align with the underlying factor structure of the RPBS. Some of the items which Peltzer (2002; 2003) included in the scale as examples of negative superstitions which may predict bad luck include owls being seen next to the home, an adult falling in one's presence or a single dove being seen flying, all of which are understood to be traditional African superstitions. Unfortunately, the South African version of the scale could not be obtained, and as a result of this, a new modified version of the scale was created for the purposes of this study by combining items from the original RPBS and Peltzer's (2002; 2003) scale. The Modified Paranormal Beliefs Scale (MPBS) is presented in Appendix C and includes original items from the RPBS (Tobacyk & Milford, 1983; Tobacyk, 2004), such as:

- The soul continues to exist though the body may die
- A person's thoughts can influence the movement of a physical object
- There are actual cases of witchcraft
- The idea of predicting the future is foolish (Tobacyk, 2004, p.96).

The original subscales of the RPBS were retained in the new scale. The Modified Paranormal Beliefs Scale was piloted on a group of four postgraduate students studying neuropsychology, as well as a neuropsychologist from a foreign university and a clinical

psychologist with an interest in neuropsychology. These individuals provided feedback regarding the items included in the scale.

### 3.4.3 The NEO Personality Inventory-Revised (NEO PI-R)

The NEO PI-R derives from the Five Factor model of personality, which posits five domains of personality, in the form of Neuroticism, Extraversion, Openness to Experience, Agreeableness and Conscientiousness. These broad factors are based on numerous adjectives which are used to describe personality traits. Factors are understood to represent groups of traits which are related to one another. The traits themselves represent facets of the individual's personality. In the present study, personality was assessed using the NEO PI-R, in order to measures the five domains of personality and their relative facets. The entire test consists of 240 items and takes approximately 35 minutes to complete. Overall scores and facet scale scores can be calculated, and can then be converted to standard scores (Costa & McCrae, 1995). Internal consistency reliabilities for each of the domains range from .87 to .92. Test-retest reliability is approximately .75 (Costa & McCrae, 1995). Research in South Africa using the NEO PI-R has shown that the structure of personality, as measured by the five factor model, is suitably assessed by the instrument (Heuchert, Parker, Stumpf & Myburgh, 2000). Some differences between race groups have been found to exist within scores in the domains and facets measured by the NEO PI-R, with particular reference to the Openness to Experience domain. Researchers have questioned whether this is a direct effect of race, or rather the result of socioeconomic or cultural differences (Heuchert et al., 2000).

Due to the extensive length of the test battery which was used in the study, however, it was decided to use only the Neuroticism subscale of the NEO PI-R, as Neuroticism has been found to correlate positively with paranormal beliefs (Thalbourne et al., 1995; Wiseman, 2003). Neuroticism represents a lack of emotional stability, and may also reflect maladjustment. The facets associated with Neuroticism within the NEO PI-R are Anxiety, Angry Hostility, Depression, Self-consciousness, Impulsiveness and Vulnerability. Individuals with low Neuroticism scores are generally composed, serene

and unperturbed by events, being capable of dealing with demanding events without becoming distressed. Individuals with high Neuroticism scores are more prone to anxiety, aggression and sadness (Costa & McCrae, 1995).

### 3.4.4 Executive Function and Logical Reasoning Test Battery

To assess the numerous components associated with executive function, in terms of both behaviours and mental processes, three different measures of executive functioning were utilised in the present study, in the form of the Wisconsin Card Sorting Test, Raven's Progressive Matrices and the Behavioural Assessment of the Dysexecutive Syndrome. By making use of a battery of tests, the study was better able to explore the numerous distinct facets of executive functioning (Chan et al., 2008).

*Wisconsin Card Sorting Test (WCST)*

The WCST, originally developed by Berg and Grant in 1948 (Berg, 1948; Grant & Berg, 1948), was used to measure each participant's level of executive functioning. It has been utilized in a great deal of research, and is one of the most frequently employed measures of executive function, being used by 70% of neuropsychologists (Alvarez & Emory, 2006).

The Wisconsin Card Sorting Test is generally used to "assess perseveration and abstract thinking" (Psychological Assessment Resources, 2005), but it is also used as a neuropsychological instrument for assessing executive function in the form of "strategic planning, organized searching, utilizing environmental feedback to shift cognitive sets, directing behaviour toward achieving a goal, and modulating impulsive responding" (Psychological Assessment Resources, 2005), by assessing an individual's abilities for "shifting, updating, and inhibition" (Miyake et al., 2000b, p.58). In the test, individuals are required to sort cards, each of which features a simple geometric pattern which is either red, green, yellow or blue. Cards are sorted according to a design component, whereby cards are "matched on color (red, green, blue, yellow), shape (triangle, star, cross, circle), or number (1, 2, 3, 4)" (Huizinga, Dolan & van der Molen, 2006, p.2021).

The rules for the sorting process are revealed through minimal feedback throughout the task, as sorting continues and the rules for the process change once a participant has established a certain pattern of correct sorting. The individual must then adjust to this change and the new rule in order to continue sorting the cards correctly (Head, Kennedy, Rodrigue & Raz, 2009).

The manual version of the test takes approximately fifteen to thirty minutes to complete and fifteen to thirty minutes to score. Results from the test are calculated from the categories of cards which are sorted correctly and from the number of and types of errors made, which serve to indicate perseveration (Alvarez & Emory, 2006; Strauss et al., 2006). Results from the test thus include the overall number of trials administered in the form of the number of cards which the individual was required to sort until they had either completed all six categories by matching cards to the principle of colour, number or form or had utilised all 128 cards, the total number of correct responses which were made and the total number of errors which were made by the individual (Heaton, Chelune, Talley, Kay & Curtiss, 1993). Perseverative responses and perseverative errors are also calculated and refer to the extent to which an individual "persists in responding to a stimulus characteristic that is incorrect" (Heaton et al., 1993, p.8). Similarly, nonperseverative errors, conceptual level responses – those responses in which the individual successfully matches cards to principle over a certain number of trials -, the overall number of categories completed, and the number of trials required to complete the first category are calculated for each individual's performance on the task. A failure to maintain set score may also be calculated, and reflects failures to maintain correct responses within a category, even when at least five correct matches have been made. The individual's learning abilities and potential improvement across trials can also be calculated, in the form of a learning to learn score (Strauss et al., 2006).

Normed standardized scores for non brain-damaged individuals are presented in the Wisconsin Card Sorting Test manual, and are classified according to age and level of education. Within the present study, individuals were thus classified as belonging to one of three groups - 13 to 15 years of education, 16 to 17 years of education or 18 or more

years of education – in accordance with the recommendations made by Heaton et al. (1993) in the Wisconsin Card Sorting Test manual. Using age and education norms, standardized scores for participants may be calculated (Heaton et al., 1993). Concerns have been raised regarding the applicability of these norms to a South African population (Skuy, Schutte, Fridjhon & O'Carroll, 2001), but given that the current research was conducted within a tertiary education institution, executive function levels were expected to be relatively high, based on the effects which education has been shown to have on these cognitive abilities (Strauss et al., 2006).

*Raven's Progressive Matrices Test (RPM)*

The RPM is a test of "inductive reasoning" (Strauss et al., 2006, p.229) and tests the individual's "ability to forge new insights, the ability to discern meaning in confusion, the ability to perceive, and the ability to identify relationships" (Raven, Court & Raven, 1996, p.1). The Standard Progressive Matrices contains 60 items, which are divided into 5 sets, with each set being composed of 12 items. Each item consists of a pattern, of which one part has been removed. Between 6 and 8 possible pattern pieces are presented, but only one represents the correct pattern which matches the original pattern of the item. Items become more challenging as individuals work through the sets, as various types of matrix transformation are tested (Raven et al., 1996; Strauss et al., 2006).

The test takes approximately 25 minutes to complete and is suitable for individuals from the age of six years old (Raven et al., 1996). Performance has been shown to improve with age and level of education, and few gender-related differences have been found. The overall number of correct scores is recorded and these scores are then converted to percentile scores. Both split-half and test-retest reliability have been shown to be approximately .80 in American and European samples (Strauss et al., 2006), while South African samples have shown internal consistency values between .73 and .92 (Rushton & Skuy, 2000).

*Behavioural Assessment of the Dysexecutive Syndrome (BADS)*

The BADS was used to further assess the executive function abilities of individuals. The test measures the "organisation and planning" (Strauss et al., 2006, p.402) abilities of individuals and consists of six different tests which reflect everyday activities. Included in this battery of tests is the Rule Shift Cards Test, which measures an individual's capacity to shift between designated rules, while the Action Program Test examines problem-solving and planning. The Key Search Test investigates an individual's search strategy abilities, and the Temporal Judgement Test tests reasoning skills. The Zoo Map Test examines the individual's ability to plan, while the Modified Six Elements Test investigates organisation. The test takes approximately 30 minutes to complete and subtest scores and an overall battery score are generated. These scores can be standardized according to the norms given in the BADS Manual (Wilson, Alderman, Burgess, Emslie & Evans, 1996). While no ethnicity or gender effects have been reported, standardised scores are not currently available for a South African sample (Strauss et al., 2006).

### 3.4.5 Superstitious and Paranormal Beliefs Interview

Seven participants with comparably high scores on the Modified Paranormal Beliefs Scale were asked to take part in an audio taped interview, which assessed the nature of superstitious and paranormal beliefs from a qualitative perspective. The individuals who were invited to participate in the interviews were chosen on the basis of their MPBS scores, once the scores of the Traditional Religious Beliefs subscale had been excluded from the total. This was done in order to control for differences in religious beliefs which might affect overall MPBS scores. Those individuals who were interviewed thus scored highly on the Psi, Witchcraft, Superstition, Spiritualism, Extraordinary Life Forms and Precognition subscales of the MPBS.

Individuals who participated in the interview process were asked to sign a form agreeing to participation in the interview process (Appendix D). A second form, agreeing to allow their interview with the researcher to be audio taped (Appendix E) was also signed. The

interview format was semi-structured (Appendix F), as some flexibility was important in the interview process (Whitley, 2002). Questions focused on the individual's feelings about superstitious and paranormal beliefs as a whole, their feelings about their own superstitious and paranormal beliefs, whether they believed themselves to be superstitious and the meanings which they ascribe to their beliefs. Additionally, individuals were asked about the ways in which they rationalise their beliefs and the reasoning processes which they use when acting in accordance with their superstitious and paranormal beliefs. Interview responses were transcribed by the researcher.

## 3.5 Procedure

Participants were first required to complete a demographic questionnaire (Appendix B), specifying their gender, age, level of education, socioeconomic status, population group and religious affiliation. Participants were then required to complete the Modified Paranormal Beliefs Scale (Appendix C) and the NEO PI-R neuroticism subscale. In order to assess each participant's level of executive function, individuals then completed a battery of executive function tests, in the form of the Wisconsin Card Sorting Test, the Raven's Progressive Matrices Test and the Behavioural Assessment of the Dysexecutive Syndrome. The entire process took approximately 90 minutes to complete for each participant.

Finally, 7 individuals with high superstitious and paranormal beliefs were asked to participate in a brief interview process to assess their understanding of their superstitious and paranormal beliefs and the reasoning processes which underlie the maintenance of such beliefs.

## 3.6 Data Analysis

### 3.6.1. Quantitative Data Analysis

Data drawn from the demographic questionnaire was used to generate descriptive

statistics for the sample, in the form of frequencies and percentages. Descriptive statistics for the Modified Paranormal Beliefs Scale – including overall and subscale scores and a total which excluded the Traditional Religious Beliefs subscale - and Neuroticism subscale of the NEO PI-R were generated from the data. Raw data from the Wisconsin Card Sorting Test was calculated from each administration of the test. Raw scores were then converted to standardised scores, using the norms presented in the WCST manual, in order to allow for comparisons to be made across the sample, despite potential differences in age and level of education. Similarly, raw scores from the Raven's Progressive Matrices were converted to the appropriate standardised scores and Behavioural Assessment of the Dysexecutive Syndrome test scores were converted to age-corrected standardised scores (Strauss et al., 2006). Data from the WCST, RPM and BADS were used to generate descriptive statistics for the sample.

All data obtained from the sample were also subjected to a distribution analysis, in order to establish whether the data was normally distributed. Measures of skewness and kurtosis were of particular interest in this regard (Huck, 2009).

Spearman's correlations were conducted instead of Pearson's correlations because of concerns regarding the normality of the data. These correlations were performed to establish whether a relationship existed between demographic variables of an interval nature, in the form of age, number of years of post-matric education and household socioeconomic status and MPBS scores. Similarly, relationships between age, number of years of post-matric education and household socioeconomic status and scores obtained from the Neuroticism scale of the NEO PI-R were also investigated using Spearman's correlations. The nature of the relationships between age and performance on each of the tests of executive function, in the form of the WCST, RPM and BADS – all of which presented interval scale data – were also tested using Spearman's correlations. Similarly, the nature of the relationship between education and performance on the WCST, RPM and BADS were tested using further Spearman's correlations. Household socioeconomic status was also correlated with scores obtained from the WCST, RPM and BADS. Kruskal-Wallis nonparametric one-way ANOVA's were performed to establish whether

the demographic variables – in the form of education category, gender, population group, religious affiliation and the socioeconomic variables of parental employment status, parental occupational group, parental education level and participant employment status - influenced performance on the measures used within the study. This statistical test was chosen based on the nature of these demographic variables, which were categorical in scale and subsequently did not meet parametric data requirements (Howell, 2004; Huck, 2009).

Further Spearman's correlations were conducted to establish whether relationships existed between scores from the MPBS and scores from the Neuroticism scale of the NEO PI-R. Similarly, associations between MPBS scores and performance on the WCST, RPM and BADS were investigated using Spearman's correlations, to establish whether superstitious and paranormal beliefs are in any way associated with either improved or poorer performance on these measures of executive function. Finally, Spearman's correlations were performed to establish whether any type of relationship existed between performance on any of the tests of executive function, in the form of the WCST, RPM and BADS. Scores from each measure were thus correlated with those of the other measures, in order to test the nature of the relationships between these three variables.

### 3.6.2 Qualitative Data Analysis

Following transcription, the qualitative data obtained from the interviews with participants was examined from a phenomenological perspective, due to the researcher's interest in understanding the unique experiences of individuals who subscribe to superstitious and paranormal beliefs (Fossey, Harvey, McDermott & Davidson, 2002). This perspective represents a noticeable contrast to the positivist paradigm from which the quantitative data within the study was analysed. Positivism – and the scientific method in general – "relies on deductive logic, combined with observation and experiment in the empirical world, to refute propositions and confirm probabilistic causal laws, which are used to make generalizations about the nature of phenomena" (Fossey et al., 2002, p.718). While the positivist paradigm is certainly useful for interpreting the

quantitative data within the current study, the data obtained from the interviews conducted with participants was of a qualitative nature. A phenomenological approach was thus adopted with regard to data analysis, as this data was primarily intended to address questions regarding the meaning and understandings which underlie beliefs in superstitious and paranormal phenomena. As noted by Fossey et al. (2002), qualitative research focuses on gaining an appreciation of the significance and implications of the actions of individuals and broader events, and seeks to explore these significances from the perspectives of the individuals concerned.

Thematic content analysis was used to analyse the interviews, by "identifying, analysing and reporting patterns (themes) within the data" (Braun & Clarke, 2006, p.79). Themes are understood to signify a particular trend within the data, and were analysed both within individual interviews and across the qualitative data. Following broad readings of each of the interviews, codes were created for the themes which were identified and central, recurring patterns were thus identified in order to present a detailed description of the data (Braun & Clark, 2006). In this way, the common superstitious and paranormal beliefs held by participants and their feelings toward such phenomena, both in general and in their own lives, could be identified. The underlying meaning which their beliefs hold for them and the rationalization processes which relate to such beliefs was also examined. The analysis process thus focused on "understanding the subjective meaning of experiences and situations for the participants themselves" (Fossey et al., 2002, p.728). Due to this phenomenological approach, it was important that the researcher's self-reflexivity was taken into account, as the possibility of issues regarding subjectivity and value judgments arising in the analysis process must be acknowledged. A report regarding the researcher's self-reflexivity is included in Appendix G.

### 3.7 Ethical Considerations

Ethical clearance was obtained from the Human Research Ethics Committee of the School of Human and Community Development of the University of the Witwatersrand to proceed with the research project, under the protocol number MPSYC/10/002. A copy

of the clearance certificate is included in Appendix G. Permission was obtained from course co-ordinators and lecturers at the University of the Witwatersrand to approach students for the purposes of obtaining the sample. Students were informed of the nature and purpose of the research by means of a subject information sheet. Participants were required to sign an informed consent form, which formed part of the demographic questionnaire given to participants. Participation in the study was voluntary and individuals were not disadvantaged if they chose not to participate. Individuals were allowed to withdraw themselves from the study at any time, with no negative consequences. No potential issues regarding the sensitivity of the sample arose, as the individuals who participated in the study were consenting adults, and the exclusion criteria ensured that potentially sensitive subjects, in the form of individuals suffering from brain damage were excluded from the sample. The contact details for free telephonic counselling services were made available to the participants, if any concern regarding superstitious or paranormal beliefs arose.

Due to the interactive nature of the administration of the tests within the executive function battery and the qualitative interview process, anonymity was not possible within this context. Overall, however, anonymity was ensured by means of a coding system, whereby each individual's demographic information questionnaire, superstitious beliefs scale, executive function test battery, personality scale and interview responses shared a single numerical code, ensuring that the identity of the participant remained anonymous, while allowing for the correlation of the results of the measures for statistical purposes for data collection. No demographic information beyond the participant's age, gender, level of education, socio-economic status, population group and religious affiliation were recorded, both within data collection and the research report, and confidentiality was maintained by the researcher. The data will be kept for a period of five years, in a safe place at the University of the Witwatersrand, until no longer required, and will then be destroyed. Participants were informed of the possibility that the results obtained from the research may be published or presented at a conference, by means of the informed consent form included in the demographic questionnaire.

Individuals who were asked to participate in the interview process were asked to sign two forms, one agreeing to participation in the interview process (Appendix D) and a second form, agreeing to allow their interview with the researcher to be audio taped (Appendix E). The identity of the participants was known to the researcher, because of the interactive nature of the interview process, but confidentiality of the participant's identities was maintained. Anonymity was assured by means of a numerical coding system and the creation of pseudonyms for participants and potentially identifying information was not included in the research report. Individuals were under no obligation to participate in the interview process and could withdraw at any time if they wished.

The overall results of the study will be made available to participants via an internet blog, but individual results will not be made available to individuals in order to maintain anonymity. Confidentiality of the data will be maintained by the researcher, and no identifying characteristics of participants are included in the research report. Additionally, data was analyzed in relation to the group, and not in relation to individuals.

# CHAPTER FOUR
# RESULTS

## 4.1 Quantitative results

### 4.1.1 Descriptive Statistics - Demographic Variables

Descriptive statistics were generated for the demographic variables obtained from the sample. The average age of participants was 23.3 years (*SD* = 2.02). The age of participants ranged from 21 to 28 years. The number of years of post-matric education ranged from 2 to 11 years (*M* = 5.07, *SD* = 1.77). Further descriptive statistics for the sample, in the form of age, gender, education, population group, religious affiliation and socioeconomic status and are presented in Tables 4.1.1.1 to 4.1.1.4.

Table 4.1.1.1
*Frequencies and Percentages of Demographic Variables of Age, Education Category and Gender*

| Demographic variable | Frequency | Percentage |
|---|---|---|
| Age | | |
| 21 | 9 | 20.93 |
| 22 | 8 | 18.60 |
| 23 | 11 | 25.58 |
| 24 | 5 | 11.63 |
| 25 | 2 | 4.65 |
| 26 | 4 | 9.30 |
| 27 | 2 | 4.65 |
| 28 | 2 | 4.65 |
| Education category | | |
| 13 to 15 years | 6 | 13.95 |
| 16 to 17 years | 24 | 55.81 |
| ≥ 18 years | 13 | 30.23 |
| Gender | | |
| Male | 18 | 41.86 |
| Female | 25 | 58.14 |

Table 4.1.1.2
*Frequencies and Percentages of Demographic Variables of Population Group and Religious Affiliation*

| Demographic variable | Frequency | Percentage |
|---|---|---|
| Population group | | |
| African | 9 | 20.93 |
| White | 28 | 65.12 |
| Asian | 2 | 4.65 |
| Indian | 3 | 6.98 |
| Coloured | 1 | 2.33 |
| Religious affiliation | | |
| Christian | 20 | 46.51 |
| Jewish | 4 | 9.30 |
| Muslim | 2 | 4.65 |
| Hindu | 2 | 4.65 |
| Buddhist | 1 | 2.33 |
| Spiritual | 5 | 11.63 |
| Atheist | 3 | 6.98 |
| Agnostic | 6 | 13.95 |

Table 4.1.1.3
*Mean and Standard Deviation for Household Socioeconomic Status*

| Variable | *M* | *SD* |
|---|---|---|
| Household socioeconomic status | 8.19 | .93 |

Table 4.1.1.4
*Frequencies and Percentages for Socioeconomic Status Variables*

| Socioeconomic status variable | Frequency | Percentage |
|---|---|---|
| Parental employment status | | |
| Father only employed | 9 | 20.93 |
| Mother only employed | 6 | 13.95 |
| Both parents/guardians employed | 25 | 58.14 |
| Both parents retired | 2 | 4.65 |
| Unknown/missing values | 1 | 2.33 |
| Parental occupation group | | |
| Paternal occupation group | | |
| Professional and managerial | 24 | 55.18 |
| Middle white-collar | 7 | 16.28 |
| Skilled artisans and status equivalent | 4 | 9.30 |
| Unknown/missing values | 8 | 18.60 |
| Maternal occupation group | | |
| Professional and managerial | 20 | 46.51 |
| Middle white-collar | 12 | 27.91 |
| Unskilled manual and menial | 2 | 4.65 |
| Unknown/missing values | 9 | 20.93 |
| Parental education level | | |
| Paternal education level | | |
| ≤ Standard 8 | 2 | 4.65 |
| Standard 10 | 10 | 23.26 |
| Diploma | 11 | 25.58 |
| Degree | 13 | 30.23 |
| Doctorate | 3 | 6.98 |
| Unknown | 4 | 9.30 |
| Maternal education level | | |
| ≤ Standard 8 | 6 | 13.95 |
| Standard 9 | 2 | 4.65 |
| Standard 10 | 15 | 34.88 |
| Diploma | 9 | 20.93 |
| Degree | 9 | 20.93 |
| Unknown | 2 | 4.65 |
| Participant employment status | | |
| Employed | 18 | 41.86 |
| Not employed | 25 | 58.14 |

Mean scores and standard deviations were generated for the results obtained from the Modified Paranormal Beliefs Scale. As a modified version of Tobacyk's (2004) Paranormal Beliefs Scale was used, the scores obtained from the current study cannot be compared to the results of other studies. Summary statistics for the MPBS are presented in Table 4.1.1.5.

Table 4.1.1.5
*Means and Standard Deviations for Paranormal and Superstitious Beliefs Subscales and Overall Modified Paranormal Beliefs Scale Scores*

| Variable | *M* | *SD* | Minimum scores | Maximum scores |
|---|---|---|---|---|
| Paranormal beliefs scale | | | | |
| Traditional religious beliefs | 20.09 | 8.16 | 4 | 28 |
| Psi | 13.98 | 6.28 | 4 | 28 |
| Witchcraft | 15.42 | 7.44 | 4 | 28 |
| Superstitions | 5.88 | 4.03 | 3 | 17 |
| Spiritualism | 12.12 | 6.35 | 4 | 26 |
| Extraordinary life forms | 5.49 | 3.62 | 3 | 16 |
| Precognition | 10.28 | 3.95 | 3 | 20 |
| Paranormal beliefs total | 83.26 | 29.01 | 25 | 147 |
| Paranormal beliefs total (excluding traditional religious beliefs) | 63.16 | 23.93 | 21 | 119 |

Mean scores and standard deviations were also generated for the results obtained from the Neuroticism subscale of the NEO PI-R. Mean scores indicate that Neuroticism subscale scores of participants in the current study fell on the cusp of the Average and High percentiles groupings. Anxiety and Vulnerability facet scores fell with the High percentile grouping, while Angry Hostility, Depression, Self-consciousness and Impulsiveness scores fell within the Average percentile grouping. Summary statistics are presented in Table 4.1.1.6.

Table 4.1.1.6
*Means and Standard Deviations for NEO PI-R Neuroticism Subscale Facet and Overall Neuroticism Scores*

| Variable | *M* | *SD* | Minimum score | Maximum score |
|---|---|---|---|---|
| NEO PI-R – Neuroticism subscale facets | | | | |
| Anxiety | 57.77 | 10.92 | 34 | 80 |
| Angry hostility | 54.42 | 11.21 | 34 | 78 |
| Depression | 53.35 | 11.90 | 37 | 80 |
| Self-consciousness | 51.26 | 11.12 | 30 | 72 |
| Impulsiveness | 48.58 | 10.08 | 30 | 73 |
| Vulnerability | 60.02 | 10.69 | 36 | 80 |
| Neuroticism subscale total | 55.63 | 9.93 | 35 | 76 |

Mean scores and standard deviations for the WCST and RPM were also generated and are presented in Table 4.1.1.7 and 4.1.1.8 respectively. As these are normed tests, and percentile scores are based on unstandardised raw scores, the scores obtained by participants on these two tests cannot be compared to the percentile scores provided by the authors of the WCST and RPM (Heaton et al., 1993; Raven et al., 1996).

Table 4.1.1.7
*Means and Standard Deviations for Wisconsin Card Sorting Test Scores*

| Variable | *M* | *SD* | Minimum score | Maximum score |
|---|---|---|---|---|
| Wisconsin Card Sorting Test | | | | |
| Trials | 90.61 | 21.19 | 70 | 128 |
| Total number correct | 69.33 | 7.96 | 53 | 94 |
| Errors | 97.72 | 14.72 | 60 | 120 |
| Perseverative responses | 97.19 | 17.08 | 57 | 139 |
| Perseverative errors | 96.35 | 17.26 | 57 | 133 |
| Nonperseverative errors | 98.91 | 12.38 | 64 | 123 |
| Conceptual level responses | 94.63 | 14.10 | 58 | 115 |
| Categories completed | 5.37 | 1.51 | 1 | 6 |
| Trials to complete first category | 13.79 | 6.86 | 10 | 37 |
| Failure to maintain set | .61 | .88 | 0 | 3 |

Table 4.1.1.8
*Means and Standard Deviations for Raven's Progressive Matrices Test Scores*

| Variable | *M* | *SD* | Minimum score | Maximum score |
|---|---|---|---|---|
| Raven's Progressive Matrices Test Total | 51.16 | 4.59 | 41 | 59 |

The Temporal Judgement subtest of the BADS proved to be problematic within the context of the present study. The test consists of four questions about everyday events and participants are required to make a reasonable estimate about the length of time associated with each of the questions posed (Wilson et al., 1996). The questions were thus:

1. How long does it take to do a routine dental check up?
2. How long does it take a window cleaner to clean the windows of an average size house?
3. How long do most dogs live for?
4. How long does it take to blow up a party balloon? (Wilson et al, 1996, p.12).

While most participants performed reasonably well with regard to estimating the length of time associated with question 1, 3 and 4, problems were encountered with question 2. The BADS manual indicates that it would take between 15 and 25 minutes for "a window cleaner to clean the windows of an average size house" (Wilson et al, 1996, p.12). With regard to the answers given by participants in the sample, however, the estimates ranged from 5 minutes to 12 hours. This may be due differences in the size of South African and British houses and points to possible issues regarding the validity of this item in terms of the South African context. It was thus decided to adapt the item for use in this sample. Guesses which estimated the time as being between 30 minutes and 3 ½ hours were thus marked as correct, for the purposes of this research, as the mean of the guesses made by the sample was 129.58 minutes (*S.D.* 91.44). Descriptive statistics for BADS scores are presented in Table 4.1.1.9. The mean standardised scores ($M$ = 100.93, $SD$ = 12.56)

obtained by the sample in the current study fell within the middle of the Average classification grouping presented by Wilson et al. (1996).

Table 4.1.1.9
*Means and Standard Deviations for Behavioural Assessment of the Dysexecutive Syndrome Scores*

| Variable | *M* | *SD* | Minimum score | Maximum score |
|---|---|---|---|---|
| Behavioural Assessment of the Dysexecutive Syndrome | | | | |
| Rule shift card test | 3.47 | .77 | 0 | 4 |
| Action program test | 3.77 | .48 | 2 | 4 |
| Key search test | 2.77 | 1.21 | 0 | 4 |
| Temporal judgement test | 1.93 | .77 | 1 | 4 |
| Zoo map test | 2.91 | .87 | 1 | 4 |
| Six elements test | 3.44 | .91 | 1 | 4 |
| Standardised score | 100.93 | 12.56 | 67 | 124 |
| Age corrected standard score | 98.33 | 14.15 | 59 | 124 |

4.1.2 Distribution Analyses

The results of the distribution analyses, in the form of skewness coefficients and kurtosis values, revealed a number of problematic trends within the data. While the variable of age was positively skewed with a value of .82 and a kurtosis value of -.16, which were acceptable, education was both problematically positively skewed at 1.12 and presented with a kurtosis value of 1.80, indicating that this data did not present a normal distribution. The distribution of the household socioeconomic status data was, however, normally distributed (skewness = -.76; kurtosis = -.58). Distribution analyses could not be performed on any of the other demographic variables, because the represented categorical data.

In terms of the normality of the data obtained from the MPBS, the overall scores from the scale fell within a normal distribution (skewness = -.11; kurtosis = -.50). Similarly, when Traditional Religious Belief scores were removed from the overall MPBS score, the distribution remained acceptable in terms of normality (skewness = .26; kurtosis = -.73).

Only two subscales of the MPBS proved problematic in terms of skewness, with the Superstitious Beliefs subscale presenting a skewness coefficient of 1.17 and the Extraordinary Life Forms subscale presenting a skewness coefficient of 1.74. In terms of kurtosis, the Extraordinary Life Forms subscale again proved problematic, as it had a kurtosis value of 2.42. Similarly, the Witchcraft subscale presented a problematic kurtosis value of -1.11, despite having a skewness coefficient of .12. The Traditional Religious Beliefs subscale (skewness = -.86; kurtosis = -.53), Psi subscale (skewness = .37; kurtosis = -.63), Spiritualism subscale (skewness = .47; kurtosis = -.71) and Precognition subscale (skewness = .02; kurtosis = .13) all presented acceptable skewness and kurtosis values.

All the facet scores of the Neuroticism subscale of the NEO PI-R fell within a normal distribution, as evidenced by both skewness coefficients and kurtosis values. The Anxiety facet subscale thus presented an acceptable skewness coefficient of -.06 and a kurtosis value of -.48, while the Angry Hostility facet subscale presented an acceptable skewness coefficient of .09 and a kurtosis value of -.61. Similar results were revealed for the remaining facet subscales of Depression (skewness = .41; kurtosis = -.82), Self-consciousness (skewness = -.05; kurtosis = -.88), Impulsiveness (skewness = .20; kurtosis = .06) and Vulnerability (skewness = .13; kurtosis = -.48). Overall, the skewness coefficient for the total Neuroticism score distribution was .02, while the kurtosis value was -.90.

Data obtained from the WCST revealed a normal distribution with regard to the number of trials (skewness = .91; kurtosis = -.73), percent errors (skewness = -.93; kurtosis = .20), percent perseverative responses (skewness = -.44; kurtosis = .53) and percent perseverative errors (skewness = -.63; kurtosis = .11). The data from the total number of correct responses (skewness = 1.08; kurtosis = 1.50), number of categories (skewness = -2.32; kurtosis = 3.94) and number of trials to complete first category (skewness = 2.57; kurtosis = 5.56) were not normally distributed, however. Additionally, while the skewness coefficient of nonperseverative errors was acceptable (skewness = -.95), the kurtosis value was 1.12. Conversely, the kurtosis value of percent conceptual level responses was .58, while the skewness coefficient proved to be problematic, with a value

of -1.15. The variable of failure to maintain set presented a similar pattern, with a kurtosis value of .89 and a skewness coefficient of 1.33.

The distribution of the RPM data was normal, with a skewness coefficient for the RPM total of -.39 and a kurtosis value of -.45. With regard to the BADS, a number of subtests from the BADS failed to fall within a normal distribution. These included the Rule Shift Card test, which had a skewness coefficient of -2.37 and a kurtosis value of 8.81 and the Action Program test, with a skewness coefficient of -1.97 and a kurtosis value of 3.31. Similarly, the Six Elements test presented a skewness coefficient of -1.62 and a kurtosis value of 1.74. Skewness coefficients and kurtosis values of the Key Search test (skewness = -.62; kurtosis = -.60), Temporal Judgement test (skewness = .45; kurtosis = -.19) and Zoo Map test (skewness = -.27; kurtosis = -.72) indicated that these data fell within a normal distribution, however. Overall standardised scores which were corrected for age also fell within a normal distribution, with a skewness coefficient of -.56 and a kurtosis value of .09.

As a result of the problematic skewness coefficients and kurtosis values reflected in many of the variables, it was decided to use Spearman's correlations instead of Pearson's correlations in analysing the data, because the data did not present a normal distribution. With regard to testing the effects of variables on the various measures used within the study, Kruskal-Wallis nonparametric one-way ANOVA's were performed in place of parametric one-way ANOVA's because of the skewness values presented by the data (Howell, 2004; Huck, 2009).

### 4.1.3 The Relationships between Demographic Variables and Superstitious and Paranormal Beliefs

The relationship between each of the demographic variables and levels of superstitious and paranormal beliefs was tested in order to ascertain whether performance on the Modified Paranormal Beliefs Scale was affected by age, gender, level of education, population group, religious affiliation or socioeconomic status. As illustrated in Tables

I1.1 to I1.3 (Appendix I)[1], no significant relationships existed between the demographic variables of age, education or household socioeconomic status and any of the subscales of the MPBS. Additionally, no significant relationships were found to exist between these demographic variables and both overall MPBS scores and MPBS scores which excluded religious beliefs.

Kruskal-Wallis tests were conducted to establish whether broader education categories affected MPBS scores. No significant differences were found to exist between education categories and MPBS scores. Further Kruskal-Wallis tests were performed between the variables of gender, population group and religious affiliation and the MPBS. Neither gender nor population group were found to have any significant effect on MPBS scores. Religion was found to influence MPBS scores, however, with regard to the Traditional Religious Beliefs subscale ($H = 24.80$, $p = .001$) and the Witchcraft subscale ($H = 14.67$, $p = .041$). These results are reflected in Table I1.4 (Appendix I).

Finally, socioeconomic variables in the form of parental employment status, parental occupational group, parental level of education and participant employment status were tested against MPBS scores. Of these variables, maternal employment status was the only one which was found to result in significant differences in MPBS scores, with regard to the Superstitions subscale ($H = 8.38$, $p = .039$) and the Precognition subscale ($H = 8.23$, $p = .042$). Results for the abovementioned socioeconomic status variables are presented in Table I1.5 (Appendix I). These results suggest that few relationships existed between socioeconomic status variables and MPBS scores.

### 4.1.4 The Relationship between Demographic Variables and Neuroticism

The relationships between demographic variables and the personality variable of Neuroticism, as measured by the Neuroticism subscale of the NEO PI-R, were tested by means of Spearman's correlations, to establish whether any of the demographic variables might be associated with the variable of Neuroticism. Spearman's correlations revealed

[1] Predominantly nonsignificant results are included in tabulated form in the appendices.

that no significant relationships existed between age, education or household socioeconomic status and any of the facets of the Neuroticism subscale. Data from these correlations is presented in Table J1.1 to J1.3 (Appendix J). Similarly, no significant relationships existed between these demographic variables and overall Neuroticism scores.

With regard to nominal variables, Kruskal-Wallis one-way ANOVAs were performed between demographic variables and Neuroticism scores. Education category, gender, population group and religious affiliation were not found to affect Neuroticism scores. Results from these tests are presented in Table J1.4 in Appendix J. With regard to the socioeconomic variables, parental employment status, parental occupational group and parental level of education were not found to affect Neuroticism scores. Participant employment status was, however, found to influence the Vulnerability subscale of the Neuroticism scale ($H = 8.00$, $p = .005$), but no other significant differences were found. The results of these tests are presented in Table J1.5 (Appendix J).

### 4.1.5 The Relationship between Demographic Variables and Measures of Executive Function

Spearman's correlations and Kruskal-Wallis one-way ANOVAs were performed in order to establish whether any type of significant relationship existed between demographic variables and performance on the WCST. The results of Spearman's correlations between WCST score variables and age, education and household socioeconomic status respectively reveal that significant moderate, positive relationships exist between the average number of categories completed in the WCST and both age ($r = .346$; $p = .022$) and education ($r = .388$; $p = .010$). A moderate, negative correlation between household socioeconomic status and failure to maintain set within the WCST ($r = -.337$; $p = .027$) was found, suggesting that individuals with higher socioeconomic status were less likely to fail to maintain set during their WCST. No other significant relationships were found between these demographic variables and WCST scores, as indicated in Tables K1.1 to K1.3 (Appendix K).

The results of Kruskal-Wallis one-way ANOVAs between WCST score variables and the demographic variables of education category revealed that this variable did not result in significant differences in WCST scores. Similarly, gender was not associated with significant differences in WCST scores. Population group was found to affect WCST scores, but only with regard to number of categories completed ($H = 15.50$, $p = .004$). No other significant differences were found to exist with regard to population group and WCST scores. Kruskal-Wallis one-way ANOVAs revealed that religion did not affect WCST scores. These results are reflected in Table K1.4 (Appendix K).

With regard to socioeconomic variables, parental employment status and parental occupation group did not significantly affect WCST scores. Significant differences were found to exist with regard to paternal education level and the WCST variables of number of trials, percentage of errors, percentage of perseverative responses, percentage of perseverative errors, percentage of nonperseverative errors, percentage of conceptual level responses and number of categories completed. Similarly, significant differences were revealed when maternal education level was tested against WCST scores, with regard to the variables of number of trials, percentage of perseverative responses and number of trials to complete first category. These results suggest that higher socioeconomic status, as measured by paternal and maternal education levels, was associated with better performance on the WCST. Participant employment status also resulted in significant differences in WCST scores, with regard to number of trials and percentage of nonperseverative errors, suggesting that higher socioeconomic status was also associated with improved performance on the WCST. These results are presented in Table 4.1.5.1.

Table 4.1.5.1
*Kruskal-Wallis Nonparametric One-Way ANOVAs for Socioeconomic Status Variables by Wisconsin Card Sorting Test Scores*

| Variable | | Parental employment status | Paternal occupation group | Maternal occupation group | Paternal education level | Maternal education level | Participant employment status |
|---|---|---|---|---|---|---|---|
| Wisconsin Card Sorting Test | | | | | | | |
| Trials | H statistic | 7.27 | 2.29 | 1.69 | 11.80* | 11.74* | 5.01* |
| | p-value | .122 | .515 | .639 | .038 | .039 | .025 |
| Total number correct | H statistic | 5.37 | 2.90 | 3.83 | 1.91 | 10.00 | 1.18 |
| | p-value | .252 | .408 | .281 | .862 | .075 | .277 |
| Errors | H statistic | 7.42 | 6.86 | 1.07 | 16.42* | 9.50 | 3.11 |
| | p-value | .115 | .077 | .784 | .006 | .091 | .078 |
| Perseverative responses | H statistic | 6.59 | 6.71 | .44 | 15.09* | 11.80* | 2.19 |
| | p-value | .159 | .082 | .931 | .010 | .038 | .139 |
| Perseverative errors | H statistic | 6.13 | 5.90 | .34 | 12.47* | 10.07 | 1.20 |
| | p-value | .190 | .117 | .952 | .029 | .073 | .273 |
| Nonperseverative errors | H statistic | 7.30 | 4.85 | 2.59 | 13.24* | 5.75 | 6.79* |
| | p-value | .121 | .183 | .460 | .021 | .331 | .009 |
| Conceptual level responses | H statistic | 5.84 | 4.72 | 1.18 | 16.24* | 9.23 | 3.42 |
| | p-value | .211 | .193 | .758 | .006 | .100 | .064 |
| Categories completed | H statistic | 1.37 | 3.41 | 3.62 | 11.62* | 7.41 | 3.03 |
| | p-value | .849 | .333 | .305 | .040 | .192 | .082 |
| Trials to complete first category | H statistic | 3.42 | 6.68 | 1.24 | 4.20 | 12.88* | .23 |
| | p-value | .490 | .083 | .743 | .521 | .025 | .630 |
| Failure to maintain set | H statistic | 4.73 | 1.82 | 3.23 | 5.27 | 9.20 | .19 |
| | p-value | .316 | .611 | .357 | .385 | .101 | .663 |

*significant at the .05 level

Spearmans's correlations and Kruskal-Wallis one-way ANOVAs were used to establish whether demographic variables might be associated with performance on the RPM. Spearmans's correlations revealed that no significant relationship existed between age and performance on the RPM. Similarly, education and household socioeconomic status did not reveal any significant relationship with RPM scores. These results are presented in Table K1.5 (Appendix K). Kruskal-Wallis tests between demographic variables and RPM scores revealed a similar pattern, as education category, gender, population group and religious affiliation were not found to result in significant differences on RPM scores. Similarly, parental employment status and parental education level did not reveal any significant differences in test scores. Maternal occupation group, however, did prove to be influential with regard to RPM scores ($H = 8.41$, $p = .038$), suggesting that occupation groups associated with higher socioeconomic status were associated with higher RPM scores. Paternal occupation group did not result in any significant differences. Finally, participant employment status did result in significant differences in RPM scores ($H = 12.30$, $p = .001$), suggesting that better performance on the RPM was influenced by employment, which is representative of higher socioeconomic status. The results of the abovementioned Kruskal-Wallis tests are presented in Table K1.6 and K1.7 (Appendix K).

The relationships between the demographic variables of age, education and household socioeconomic status and performance on the BADS were tested by means of Spearman's correlations and the results of these correlations are presented in Tables K1.8 to K1.10 (Appendix K). No significant relationships were found to exist between age or education and performance on the BADS. Household socioeconomic status only correlated with one subtest, in the form of the Temporal Judgement test. The relationship between these 2 variables was of a moderate, positive nature, with $r = .340$ ($p = .025$).

With regard to the Kruskal-Wallis one-way ANOVAs which were performed between demographic variables and BADS test scores, no significant differences in BADS scores were associated with education category. Similarly, gender failed to reveal significant differences in BADS scores. Population group, however, did reveal significant

differences, with regard to scores on the Key Search Test and overall age-corrected standardised scores. With regard to religion, this variable only resulted in significant differences in BADS scores on the Temporal Judgment subtest ($H$ = 14.57, $p$ = .042). These results are reflected in Table 4.1.5.2.

Table 4.1.5.2
*Kruskal-Wallis Nonparametric One-Way ANOVAs for Demographic Variables and Behavioural Assessment of the Dysexecutive Syndrome Scores*

| Variable | | Education category | Gender | Population group | Religious affiliation |
|---|---|---|---|---|---|
| BADS | | | | | |
| Rule shift card test | H statistic | 5.94 | .04 | 9.49 | 5.61 |
| | p-value | .051 | .844 | .050 | .586 |
| Action program test | H statistic | 1.08 | .39 | 5.97 | 5.36 |
| | p-value | .584 | .531 | .201 | .617 |
| Key search test | H statistic | .40 | 1.16 | 10.40* | 3.99 |
| | p-value | .819 | .282 | .034 | .781 |
| Temporal judgement test | H statistic | 4.25 | 1.44 | 8.14 | 14.57* |
| | p-value | .120 | .230 | .087 | .042 |
| Zoo map test | H statistic | 4.51 | .08 | 2.05 | 4.24 |
| | p-value | .105 | .785 | .727 | .751 |
| Six elements test | H statistic | 1.85 | 1.19 | 8.39 | 3.74 |
| | p-value | .397 | .275 | .078 | .809 |
| Age corrected standard score | H statistic | 2.25 | .82 | 10.89* | 2.93 |
| | p-value | .325 | .365 | .028 | .891 |

* significant at the .05 level

Parental employment status did not result in any significant differences in BADS scores, but paternal occupation group did result in significant differences in BADS scores with regard to overall age-corrected standardised scores ($H$ = 10.14, $p$ = .017). Maternal occupation group only proved to be influential with regard to scores on the Action Program subtest, with $H$ = 11.26 ($p$ = .010). Neither paternal nor maternal education level resulted in significant differences in BADS scores. Participant employment status did result in significant differences in BADS scores, however, with regard to the Key Search subtest ($H$ = 6.70, $p$ = .010), the Zoo Map subtest ($H$ = 5.55, $p$ = .019) and overall age-corrected standardised scores ($H$ = 8.20, $p$ = .004). These results are reflected in Table

4.1.5.3 below and suggest that higher socioeconomic status was associated with better performance on the BADS.

Table 4.1.5.3
*Kruskal-Wallis Nonparametric One-Way ANOVAs for Socioeconomic Status Variables and Behavioural Assessment of the Dysexecutive Syndrome Scores*

| Variable | | Parental employment status | Paternal occupation group | Maternal occupation group | Paternal education level | Maternal education level | Participant employment status |
|---|---|---|---|---|---|---|---|
| BADS | | | | | | | |
| Rule shift card test | H statistic | 2.17 | 1.61 | 3.53 | 5.11 | 7.38 | 3.72 |
| | p-value | .705 | .658 | .318 | .402 | .194 | .054 |
| Action program test | H statistic | 2.70 | 3.31 | 11.26* | 4.07 | 9.24 | .39 |
| | p-value | .609 | .347 | .010 | .540 | .100 | .531 |
| Key search test | H statistic | 2.59 | 5.64 | 5.09 | 1.56 | 10.22 | 6.70* |
| | p-value | .629 | .131 | .166 | .906 | .069 | .010 |
| Temporal judgement test | H statistic | 5.64 | 2.90 | 5.33 | 6.34 | 7.49 | .002 |
| | p-value | .228 | .408 | .149 | .275 | .187 | .968 |
| Zoo map test | H statistic | 1.26 | 2.04 | 4.34 | 2.31 | 3.58 | 5.55* |
| | p-value | .868 | .565 | .227 | .804 | .611 | .019 |
| Six elements test | H statistic | 4.96 | 2.63 | 5.41 | 8.85 | 1.75 | .64 |
| | p-value | .291 | .453 | .144 | .115 | .883 | .423 |
| Age corrected standard score | H statistic | 1.83 | 10.14* | 7.68 | 3.90 | 7.88 | 8.20* |
| | p-value | .767 | .017 | .053 | .564 | .163 | .004 |

* significant at .05 level

### 4.1.6 The Relationship between Superstitious and Paranormal Beliefs and Personality

The relationship between superstitious and paranormal beliefs and the personality variable of Neuroticism was investigated by means of Spearman's correlations between scores obtained from the MPBS and the Neuroticism subscale of the NEO PI-R. No significant relationship was found to exist between overall Neuroticism scores and total MPBS scores. More detailed correlations between the Neuroticism facet scores and MPBS subscale scores revealed that self-consciousness was the only Neuroticism variable significantly associated with MPBS scores. This was only evident in correlations between Self-consciousness and the Psi subscale ($r$ = .309, $p$ = .043), however. These results suggest that a moderate positive relationship exists between Self-consciousness and Psi. No other significant relationships were found. These results are reflected in Table L1.1 (Appendix L).

### 4.1.7 The Relationship between Superstitious and Paranormal Beliefs and Executive Function

The relationship between superstitious and paranormal beliefs and executive function was investigated by correlating scores from the MPBS with scores obtained from the WCST, RPM and BADS respectively, using Spearman's correlations. Correlations between WCST scores and MPBS scores indicated that a number of correlations existed between performance on the WCST and superstitious and paranormal beliefs. Number of trials completed was strongly positively associated with Traditional Religious Beliefs ($r$ = .421, $p$ = .005), Witchcraft ($r$ = .502, $p$ = .001), Spiritualism ($r$ = .408, $p$ = .006). Moderate positive correlations were found between number of trials completed and Psi ($r$ = .378, $p$ = .012) and Extraordinary Life Forms ($r$ = .368, $p$ = .015). These results suggest that better performance on the WCST, in the form of trials completed, was associated with higher scores on the MPBS.

Total number of correct responses was similarly strongly positively associated with Superstition ($r$ = .447, $p$ = .002), and moderately positively associated with Traditional

Religious Beliefs ($r$ = .334, $p$ = .028) and Witchcraft ($r$ = .339, $p$ = .026), suggesting that greater numbers of correct responses on the WCST were associated with higher scores on these subscales on the MPBS. The total number of errors was strongly negatively associated with Psi ($r$ = -.443, $p$ = .003), Witchcraft ($r$ = -.408, $p$ = .006) and moderately negatively associated with Traditional Religious Beliefs ($r$ = -.338, $p$ = .026), Spiritualism ($r$ = -.333, $p$ = .028) and Extraordinary Life Forms ($r$ = -.314, $p$ = .040). These results suggest that a greater number of errors on the WCST, indicative of poorer performance, were associated with lower MPBS scores. Percentage of perseverative responses was strongly negatively associated with Traditional Religious Beliefs ($r$ = -.432, $p$ = .003), Witchcraft ($r$ = -.492, $p$ = .001), and moderately negatively associated with Psi ($r$ = -.349, $p$ = .021), Spiritualism ($r$ = -.359, $p$ = .017) and Extraordinary Life Forms ($r$ = -.386, $p$ = .010), suggesting that poorer performance on the WCST, in the form of more perseverative responses, was associated with lower MPBS scores. Similarly, percentage of perseverative errors was strongly negatively associated with Traditional Religious Beliefs ($r$ = -.445, $p$ = .003) and Superstitions ($r$ = -.469, $p$ = .001) and moderately negatively associated with Psi ($r$ = -.390, $p$ = .009) Spiritualism ($r$ = -.329, $p$ = .031) and Extraordinary Life Forms ($r$ = -.330, $p$ = .030). These results indicate that poorer performance on the WCST, in the form of higher numbers of perseverative errors, were associated with lower MPBS scores. Percentage of nonperseverative errors, by comparison, was moderately negatively associated with Psi ($r$ = -.396, $p$ = .008), suggesting that fewer nonperseverative errors were associated with increased Psi scores. Percentage of conceptual level responses was moderately negatively associated with Traditional Religious Beliefs ($r$ = -.355, $p$ = .019), Psi ($r$ = -.319, $p$ = .036) and Witchcraft ($r$ = -.377, $p$ = .012), while number of categories completed was moderately negatively associated with Traditional Religious Beliefs ($r$ = -.306, $p$ = .046) and Witchcraft ($r$ = -.387, $p$ = .010). These results suggest that better performance on the WCST, in the form of a greater number of conceptual level responses and a greater number of categories completed were associated with lower scores on the MPBS. Number of trials to complete first category was moderately positively associated with Spiritualism ($r$ = .360, $p$ = .017), while Failure to maintain set was strongly positively associated with Witchcraft ($r$ = .412, $p$ = .006), suggesting that poorer performance on the

WCST, in the form of a greater number of trials to complete the first category and more instances of failure to maintain set were associated with lower levels of belief in Spiritualism and Witchcraft respectively. All the variables of the WCST correlated with overall MPBS scores and MPBS scores when Traditional Religious Beliefs scores were excluded from the total. Thus, number of trials was strongly positively associated with both overall MPBS scores ($r$ = .555, $p$ = .0001) and MPBS scores when Traditional Religious Beliefs scores were excluded from the total ($r$ = .544, $p$ = .0001). Moderate positive correlations were found to exist between overall MPBS scores and MPBS scores when Traditional Religious Beliefs scores were excluded from the total and Total number correct ($r$ = .401, $p$ = .007 and $r$ = .382, $p$ = .011). These results suggest that improved performance on the WCST was associated with higher levels of superstitious and paranormal belief. Trials to complete first category ($r$ = .351, $p$ = .020 and $r$ = .339, $p$ = .026) and Failure to maintain set ($r$ = .343, $p$ = .024 and $r$ = .353, $p$ = .020), suggesting that poorer performance on the WCST was associated with lower MPBS scores. Strong negative correlations were found to exist between overall MPBS scores and MPBS scores when Traditional Religious Beliefs scores were excluded from the total and Number of errors, Percentage of Perseverative Responses, Percentage of Perseverative Errors, and Conceptual Level Responses. Moderate negative associations were found between overall MPBS scores and MPBS scores when Traditional Religious Beliefs scores were excluded from the total and Percentage of nonperseverative errors and Number of categories competed. These negative correlations suggest that better performance on the WCST, in the form of lower scores on Percentage of Perseverative Responses, Percentage of Perseverative Errors, Conceptual Level Responses, Percentage of nonperseverative errors and Number of categories, was associated with higher scores on the MPBS Results from these correlations are presented in Table 4.1.7.1.

Table 4.1.7.1
*Spearman's Correlations between Modified Paranormal Beliefs Scale Scores and Wisconsin Card Sorting Test Scores*

| | Traditional religious beliefs | Psi | Witchcraft | Superstitions | Spiritualism | Extraordinary life forms | Precognition | Paranormal beliefs total | Paranormal beliefs total (excluding traditional religious beliefs) |
|---|---|---|---|---|---|---|---|---|---|
| Trials | .421* | .378* | .502* | .290 | .408* | .368* | .270 | .555* | .544* |
| | .005 | .012 | .001 | .059 | .006 | .015 | .081 | .0001 | .0001 |
| Total number correct | .334* | .156 | .339* | .447* | .278 | .179 | .238 | .401* | .382* |
| | .028 | .319 | .026 | .002 | .071 | .252 | .126 | .007 | .011 |
| Errors | -.338* | -.443* | -.408* | -.218 | -.333* | -.314* | -.262 | -.497* | -.479* |
| | .026 | .003 | .006 | .161 | .028 | .040 | .090 | .001 | .001 |
| Perseverative responses | -.432* | -.349* | -.492* | -.288 | -.359* | -.386* | -.232 | -.529* | -.496* |
| | .003 | .021 | .001 | .061 | .017 | .010 | .135 | .0002 | .001 |
| Perseverative errors | -.445* | -.390* | -.469* | -.277 | -.329* | -.330* | -.236 | -.521* | -.478* |
| | .003 | .009 | .001 | .072 | .031 | .030 | .128 | .0003 | .001 |
| Nonperseverative errors | -.154 | -.396* | -.242 | -.164 | -.285 | -.293 | -.183 | -.378* | -.396* |
| | .326 | .008 | .118 | .297 | .064 | .056 | .241 | .012 | .008 |
| Conceptual level response | -.355* | -.319* | -.377* | -.177 | -.258 | -.237 | -.247 | -.437* | -.401* |
| | .019 | .036 | .012 | .257 | .096 | .127 | .111 | .003 | .007 |
| Categories completed | -.306* | -.221 | -.387* | -.069 | -.158 | -.255 | -.159 | -.355* | -.333* |
| | .046 | .155 | .010 | .661 | .313 | .099 | .312 | .019 | .029 |
| Trials to complete first category | .171 | .215 | .263 | .134 | .360* | .252 | .289 | .351* | .339* |
| | .276 | .167 | .089 | .394 | .017 | .104 | .060 | .020 | .026 |
| Failure to maintain set | .221 | .225 | .412* | .185 | .239 | .179 | .178 | .343* | .353* |
| | .155 | .149 | .006 | .237 | .123 | .253 | .256 | .024 | .020 |

* significant at .05 level

Despite the large number of significant correlations which were found between WCST scores and MPBS scores, moderate positive correlations were only found to exist between RPM scores and the MPBS subscales of Superstitions ($r$ = -.327, $p$ = .032) and Extraordinary Life Forms ($r$ = -.371, $p$ = .014). These results suggest that higher scores on the RPM were associated with lower scores on the MPBS Superstitions and Extraordinary Life Forms subscales. No other significant correlations were found between superstitious and paranormal beliefs and RPM scores. Results from these correlations are presented in Table M1.1 (Appendix M).

Few significant relationships were found to exist between the subtests of the BADS and the MPBS. Traditional Religious Beliefs were found to correlate with the Temporal Judgement Test ($r$ = .377; $p$ = .012) and the Zoo Map Test ($r$ = .348; $p$ = .022). These results suggest that better performance on the BADS was moderately positively associated with higher scores on the MPBS. No significant relationships were found to exist between MPBS scores and overall BADS scores. Results from these correlations are presented in Table M1.2 (Appendix M).

### 4.1.8 The Relationship between Measures of Executive Function

Spearman's correlations were performed to establish whether any type of relationship existed between performance on any of the tests of executive function, in the form of the WCST, RPM and BADS. Scores from each measure were correlated with those of the other measures, in order to test the nature of the relationships between these three variables.

Correlations between WCST scores and RPM scores revealed that a moderate positive relationship existed between percentage of nonperseverative errors and RPM scores ($r$ = .314, $p$ = .041), suggesting that higher RPM scores were associated with greater numbers of nonperseverative errors on the WCST. These results are reflected in Table N1.1 (Appendix N). Correlations between WCST scores and BADS scores revealed that moderate negative relationships existed between Key Search test scores and number of

trials completed ($r$ = -.319, $p$ = .037), suggesting that poorer Key Search test scores are associated with a greater number of trials completed on the WCST. Moderate positive relationships existed between percentage of conceptual level responses and Key Search test scores ($r$ = .322, $p$ = .036) and a strong positive relationship between number of categories completed ($r$ = .470, $p$ = .002) and Key Search test scores, suggesting a relationship between improved performance on both tests. Number of categories completed on the WCST also correlated with Action Program test scores ($r$ = .338, $p$ = .027), BADS total scores ($r$ = .404, $p$ = .007), Standardised scores ($r$ = .404, $p$ = .007) and Age corrected standardised scores ($r$ = .404, $p$ = .007), suggesting that better performance on both measures correlated positively, with correlations ranging from moderate to strong. No other significant relationships existed between WCST scores and BADS test scores. These results are summarised in Table N1.2 (Appendix N).

Similarly, correlations between BADS scores and RPM scores indicated strong positive relationships between scores on the Key Search test and RPM scores ($r$ = .579, $p$ < .0001), suggesting that higher scores on both measures correlate. Additionally, moderate positive relationships also existed between RPM scores and overall age corrected standardised scores ($r$ = 0.396, $p$ = .008) respectively, suggesting that high RPM scores are associated with high BADS scores. These results are reflected in Table N1.3 (Appendix N).

**4.2 Qualitative Results**

Interviews were conducted with those participants who were found to score comparatively highly on the MPBS. Descriptive statistics for the qualitative sample are presented in Table 4.2.1.1 below.

Table 4.2.1.1
*Descriptive Statistics for Qualitative Interview Sample*

| | Pseudonym[2] | Age | Gender | Population group | Religious affiliation | MPBS score |
|---|---|---|---|---|---|---|
| Participant A | Bradley Levine | 24 | Male | White | Jewish | 102 |
| Participant B | Lebogang Molefi | 23 | Female | African | Christian | 104 |
| Participant C | Batabile Mdluli | 21 | Female | African | Agnostic | 92 |
| Participant D | Tracey Young | 26 | Female | White | Agnostic | 119 |
| Participant E | Kelly Williams | 21 | Female | Coloured | Christian | 92 |
| Participant F | Chantelle Oliveira | 24 | Female | White | Christian | 90 |
| Participant G | Matthew Ross | 24 | Male | White | Christian | 90 |

Thematic context analysis revealed a number of underlying themes in the qualitative data which was derived from the interviews. These included the legitimacy of superstitious and paranormal beliefs, the logic underlying these beliefs, individual feelings about superstitious and paranormal beliefs and the meanings which individuals attribute to beliefs of this nature. The superstitions which individuals hold were also investigated, as were the understandings which individuals possessed regarding their superstitious and paranormal beliefs.

[2] Initials of assigned pseudonyms are used for reference purposes in the qualitative results section.

### 4.2.1 The Legitimacy of Superstitious and Paranormal Beliefs

All the participants interviewed felt that superstitious and paranormal beliefs were legitimate and justifiable beliefs. Some participants felt that legitimacy was afforded to these beliefs because they are accepted by society. As one participant explained, "*It's something that's been passed down and if people talk about it, I feel that it's, it's an accepted sort of cultural, sort of, reaction to something*" (Participant B.L.). Similarly, another participant felt that "*When you see how much, um, an entire community or an entire culture believes in something, you know, there's more drive behind that*" (Participant M.R). With regard to those who are not superstitious, some participants saw these individuals as not identifying with the cultural practices associated with superstitious behaviours (Participant B.L.).

The inherited nature of superstitious beliefs was identified by many participants (Participants B.M., M.R. and L.M), as beliefs were often inherited from family members, who had taught participants about the importance of superstitions and practicing superstitious behaviours, within their familial and cultural context (Participants L.M. and T.Y.). Superstitious and paranormal beliefs could thus be seen as "*a learned way of reacting to things*" (Participant B.L.). One participant noted that people continue to subscribe to superstitions "*because that's what their parents did and what their parents did*" (Participant B.M.), indicating the important role which familial beliefs play in perpetuating the practice of superstitions. Similarly, some participants practiced certain superstitions because other members of society – both within their own culture and within cultures which they had been exposed to - did so (Participant M.R.). Thus, exposure to certain cultural contexts influenced the superstitious and paranormal beliefs which individuals subscribed to. One individual, for example, had conducted research in African "muti" markets, and felt that his exposure to this cultural phenomenon had influenced his superstitious beliefs. This was despite his upbringing and cultural background being very different to that of the traditional African culture from which many of his acquired superstitious and paranormal beliefs are derived. He explained that because the culture itself has a strong historical background, he felt that the beliefs were justified and

legitimate, and subsequently subscribed to new forms of superstition (Participant M.R.).

Interviews revealed that personal superstitious beliefs and culturally sanctioned superstitious beliefs were differentiated between by some participants. Personal superstitious beliefs were identified as unique, idiosyncratic beliefs which individuals held and which were often accompanied by certain rituals which they themselves had invented. By contrast, culturally sanctioned superstitious beliefs are those beliefs which have been taught to individuals by their family, friends, community or society in general (Participants B.L., B.M., C.O. and M.R.). While some participants believed in both types of superstitions and felt that both were legitimate, others felt that culturally sanctioned superstitions were more legitimate than personal superstitions (Participants B.L. and M.R.). The extent to which others believe in the same superstitions may also serve to perpetuate the superstitious beliefs. For example, one participant mentioned that when she is confronted with a bad omen, she tends to ask those around her is they share her beliefs regarding the superstition (Participant L.M.), emphasising the degree to which many superstitious and paranormal beliefs are intimately connected to culture.

### 4.2.2 The Logic Underlying Superstitious and Paranormal Beliefs

Many participants did not feel that superstitious and paranormal beliefs were logical and were accepting of the failure in logic which acting upon these beliefs might represent (Participants B.M., T.Y., K.W. and C.O.). Superstitious and paranormal beliefs were thus predominantly seen as phenomena which are "*not really rational and you can't rationalise them*" (Participant T.Y.), indicating the lack of logic underlying these beliefs. Nevertheless, many of the individuals interviewed continued to believe in superstitious and paranormal phenomena (Participants B.M., T.Y., K.W. and C.O). Thus, for example, participant K.W. explained that walking under a ladder or breaking a mirror meant that she would "*have bad luck*" and as a result, "*then bad things will happen to me*" (Participant K.W.). One participant, however, did believe that superstitious and paranormal beliefs were logical, because of the importance that was placed upon these beliefs in her home environment. Based on the significant role which such beliefs had

played in her upbringing, she felt that they often represented a rational explanation for everyday phenomena (Participant L.M.).

A variety of perspectives were presented by participants with regard to the purposes which superstitious and paranormal beliefs serve. Thus, for example, enacting superstitious behaviours was seen as a form of precaution against bad luck, originating from "*careful people*" (Participant B.L.). Similarly, another participant believed that superstitious and paranormal beliefs were a way of providing protection, in order to "*keep children out of dangerous places*" and "*to keep people away from their enemies*" (Participant B.M.). The use of superstitious beliefs as a form of precaution and protection was linked to the rationalisations which underpinned these beliefs. As one participant explained, "*if you're being careful about something, you're thinking through something logically*" (Participant B.L.). Thus, certain rationalisations enforced beliefs regarding superstitious behaviours as a form of protection.

Occasionally, individuals felt less inclined to subscribe to superstitious and paranormal beliefs, because of their exposure to education, which they often perceived as allowing them to rationalise experiences from a scientific perspective, instead of attributing events to superstitious and paranormal phenomena (Participants L.M. and C.O.). Exposure to scientific reasoning and explanations for phenomena, such as lightning, for example, has persuaded some individuals to abandon the superstitious beliefs with which they had grown up (Participant L.M.). Some participants, however, felt that the distinction between superstition and science was not clear enough, and were thus forced to grapple with the differing perspectives presented by both science and superstition (Participant T.Y.). One participant also felt that superstitious practices, such as predicting the future, might be better explained from a logic-based perspective. Thus, in the case of individuals who seem able to predict the future, these people are instead able to process information about the world in a different way, as a result of their "*strong intuition*" (Participant T.Y.). Abandoning beliefs which had been instilled since childhood – and which are often still held by the individual's family and community – may prove to be a complicated task however. As one participant explained, "*There's a bit of cognitive dissonance with me*

*because I have these superstitious beliefs, but I also have my education and it's difficult 'cause those two don't really gel*" (Participant C.O.). Some participants, however, did feel that they had "outgrown" superstitions which were taught to them during their childhood. As adults, they were now able to interpret experiences from a more intellectual standpoint (Participant L.M.).

### 4.2.3 Personal Superstitious and Paranormal Beliefs

The majority of the participants who were interviewed admitted to being superstitious. Many, however, felt that they only held certain superstitions and were not superstitious in all circumstances (Participants L.M., B.M., T.Y., K.W., C.O., and M.R.). One participant, however, did not believe that they were superstitious (Participant B.L.).

Common culturally sanctioned superstitions which participants believed in and behaved in accordance with were diverse. They included avoiding broken mirrors, black cats and walking under ladders in order to evade bad luck (Participants BL., L.M., K.W. and C.O.). One participant also avoided whistling indoors, which she believed would cause financial losses (Participant C.O.). Participant L.M. identified both owls and lightning as bad omens. Two participants were especially superstitious about spilling salt and perceived it as unlucky (Participants K.W. and C.O.). Participant T.Y. elaborated on her belief in fortune-telling, ghosts and alternative healing techniques.

Personal superstitious beliefs were not as common as culturally sanctioned superstitious and paranormal beliefs. One participant, however, revealed that he had his own unique superstitious practices which he performed prior to participating in sports events, to promote good luck during a match (Participant B.L.). Another believed that wearing a certain pair of shoes together with a specific pair of socks meant that she would be caught in the rain, and subsequently avoided wearing this combination in order to avoid misfortune (Participant B.M.). Similarly, participant T.Y. maintained a strong belief in good luck charms, explaining how she believed that wearing specific items of jewellery or certain crystals would "*attract certain energies*" (Participant T.Y.). Thus, personal

superstitions often presented unique ways of generating good luck for individuals (Participants B.L. and T.Y.).

### 4.2.4 The Motivations Underlying Superstitious and Paranormal Beliefs

A variety of motivations were found to underpin the practice of superstitious behaviours by the participants in the qualitative sample. Superstitious actions, for example, were often performed to avoid attracting bad luck. Similarly, unlucky occurrences were often attributed to superstitious or paranormal phenomena. As one participant explained, "*If something bad happens, then I'd most probably link that to some superstitious thing*" (Participant L.M.). Interestingly, some participants did not attribute positive events in their lives to superstitious and paranormal phenomena. Superstitious beliefs were thus relied upon as explanations for negative events and superstitious behaviours were seen as a way of deterring bad luck. Good luck and positive events, however, were not attributed to superstitious or paranormal phenomena (Participant L.M.). Similarly, the majority of the individuals who were interviewed identified actions which they performed to avoid bad luck (Participants B.L., L.M., B.M., K.W., and C.O.). Far fewer, however, mentioned actions which they performed to attract good luck (Participants T.Y. and K.W.).

Superstitious actions continued to be performed because they had provided the desired results – of either attracting good luck or deterring misfortune - in the past (Participant B.M.). Thus, previous successes were seen as confirming the legitimacy of superstitious and paranormal beliefs. The legitimacy of superstitious and paranormal beliefs was also fostered in other ways, which gave rise to motivations to perform the actions associated with these beliefs. Participant L.M., for example, explained that she begun to believe in certain superstitious phenomena because of "*confirming things that have happened that actually make me believe in some of them*" (Participant L.M.). With regard to explaining why superstitious actions might be perpetuated, one participant felt that successful results generated from superstitious acts might be due to the "placebo effect" and that the positive emotions associated with belief in positive superstitions were capable of "*giving me a little bit of confidence to get through the day*" (Participant T.Y.). In instances where

the desired results were not achieved, despite the appropriate superstitious actions being performed, participants were not distressed by this (Participant B.M).

Emotional effects were found to play a significant role in motivating the practice of superstitious beliefs. Participant T.Y., for example, believed that her superstitious beliefs were illogical, but continued to practice them, because of the positive emotional effects, such as feelings of confidence and empowerment, which many of her superstitious practices provided. Emotions were also linked to the perpetuation of superstitious practices. As one participant explained,

> *I don't think there is anything logical. I can't say that there's been, like, this obvious pay-off where I did x, I wore y and so I got the result I wanted. But there is enough of an emotional pay-off* (Participant T.Y.).

Conversely, performing actions which were believed to promote bad luck, such as walking under a ladder, for example, often resulted in anxiety for individuals. This was because they feared that their actions would generate bad luck, despite their awareness of the illogical reasoning which underlies the superstition (Participant K.W.). With regard to the anxiety associated with the possibility of generating misfortune, the practice of superstitious actions was also perpetuated as a form of precaution, in order to avoid attracting bad luck. As one participant explained, "*To some degree, I think it's going to happen, like, if I break a mirror, I'm going to have seven years bad luck, so just to be safe…*" (Participant K.W.). Thus, while some participants were uncertain about the legitimacy of superstitious and paranormal beliefs, they often continued to practice superstitious behaviours, in case some truth did lie beneath the culturally sanctioned beliefs with which they had been raised (Participants B.L., K.W. and M.R.) The practice of superstitious rituals also presented a way of reducing anxiety for some participants (Participants B.L., T.Y., K.W. and C.O.). Exposure to superstitious phenomena which might cause bad luck – such as walking under a ladder, for example – was felt to be an anxiety-provoking experience, because participants did not want to attract bad luck (Participant K.W.). When asked about what they feared might happen, one participant

explained, "*I actually don't know. I think it's just a general sense of doom and gloom. Like, it's just a general sense of something that's going to happen*" (Participant C.O.).

Despite the conscious motivations identified by many participants, superstitious behaviours were often performed without participants being aware of them. This suggests that superstitious behaviours may sometimes occur automatically, and without reasoning on the part of the individual (Participants B.M. and T.Y.). Thus, as one participant noted, "*I don't actually notice that I'm doing it until after I've done it*" (Participant B.M.).

Hearing about superstitious beliefs and then experiencing events related to them sometimes reinforced superstitious beliefs and made individuals more likely to practice superstitious behaviours (Participant M.R.). Thus, superstitions might serve as explanations for events. As one participant explained, "*you naturally try and find a common factor and if you've been told about some superstition and you see that, you're like 'Oh! Oh! There you go! You see!*" (Participant M.R.).

### 4.2.5 Meanings and Understandings Underlying Superstitious and Paranormal Beliefs

A number of meanings were associated with the superstitious and paranormal beliefs held by participants. While participant B.L. was reluctant to link any form of meaning to his superstitious beliefs, he did view them as precautionary measures against misfortune. By contrast, the use of superstitious actions as a way of controlling the future was expressed by one participant, who explained that "*To predict the future also makes the future a little bit more contained, I suppose. Maybe it's a control thing. So, it doesn't seem as scary as the unknown. There's some predictability in what's going to happen*" (Participant T.Y.). This feeling of control resulted in feelings of empowerment when faced with the unpredictability of the future. Another theory posited by a participant regarding the underlying meanings of superstitious and paranormal beliefs was that these beliefs helped individuals to make sense of inexplicable phenomena (Participant M.R.). Thus, "*if you don't understand it, then you can attribute it to a superstition or some spiritual belief*" (Participant M.R.).

There was awareness among some participants that superstitious beliefs were sometimes acted upon, without any form of reasoning underlying these actions (Participants B.L., K.W. and M.R.). As one participant explained, "*They're just there and they're things that you have to do*" (Participant K.W.). Similarly, one participant felt that the original meanings attached to superstitious beliefs have disappeared over time. The practices and actions associated with the superstitions have remained, however. She thus explained that at one point, "*there was a good reason and how ironic that I don't know the reason. But there was a good reason why people did it -because it meant something*" (Participant C.O.). As a result, the majority of participants continued to believe in superstitious phenomena because they had played a significant role in their upbringing (Participants B.L., L.M., C.O. and K.W.). As one participant explained, "*If I hadn't been exposed to them, I don't think I'd actually believe in them*" (Participant L.M.). Exposure to superstitious and paranormal beliefs in childhood was not the only factor which influenced the extent to which individuals subscribed to these beliefs. One individual participated in superstitious beliefs - which he was only exposed to when he was an adult - as a mark of respect towards another culture, which was quite different from the cultural background in which he was raised (Participant M.R.). Thus, factors such as respect and the extent to which certain cultural beliefs may resonate with an individual may influence the superstitious and paranormal beliefs which they ascribe to.

Religion provided a point of contention within the realm of superstitious and paranormal beliefs. Based on the similar background which superstitious and religious beliefs share, in terms of their inherited and culturally sanctioned nature, these findings are perhaps unsurprising. Participant C.O. pointed out the difficulties associated with differentiating between religious beliefs and superstitious beliefs and felt that both provided reassurance for her, in their own unique ways (Participant C.O.). The distinction between religious and superstitious beliefs was often blurred however. For example, one participant explained that she would pray in order to attract good luck (Participant K.W.), while another participant resorted to prayer when confronted with bad omens, in order to deter the misfortune which might accompany them (Participant L.M.).

# CHAPTER FIVE
# DISCUSSION

## 5.1 Quantitative results

### 5.1.1 The Relationship between Demographic Variables and Superstitious and Paranormal Beliefs

Demographic variables were found to result in few significant differences with regard to superstitious and paranormal beliefs. Thus, no significant relationship was found to exist between age and MPBS scores. These findings align with those of Aarnio & Lindeman (2005) and Wolfradt (1997), who found that superstitious and paranormal beliefs are not significantly associated with age. Other studies, however, have found that these beliefs are influenced by age, and that younger individuals appear to be more likely to subscribe to beliefs of this nature (Irwin, 2000; Tobacyk et al., 1988b; Torgler, 2007; Vyse, 1997). These results have also been replicated within a South African context by Peltzer (2003), who found that secondary school students were significantly more superstitious than university students. The age range within Peltzer's (2003) study was 15 to 36. The lack of findings with regard to the relationship between age and superstitious and paranormal beliefs within the present study might be due to the relatively narrow age range of the sample, as the age range within the current study was between 21 and 28 years of age ($M$ = 23.30, $S.D.$ = 2.02). Greater variations in superstitious belief based on the effects of age may therefore not be evident, due to a truncation of range. Alternatively, the effects of age on superstitious beliefs may only be evident when adolescents and middle-aged or older adults are compared. As the sample of the present study was composed of young adults, significant differences superstitious beliefs with regard to differences in age may not be evident.

No significant relationships were found to exist between education – in terms of both number of years of education and broader education categories - and MPBS scores. These findings contrast those of other studies which have found that superstitious and

paranormal beliefs are less common amongst individuals with higher levels of education (Aarnio & Lindeman, 2005; Otis & Alcock, 1982; Torgler, 2007). The lack of findings in the present study could be attributed to the relatively well-educated nature of the current sample. The average number of post-matric years of study was 5.07 (*SD* = 1.77) and 86.05% of the sample had studied for at least 16 years. Thus, the skewed nature of the education data within the present sample may account for these findings, as education was both problematically positively skewed at 1.12 and presented with a kurtosis value of 1.80, indicating that this data did not present a normal distribution. These results should therefore be interpreted with caution, given the nature of the sample.

Gender was not found to result in any significant differences in MPBS scores. These findings are contrary to those of numerous studies, which have indicated that gender differences do exist with regard to superstitious and paranormal beliefs, with either women (Clarke, 1991; Irwin, 1993; Wolfradt, 1997; Wiseman & Watt, 2004) or men (Houran, 1997; Vitulli & Luper, 1998) being more inclined towards such beliefs. Interestingly, the results of the current study, with regard to the effects of gender on superstitious and paranormal beliefs, are similar to those found by Peltzer (2002; 2003) in his studies on superstitious and paranormal beliefs among South African secondary school and university students. Thus, within the South African context, gender does not appear to be associated with significant differences in levels of superstitious and paranormal belief. The results of the present study therefore confirm these findings. This represents an interesting potential trend with regard to patterns of belief in superstitious and paranormal phenomena in South Africa, and may provide an interesting focus for future research, as these results are dissimilar to those of studies conducted in Western society (Clarke, 1991; Irwin, 1993; Wolfradt, 1997; Wiseman & Watt, 2004).

Population group was not found to result in any significant differences in MPBS scores. These results support those of a study by Rogers et al. (2006), who found no significant differences between different population groups with regard to superstitious and paranormal beliefs. The results of the present study are, however, contrary to those of a number of older studies which have revealed that population group may be associated

with differences in the extent to which such beliefs are held (Emmons & Sobal, 1981; Tobacyk et al., 1988a). As relatively little research has explored cross-cultural differences in relation to the degree to which superstitious and paranormal beliefs are held, it is difficult to interpret these results meaningfully. Similarly, few studies have examined the relationship between ethnicity and superstitious and paranormal beliefs within a South African context, resulting in further difficulties with regard to interpretation (Peltzer, 2003). It is important to note, however, that the sample within the present study was predominantly White. This over-representation of a single population group may account for the lack of significant differences between population groups, as insufficient variations may have existed between the scores of individuals, both within and between population groups. Additionally, the extent to which Western superstitious and paranormal beliefs have potentially been adopted within a South African context must also be considered. The spread of Western thoughts and beliefs may have significant effects on the beliefs of individuals from all population groups within South Africa, due to the effects of acculturation. Western superstitions may also be held alongside traditional African superstitions, as is reflected in the qualitative data of the present study. Differences in superstitious and paranormal beliefs between population groups may therefore diminish.

Religion was found to influence MPBS scores, with regard to the Traditional Religious Beliefs subscale. These results are to be expected, as this subscale, as its name implies, measures the extent to which individuals hold conventional religious attitudes. Religion was also found to result in significant differences with regard to the Witchcraft subscale of the MPBS. These results are not as pronounced as those of other studies, which have found stronger correlations between religious and superstitious and paranormal beliefs (Emmons & Sobal 1981; Orenstein, 2002; Tobacyk & Wilkinson, 1990). Given that the vast majority (46.51%) of the sample within the current study was Christian, however, these results should be interpreted cautiously, as other religious affiliations are under-represented in the sample. A sample with more diverse religious beliefs may present a very different picture. Of particular interest within a South African sample would be the extent to which traditional African spiritual beliefs, such as those held by individuals who

are part of African Indigenous Churches such as the Zionist Christian Church, align or diverge from the subscales on the MPBS, as both superstitious and paranormal beliefs and religious beliefs are upheld by this population (Elion & Strieman, 2001).

With regard to the socioeconomic status variables of paternal employment status, parental occupational group, parental level of education, participant employment status and household socioeconomic status, no significant relationships were found to exist between these variables and MPBS scores. Maternal employment status was, however, found to result in significant differences in MPBS scores, on both the Superstitions and Precognition subscales. As the relationship between superstitious and paranormal belief and socioeconomic status remains under-researched, it is difficult to interpret these results within a broader context. Theoretically, it has been suggested that lower socioeconomic status should correlate with greater belief in superstitious and paranormal phenomena, in line with the deprivation hypothesis (Irwin, 1993; Torgler, 2007). Research has failed to support this hypothesis, however, as studies have indicated that low socioeconomic status is often associated with minimal belief in superstitious and paranormal phenomena, as was evident in the current study. This may be due to the focus by individuals within lower income brackets on material, rather than spiritual, needs, in accordance with Maslow's hierarchy, as less time and resources are available to spend considering abstract factors which might result in potentially positive or negative outcomes (Emmons & Sobal, 1981; Maslow, 1970; Sheils & Berg, 1977; Torgler, 2007). Given that the present research was conducted on a sample of university students, socioeconomic status within this population may be relatively high, by comparison to the majority of South Africans who live in poverty, with almost 71% of individuals in rural areas living below the poverty line (Mayekiso & Tshemese, 2007)

### 5.1.2 The Relationship between Demographic Variables and Neuroticism

The relationships between demographic variables and the personality variable of Neuroticism, as measured by the Neuroticism subscale of the NEO PI-R, revealed that no significant relationships existed between age and Neuroticism. These findings contrast

those of McCrae & Costa (1999), who have found that Neuroticism decreases with age. The results within the present study are likely due to the narrow age range of the sample, as more significant differences are generally only found when personality variables between adolescents and adults are compared. The small size of the sample must also be taken into account in this regard (McCrae & Costa, 1999; Costa & McCrae, 2006).

Education and education category were not associated with any significant differences in Neuroticism scores. Little research has been conducted with regard to the effects of education on NEO PI-R scores (Goldberg, Sweeney, Merenda & Hughes, 1998). A study by Goldberg et al. (1998), however, supports the findings of the present study, as no significant relationships were found between Neuroticism and education. No significant differences were found to exist in Neuroticism scores with regard to gender. While these findings support those of Goldberg et al. (1998), they contradict those of Costa, Terracciano & McCrae (2001), who found that women score more highly than men on the Neuroticism subscale of the NEO PI-R. Research on the effects of gender on personality has generally revealed weak relationships between the two variables. The most pronounced differences in personality between males and females are expected to be evident in the NEO PI-R, as a result of the domains of Agreeableness and Extraversion, but research has not reflected significant differences along gender lines (Goldberg et al., 1998). The present study therefore confirms these findings.

Similar to the findings of Goldberg et al. (1998), population group within the current study was not found to result in significant differences in Neuroticism scores. As little research has been conducted into personality differences which might exist between population groups, these results are difficult to interpret, especially as only one domain of personality was measured. Future studies into potential personality differences across population groups would therefore be valuable, especially within a South African context, given the diverse nature of the population. Such research would also benefit the adaptation of personality instruments for the South African population. Religious affiliation was also not found to affect Neuroticism scores. Religion has, however, been linked to higher levels of Neuroticism, as a study by Saroglou (2000) found that

Neuroticism correlated positively with extrinsic religion practices and negatively correlated with religious fundamentalism. The results of the present study may have been affected by the lack of religious diversity within the sample.

With regard to the socioeconomic variables, parental employment status, parental occupational group, parental level of education and household socioeconomic status were not found to affect Neuroticism scores. Participant employment status however, was found to influence the Vulnerability subscale of the Neuroticism scale. The lack of significant findings with regard to the relationship between socioeconomic status and Neuroticism is surprising, as the majority of the literature suggests that lower socioeconomic status is associated with increased levels of Neuroticism, as reflected by higher scores on the Depression and Hostility subscales of the NEO PI-R (Bosma, van de Mheen & Mackenbach, 1999; Barefoot et al., 1991; Kubzansky, Kawachi & Sparrow, 1999). The findings of the current study support those of Jonassaint, Siegler, Barefoot, Edwards & Williams (2009), however, as this study too found that socioeconomic status was not associated with Neuroticism, with the exception of paternal level of education, which was found to be associated with high levels of Neuroticism when paternal level of education was low. As the sample of the study was composed of university students, few instances of low socioeconomic status may have been reported, given that individuals within this population are able to afford university fees, either by themselves or with the assistance of their parents or a scholarship or bursary. Few variations in socioeconomic status may thus be evident within this sample.

### 5.1.3 The Relationship between Demographic Variables and Measures of Executive Function

The effects of demographic variables on performance on the WCST were minimal. No significant relationships were found to exist between age and the majority of the variables of the WCST, with the exception of a weak, positive relationship between the average number of categories completed in the WCST and age. This suggests that older participants completed a greater number of categories within the WCST than their

younger counterparts, and subsequently performed better on the test. While age has been found to result in differences in scores on the WCST (Heaton et al., 1993; Rhodes, 2004), the lack of significant results in the present study may be attributed to the relatively narrow age range of the sample, as performance has been shown to remain consistent in participants who are between 20 and 50 years of age (Rhodes, 2004).

A small relationship has been found to exist between education and performance on the WCST. Thus, higher levels of education are associated with improved performance on the test (Heaton et al., 1993; Strauss et al., 2006). The results of the present study revealed few significant relationships between education and performance on the WCST. A significant weak, positive relationship was found to exist between the average number of categories completed in the WCST and education, suggesting that higher levels of education were associated with greater numbers of categories being completed in the WCST, indicative of better performance on the WCST. Broader education category, however, was not found to affect WCST scores. Given that the education levels within the present sample were particularly high, as the participants for the study were university students, few significant differences existed between individuals in terms of level of education. Had the study compared individuals with only secondary education to individuals with tertiary education, differences in performance on the WCST may potentially have been more pronounced.

Gender was not associated with significant differences in WCST scores. These results support those of numerous studies which have not found any significant relationships between gender and WCST performance (Heaton et al., 1993; Rosselli & Ardilla, 1993; Shu, Tien, Lung & Chang, 2000). By contrast, population group was found to affect WCST scores, with regard to number of categories completed. These results echo the concerns raised by Skuy et al. (2001) regarding the possibility that test performance within a South African context may be greatly affected by ethnicity and culture, and that South Africans may perform more poorly on the test than their American or European counterparts. As no South African norms for the WCST are currently available, the raw scores of the test were standardised according to American norms, which may not truly

reflect the performance of South African individuals. These results should therefore be interpreted with caution. Within the present study, however, religion was not found to result in any significant differences in WCST scores. As little research has been conducted with regard to the effects of religious belief on WCST performance, these results are difficult to interpret.

With regard to socioeconomic variables, parental employment status and parental occupation group did not significantly affect WCST scores. Paternal education level was found to influence performance on the WCST with regard to number of trials, percentage of errors, percentage of perseverative responses, percentage of perseverative errors, percentage of nonperseverative errors, percentage of conceptual level responses and number of categories completed. These findings are consistent with those of Shu et al. (2000) who found that paternal education level can influence WCST scores. Maternal education level was also found to affect WCST scores with regard to number of trials, percentage of perseverative responses and number of trials to complete first category. Similarly, participant employment status resulted in significant differences with regard to number of trials and percentage of nonperseverative errors. Other than a correlation between household socioeconomic status and failure to maintain set within the WCST, no other significant relationships were found to exist between household socioeconomic status and WCST scores. These findings suggest that socioeconomic status may play an important role in mediating performance on the WCST, as has been suggested by a number of studies (Ardila, Ostrosky-Solis, Rosselli, & Gomez, 2000; Mortiner & Graves, 1993; Ostrosky, Ardila, Rosselli, Lopez-Arango, & Uriel-Mendoza, 1998; Shu et al., 2000). Research suggests that low socioeconomic status is frequently associated with less mental stimulation in the home environment than is characteristically found in higher socioeconomic status environments, which may in turn affect central nervous system development and subsequently, performance on measure of executive function (Alvarez, 1983; Ardila et al., 2000).

With regard to the effects of demographic variables on performance on the RPM, few significant relationships were found to exist. Thus, neither age, number of years of

education or education category was found to result in significant differences in performance on the RPM. These results contrast those of other studies which have shown that performance on the RPM is affected by both age and education (Salthouse, 1993; Strauss et al., 2006). The limited age range, as well as the relatively high education levels within the sample may account for the lack of significant results in this regard. Gender has been associated with differences in performance (Lynn, Allik & Irwing, 2004; Strauss et al., 2006), but the current study's results paralleled those of another South African study, which also reported no significant results with regard to gender (Rushton, Skuy & Fridjhon, 2003). No significant results were found for population group, contrasting similar studies within the South African context, which found significant differences in RPM scores across ethnicities (Rushton & Skuy, 2000). No significant results were found for religion and RPM scores. Given the lack of research into the potential relationship between these two variables, these results are difficult to interpret.

Socioeconomic variables were found to be somewhat influential with regard to RPM performance, however. Both maternal occupation group and participant employment status resulted in significant differences in RPM scores. Parental employment status and education level, paternal occupation group and household socioeconomic status, however, did not reveal any significant relationships with RPM scores. These results align with the findings of other studies which suggest that socioeconomic variables may play a modest role in performance on the RPM, based on the effects of education and environmental stimulation, as individuals with higher socioeconomic status are more likely to be able to afford and subsequently attain higher levels of education and are more likely to be exposed to environmental stimuli which foster cognitive development (Measso et al., 1993; Strauss et al., 2006).

Performance on the BADS was minimally affected by demographic variables. Thus, no significant relationships were found to exist between BADS scores and age, education, education category and gender respectively. These results are consistent with those of Wilson et al. (1996). As little research has been conducted into the potential effects of age, education and gender on performance on the BADS, these results are difficult to

interpret (Strauss et al, 2006). Population group, however, did reveal significant differences with regard to the Key Search Test, total scores, standardised scores and age-corrected standardised scores. No research into the effects of population group on performance on the BADS could be found to compare these results to. Similarly, religion was found to result in significant differences on the Temporal Judgment subtest. Given that the Temporal Judgment subtest was adjusted for use within a South African context, these results should be interpreted cautiously. Socioeconomic status variables presented mixed results with regard to performance on the BADS. Parental employment status and parental education levels did not result in any significant differences in BADS scores. Paternal occupation group resulted in significant differences in BADS scores with regard to total scores, standardised scores and age-corrected standardised scores. Maternal occupation group only proved to be influential with regard to scores on the Action Program subtest. Participant employment status did result in significant differences in BADS scores, however, with regard to the Key Search subtest, the Zoo Map subtest, total scores, standardised scores and age-corrected standardised scores. Household socioeconomic status only correlated with one subtest, in the form of the Temporal Judgement test. It is difficult to interpret these results, however, as little research into the impact of these demographic variables on BADS scores has been conducted (Strauss et al., 2006).

### 5.1.4 The Relationship between Superstitious and Paranormal Beliefs and Personality

The current study aimed to investigate the extent to which personality affects the degree to which individuals believe in and behave in accordance with superstitious and paranormal beliefs. Research conducted by Wiseman & Watt (2004) found that a significant relationship existed between superstitious and paranormal beliefs and Neuroticism. The current study, however, found few significant relationships between superstitious and paranormal beliefs and personality. No relationship was found to exist between overall Neuroticism scores and total MPBS scores. Correlations between the Neuroticism facet scores and MPBS subscale scores revealed that one Neuroticism variable - self-consciousness - was significantly associated with any of the MPBS

subscale scores, in the form of the Psi subscale. No other significant relationships were found. These findings contrast those of Peltzer (2002), who found significant relationships between Neuroticism and the extraordinary life forms and spiritualism subscale of the PBS respectively. These findings suggest that the relationship between superstitious and paranormal beliefs and Neuroticism may not be as apparent or as strong as has been suggested by previous studies (Wiseman & Watt, 2004). Given that Peltzer (2002) found significant relationships between Neuroticism and only two PBS subscales, concerns may also be raised regarding the validity of both the PBS and the NEO PI-R within the South African context and similar concerns should be extended to the present study, as the items and underlying factor structures of both instruments may not be suitable for use within this context.

### 5.1.5 The Relationship between Superstitious and Paranormal Beliefs and Executive Function

The primary aim of the current study was to establish whether a relationship existed between the neuropsychological profile of individuals – in the form of prefrontal cortex executive function - and superstitious and paranormal beliefs in a sample of non brain-damaged South African adults from various cultural backgrounds. In this regard, significant relationships were found to exist between performance on the WCST and superstitious and paranormal beliefs. Number of trials completed correlated positively with Traditional Religious Beliefs, Psi, Witchcraft, Spiritualism and Extraordinary Life Forms, suggesting that higher scores on the aforementioned subscales were associated with a greater number of trials being completed on the WCST. Similarly, higher number of correct responses was associated with greater scores on the Traditional Religious Beliefs, Witchcraft and Superstition subscales. These results imply that higher levels of executive function, as evidenced by performance on the WCST, were associated with greater belief in superstitious and paranormal phenomena.

Correlations derived from scores on the MPBS and WCST revealed that poorer performance on the WCST – as indicated by higher scores on the variables of total

number of errors, percentage of perseverative responses, percentage of perseverative errors and percentage of nonperseverative errors – was associated with lower scores on the MPBS and subsequently, fewer superstitious and paranormal beliefs. Other results, with regard to percentage of conceptual level responses and number of categories completed contradict those above, as they suggest that higher scores – indicative of better performance on the WCST - on these variables are associated with lower scores on the MPBS. Additionally, poorer performance on the WCST (as indicated by higher scores on the variables of number of trials to complete first category and failure to maintain set) was associated with higher scores on the MPBS. All the variables of the WCST correlated with overall MPBS scores and MPBS scores when Traditional Religious Beliefs scores were excluded from the total. Overall, higher scores on the MPBS were associated with a greater number of trials completed and a higher total number of correct responses on the WCST. Conversely, higher scores – indicative of poor performance - on the variables of total number of errors, percentage of perseverative responses, percentage of perseverative errors and percentage of nonperseverative errors were associated with lower scores on the MPBS. Higher scores - indicative of better performance on the WCST - on the variables of percentage of conceptual level responses and number of categories completed were associated with lower scores on the MPBS. Finally, higher scores on the variables of number of trials to complete first category and failure to maintain set – associated with poorer performance on the WCST – were associated with higher scores on the MPBS.

These results suggest that better performance on the WCST may be associated with higher levels of belief in superstitious and paranormal phenomena. These findings contradict other studies which have suggested an inverse relationship between executive function abilities and superstitious and paranormal beliefs (Wain & Spinella, 2007; Hergovich & Arendasy, 2005). Given that these studies did not utilise the WCST, however, it is difficult to compare the findings of the present study. Concerns must be raised, however, with regard to the possibility that the dimensions of executive function measured by the WCST are different to those measured in previous studies. Alternatively, concerns about the validity of the WCST and the MPBS within the South African context

must be raised, as the identified constructs may not be measured in a suitable manner, due to a lack of validity on the part of the instruments utilised.

Few significant relationships were found to exist between RPM and BADS scores and MPBS scores. Thus, RPM scores were only found to correlate with the subscales of Superstitions and Extraordinary Life Forms. These correlations were negative in nature and suggest that higher scores on the RPM – indicative of better performance – are associated with lower levels of superstitious and paranormal beliefs. These findings support those of other studies which have found similar negative relationships to exist between reasoning and superstitious and paranormal beliefs (Wierzbicki, 1985), but as few other relationships few found between the MPBS and RPM scores, these results are not particularly substantial. Similarly, no significant relationships were found to exist between MPBS scores and overall BADS scores, and few significant relationships were found to exist between the subtests of the BADS and MPBS scores. The only subscale of the MPBS which correlated with BADS scores was the Traditional Religious Beliefs subscale, which was found to correlate with the Temporal Judgement Test and the Zoo Map Test. These results suggest that differences in executive function ability may not be significantly influenced by beliefs in superstitious and paranormal phenomena. Alternatively, the BADS and RPM may not measure the aspects of executive function affected by superstitious and paranormal beliefs. As little research has been conducted into this area of interest with these instruments as measures of executive functioning, it is difficult to draw conclusions about these findings.

Overall, results for correlations between measures of executive function and superstitious and paranormal beliefs suggest that the relationship between these two variables is complex. Few relationships were found to exist between MPBS scores and performance on the RPM and BADS respectively. While numerous relationships were found to exist between MPBS subscale scores and WCST variables, very few of these supported the findings of previous research, which have suggested that a negative relationship exists between executive function and superstitious and paranormal beliefs (Wain & Spinella, 2007). Percentage of conceptual level responses and number of categories completed

were the only variables to reveal a significant negative relationship with MPBS scores. These correlations indicate that lower levels of superstitious and paranormal belief are associated with better performance on the WCST. Conversely, however, positive correlations were found to exist between executive function and superstitious and paranormal beliefs, suggesting that better performance on numerous variables of the WCST was associated with greater MPBS scores.

The dissimilar nature of the relationships found between executive function and superstitious and paranormal beliefs in the present study suggest that, to some extent, an inverse relationship exists between executive function and superstitious and paranormal beliefs. Some of the results, however, revealed that executive function and superstitious and paranormal beliefs are positively related, contradicting the findings of previous studies (Wain & Spinella, 2007; Hergovich & Arendasy, 2005). These findings suggest that the relationship between executive function and superstitious and paranormal beliefs is a complicated one, and that other aspects of cognitive and reasoning ability must be taken into account. Theories such as the cognitive deficits hypothesis, which suggests that poorer cognitive skills are associated with greater belief in superstitious and paranormal phenomena, may provide an insufficient explanation for the maintenance of superstitious and paranormal beliefs (Irwin, 1993; Hergovich & Arendasy, 2005). Research has indicated, for example, that differences in levels of paranormal belief may be associated with cognitive ability, rather than general critical thinking or reasoning abilities (Musch & Ehrenberg, 2002). As intelligence was not measured within the current study, the cognitive ability hypothesis cannot be confirmed or refuted. It does, however, represent a possible alternative explanation for the results observed within the present study, as increased levels of belief in superstitious and paranormal phenomena may be associated with lower levels of intelligence, in the form of poor critical thinking and reasoning ability. Some insight into potential relationships between reasoning as a domain of intelligence may be provided by the RPM scores within the present study. The RPM is understood to measure intellectual ability in the form of nonverbal reasoning and convergent validity with the Wechsler and Stanford-Binet intelligence scales has been demonstrated (Strauss et al., 2006). The results within the present study revealed negative

correlations between RPM and MPBS scores, providing support for the hypothesis about the potential relationship between intelligence and superstitious and paranormal beliefs. A more extensive battery of assessment measures designed to evaluate intelligence may provide interesting results within this domain of inquiry.

It is important to note that correlations between WCST scores and RPM scores revealed that a significant, positive relationship existed between percentage of nonperseverative errors and RPM scores, suggesting that greater numbers of nonperseverative errors – indicative of poorer performance – are associated with higher RPM scores. Correlations between WCST scores and BADS scores revealed that significant negative relationships existed between Key Search test scores and number of trials completed. Thus, higher Key Search Test scores were associated with fewer trials being completed on the WCST. Positive relationships were found to exist between Key Search test scores and percentage of conceptual level responses and number of categories completed, suggesting that higher Key Search test scores were associated with higher scores on these WCST variables, which are indicative of better performance. Number of categories completed on the WCST also correlated positively with Action Program test scores, BADS total scores, Standardised scores and Age corrected standardised scores. These findings suggest that a greater number of categories completed on the WCST were associated with higher scores on the BADS with regard to these variables, and parallel the findings of Norris & Tate (2000). No other significant relationships existed between WCST scores and BADS test scores. Correlations between BADS scores and RPM scores indicated significant positive relationships also existed between RPM scores and scores on the Key Search Test, BADS total scores, standardised scores and age corrected standardised scores respectively. Thus, higher RPM scores were associated with better levels of performance on these BADS variables.

These findings suggest that the three measures used within the study correlated relatively poorly with one another, as few significant positive relationships were found to exist between the numerous variables of the WCST, RPM and BADS respectively. These findings may be accounted for by the fact that the three tests can be seen to measure quite

dissimilar abilities, ranging from the assessment of “the ability to form abstract concepts, to shift and maintain set, and to utilise feedback” (Strauss et al., 2006, p.526) in the case of the WCST, to reasoning in the case of the RPM. By contrast, the BADS assesses executive function abilities (Strauss et al., 2006). It must be noted, however, that executive function covers a diverse range of abilities, which

> allow an individual to perceive stimuli from his or her environment, respond adaptively, flexibly change direction, anticipate future goals, consider consequences, and respond in an integrated or common-sense way, utilising all these capacities to serve a common purposive goal (Baron, 2004, p.135).

Thus, the three measures utilised within this study may have failed to correlate significantly on account of the very different abilities which they measure. The WCST was found to correlate the most successfully with the MPBS. This may suggest that concept formation, feedback utilisation and set maintenance and shifting (Strauss et al., 2006) are in some way linked to the type of reasoning which underlies superstitious and paranormal beliefs. It is important to note, however, that better performance on the WCST was not always associated with lower levels of belief in superstitious and paranormal phenomena, as the cognitive deficit hypothesis would suggest (Irwin, 1993; Hergovich & Arendasy, 2005). As a result, other cognitive abilities, such as general intelligence or abilities linked to executive function - may thus play a significant role in the formation of and adherence to superstitious and paranormal beliefs (Musch & Ehrenberg, 2002).

### 5.2 Qualitative Results

The qualitative aspect of the current study aimed to uncover the underlying meanings which superstitious and paranormal beliefs hold for individuals and the ways in which individuals rationalise their belief in these phenomena. The results of the qualitative investigation into superstitious and paranormal beliefs revealed that these beliefs were

viewed as legitimate and justifiable beliefs and that the societal and cultural acceptance of such beliefs played a strong role in maintaining this legitimacy. These findings align with those of other studies which have found that the culturally sanctioned and inherited nature of such beliefs is seen as essential to their definition as superstitious beliefs (Rudski, 2003). The current study revealed that participants felt that the extent to which others believe in the same superstitions may also serve to perpetuate the superstitious and paranormal beliefs. These findings emphasise the degree to which these beliefs are intimately connected to culture and the extent to which exposure to certain cultural contexts may influence the beliefs to which individuals subscribe. Hearing about superstitious beliefs and then experiencing events related to them may reinforce superstitious beliefs. This may result in individuals being more likely to practice superstitious behaviours. Factors such as respect and the extent to which certain cultural beliefs may resonate with an individual may influence the superstitious and paranormal beliefs to which they ascribe. These findings parallel those of previous studies which have emphasised the extent to which superstitious and paranormal beliefs are culturally and socially shared (Devine, 1989) and are taught through "socialisation processes" (Kramer & Block, 2008, p.785). Within the present study, those who are not superstitious were seen as not identifying with the cultural practices associated with superstitious behaviours, emphasising the socio-cultural nature which underlies superstitious and paranormal beliefs (Devine, 1989; Kramer & Block, 2008)

Superstitious and paranormal beliefs were often identified as being legitimate because of their inherited nature. Beliefs were often inherited from family members, who had taught participants about the importance of superstitions and practicing superstitious behaviours. Such beliefs, and their associated behaviours, may thus become a learned way of reacting to and coping with certain events. Familial beliefs thus play a significant role in perpetuating the practice of superstitions, as has been confirmed by research by Jahoda (1969). Belief in superstitious and paranormal phenomena "persists because of people's traditional belief that illness, bad luck or ailment is as a result of witchcraft, evil people, ghosts, fortune tellers, dwarfs and demons" (Akande, 2010, p.8). Superstitious and paranormal beliefs were also felt to be logical in some instances because of the

importance placed upon these beliefs in the home environment, due to the seemingly rational explanations for everyday phenomena which they have come to represent. These findings support those of other studies which have emphasised the significance of superstitious and paranormal phenomena in daily life within the South African context (Akande, 2010).

While superstitious and paranormal beliefs have been emphasised by society, the meaning underlying these beliefs has often fallen away. Within the present study, there was awareness among some participants that superstitious beliefs were sometimes acted upon without any form of reasoning underlying these actions, because they did not know the motivations for the behaviours. Similarly, one participant felt that the original meanings attached to superstitious beliefs have disappeared over time. The practices and actions associated with the superstitions have remained, however. The majority of participants continued to believe in superstitious phenomena because they had played a significant role in their upbringing, emphasising the inherited nature of superstitious and paranormal beliefs (Akande, 2010, Devine, 1989).

The current study illustrated that superstitious and paranormal beliefs are understood to be illogical and irrational, and represent phenomena which lie beyond rationalisation. Nevertheless, many of the individuals continued to believe in superstitious and paranormal phenomena. These results correspond with Ellis's (1962) theory of irrational beliefs, which suggests that irrational beliefs, such as superstitious and paranormal beliefs, are inflexible and thus hinder and alter thought patterns, by "introducing personal or situational factors" (Williams & Irwin, 1991, p.1340) which affect thought outcomes (Tobacyk & Milford, 1982).

Individuals often felt less inclined to subscribe to superstitious and paranormal beliefs because of their exposure to education, which they perceived as allowing them to rationalise experiences from a scientific perspective, instead of attributing events to superstitious and paranormal phenomena. Thus, exposure to scientific reasoning and explanations for phenomena persuaded individuals to abandon superstitious beliefs.

These findings align with those of other studies, which have pointed to the distinctions which have been drawn between scientific and superstitious belief and the contentions between them (Irwin, 1993; Lindeman & Saher, 2007). Some participants felt that they had "outgrown" superstitions which were taught to them during their childhood, because as adults, they were now able to interpret experiences from a more intellectual standpoint. Abandoning beliefs which had been instilled since childhood – and which are still held by the individual's family and community – may prove to be a complicated task however, given the inherited and cultural significance which these beliefs often hold (Akande, 2010).

The majority of the participants who were interviewed admitted to being superstitious. Many, however, felt that they only held certain superstitions and were not superstitious in all circumstances. These findings support those of previous studies, which have found that individuals who subscribe to superstitious and paranormal beliefs are frequently aware of their illogical behaviour, but struggle to prevent themselves from performing the actions and rituals associated with their beliefs, and thus continue to carry out these behaviours (Gmelch & Felson, 1980; Keinan, 2002). Within the present study, superstitious actions also continued to be performed because they had provided the desired results in the past. Previous successes were thus seen as confirming the legitimacy of superstitious and paranormal beliefs. These findings confirm the findings of Darke & Freedman (1997), who found that when positive results in one instance were perceived as being achieved as a result of luck, success in results in later events – which were often unconnected and unrelated to the first event – was expected to occur because of expectations related with luck.

Within the present study, personal superstitious beliefs were identified as idiosyncratic beliefs which individuals held and which were often accompanied by certain rituals which they themselves had invented. By contrast, culturally sanctioned superstitious beliefs are those beliefs which have been taught to individuals by their family, friends, community or society. Common culturally sanctioned superstitions which participants believed in and behaved in accordance with were diverse. They included avoiding broken

mirrors, black cats and walking under ladders in order to evade bad luck and avoiding whistling indoors to avoid financial losses. Similarly, spilling salt was seen as unlucky, while owls and lightning were perceived to represent bad omens. Some participants also expressed a belief in fortune-telling, ghosts and alternative healing techniques. Within the present study, personal superstitious beliefs were not as common as culturally sanctioned superstitious and paranormal beliefs. Personal superstitions did, however, present unique ways of generating good luck for individuals. Similar to the findings of previous studies (Darke & Freedman, 1997), the current study found that personal superstitions centred on superstitious practices which might be performed prior to participating in sports events and belief in good luck charms. These superstitious beliefs are maintained because of the previous successes which have been attributed to these practices (Darke & Freedman, 1997; Kramer & Block, 2008).

With regard to explaining why superstitious actions might be perpetuated, one participant felt that successful results generated from superstitious acts might be due to the "placebo effect" and that the positive emotions associated with belief in positive superstitions were capable of providing confidence. This suggestion corresponds to the findings of previous research, which have found that belief in superstitious and paranormal phenomena "can create a self-fulfilling prophecy; thus, a belief that the situation will improve as a consequence of some magical ritual might increase optimism, decrease stress, and improve task performance - all of which may enhance one's sense of control" (Keinan, 2002, p.103). Interestingly, within the present study, in instances where the desired results were not achieved, despite the appropriate superstitious actions being performed, participants were not distressed by this. Good luck and positive events were seldom attributed to superstitious or paranormal phenomena and few participants spoke about actions which were performed to attract good luck. The majority of the interviews focussed on rituals performed to avoid misfortune. Similarly, unlucky occurrences, however, were often attributed to superstitious or paranormal phenomena. These findings support those of previous studies, which have found that significant failures may often be blamed on superstitious and paranormal phenomena (Case et al., 2004).

Anxiety has been identified as a significant motivating factor in the performance of many superstitious practices (Irwin, 2000). As participants in the study explained, encountering superstitious phenomena which might cause bad luck or performing actions which might promote bad luck resulted were associated with anxiety, as they feared that these occurrences would generate misfortune. Enacting superstitious behaviours can thus be seen as a form of precaution against bad luck or a way of providing protection. These superstitious behaviours may also be conducted by somewhat sceptical individuals, who fear that some truth may underlie superstitious and paranormal beliefs. Thus use of superstitious actions as a way of controlling the future and gaining a sense of control and empowerment was also explored within the present study. These findings parallel those of other studies which have found superstitious actions are often used by individuals, "with a strong need for control, in an attempt to overcome perceived uncertainty in their surroundings" (Wiseman & Watt, 2004, p.1534). These attempts at control are often made as a result of underlying anxiety (Irwin, 2000). Magical thinking – the belief that "one's thoughts, words, or actions can achieve specific physical effects in a manner not governed by the principles of ordinary transmission of energy or information" (Zusne & Jones, 1989, p.13) – has been found to underlie superstitious and paranormal beliefs and has been found to increase in times of stress and threat (Case et al., 2004; Keinan, 1994; McCann & Stewin, 1984). This increase may be due to feelings of loss of control which arise in times of stress, as individuals resort to magical thinking – in the form of superstitious and paranormal beliefs – in order to restore this perceived sense of control (Friedland, Keinan, & Regev, 1992; Keinan, 1994; Keinan, 2002). Within the current study, superstitions were often felt to serve as explanations for events, and helped individuals to make sense of inexplicable phenomena, as that which is not understood could be attributed to being the result of superstitious or paranormal phenomena. These findings parallel those of other studies, which have found that superstitious and paranormal beliefs can serve as explanations for incomprehensible or unusual phenomena (Keinan, 2002). Reliance on these explanations provides reassurance to the individual by making "the person's world more understandable, predictable, and controllable" (Keinan, 2002, p.103).

Positive emotional effects were identified as being a strong motivating factor for maintaining superstitious and paranormal beliefs. Feelings such as confidence and empowerment were associated with superstitious practices, such as the use of good luck charms. Thus, superstitious rituals may serve as mechanisms which help individuals to create a feeling of control over that which is uncertain (Keinan, 2002). Research has confirmed that positive superstitions may serve useful psychological purposes, such as offering coping mechanisms in times of distress (Akande, 2010; Jahoda, 1969; Taylor, 1989).

Despite the conscious motivations identified by many participants, superstitious behaviours were often performed without awareness, suggesting that superstitious behaviours may sometimes occur automatically, and without reasoning on the part of the individual. These findings contrast those of previous research, which has indicated that superstitious and paranormal beliefs "represent a set of cultural associations" (Kramer & Block, 2008, p.785), which may be nonconsciously triggered by environmental cues. Individuals can, however, exercise cognitive control over these associations and halt or alter superstitious behaviours (Devine, 1989). While superstitious beliefs may be processed nonconsciously, the rituals which accompany such beliefs are unlikely to occur on a nonconscious level, however. Much superstitious behaviour is thus performed with awareness (Darke & Freedman, 1997) and represents concerted efforts on the part of the individual to avoid misfortune or to attract good luck (Kramer & Block, 2008).

Religion provided a point of contention within the realm of superstitious and paranormal beliefs. Based on the similar background which superstitious and religious beliefs share, in terms of their inherited and culturally sanctioned nature, difficulties in differentiating between religious beliefs and superstitious beliefs emerge (Orenstein, 2002). Some studies have indicated that religious beliefs may be seen to fall beyond the realm of superstitious and paranormal beliefs (Rudski, 2003). Within the present study, some participants would pray in order to attract good luck while others participant resorted to prayer when confronted with bad omens. These practices highlight the extent to which religious beliefs are often seen to fall within the realm of superstition and the extent to

which they may be used in conjunction with superstitious and paranormal beliefs to deter misfortune or to attract good luck (Emmons & Sobal, 1981; Orenstein, 2002).

## 5.3 Limitations, Suggestions for Further Research and Conclusion

### 5.3.1 Limitations

It is important to note that certain limitations existed within the study. The sample size was relatively small, and a larger sample would likely prove influential, especially with regard to statistical significance, as tests such as the Spearman's correlation and the Kruskal-Wallis nonparametric one-way ANOVA are sensitive to small sample sizes (Howell, 2004). Expanding the size of the sample within the context of this study proved to be difficult, however, given the interactive nature of the data collection process, which required testing sessions lasting approximately 90 minutes to be conducted with each participant. Thus, obtaining additional participants proved to be difficult due to time constraints in the data collection process.

A second limitation of the study relates to the nature of the demographic characteristics of the sample. 65.12% of the sample was White, while the remaining the 34.88% of the sample was composed of African, Asian, Indian and Coloured individuals. This is certainly not representative of the general composition of the South African population (Stats SA, 2001), and a more representative sample would have been preferable and may have significantly affected the results of the study.

Thirdly, concerns may be raised about the normality of the data which were derived from the sample. With regard to demographic variables, age and household socioeconomic status were normally distributed. Education, however, had a kurtosis value of 1.8, indicating a lack of normality. Similarly, while the MPBS and the Neuroticism subscale of the NEO PI-R presented normal distributions, the two measures within the executive function battery indicated problematic skewness coefficients and kurtosis values. On the WCST scores, for example, total number of correct responses, number of categories

completed, number of trials to complete first category, percentage of nonperseverative errors, percentage of conceptual level responses and failure to maintain set all presented with either high skewness coefficients or large kurtosis values. In the case of the BADS, overall scores, standardised scores and age corrected standardised scores fell within a normal distribution. A number of subtests of the BADS, including the Rule Shift Card test, the Action Program test and the Six Elements test, had problematic skewness coefficients and large kurtosis values. As a result of the lack of normality associated with WCST and BADS scores, findings associated with these two measures should be interpreted with caution in the context of this study.

A final limitation of the study relates to the Modified Paranormal Beliefs Scale. As a result of the modifications made to the original Paranormal Beliefs Scale (Tobacyk & Milford, 1983; Tobacyk, 2004), it was not possible to compare the current sample's performance on the MPBS with scores obtained by other samples in previous research. These comparisons may have proved useful with regard to establishing whether the current sample represented a highly superstitious group.

### 5.3.2 Suggestions for Future Research

With regard to directions for future research, the development of a South African version of the Paranormal Beliefs Scale (Tobacyk & Milford, 1983; Tobacyk, 2004) would likely be the most beneficial starting point for furthering research on South African superstitious and paranormal beliefs. While some efforts have been made in this regard by Peltzer (2002, 2003), the area remains under-researched. As South African superstitions are unique and quite different from many Western superstitions, a suitable scale would prove highly valuable for future studies within the South African context. Given the disparate results of the current study, a replication with a larger sample might also establish a less ambiguous relationship between executive function and superstitious and paranormal beliefs. Additionally, as noted by Wiseman & Watt (2004), Tobacyk & Milford's (1983) PBS focuses solely on negative superstitions. Future research on superstitious beliefs might reveal very different results if positive superstitions were

measured in addition to their negative counterparts.

### 5.3.3 Conclusion

This study investigated the relationship between superstitious and paranormal beliefs and executive function in a sample of non brain-damaged adults. The relationship between personality and belief in superstitious and paranormal phenomena was also investigated. Superstitious and paranormal beliefs were measured by means of a Modified Paranormal Beliefs Scale (Tobacyk & Milford 1983; Peltzer, 2002; Peltzer, 2003), while executive function was evaluated using the Wisconsin Card Sorting Test, the Raven's Progressive Matrices Test and the Behavioural Assessment of Dysexecutive Syndrome.

The study revealed that few relationships existed between demographic variables and superstitious and paranormal beliefs, with no significant relationships being found to exist between superstitious and paranormal beliefs and age, education, gender and population group respectively. Relationships were, however, found to exist between superstitious and paranormal beliefs and both religion and some socioeconomic status variables. Socioeconomic status was found to correlate with Neuroticism scores, but no other significant relationships were found to exist between Neuroticism and demographic variables. Performance on measures of executive function, in the form of the WCST, RPM and BADS, were minimally affected by demographic variables. Significant relationships were found to exist between WCST scores and the variables of age, education, population group and socioeconomic status, but socioeconomic status proved to be the only variable associated with performance on the RPM. Population group, religion and socioeconomic status were found to result in significant differences in BADS scores.

Few significant relationships were found to exist between superstitious and paranormal beliefs and personality. Similarly, few relationships were found to exist between superstitious and paranormal belief scores and performance on two of the measures of executive function, in the form of the RPM and BADS respectively. A number of

incongruous relationships were found to exist between superstitious and paranormal belief scores and WCST variables, however. Thus, some correlations indicate that lower levels of superstitious and paranormal belief are associated with better performance on the WCST, but other positive correlations were found to exist between executive function and superstitious and paranormal beliefs. Some of the findings of the current study thus contradict those of previous studies which have supported the cognitive deficits hypothesis (Wain & Spinella, 2007), and consequently suggest that the relationship between superstitious and paranormal beliefs and executive function is not a simple one, and that other aspects of cognitive ability must be taken into account (Musch & Ehrenberg, 2002).

With regard to the qualitative findings of the study, superstitious and paranormal beliefs were found to represent important culturally beliefs, which were transmitted through families, cultures and societies. Legitimacy was ascribed to these beliefs because of their culturally-sanctioned nature. While many individuals were aware of the illogical nature of superstitious and paranormal beliefs, they continued to practice them because of both their inherited nature and the psychological effects associated with them. These psychological effects included the reduction of anxiety and the sense of control which performing superstitious rituals resulted in, as individuals felt that misfortune was deterred or that they would attract good luck. Superstitious beliefs were sometimes triggered by environmental cues of which individuals were not aware and rituals were performed without individuals understanding the origins of their beliefs. Some contentions did emerge between superstitious and paranormal beliefs and both religious and scientific beliefs, however. These qualitative findings might provide useful insights into the ways in which individuals reason and think about superstitious and paranormal beliefs.

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**Appendix A: Subject Information Sheet**



UNIVERSITY
OF THE
WITWATERSRAND,
JOHANNESBURG

School of Human and Community Development
*Private Bag 3, Wits 2050, Johannesburg, South Africa*
*Tel: 073 817 3716*
*Email: candice.schneider@hotmail.com*

Dear student

My name is Candice Schneider and I am currently completing my Masters in Research Psychology degree at the University of the Witwatersrand. For the purposes of obtaining my degree, I am conducting research into executive function and superstitious and paranormal beliefs. Executive function broadly refers to an individual's abilities to plan and adapt their behaviour according to environmental feedback, the ability to sustain attention, reason and anticipate the consequences of one's actions, while superstitious beliefs are paranormal or anomalous phenomena which are incompatible with scientific explanation.

The research aims to ascertain whether superstitious beliefs and behaviours are associated with executive function and personality. For the purposes of the study, a large, demographically representative sample is required, and as such, I would like to invite you to participate in my research. Participation will require each volunteer to complete a brief demographic questionnaire, a questionnaire on superstitious beliefs, a personality test and three tests of executive function. The entire process should take no more than 90 minutes. Some participants may also be invited back for a brief interview on their superstitious beliefs.

The participation process is entirely voluntary, and you are free to withdraw from the study at any point, without any negative consequences. Anonymity will be maintained throughout the testing process, as participants will not be required to provide their names on any of the questionnaires or tests used. Your responses will be anonymous, as a numerical coding system will be used for each participant's responses. All data will be processed by myself, and once collected, overall test results from all measures from the sample will be analyzed to determine whether any significant relationships exist between the variables of interest. Individual test results will not be analyzed independently and confidentiality of the information obtained from the study will be maintained. The data collected will be kept in a safe place at the University of the Witwatersrand for a period of five years, to allow for the data to be checked and for potentially use in later studies. The research and data obtained may be published in a psychological journal and the findings of the research may be presented at future psychological conferences. The overall findings of the research will be made available to participants by means of an internet site.

Your participation in the study would be greatly appreciated. If you have any further queries, please do not hesitate to contact for additional information.

Kind regards

Candice Schneider

**Appendix B: Demographic Questionnaire** **Participant code: _____**

Please complete the brief demographic questionnaire below. The information which you provide below will be used solely for the purposes of acquiring the necessary demographic information for the research and will be kept confidential. Participation is completely voluntary and you may choose to withdraw from the study at any stage. The information drawn from the tests will be confidential and the data will be kept in a safe place at the University of the Witwatersrand for a period of five years, at which point it will be destroyed. The data collected from this research may be published in a research journal or presented at future research conferences. By completing this questionnaire, you consent to participate in the research.

Age: _____

Number of years of post-matric education: _____

Gender: (please tick whichever is appropriate)

Male: ☐ Female: ☐

Population group:

African: ☐ White: ☐ Asian: ☐

Indian: ☐ Coloured: ☐ Other (please specify): _____

Religious affiliation (please specify): _____

Socioeconomic status: (please tick whichever is appropriate)

1. Are your parents/guardians currently employed?

   Father only employed: ☐ Mother only employed: ☐

   Both parents/guardians are employed: ☐

2. What kind of work do your parents do?
   For example: lawyer, doctor, teacher.
   Father: _____
   Mother: _____

3. What is the highest level of education which your parents have?
   For example: grade 10; matric; diploma; degree.
   Father: _____

Mother: _____

4. Do you have a job?

   Yes: ☐ No: ☐

5. Which of the following do you have at home:

   Own car: ☐ Radio/HiFi: ☐ Television: ☐

   DVD player: ☐ Refrigerator: ☐ Microwave: ☐

   Dishwasher: ☐ Electricity: ☐ Running water: ☐

Have you ever experienced any form of brain injury?

Yes: ☐ No: ☐

Signature: _____
Date: _____

## Appendix C:

Modified Paranormal Beliefs Scale Participant code: _____

Please indicate how much you agree or disagree with each item by putting a cross through the statement which best describes your beliefs. There are no right or wrong answers. This is a sample of your own beliefs and attitudes. Thank you.

1. The soul continues to exist though the body may die.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

2. Some individuals are able to levitate (lift) objects through mental forces.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

3. Black magic does not exist.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

4. Certain animals (e.g. owls and cats) have the power to bring bad luck.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

5. Your mind or soul can leave your body and travel (astral projection).

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

6. Creatures such as Big Foot, the Loch Ness Monster and the Tokoloshi exist.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

7. Dreams cannot provide information about the future.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

8. There is a devil.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

9. Psychokinesis, the movement of objects through psychic powers, does occur.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

10. Witches do not exist.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

11. Certain numbers, such as 13 and 6, can bring bad luck.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

12. During altered states, such as sleep or trances, the spirit can leave the body.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

13. Monsters live in forests and can make people disappear.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

14. The horoscope accurately tells a person’s future.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

15. I believe in God.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

16. A person's thoughts cannot influence the movement of a physical object.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

17. Through the use of formulas and incantations, it is possible to cast spells on persons.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

18. Certain birds (e.g. crows, doves or pigeons) flying past means bad luck.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

19. Reincarnation does not occur.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

20. The living dead (e.g. zombies) exist.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

21. The idea of predicting the future is foolish.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

22. There is a heaven and hell.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

23. Mind reading is not possible.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

24. There are actual cases of witchcraft.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

25. It is possible to communicate with the dead.

| | | | | | | |
|---|---|---|---|---|---|---|
| Strongly disagree | Moderately disagree | Slightly disagree | Uncertain | Slightly agree | Moderately agree | Strongly agree |

**Appendix D**

Participant Consent Form for Interview

I understand that my participation in this research involves participating in an interview.
I understand that I may decline answering any questions I prefer not to.
I understand that I may withdraw from this research at any time.
I understand that all responses that I have supplied will remain confidential and no identifying information will be included in the final research report.

I consent to participate in this study.

……. (signature) ……. (date)

**Appendix E**

Participant consent form (tape-recorded interview)

I understand that this interview will be tape-recorded and transcribed by the researcher. I understand that no identifying information will be included in the transcripts or final research report. I understand that the data will be kept in a safe place at the University of the Witwatersrand for a period of five years, at which point it will be destroyed. The data collected from this research may be published in a research journal or presented at future research conferences.

I consent to have my interview recorded in this study.

…… (signature) ……. (date)

## Appendix F

Superstitious and Paranormal Beliefs Interview Schedule

1. What do you think about superstitions in general? Do you think that they are legitimate, logical beliefs?
2. Do you think that you are superstitious?
3. Is there anything which you are specifically superstitious about?
4. Why do you believe in or behave in accordance with the superstitions which you have mentioned?
5. What meaning do the superstitions which you have mentioned hold for you?
6. How do you understand your superstitious beliefs? What reasoning underlies your beliefs?

## Appendix G
## Self-reflexivity Report

Despite the positivist paradigm employed with regard to the quantitative aspects of the current study, a qualitative approach was used to collect and analyse the qualitative data which was obtained from interviews with participants. The qualitative data was analysed from a phenomenological perspective, and, as a result, it is important that I, as the researcher, am aware of the impact which my own subjective thoughts, feelings and expectations may have had on the analysis process.

I am a 24 year old, White, female, middle-class South African citizen. My home language is English and I am currently completing my MA Research Psychology degree. While I do not currently consider myself to be particularly superstitious, I am aware that I was highly superstitious during my adolescence. I do also believe in some paranormal phenomena, such as Psi and precognition. With regard to my religious beliefs, I am a Progressive Jew, but I have a strong interest in other religions.

The underlying motivation for conducting the qualitative element of the current study was to explore the ways in which individuals rationalised their superstitious and paranormal beliefs, and to understand the meanings which these beliefs held for them. I was particularly interested in this topic, because superstitious and paranormal beliefs may appear to represent irrational thoughts and practices, but are often rationalised by individuals.

During the data collection process, I was aware of the effects which being a young, White female may have on the interview process. As a result, I conducted the interviews in a relatively informal manner, in order to establish rapport with participants and to convey that the interview provided a safe environment. All the participants – even those who did not believe themselves to be superstitious – appeared to be willing to discuss their beliefs and the reasoning and meanings which underpinned their beliefs. As the researcher and interviewer, I was constantly aware of my reflexivity, and sought to assure participants of

my interest in their beliefs, while avoiding conveying a sense of scrutiny or judgment.

With regard to the data analysis process, I sought to remain as objective as possible while analysing the interviews, in order to allow the meanings conveyed by the participants to emerge. In doing so, I felt that I was able to avoid allowing any preconceived ideas which I might have had regarding the data influence the analysis process. I was, however, constantly aware of my role as the researcher and endeavoured to ensure that the results of the research reflected the feelings and perspectives of the participants.

## Appendix H

## Ethical Clearance Certificate

**UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG**

**HUMAN RESEARCH ETHICS COMMITTEE (SCHOOL OF HUMAN & COMMUNITY DEVELOPMENT**

| | |
|---|---|
| **CLEARANCE CERTIFICATE** | **PROTOCOL NUMBER: MPSYC/10/002** |
| **PROJECT TITLE:** | Examining the relationship between executive functioning and superstitious belief |
| **INVESTIGATORS** | Candice Schneider |
| **DEPARTMENT** | Psychology |
| **DATE CONSIDERED** | 23/03/10 |
| **DECISION OF COMMITTEE*** | Approved |

**This ethical clearance is valid for 2 years and may be renewed upon application**

**DATE: 01 June 2010**

**CHAIRPERSON** _____
**(Professor K. Cockcroft)**

cc Supervisor:

Prof Marilyn Lucas
Psychology

---

**DECLARATION OF INVESTIGATOR (S)**

To be completed in duplicate and **one copy** returned to the Secretary, Room 100015, 10th floor, Senate House, University.

I/we fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure be contemplated from the research procedure, as approved, I/we undertake to submit a revised protocol to the Committee.

**This ethical clearance will expire on 31 December 2012**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

## Appendix I

## Tables Pertaining to the Relationships between Demographic Variables and Modified Paranormal Beliefs Scale Scores

Table I1.1
*Spearman's Correlations between Age and Modified Paranormal Beliefs Scale Scores*

| Variable | Correlation with age | p-value |
|---|---|---|
| Paranormal beliefs scale | | |
| Traditional religious beliefs | .037 | .816 |
| Psi | .058 | .713 |
| Witchcraft | - .109 | .490 |
| Superstitions | - .049 | .756 |
| Spiritualism | - .191 | .223 |
| Extraordinary life forms | -.237 | .126 |
| Precognition | .028 | .860 |
| Paranormal beliefs total | -.077 | .624 |
| Paranormal beliefs total (excluding traditional religious beliefs) | -.118 | .453 |

* significant at the .05 level

Table I1.2
*Spearman's Correlations between Education and Modified Paranormal Beliefs Scale Scores*

| Variable | Correlation with education | p-value |
|---|---|---|
| Paranormal beliefs scale | | |
| Traditional religious beliefs | -.032 | .839 |
| Psi | -.035 | .826 |
| Witchcraft | -.167 | .287 |
| Superstitions | .072 | .649 |
| Spiritualism | -.233 | .133 |
| Extraordinary life forms | -.112 | .475 |
| Precognition | -.034 | .831 |
| Paranormal beliefs total | -.114 | .471 |
| Paranormal beliefs total (excluding traditional religious beliefs) | -.160 | .309 |

* significant at the .05 level

Table I1.3
*Spearman's Correlations between Household Socioeconomic Status and Modified Paranormal Beliefs Scale Scores*

| Variable | Correlation with household SES | p-value |
|---|---|---|
| Paranormal beliefs scale | | |
| Traditional religious beliefs | -.104 | .509 |
| Psi | .001 | .996 |
| Witchcraft | -.251 | .105 |
| Superstitions | .010 | .948 |
| Spiritualism | .003 | .986 |
| Extraordinary life forms | -.193 | .215 |
| Precognition | -.117 | .456 |
| Paranormal beliefs total | -.151 | .338 |
| Paranormal beliefs total (excluding traditional religious beliefs) | -.138 | .380 |

* significant at the .05 level

Table I1.4
*Kruskal-Wallis Nonparametric One-Way ANOVAs for Modified Paranormal Beliefs Scale Scores by Demographic Variables*

| Variable | | Education category | Gender | Population group | Religious affiliation |
|---|---|---|---|---|---|
| Paranormal beliefs scale | | | | | |
| Traditional religious beliefs | H statistic | .16 | .92 | 5.59 | 24.80* |
| | p-value | .925 | .337 | .232 | .001 |
| Psi | H statistic | .77 | .10 | .81 | 8.35 |
| | p-value | .679 | .748 | .938 | .303 |
| Witchcraft | H statistic | .25 | 2.12 | 6.50 | 14.67* |
| | p-value | .881 | .146 | .165 | .041 |
| Superstitions | H statistic | 1.30 | .001 | 6.76 | 10.73 |
| | p-value | .521 | .978 | .149 | .151 |
| Spiritualism | H statistic | 1.46 | .12 | 5.13 | 7.44 |
| | p-value | .481 | .729 | .274 | .385 |
| Extraordinary life forms | H statistic | 1.10 | 3.27 | 5.32 | 8.89 |
| | p-value | .578 | .071 | .256 | .260 |
| Precognition | H statistic | 1.26 | .10 | 5.95 | 10.28 |
| | p-value | .534 | .757 | .203 | .173 |
| Paranormal beliefs total | H statistic | 1.11 | 1.02 | 5.82 | 9.70 |
| | p-value | .573 | .313 | .213 | .206 |
| Paranormal beliefs total (excluding traditional religious beliefs) | H statistic | 1.64 | .64 | 5.99 | 8.63 |
| | p-value | .441 | .424 | .200 | .281 |

* significant at the .05 level

Table I1.5
*Kruskal-Wallis Nonparametric One-Way ANOVAs for Socioeconomic Status Variables by Modified Paranormal Beliefs Scale Scores*

| Variable | | Parental employment status | Paternal occupation group | Maternal occupation group | Paternal education level | Maternal education level | Participant employment status |
|---|---|---|---|---|---|---|---|
| Paranormal beliefs scale | | | | | | | |
| Traditional religious beliefs | H statistic | 1.70 | .49 | .44 | 2.42 | 4.53 | .08 |
| | p-value | .790 | .921 | .932 | .789 | .477 | .784 |
| Psi | H statistic | 3.90 | 2.38 | 4.83 | 4.74 | .47 | .75 |
| | p-value | .419 | .497 | .185 | .449 | .993 | .388 |
| Witchcraft | H statistic | 2.61 | .87 | 1.55 | 10.32 | 2.44 | .07 |
| | p-value | .626 | .833 | .670 | .067 | .785 | .786 |
| Superstitions | H statistic | 4.35 | 2.19 | 8.38* | 6.41 | 2.98 | .71 |
| | p-value | .361 | .534 | .039 | .268 | .703 | .401 |
| Spiritualism | H statistic | 2.58 | 1.37 | 2.09 | 2.23 | 3.17 | .004 |
| | p-value | .631 | .714 | .555 | .816 | .674 | .951 |
| Extraordinary life forms | H statistic | 5.31 | .10 | 6.29 | 8.20 | 4.48 | .88 |
| | p-value | .257 | .992 | .098 | .145 | .482 | .349 |
| Precognition | H statistic | 3.69 | 2.83 | 8.23* | 3.69 | 1.79 | 2.28 |
| | p-value | .450 | .420 | .042 | .596 | .878 | .131 |
| Paranormal beliefs total | H statistic | 4.10 | 1.69 | 5.24 | 5.50 | 1.74 | .01 |
| | p-value | .393 | .639 | .155 | .358 | .884 | .941 |
| Paranormal beliefs total (excluding traditional religious beliefs) | H statistic | 5.72 | 1.87 | 6.11 | 6.62 | 1.38 | .0002 |
| | p-value | .221 | .600 | .106 | .251 | .927 | .990 |

* significant at the .05 level

## Appendix J

## Tables Pertaining to the Relationships between Demographic Variables and Neuroticism Scores

Table J1.1
*Spearman's Correlations between Age and NEO PI-R Neuroticism Subscale Facet and Overall Neuroticism Scores*

| Variable | Correlation with age | p-value |
|---|---|---|
| NEO PI-R – Neuroticism subscale facets | | |
| Anxiety | -.015 | .923 |
| Angry hostility | -.008 | .959 |
| Depression | -.017 | .914 |
| Self-consciousness | .114 | .471 |
| Impulsiveness | .090 | .569 |
| Vulnerability | -.203 | .194 |
| Neuroticism subscale total | -.016 | .917 |

* significant at the .05 level

Table J1.2
*Spearman's Correlations between Education and NEO PI-R Neuroticism Subscale Facet and Overall Neuroticism Scores*

| Variable | Correlation with education | p-value |
|---|---|---|
| NEO PI-R – Neuroticism subscale facets | | |
| Anxiety | .130 | .408 |
| Angry hostility | .030 | .850 |
| Depression | .065 | .679 |
| Self-consciousness | .230 | .139 |
| Impulsiveness | -.017 | .914 |
| Vulnerability | -.053 | .737 |
| Neuroticism subscale total | .089 | .573 |

* significant at the .05 level

Table J1.3
*Spearman's Correlations between Household Socioeconomic Status and NEO PI-R Neuroticism Subscale Facet and Overall Neuroticism Scores*

| Variable | Correlation with age | p-value |
|---|---|---|
| NEO PI-R – Neuroticism subscale facets | | |
| Anxiety | -.031 | .845 |
| Angry hostility | .020 | .898 |
| Depression | -.068 | .668 |
| Self-consciousness | .009 | .954 |
| Impulsiveness | -.070 | .659 |
| Vulnerability | -.202 | .195 |
| Neuroticism subscale total | -.052 | .742 |

* significant at the .05 level

Table J1.4
*Kruskal-Wallis Nonparametric One-Way ANOVAs for Demographic Variables by NEO PI-R Neuroticism Subscale Facet and Overall Neuroticism Scores*

| Variable | | Education category | Gender | Population group | Religious affiliation |
|---|---|---|---|---|---|
| NEO PI-R – Neuroticism subscale facets | | | | | |
| Anxiety | H statistic | .58 | 3.80 | 4.03 | 4.44 |
| | p-value | .747 | .051 | .402 | .729 |
| Angry hostility | H statistic | .02 | 2.89 | 4.73 | 3.37 |
| | p-value | .990 | .089 | .316 | .849 |
| Depression | H statistic | .53 | .002 | 3.98 | 11.93 |
| | p-value | .768 | .961 | .409 | .103 |
| Self-consciousness | H statistic | 1.62 | .08 | 2.33 | 5.83 |
| | p-value | .446 | .777 | .675 | .560 |
| Impulsiveness | H statistic | .08 | 1.53 | 3.46 | 6.47 |
| | p-value | .960 | .217 | .484 | .487 |
| Vulnerability | H statistic | .28 | 1.62 | 2.64 | 8.41 |
| | p-value | .870 | .203 | .620 | .298 |
| Neuroticism subscale total | H statistic | .33 | .49 | 4.49 | 6.37 |
| | p-value | .848 | .482 | .344 | .497 |

* significant at the .05 level

Table J1.5
*Kruskal-Wallis Nonparametric One-Way ANOVAs for Socioeconomic Status Variables by NEO PI-R Neuroticism Subscale Facet and Overall Neuroticism Scores*

| Variable | | Parental employment status | Paternal occupation group | Maternal occupation group | Paternal education level | Maternal education level | Participant employment status |
|---|---|---|---|---|---|---|---|
| NEO PI-R – Neuroticism subscale facets | | | | | | | |
| Anxiety | H statistic | 5.81 | 1.12 | 2.17 | 6.67 | 5.67 | .21 |
| | p-value | .214 | .772 | .538 | .246 | .340 | .648 |
| Angry hostility | H statistic | 1.49 | 1.29 | .18 | 7.33 | 9.60 | .17 |
| | p-value | .828 | .733 | .980 | .197 | .088 | .684 |
| Depression | H statistic | 3.32 | 5.43 | .39 | 7.35 | 4.55 | 2.46 |
| | p-value | .507 | .143 | .943 | .196 | .473 | .117 |
| Self-consciousness | H statistic | 5.97 | 2.58 | 5.79 | 4.70 | 5.25 | .18 |
| | p-value | .201 | .461 | .123 | .454 | .386 | .675 |
| Impulsiveness | H statistic | 2.04 | 5.08 | .40 | 3.01 | 3.85 | 2.82 |
| | p-value | .728 | .166 | .941 | .699 | .571 | .093 |
| Vulnerability | H statistic | 4.32 | 3.24 | 1.64 | 5.48 | 3.99 | 8.00* |
| | p-value | .365 | .357 | .650 | .361 | .550 | .005 |
| Neuroticism subscale total | H statistic | 3.02 | 3.05 | 1.53 | 4.52 | 7.28 | .66 |
| | p-value | .555 | .384 | .675 | .477 | .201 | .416 |

* significant at the .05 level

## Appendix K

## Tables Pertaining to Relationships between Demographic Variables and Measures of Executive Function

Table K1.1
*Spearman's Correlations between Age and Wisconsin Card Sorting Test Scores*

| Variable | Correlation with age | p-value |
|---|---|---|
| Wisconsin Card Sorting Test | | |
| Trials | -.289 | .060 |
| Total number correct | -.067 | .671 |
| Errors | .090 | .570 |
| Perseverative responses | -.002 | .991 |
| Perseverative errors | -.007 | .963 |
| Nonperseverative errors | .136 | .387 |
| Conceptual level responses | .041 | .794 |
| Categories completed | .346* | .022 |
| Trials to complete first category | .050 | .752 |
| Failure to maintain set | -.280 | .069 |

* significant at the .05 level

Table K1.2
*Spearman's Correlations between Education and Wisconsin Card Sorting Test Scores*

| Variable | Correlation with education | p-value |
|---|---|---|
| Wisconsin Card Sorting Test | | |
| Trials | -.268 | .082 |
| Total number correct | -.050 | .752 |
| Errors | .019 | .906 |
| Perseverative responses | -.024 | .878 |
| Perseverative errors | -.099 | .528 |
| Nonperseverative errors | .095 | .547 |
| Conceptual level responses | .028 | .862 |
| Categories completed | .388* | .010 |
| Trials to complete first category | .028 | .860 |
| Failure to maintain set | -.140 | .374 |

* significant at the .05 level

Table K1.3
*Spearman's Correlations between Household Socioeconomic Status and Wisconsin Card Sorting Test Scores*

| Variable | Correlation with household SES | p-value |
|---|---|---|
| Wisconsin Card Sorting Test | | |
| Trials | -.079 | .619 |
| Total number correct | -.090 | .567 |
| Errors | -.019 | .904 |
| Perseverative responses | .049 | .755 |
| Perseverative errors | .042 | .793 |
| Nonperseverative errors | -.089 | .574 |
| Conceptual level responses | -.015 | .923 |
| Categories completed | .134 | .395 |
| Trials to complete first category | .076 | .631 |
| Failure to maintain set | -.337* | .027 |

* significant at the .05 level

Table K1.4
*Kruskal-Wallis Nonparametric One-Way ANOVAs between Demographic Variables and Wisconsin Card Sorting Test Scores*

| Variable | | Education category | Gender | Population group | Religious affiliation |
|---|---|---|---|---|---|
| Wisconsin Card Sorting Test | | | | | |
| Trials | H statistic | 2.32 | .03 | 7.47 | 8.58 |
| | p-value | .314 | .872 | .113 | .284 |
| Total number correct | H statistic | .94 | 1.32 | 2.68 | 8.60 |
| | p-value | .625 | .251 | .613 | .283 |
| Errors | H statistic | .54 | .02 | 3.91 | 9.52 |
| | p-value | .763 | .892 | .419 | .218 |
| Perseverative responses | H statistic | .28 | .17 | 3.72 | 13.81 |
| | p-value | .870 | .684 | .445 | .055 |
| Perseverative errors | H statistic | 1.06 | .28 | 4.48 | 13.35 |
| | p-value | .588 | .596 | .345 | .064 |
| Nonperseverative errors | H statistic | .16 | .23 | 4.09 | 5.28 |
| | p-value | .925 | .630 | .394 | .625 |
| Conceptual level responses | H statistic | 1.42 | .07 | 3.85 | 10.76 |
| | p-value | .492 | .786 | .426 | .150 |
| Categories completed | H statistic | 4.25 | .92 | 15.50* | 6.05 |
| | p-value | .119 | .336 | .004 | .534 |
| Trials to complete first category | H statistic | .57 | 1.46 | 3.54 | 4.84 |
| | p-value | .752 | .226 | .471 | .680 |
| Failure to maintain set | H statistic | 1.20 | .001 | 6.48 | 5.05 |
| | p-value | .548 | .978 | .166 | .653 |

* significant at the .05 level

Table K1.5
*Spearman's Correlations between Demographic Variables of Age, Education and Household Socioeconomic Status and Raven's Progressive Matrices Scores*

| | Correlation with RPM scores | p-value |
|---|---|---|
| Age | .284 | .065 |
| Education | .282 | .067 |
| Household socioeconomic status | .202 | .195 |

* significant at the .05 level

Table K1.6
*Kruskal-Wallis Nonparametric One-Way ANOVAs for Demographic Variables by Raven's Progressive Matrices Scores*

| Variable | H statistic | p-value |
|---|---|---|
| Education category | 5.39 | .068 |
| Gender | 1.05 | .305 |
| Population group | 7.51 | .112 |
| Religion | 4.47 | .725 |

* significant at the .05 level

Table K1.7
*Kruskal-Wallis Nonparametric One-Way ANOVAs for Socioeconomic Status Variables by Raven's Progressive Matrices Scores*

| Variable | H statistic | p-value |
|---|---|---|
| Parental employment status | 6.57 | .160 |
| Paternal occupation group | 1.41 | .704 |
| Maternal occupation group | 8.41* | .038 |
| Paternal education level | 5.65 | .342 |
| Maternal education level | 5.50 | .358 |
| Participant employment status | 12.30* | .001 |

Table K1.8
*Spearman's Correlations between Age and Behavioural Assessment of the Dysexecutive Syndrome Scores*

| Variable | Correlation with age | p-value |
|---|---|---|
| BADS | | |
| Rule shift card test | .057 | .716 |
| Action program test | .204 | .191 |
| Key search test | .125 | .429 |
| Temporal judgement test | -.072 | .648 |
| Zoo map test | -.021 | .895 |
| Six elements test | .144 | .360 |
| Age corrected standard score | .074 | .641 |

* significant at the .05 level

Table K1.9
*Spearman's Correlations between Education and Behavioural Assessment of the Dysexecutive Syndrome Scores*

| Variable | Correlation with education | p-value |
|---|---|---|
| BADS | | |
| Rule shift card test | -.150 | .339 |
| Action program test | .234 | .132 |
| Key search test | .111 | .483 |
| Temporal judgement test | .059 | .707 |
| Zoo map test | -.118 | .453 |
| Six elements test | .308 | .044 |
| Age corrected standard score | .076 | .629 |

* significant at the .05 level

Table K1.10
*Spearman's Correlations between Household Socioeconomic Status and Behavioural Assessment of the Dysexecutive Syndrome Scores*

| Variable | Correlation with household SES | p-value |
|---|---|---|
| BADS | | |
| Rule shift card test | .007 | .963 |
| Action program test | .024 | .881 |
| Key search test | .157 | .316 |
| Temporal judgement test | .340* | .025 |
| Zoo map test | -.030 | .852 |
| Six elements test | .070 | .656 |
| Age corrected standard score | .204 | .192 |

* significant at the .05 level

## Appendix L

## Tables Pertaining to the Relationship between Modified Paranormal Beliefs Scale Scores and Neuroticism Scores

Table L1.1
*Spearman's Correlations between Modified Paranormal Beliefs Scale Scores and NEO PI-R Neuroticism Subscale Facet and Overall Neuroticism Scores*

| Variable | Anxiety | Angry hostility | Depression | Self-consciousness | Impulsiveness | Vulnerability | Neuroticism subscale total |
|---|---|---|---|---|---|---|---|
| Traditional religious beliefs | -.032<br>.838 | .038<br>.812 | .086<br>.587 | -.080<br>.613 | -.258<br>.095 | -.084<br>.593 | -.079<br>.616 |
| Psi | -.038<br>.811 | .140<br>.372 | -.207<br>.184 | -.309*<br>.043 | -.039<br>.803 | -.142<br>.368 | -.143<br>.362 |
| Witchcraft | -.074<br>.639 | .003<br>.987 | -.142<br>.366 | -.292<br>.057 | -.118<br>.453 | -.186<br>.233 | -.195<br>.211 |
| Superstitions | .222<br>.154 | .271<br>.079 | .092<br>.560 | -.057<br>.717 | -.049<br>.755 | .039<br>.807 | .141<br>.369 |
| Spiritualism | .040<br>.799 | .146<br>.352 | -.106<br>.501 | -.222<br>.154 | -.174<br>.266 | -.133<br>.397 | -.118<br>.456 |
| Life forms | .205<br>.189 | .086<br>.584 | .080<br>.614 | -.095<br>.547 | -.041<br>.797 | .075<br>.635 | .086<br>.586 |
| Precognition | .004<br>.982 | .116<br>.462 | -.080<br>.613 | -.184<br>.240 | -.046<br>.771 | -.173<br>.269 | -.091<br>.566 |
| PBS total | .030<br>.850 | .132<br>.402 | -.078<br>.619 | -.249<br>.108 | -.158<br>.314 | -.131<br>.406 | -.112<br>.479 |
| PBS total (excluding traditional religious beliefs) | .046<br>.771 | .154<br>.326 | -.123<br>.436 | -.272<br>.077 | -.092<br>.562 | -.119<br>.451 | -.099<br>.531 |

## Appendix M

## Tables Pertaining to the Relationship between Modified Paranormal Beliefs Scale Scores and Executive Function

Table M1.1
*Spearman's Correlations between Modified Paranormal Beliefs Scale and Raven's Progressive Matrices Scores*

| | Correlation with RPM scores | p-value |
|---|---|---|
| Traditional religious beliefs | .015 | .925 |
| Psi | .046 | .773 |
| Witchcraft | -.053 | .738 |
| Superstitions | -.327* | .032 |
| Spiritualism | -.111 | .482 |
| Extraordinary life forms | -.371* | .014 |
| Precognition | -.020 | .898 |
| Paranormal beliefs total | -.174 | .266 |
| Paranormal beliefs total (excluding traditional religious beliefs) | -.173 | .269 |

* significant at the .05 level

Table M1.2
*Spearman's Correlations between Modified Paranormal Beliefs Scale and Behavioural Assessment of the Dysexecutive Syndrome Scores*

| | Rule shift card test | Action program test | Key search test | Temporal judgement test | Zoo map test | Six elements test | Age corrected standard score |
|---|---|---|---|---|---|---|---|
| Traditional religious beliefs | -.092 | -.083 | -.150 | -.377* | .348* | .149 | -.043 |
| | .558 | .599 | .339 | .012 | .022 | .343 | .784 |
| Psi | -.010 | -.017 | -.083 | .095 | .001 | -.171 | -.081 |
| | .948 | .916 | .600 | .549 | .998 | .275 | .608 |
| Witchcraft | -.042 | -.103 | -.153 | -.084 | .146 | .005 | -.090 |
| | .790 | .515 | .329 | .596 | .353 | .975 | .569 |
| Superstitions | -.071 | -.066 | -.187 | -.061 | .029 | -.230 | -.147 |
| | .652 | .675 | .231 | .699 | .856 | .138 | .349 |
| Spiritualism | .023 | -.011 | .004 | .084 | .084 | -.036 | .068 |
| | .884 | .942 | .982 | .593 | .595 | .820 | .668 |
| Extraordinary life forms | -.108 | -.036 | -.160 | -.137 | .114 | -.106 | -.108 |
| | .495 | .819 | .308 | .385 | .470 | .503 | .492 |
| Precognition | .032 | -.107 | .017 | -.281 | .165 | -.216 | -.055 |
| | .841 | .497 | .914 | .068 | .293 | .165 | .728 |
| Paranormal beliefs total | -.040 | -.089 | -.171 | -.113 | .192 | -.080 | -.082 |
| | .798 | .573 | .276 | .475 | .218 | .613 | .603 |
| Paranormal beliefs total (excluding traditional religious beliefs) | -.036 | -.050 | -.136 | -.050 | .142 | -.187 | -.091 |
| | .819 | .750 | .387 | .750 | .365 | .231 | .563 |

* significant at the .05 level

## Appendix N

## Tables Pertaining to the Relationships between Measures of Executive Function

Table N1.1
*Spearman's Correlations between Wisconsin Card Sorting Test and Raven's Progressive Matrices Scores*

| Variable | Correlation with RPM | p-value |
|---|---|---|
| Wisconsin Card Sorting Test | | |
| Trials | -.296 | .054 |
| Total number correct | -.250 | .106 |
| Errors | .188 | .228 |
| Perseverative responses | .133 | .394 |
| Perseverative errors | .072 | .647 |
| Nonperseverative errors | .314* | .041 |
| Conceptual level responses | .217 | .163 |
| Categories completed | .258 | .095 |
| Trials to complete first category | -.207 | .184 |
| Failure to maintain set | -.073 | .642 |

* significant at the .05 level

Table N1.2
*Spearman's Correlations between Behavioural Assessment of the Dysexecutive Syndrome and Wisconsin Card Sorting Test Scores*

| | Rule shift card test | Action program test | Key search test | Temporal judgement test | Zoo map test | Six elements test | Age corrected standard score |
|---|---|---|---|---|---|---|---|
| WCST | | | | | | | |
| Trials | -.149 | -.174 | -.319* | -.115 | .127 | -.142 | -.270 |
| | .341 | .266 | .037 | .464 | .417 | .363 | .080 |
| Total number | -.103 | -.092 | -.146 | -.044 | .027 | .008 | -.101 |
| correct | .512 | .556 | .351 | .779 | .864 | .960 | .518 |
| Errors | .157 | .106 | .288 | .091 | -.103 | .041 | .250 |
| | .314 | .500 | .061 | .564 | .510 | .795 | .106 |
| Perseverative | .122 | .145 | .282 | .081 | -.083 | .019 | .262 |
| responses | .435 | .354 | .067 | .606 | .598 | .903 | .090 |
| Perseverative | .128 | .168 | .287 | .075 | -.121 | -.008 | .252 |
| errors | .415 | .284 | .062 | .634 | .439 | .959 | .104 |
| Nonperseverative | .191 | -.015 | .285 | .076 | -.058 | .089 | .251 |
| errors | .220 | .925 | .064 | .629 | .712 | .572 | .105 |
| Conceptual level | .186 | .090 | .322* | .070 | -.167 | .095 | .251 |
| responses | .234 | .566 | .036 | .655 | .286 | .544 | .105 |
| Categories | .119 | .338* | .470* | .046 | -.117 | .228 | .404* |
| completed | .448 | .027 | .002 | .771 | .454 | .142 | .007 |
| Trials to complete | -.128 | -.203 | -.239 | -.151 | -.096 | -.096 | -.294 |
| first category | .414 | .193 | .124 | .333 | .542 | .542 | .055 |
| Failure to | .053 | -.118 | -.176 | -.030 | .020 | -.018 | -.104 |
| maintain set | .738 | .450 | .260 | .848 | .897 | .909 | .509 |

*significant at the .05 level

Table N1.3
*Spearman's Correlations between Behavioural Assessment of the Dysexecutive Syndrome and Raven's Progressive Matrices Scores*

| Variable | Correlation with RPM | p-value |
|---|---|---|
| BADS | | |
| Rule shift card test | .153 | .330 |
| Action program test | .137 | .383 |
| Key search test | .579* | <0.0001 |
| Temporal judgement test | .126 | .424 |
| Zoo map test | .071 | .651 |
| Six elements test | .204 | .190 |
| Age corrected standard score | .396* | .008 |

* significant at the .05 level