INVESTIGATING THE SPECIFICITY OF THE JUMP TO CONCLUSIONS BIAS IN SUB-CLINICAL DELUSIONAL THINKING

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A DISSERTATION

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Dissertation Abstract

Current theories in psychology now suggest that behaviours that were primarily associated with psychotic disorders, such as delusional experiences, can be observed in the healthy general population (van Os, Linscott, Myin-Germeys, Delespaul and Krabbendam, 2009). Delusions, a common symptom of schizophrenia, have been associated with a tendency to jump to conclusions. In simpler terms, it has been discussed that those that experience delusions will reach final decisions earlier than controls upon the basis of little evidence (Huq, Garety and Hemsley, 1988). The aim of the research was to investigate the factors that may moderate this susceptibility to jump to conclusions amongst the sub-clinical range of delusional thinking amongst the distinct construct measures of the Peters et al. Delusions Inventory (PDI: Peters, Day and Garety, 1996).

Numerous studies were conducted to investigate: intelligence, probability calculation ability, experimental task design and task delivery upon the emergence of the jump to conclusions bias (Chapters II-VI). Moderator analyses identified that task design and task delivery were strong predictors of the quantity of information requested prior to finalising a decision; with restricted data gathering occurring with the use of face-to-face abstract tasks (Chapter III and VI B). When tasks included neutral and emotionally-unstimulating material, a data gathering bias was either not observed (Chapter II) or data gathering was enhanced amongst those with high belief conviction. Perceived life stress, perceived task stress and specific reasoning styles were investigated in an attempt to explain the situation-specific differences (Chapters VII and VIII).

It was concluded in the General Discussion that delusional thinking appears to be associated with hasty decision making, under specific situational circumstances and can differ between the distinct constructs of the PDI measure (Peters et al. 1996). Sub-clinical delusional ideation is an overall summation of belief distress, preoccupation and conviction. The current
research argues that the three psychological dimensions of delusional belief can influence decision making uniquely; specifically in relation to the emergence of a data gathering bias.
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INTRODUCTION

Our beliefs are fundamental to who we are. We uphold beliefs about ourselves and others and the very world in which we live. Our beliefs are the very foundations to our understanding and perception of reality. The notion of what a belief actually is, is somewhat more difficult to outline. Generally, it is accepted that a belief is ‘something one accepts as true or real’ (Oxford Dictionaries, 2014). Nevertheless, such descriptions neglect to outline the form that a belief may take; whether a belief is a feeling or an idea or a combination of the two. Whilst forming and maintaining beliefs is regarded as normative behaviour, upholding beliefs that are considered false, bizarre and/or distressing is inarguably considered atypical or ‘strange’. It is beliefs such as this that have attracted much attention within the study of human cognitive psychology.

Defining Delusional Beliefs

Beliefs that are bizarre or strange are often referred to as delusions by the lay person. The term ‘delusion’ is not unfamiliar to many and is used confidently in conversation much of the time. Yet, when we attempt to tease out the core features of what a delusion actually is, we begin to appreciate the obscurities of the concept. If defining beliefs in general is tricky, then outlining the definition of a delusion is a conundrum.

A key feature that was considered critical to the identification of a delusion was the falsity of the belief itself. So much so, that the American Psychiatric Association (1994) defined delusions as ‘false beliefs based upon incorrect inference’ (p 765). This idea was further supported by the American Psychiatric Association (2000) whereby delusions were outlined as ‘beliefs that usually involve a misinterpretation of perceptions or experiences’ (p299). Up
until this time, a core characteristic of a delusion was that the belief itself was inherently false.

Yet common sense prevails and we understand that not all false beliefs are delusions; especially when the beliefs we possess are particularly self-serving. We also have to acknowledge that we can’t be right all of the time, even if we believe that we are but this does not necessarily mean we are delusional. Most recently it has been argued that delusions could in fact be true, but exist as delusions if the believer has no good reason for holding the belief (Coltheart, 2007). The current DSM-V definition has acknowledged this debate and the perceived falsity of the belief is no longer a key pre-requisite to the diagnosis of a delusional belief.

So if the potential reality of the belief is not a consistent and reliable marker for the identification of a delusion, then what is? Further key features that have been outlined are the degree of distress and disruption to day-to-day functioning that a belief can incur. As Garety and Freeman (1999) suggest it may be the degree of preoccupation, conviction and associated distress that sets delusional beliefs apart from our normative belief systems. This notion was further supported by Freeman (2008) who emphasised that not only are delusions preoccupying and distressing, but they also disrupt and interfere with social functioning. A view supported by the definition of a delusion proposed by McKay, Langdon and Coltheart (2005)

‘A person is deluded when they have come to hold a particular belief with a degree of firmness that is both utterly unwarranted by the evidence at hand, and that jeopardises their day-to-day functioning’ (p315).

Whilst extensive debate and discussion continues to surround the true nature of a delusion, of which a review can be found in Rhodes and Jones (2014), it is the above definition along with
the criteria outline by Garety et al. (1999) that shall form the basis of understanding for the research to come.

Types of Delusional Belief

There are numerous forms of delusions that are identified with the DSM-V (American Psychiatric Association, 2013). Whilst the current research will not compare the distinctions between these forms of delusions, it is necessary to have an appreciation of the wide range of delusions that can be experienced.

Persecutory or paranoid delusions are, by far, the most commonly experienced delusions (DSM-V, APA, 2013) and involve a firm belief that one is going to be harmed or harassed by another. For example, an individual may believe that there is a conspiracy against them (Peters, Day and Garety, 1996). Referential delusions include beliefs that particular gestures, comments or environmental cues are relevant to the self; whereby articles in magazines may be perceived as being written just for them (Peters et al., 1996). Grandiose delusions are experienced when individuals believe they have exceptional abilities and involve an inflated perception of the self. People experiencing grandiose delusions may believe that they are destined to be someone very important (Peters et al., 1996). Erotomanic delusions are a little less common and involve the belief that another person is in love with him or her. Finally, nihilistic delusions are experienced when the person believes that a major disaster will occur in the future and somatic delusions focus upon convictions relating to health and bodily function (DSM-V; APA, 2013).

There is on-going debate surrounding the relevance of paranormal beliefs to delusional reasoning. Whilst the nature and content of such beliefs may seem bizarre to some, to many they are not. In the United States alone, 38% of the population sample believe that ghosts or
spirits of the dead can come back in some places and in some situations (Bridgestock, 2003). Indeed, British polls reveal similar trends in the prevalence of paranormal beliefs (Fox, 2004). So much so, that measures designed to investigate delusion proneness amongst healthy individuals have incorporated questions relating to belief in the paranormal (Peters et al., 1996). This raises the question as to whether the forms of delusions outlined within the DSM-V (APA, 2013) can be observed amongst members of the healthy and general population.

**Delusional Thinking and Psychosis**

A key assumption is that delusional thinking is commonly associated as a symptom of psychosis, specifically schizophrenia. Schizophrenia, a severe psychotic disorder, is a worldwide condition with a median age of onset for both men and women within the range of 20-30 years (American Psychiatric Association, 2000, p308). Delusions are characteristic manifestations of the disorder and can be extremely distressing for sufferers.

Understandably, the condition is considerably difficult to treat. Anti-psychotic drug treatments frequently induce unpleasant adverse effects (Edwards and Smith, 2009; Otano, Izquierdo, Mondragon, Pinedo and Ayerdi, 2013; Pai, Deng, Vella, Castle and Huang, 2012); eliciting poor adherence amongst patients (Buchanan, 1992; Naber, Karow and Lambert, 2005a) that often prolongs the course of the illness and worsens the prognosis (Hofer, Baumgartner, Edlinger, Hummer, Kemmler et al., 2004).

Psychological treatments have been shown to produce significantly improved effects on symptomatology over the use of antipsychotic treatment (Lincoln, Suttner and Nestoriuc, 2008b; Zimmermann, Favrod, Trieu and Pomini, 2005). Examples of such interventions include Cognitive Behavioural Therapy (Rollinson, Haig, Warner, Garety, Kuipers, Freeman et al., 2007), Metacognitive Training (Moritz and Woodward, 2007, 2007c) and Social
Cognition and Interaction Training (Combs, Adams, Penn, Roberts, Tiegreen and Stem, 2007).

The importance of investigating cognitive factors associated with the symptoms of schizophrenia, such as delusions, has been comprehensively recognised by researchers (Frith and Corcoran, 1996; Galbraith, Manktelow and Morris, 2008; Gilleen and David, 2005; Gray and Snowden, 2005; Moritz and Woodward, 2005; Moritz et al., 2006b; Moritz, Woodward, Jelinek and Klinge, 2008b). Indeed, the more that is understood about the cognitive factors potentially influential to delusion formation and/ or maintenance, the more efficient and successful the intervention programme.

**The Continuum Hypothesis of Mental Illness**

Whilst delusional thinking was primarily linked to the signs and symptoms of mental ill health, concurrent research has highlighted the prevalence of delusions amongst normal and healthy individuals (Linscott and van Os, 2013).

The continuum approach to mental illness (also known as the fully dimensional approach) suggests that delusions signify the extreme end of the distribution of normative mental experiences (Claridge, 1988; Claridge and Beech, 1995; Strauss, 1969; van Os, 2003). As the title of the model suggests, it is alleged that cognitions and behaviour occur along a continuum; with a sub clinical range referred to as ‘schizotypy’. Individuals within this range frequently display behaviours akin to psychotic characteristics that were primarily associated with, and observed amongst, clinical psychiatric patients (Lenzenweger, Cornblatt and Putnick, 1991; Lenzenweger and Korfine, 1994; Meehl, 1962; 1990). The concept of schizotypy has attracted much research and investigation (David, 2010, Johns and van Os, 2001). In fact, even the neurological bases of schizotypy have been investigated amongst individuals from the general and healthy population (Carpenter, 2011, Kapur, 2011,
Modenato and Draganski, 2015). Interestingly, associations between a reduction in pre-frontal grey matter and high subjective self-reported schizo-typical scores have been identified (Raine, Lenez, Yarallan, LaCasse, Ventura and Colletti, 2002). Thus implying a biological basis for self-reported psychotic like experiences amongst healthy individuals from the wider sub-clinical population.

Nevertheless, debates continue within the field as to the potential categorical vs. continuum nature of the symptoms of psychosis (Lincoln, 2007; Linscott and van Os, 2010). However, the continuum hypothesis has received considerable support (Rossler, Ajdacic-Gross, Muller, Rodgers, Haker, Hengartner et al., 2015, van Os, Linscott, Myin-Germeys, Delespaual and Krabbendam, 2009). As highlighted by Johns et al., (2001), in a survey of 60,000 British adults 50% believed in some form of unscientific or parapsychological phenomena (Cox and Cowling, 1989). And in a recent additional study, Neuvo, Chatterji, Verdes, Naidoo, Arango (2010) identified delusions of reference and persecution amongst 8.4% of a non-clinical population.

Interestingly, psychotic experiences and beliefs have also been reported amongst 5-25% of healthy individuals (Stip and Letoureau, 2009) and, as stated in a review by Bell, Halligan and Ellis (2006), approximately 10% scored above the mean of psychotic inpatients on measures of delusional ideation (Peters, Joseph, Day and Garety, 2004; Peters, Joseph and Garety, 1999). Investigating delusional thinking amongst individuals from the healthy, general population avoids potential confounds, such as impairments of memory (Aleman, Hijman, de Haan and Kahn, 1999; Heinrichs and Zakzanis, 1998), attention and executive function (Sharma and Harvey, 2000), that have been frequently associated with the psychotic disorders.

It also, as previously suggested by Warman and Martin (2006), provides opportunity to study cognitive biases that may precede clinical delusion formation amongst vulnerable and
potentially ‘at risk’ individuals (Welham, Scott, Williams, Najman, Bor et al., 2009). Indeed, it has been consistently shown that the presence of psychotic-like experiences amongst adolescents within the sub-clinical range increases the risk of developing schizophrenia later in life (Dominguez, Wichers, Lieb, Wittchen and van Os, 2011).

Nevertheless, it is should be noted that not all people that score highly on levels of schizotypy are vulnerable to subsequent mental ill health, as highlighted by Nelson, Seal, Pantelis and Phillips (2013) in their recent systematic review of the dimensional relationship between schizotypy and schizophrenia. Individuals that score highly on measures of schizotypy can function well in terms of subjective well-being (Goulding, 2004) and have been shown to engage in, and sometimes excel at, creative pursuits such as writing, painting and drawing (Nelson and Rawlings, 2010).

The fully dimensional approach therefore supports that schizotypy is not a solitary marker for the subsequent development of psychopathological illness (Rawlings, Williams, Haslam, Claridge, 2008a). It has been proposed that individuals that exhibit schizotypal traits, such as delusions, are only at risk of developing psychotic symptoms when additional risk factors are in play (Rawlings et al., 2008a). It is therefore necessary to investigate what these potential risk factors may be.

Measuring Sub-clinical Delusional Thinking

Numerous psychometric instruments have been developed in an attempt to measure delusional thinking amongst the sub-clinical continuum. For example, measures such as the Magical Ideation Scale or MIS (Eckblad and Chapman, 1983) were first developed to assess the prevalence of superstitious and magical beliefs amongst the non-clinical population. However, it was noted by Peters et al. (1999), that superstitious and paranormal beliefs are surprisingly widespread and may not constitute as delusional beliefs per se.
Other measures have focussed upon assessing specific beliefs such as delusions of paranoia and/or persecution (Freeman et al., 2005) and measuring ideas of persecution and social reference (Green, Freeman, Kuipers, Bebbington, Fowler et al., 2008). Nevertheless, such methods neglected to assess the full range of delusional beliefs present amongst the healthy, general population. Additional measures, such as the Community Assessment of Psychic Experiences (CAPE: Stefanis et al., 2002) have also attempted to measure psychotic like experiences within the general population (Gaweda, Prochwicz and Cella, 2015). However, whilst the measure attempted to incorporate a greater range of psychic experiences, the measure neglected to assess the degree of distress, preoccupation and conviction associated with the belief/experience; key features of delusions provided by the definition outlined by McKay et al. (2005).

It was the intention of the Peters et al. (1999), to create an inventory that would ‘sample as wide a variety of delusions as possible’ (Peters et al., 2004, p. 558). The Peters et al. Delusions Inventory or PDI-21 (Peters et al., 1996) was developed to include items that would address a range of delusional beliefs including those relating to suspiciousness, religiosity, grandeur, paranoid, persecution, reference and depersonalisation. The measure also ensured that the distinction between delusional beliefs and delusional experiences was incorporated into assessment and that the degree of distress, belief preoccupation and belief conviction was also taken into account.

The Peters et al. Delusions Inventory (Peters et al., 1996) is a 21 item measure of delusional ideation. Participants are asked to indicate if they have experienced any of the given beliefs and mental experiences, and if so to indicate on three 5-point Likert scales how distressing they find the belief to be, how frequently they are preoccupied with the given belief and the extent to which they are convinced that the belief is true.
Whilst the measure has received criticism relating to the internal reliability of the sub-scales (Jones and Ferneyhough, 2007), conflicting research has shown that the internal validity and reliability of the PDI (Peters et al., 1999) is sound and has been consistently supported across cultures (Fonseca-Pedrero, Paino, Santaren-Rosell, Lemos-Giraldez and Muniz, 2012; Kao, Wang, Lu, Cheng and Liu, 2012; Kim, Chang, Hwang, Yi, Cho et al., 2012). In addition, the PDI (Peters et al., 1996) is widely implemented and, it would be fair to say, one of the most frequently utilised measures of delusional ideation amongst studies investigating delusion proneness (Cella, Sisti, Rocchi and Preti, 2011; Laws, Kondel, Clarke and Nillo, 2011).

**Psychological Theories of Delusions**

There are a number of psychological theories that attempt to explain the creation and maintenance of delusional ideas, and indeed these theories have attracted much investigation and research within the field of abnormal psychology. Two stage models, such as that presented by Maher (1974), will be discussed first.

**Two Stage Models**

Two stage models, such as that proposed by Maher and Ross (1984) imply that that delusions constitute rational responses to unusual perceptual experiences. In other words, delusions are born in an attempt to explain, or make sense of unusual experience (Young, 2008; see Pacherie, Green and Bayne, 2006 for a full overview). Psychological theories such as this recognise the influence of aberrant perception and subsequent cognitive misinterpretation of the experience as critical elements to delusion formation. To illustrate this concept, Young and Leafhead (1996) proposed that patients suffering with Capgras and Cotard delusions
arrive at contrasting delusional accounts due to two distinct explanations of the same abnormal experience of loss of affect. Cotard patients believe that they are not alive and that they no longer exist. Patients experience severe depression and explain loss of affect in terms of internal changes to themselves. Capgras patients believe that a friend, family member or familiar people have been replaced by an identical-looking imposter. It is theorised that patients suffering with Capgras syndrome adopt the opposite explanatory strategy and attribute their loss of affect to external changes within the environment. Despite the relevance, explanationist models face fundamental theoretical criticisms. Indeed, if delusional beliefs form for the very purpose of explaining anomalous experiences, how is it that delusional beliefs are typically very poor explanations of the events they are intended to explain (Pacherie et al., 2006)? Often more reliable and far more plausible explanations are offered to patients, and yet are dismissed in favour of the implausible account. Nevertheless, perceptual instability appears to be one potential explanation for the formation of delusions in schizophrenia (Schmack, Schnack, Priller and Sterzer, 2015).

Motivational Models

Additional theories imply that delusions serve as a defence mechanism, employed to reduce distress and anxiety and prevent loss of self-esteem (Bentall, Kinderman and Kaney, 1994). McKay et al. (2007) have emphasised motives such as this as potentially important causal forces to delusion formation. Motivational accounts of the paranoid and persecutory delusions have been investigated (Bentall and Kaney, 1996; Kinderman and Bentall, 1996, 1997), largely due to the seemingly apparent role of affective experience in those particular delusional sub types. More generally it has been shown that finding meaning in and explaining life events through delusion formation can improve health outcomes (Updegraff,
Cohen-Silver and Holman, 2008) as well as reducing distress surrounding existential concerns (Becker, 1971; Solomon, Greenberg and Pyszczynski, 1991). Interestingly, it has been suggested that a delusion ‘is restitutive, ameliorating anxieties by altering the construction of reality (Lansky, 1977, p21). A recent review by Bortolotti (2015) reinforces motivational theories of delusion formation by suggesting that delusions can provide substantial epistemic benefit which could not be attained if the delusion was not adopted in the first instance. Nevertheless, some theories imply that delusions may form as a result of inherent cognitive deficits rather than subconscious motivation.

**Theory of Mind**

Theory of mind relates to the cognitive ability to understand the needs, emotions and/ or intentions of others, along with an array of other mental states, in relation to one’s own (Premack and Woodruff, 1978). It has been argued that individuals that experience delusions of persecution and reference suffer poor theory of mind (Frith, 1992). In other words, delusions are born due to a poor appreciation of the thoughts and attitudes of others around them. For example amongst persecutory delusions, a smile from another may be interpreted as malevolent rather than friendly. It is easy to appreciate how poor theory of mind could manifest delusions of persecution or paranoia if the individual struggles to interpret the acts and thoughts of the others around them. Whilst some studies have failed to identify an association between delusions and ToM (Greig, Bryson and Bell, 2004) the theory holds merit and numerous studies have identified a link between delusions and poor theory of mind (Gooding and Pflum, 2011). The theory is an attractive one and sets out to explain delusion formation/ maintenance as a result of inherent cognitive deficits.
Jumping to conclusions

Reasoning biases are amongst the many cognitive constituents considered to be implicated in delusion formation and/or maintenance. Indeed, it is proposed that those with delusions jump to conclusions. In plainer terms, those with delusions are prone to making snap judgements and may form decisions quickly on the basis of little evidence (Huq, Garety and Hemsley, 1988).

Garety and Hemsley (1994) and Garety et al. (1999) speculated that individuals with delusions display, ‘a tendency or bias to the early acceptance and, to a lesser extent, the early rejection of hypotheses’ (Garety et al., 1999, p127). The assumptions of Garety et al. (1999) derive from studies detecting a data gathering bias, otherwise known as the jump to conclusions bias, amongst delusional schizophrenic patients (Dudley, John, Young and Over, 1997a, 1997b; Fear and Healy, 1997; Freeman, 2007; Garety, Hemsley and Wessely, 1991; Huq et al., 1988; Moritz, Woodward and Lambert, 2007b; Mortimer et al., 1996; Peters, Day and Garety, 1997; Young and Bentall, 1997b).

Hasty decision making is therefore considered to be characteristic, routine practice amongst patients suffering schizophrenia and experiencing delusional beliefs (Dudley, Taylor, Wickham and Hutton, 2015; Falcone et al., 2015). In fact, the belief that patients with delusions jump to conclusions when forming decisions, is so strongly upheld by psychologists that many meta-cognitive training programmes designed to treat patients with delusions, specifically aspire to reduce the rate of this jump to conclusions bias (Gaweda, Krezolek, Oldrys, Turska and Kokoszka, 2015; Moritz et al., 2011; Waller, Freeman, Jolley, Dunn and Garety, 2011; Warman, Martin and Lysaker, 2013). This is not surprising given the extensive literature that continues to identify the data gathering bias amongst clinical patients (Averbeck, Evans, Chouhan, Bristow and Shergill, 2011; Bristow, Tabraham, Smedley, Ward and Peters, 2014; Gaweda, Staszkiewicz and Balzan (2016); Lincoln, Salzmann, Ziegler and
However, it has been suggested that negative symptomatology associated with schizophrenia, such as impairments of memory (Aleman et al., 1999; Heinrichs et al., 1998) and apathy may operate as potential confounds; eliciting the jump to conclusions response pattern observed amongst patient groups (Menon, Mizrahi and Kapur, 2008; Menon, Pomarol-Clotet, McKenna and McCarthy, 2006; Moritz and Woodward, 2004; Woodward, Munz, LeClerc and Lecomte, 2008).

Freeman (2011) also expressed that the jump to conclusions bias may be influenced by the symptoms of psychosis itself, given that patients taking part in clinical studies may be admitted to hospital at the time of investigation and experiencing a worsening of psychotic symptoms. However, despite such postulations it has been stressed that the tendency to jump to conclusions appears to be associated with the presence of delusions rather than psychotic symptoms per se (Freeman, Pugh and Garety, 2008). Hence the tendency to arrive at a final decision early in the information gathering process continues to be observed amongst individuals within the sub-clinical range of delusion-proneness (Gaweda et al., 2015; Orenes, Navarrete, Beltran and Santmaria, 2012; Winton-Brown et al., 2015; Zawadzski, Woodward, Sokolowshki, Boon, Wong et al., 2012).

*Do people with delusions always jump to conclusions?*

Until recently, it has been widely accepted that individuals with delusions jump to conclusions. However, the robustness of this bias is now under question (Dudley, Cavanagh, Daley and Smith, 2014). According to Dudley et al. (2011), studies indicate that only around 40-70% of patients essentially exhibit the jump to conclusions reasoning style, and as
outlined by Freeman et al. (2008) around 20% without delusions display the data gathering bias. And interestingly, individuals experiencing clinical delusions report changes in their convictions over time and can further change their belief and opinion (Freeman, 2007).

Some studies observed the reasoning bias amongst only 4% of patients with schizophrenia (Rossell and O’Regan, 2008) whilst other studies failed to detect the emergence of a jump to conclusions bias entirely amongst participants without current and/or remitted delusions (Colbert, Peters and Garety, 2010). Additional studies have concluded that delusion-proneness did not significantly influence the emergence of the jump to conclusions bias even when hasty decision making was demonstrated (Balzan, Delfabbro and Galletly, 2012).

Interestingly, it has been suggested that cognitive biases, such as the jump to conclusions bias, may emerge amongst specific subtypes of delusions. It has been shown that the jump to conclusions bias appears to be related to paranoia rather than referential thinking (Menon, Addington and Remington, 2013) and may only emerge amongst clinical samples (Ho-wai So and Kwok, 2015).

It appears that the presence of the jump to conclusions bias amongst those classified as delusion-prone, clinical or otherwise, is not conclusive. And there may be numerous reasons for this. Therefore, it is essential that the potential cognitive/situational factors moderating the emergence of the jump to conclusions bias are investigated in order to enrich our understanding of delusion formation and maintenance further.

**Measuring the Jump to Conclusions Bias**

Typically, studies detecting a jump to conclusions bias amongst delusional schizophrenic patients (Huq et al., 1988) have frequently implemented the renowned ‘beads’ task. The beads task was initially employed by Phillips and Edwards (1966) to investigate decision
making amongst clinical, psychiatric and non-psychiatric control participants. The task presented participants with two jars of beads, one of which had a ratio of largely orange compared to black beads (85:15) and the second had a ratio of largely black beads compared to orange (15:85). The jars were hidden from view and participants were required to request as many or as few beads as they deemed necessary in order to infer from which of the two jars a sequence of beads was drawn (Fig. 1.1).

Figure 1.1: The beads task as presented by Garety, Freeman, Jolley, Ross, Waller et al., (2011)

Those that typically display the jump to conclusions bias reach final decisions abnormally early in the process of data gathering (Huq et al., 1988). Often, schizophrenic or delusional disorder patients display an increased tendency to decide after the first bead drawn in comparison with control participants (Freeman, Garety, Fowler, Kuipers, Bebbington et al., 2004). This task is renowned and is still used frequently to measure and observe the jump to conclusions bias (Baskak, Baran, Ozguven, Karaboga, Oner et al., 2015; Falcone, Murray, O’Connor, Hockey, Gardner-Sood et al., 2015). However, in a number of ways the design of the task can be criticised.
The obvious irrelevance of the task in relation to how people gather evidence in order to form beliefs is clear: in the beads task people are not encouraged to gather information for the very purpose of generating an opinion or perspective. Principally, delusions are defined as ‘beliefs based upon incorrect inference’ (American Psychiatric Association, 1994, p765). The artificial nature of the task demands that participants merely make a decision and opt for a choice, from essentially one of only two options.

Attempts have been made to make the original beads task more realistic by including emotionally salient, self-referent material (Dudley et al., 1997b) and descriptions of ambiguous social situations (Lincoln et al., 2011) or other seemingly ‘more realistic’ scenarios (Andreou, Schneider, Balzan, Leudecke, Roesch-Ely et al., 2015; Balzan, Ephraums, Delfrabbro and Andreou, 2016). In some instances, manipulation of the data gathering task has eliminated the jump to conclusions bias amongst high delusion-prone individuals (Balzan et al., 2016); implying that hasty decision-making may be vulnerable to specific cognitive functions.

Nevertheless, current methodologies continue to fail to provide the opportunity for individuals to gather data for the purpose of developing a belief or viewpoint and almost always include an evaluation of probabilistic ratios; a factor that could potentially increase the perceived demands of the task. The importance of investigating real-life decision making dilemmas has been recognised and everyday reasoning tasks are now being introduced into studies investigating decision making processes and argument skills (Galotti, Ciner, Altenbaumer, Geerts, Rupp et al., 2006; Weinstock, 2009; Weinstock and Flaton, 2004).

Indeed, tasks that could be considered more realistic have been developed and employed to investigate a potential self-reference bias amongst sub-clinical delusional ideation groups (Galbraith et al., 2008). Such studies emphasise the importance of understanding the forms of
thinking people implement when considering argument and/or debate in the everyday context.

It can be argued that it is both essential and necessary to investigate the jump to conclusions bias with the use of real-life decision making tasks, with the use of every day materials in a far more realistic context.

**Factors that May Influence the Jump to Conclusions Bias**

As previously noted, not all persons experiencing delusional beliefs exhibit the jump to conclusions bias. As Freeman et al. (2008) outlined, only one half of people with delusions jump to conclusions on probabilistic reasoning tasks, and interestingly 10-20% of individuals without delusions display the data gathering bias (Fine, Gardner, Cragie and Gold, 2007; Freeman, 2007; Garety, Bebbington, Fowler, Freeman and Kuipers, 2007). It is therefore possible that additional factors may influence the potential emergence of the jump to conclusions bias given that the phenomenon is not consistently observed.

**Intelligence**

Individual differences in verbal intelligence could also contribute to a vulnerability to jump to conclusions when faced with abstract decision making tasks. The associations between severe mental disorders, such as schizophrenia, and pre-morbid IQ decline are well documented (Bora, Yucel and Pantelis, 2009; Keefe and Fenton, 2007; Woodberry, Giuliano and Seidman, 2008). Indeed impaired verbal fluency has also been linked to negative and/ or positive schizotypy (Cochrane, Petch and Pickering, 2012; Ruiz, Barrantes-Vidal, Guitart and Fananas, 2008).
Whilst there are studies that have investigated the jump to conclusions bias and have neglected to include measures of intellectual functioning (Lincoln et al., 2011; Rubio et al., 2011), others have attempted to control such variables by including tests of intelligence (Freeman et al., 2008). Nevertheless, studies researching the relationship between intelligence and the emergence of the jump to conclusions bias in particular are surprisingly sparse. One such study did report differences in IQ amongst first episode psychosis patients and control participants completing the renowned beads task (Falcone et al., 2010). The tendency to jump to conclusions was associated with reduced IQ scores. However, this tendency was not specific to clinical patients. It therefore appears necessary to control for individual differences in intelligence amongst individuals within the sub-clinical range who may be inclined to jump to conclusions on decision making tasks.

*Probability Estimation*

It was confidently hypothesised by Hemsley and Garety (1986) that individuals experiencing delusions suffered impairments involving hypothesis formation and probability estimation. Due to this assumption, probability based tasks, such as the beads task, were presented to individuals experiencing delusions. The emergence of the jump to conclusions bias appeared to support the notion that delusional individuals struggle fundamentally with probability estimation, and hence it was presumed that probability errors contribute to delusion formation (Garety et al., 1991).

A number of studies have since identified a poorer performance from delusional compared to non-delusional individuals on other probability related tasks (Dudley, Young, John and Over, 1998; Linney, Peters and Ayton, 1998). Furthermore, delusion prone individuals rated unusual and delusional narratives far more likely than low delusion prone individuals.
The findings of such studies suggest that individuals experiencing delusions may have basic probability estimation impairments. However, it has been argued that people with delusions do not possess a fundamental incapability to reason about probabilities (Dudley and Over, 2003; Fine et al., 2007). Several studies observing a data gathering bias did not detect a general impairment in probability reasoning (Bentall and Young, 1996; Colbert et al., 2002; Dudley et al., 1997a). Similarly, one study found that that performance on a range of probabilistic reasoning tasks, used to assess the use of base rate information and vulnerability to the conjunction fallacy, did not predict paranormal belief (Dagnall, Parker and Munley, 2007). Paranormal belief, like delusional thinking, is often related with a firm conviction of the belief and is often linked to similar underlying cognitive biases. The literature presents a mixed picture and it is evident that further research is required in order to investigate probability judgement amongst those with delusions. If indeed those with delusions do differ in their probability reasoning, this could be a reason for the jump to conclusions response so frequently observed.

**Task Methodology and Situation- Specific Stress**

Most recently, and indeed most interestingly, it has been proposed that individuals belonging to the sub-clinical range of delusional thinking display a tendency to jump to conclusions in scenarios that induce a sense of feeling rushed (White and Mansell, 2009). And in a similar instance, it has been found that delusion prone individuals report greater confidence in their ideas when they encounter a stressful situation or feel particularly hurried in their decision making (Keefe and Warman, 2011). This research may suggest that the design of any task that
attempts to measure hastiness in decision making could in fact, paradoxically, promote to its emergence.

As highlighted by Roets and van Hiel (2008), it has been widely recognised that stressors in our environment, such as time pressure (Payne, Bettman and Luce, 1996), can negatively influence performance on cognitive tasks and even contribute to an over-reliance on short-cut decision tactics (van Hiel and Mervielde, 2007), whereby decision making under situations of stress, ‘becomes rigid with fewer alternatives scanned’ (Staal, 2004, p68).

It has been suggested that those that experience delusions possess a hyper-diligence towards threat and threat-related stimuli (Dudley et al., 2003). Insofar, that those experience paranoia are more likely to recall threat-related words compared to positive words (Greer, Smailes, Spencer, Freeston and Dudley, 2016). In addition, altered threat and safety neural processing has been identified amongst those suffering delusions in schizophrenia (Perez et al., 2015). These findings may suggest that probabilistic and seemingly abstract tasks, such as the beads task, may be perceived as stressful.

It is easy to appreciate why participants may become flustered or stressed when completing data gathering tasks such as the beads task; the task so frequently implemented to infer the presence of a jump to conclusions bias (Huq et al., 1988; Phillips et al., 1966). Participants enter a room with a researcher and are informed that there are two jars of coloured beads hidden beneath the table. The two jars contain contrasting ratios of the coloured beads and they need to decide, whilst the researcher presents a sequence of beads to them one at a time, from which of the two jars the beads are drawn whilst taking into account the prospective ratio of coloured beads in each jar.

Before they begin the experiment, they realise they are going to need to remember the colour of each bead that the researcher presents and then hides from view, in order to add up the number of each of the coloured beads they see, in order to work out the most likely ratio-and
then there is the possibility that they may still get the answer wrong. Perhaps, it is a far more rational option to avoid the stress and to take a guess at it after the first bead drawn, and consequently jump to conclusions; after all the odds are 50:50 that you will select the correct jar out of the two jars of beads. The alternative is to invest time and effort and, whilst the chance of getting the answer correct is increased, they still run the risk of getting the answer wrong, which by their own evaluation, may leave them feeling a little silly after such an investment.

Indeed the influence of stress upon the jump to conclusions bias has been recognised (Ellet, Freeman and Garety, 2008). It has been shown that manipulating the situation (stressful vs. mindful) can impact upon subsequent decision making (Ellet et al., 2008). Those exposed to stress earlier in the study requested fewer stimuli before finalising a decision than individuals exposed to the calmer, mindful condition. Whilst studies have consistently linked the presence of anxiety and/or stress to an increased tendency to jump to conclusions (Ellet et al., 2008; Lincoln, Lange, Burau, Exner and Moritz, 2010; Keefe et al., 2011), many have focussed heavily upon stress that may be induced prior to the decision making task/s. Few studies have investigated and appreciated the stress that may arise as a result of completing the very decision making task used to measure the jump to conclusions bias itself. It is possible that the jump to conclusions effect observed amongst patients with delusions, and healthy individuals from the sub-clinical range, is merely a response action to the perceived threat and/or stress of the data gathering task itself.

This supposition can be supported by a previous study that concluded that those experiencing distressing delusions exhibit a tendency to display experiential avoidance (Goldstone, Farhall and Ong, 2011). Experiential avoidance is described as a psychological coping mechanism whereby an individual who entertains negative evaluations of thoughts, feelings and sensations will thereby reveal an unwillingness or avoidance to experience these cognitions
and, in so doing, will contemplate efforts that will allow them to escape (Hayes, Strosahl and Wilson, 1999). In addition, recent studies have concluded cognitive factors such as low IQ and emotional biases may contribute to reasoning errors in complex situations (including hasty decision making) (Jolley et al., 2014).

It is clear that the possible effect of the type of decision making task presented to participants experiencing delusional beliefs requires further investigation. Likewise it is important to study not only the type of task used, but the way the task is presented to participants and how this may alter the emergence of the jump to conclusions bias.

**Reasoning Style Preferences**

Individual differences in specific reasoning style preferences could also possibly account for variations in the emergence of the jump to conclusions bias. Dual processes to decision making have been extremely well documented (Evans, 2006, 2008, 2010; Kahneman, 2003; Stanovich 2004). The inherent postulation of the generic dual process theory employed by Kahneman and Frederick (2002, 2005) is the existence of two mental systems labelled System 1 and System 2 (Stanovich, 1999). System 1 is described as a default mechanism that produces quick, automatic and intuitive answers to decision making dilemmas. In contrast, System 2 is far more analytical in its approach to the decision making task and has been associated with conscious activation and operation.

In contrast to initial dual process approaches to decision making (Kahneman et al., 2002, 2005) Rational-Experiential Theory (Epstein, 1994; Epstein and Pacini, 1999) was one of the first dualist approaches to investigate cultural, individual and dispositional differences in reasoning style with the implementation of the Rational-Experiential Inventory (REI) measure (Epstein, Pacini, Denes-Raj & Heier, 1996).
Whilst psychological investigation has highlighted that the experiential and rational scales of the REI measure are uncorrelated (Handley, Newstead and Wright, 2000; Pacini and Epstein, 1999b) an individual predominance or preference to execute one particular system more than another appears to exist (Epstein, 1985; Strack and Deutsch, 2004). For example, age related differences have been identified, with older adolescents employing a rational decision making style most frequently, and an intuitive style less frequently in comparison with younger teenagers (Baiocco, Laghi and D’Alessio, 2009).

Interestingly, it has been suggested that the experience of certain emotions can influence specific reasoning style preferences. A review of the literature suggests that positive emotional traits such as openness to experience, conscientiousness and open minded thinking are indicative of a rational reasoning style adoption (Handley et al., 2000; Marks, Hine, Blore and Phillips, 2008; Toyosawa and Karasawa, 2004). This may help to explain why increases in positive affect have been associated with a reduction in the jump to conclusion bias (Lee, Barrowclough and Lobban, 2011).

Similarly, an intuitive or experiential reasoning style has been linked to negative affect (Laborde, Dosseville and Scelles, 2010). A possible reliance on an experiential reasoning style preference may be associated with the experience of anxiety, which has in some instances, been linked to an increased susceptibility to jump to conclusions (Lincoln et al., 2010), although not all (So, Freeman and Garety, 2008).

Furthermore, it has been shown that high experiential reasoning combined with low rational reasoning was associated with persecutory ideation (Freeman, Evans and Lister, 2012). This is a rare and developing example that demonstrates specific reasoning style preferences amongst individuals within the sub clinical range of delusional ideation. According to Freeman et al. (2012) experiential thinking has been consistently linked with paranormal and
superstitious beliefs and schizotypal traits, with rational reasoning linked with the reverse (Aarnio and Linderman, 2005; Genovese, 2005; Marks et al., 2008). However, the results are mixed. In some instances, positive affect has been linked to experiential thinking and consequent referential thinking (King and Hicks, 2009). Referential thinking, like delusional thinking, involves a certain misinterpretation of experiences whereby ‘an idea that events, objects, or other people in the person’s immediate environment have a particular and unusual meaning specifically for him or her’ (American Psychiatric Association, 1987, p. 399). In addition, it has been found that grandiose delusions, that often include inflated beliefs about the self, can also be linked with positive affect (Knowles, McCarthy-Jones and Rowse, 2011).

Given the apparent contradictory research, it is clear that further investigation is required to study possible reasoning style preferences amongst individuals within the subclinical range. Whilst investigating a possible link between reasoning style and the susceptibility to jump to conclusions.

**Aims of the Current Research**

The core aim of the present research is to investigate factors that moderate and/or mediate the emergence of the jump to conclusions bias amongst individuals belonging to subclinical range of delusional thinking.

I. The initial aim of the research is to observe the presence of the jump to conclusions bias amongst a sample with delusional ideation. In addition, early studies will observe potential differences in verbal intelligence and probability
estimation ability amongst high and low scorers on the PDI (Peters et al., 1996) measure.

II. A secondary aim of the research will be to compare how data gathering tasks may influence the emergence of the jump to conclusions bias. Novel methods to investigate the jump to conclusions bias will be designed and implemented. Real-life decision-making tasks, that provide individuals with the opportunity to gather information for the purpose of generating an opinion and viewpoint, will be compared to previously employed abstract measures such as the beads task (Phillips et al., 1966).

III. The final aim of the research programme is to investigate potential explanations for the potential differences in the emergence of the jump to conclusions bias such as situation-specific stress (between the type of task presented to participants and the way the task is presented). In addition to potential reasoning style differences amongst high and low PDI scorers.

In essence, the research programme sets out to test the validity of the jump to conclusions bias amongst a non-pathological sample, and to investigate the potential impact of task measures upon the emergence of the bias. If indeed, data gathering behaviour is influenced by methodological measures, the research will attempt to investigate reasons for these differences including situational stress and cued reasoning style preferences.
CHAPTER II
Investigating the Impact of Probability Estimation and Verbal Intelligence on the Jumping to Conclusions Bias amongst Sub-Clinical Delusion Ideation

Introduction

It has been widely accepted that individuals with delusions from pathological and non-pathological samples jump to conclusions (Huq et al., 1988; Linney et al., 1998; Phillips et al., 1966). However, recently both the persistence and presence of the bias has been questioned (Dudley et al., 2014).

Recent evidence concluded that only 40-70% of schizophrenic or delusional disorder patients decided after the first bead drawn (Freeman et al., 2004) when presented with the probabilistic reasoning beads task. And interestingly 10-20% of individuals without delusions display the data gathering bias (Fine et al., 2007, Freeman, 2007; Garety et al., 2007).

Likewise, the presence of the bias also appears to be harder to detect amongst sub-clinical samples (Dudley et al., 2014). It is easy to dismiss such findings in the face of such well-established evidence to the contrary (Dudley et al., 1997a, 1997b; Fear et al., 1997; Freeman, 2007; Garety, et al., 1991; Huq, et al., 1988; Moritz et al., 2007). However, the findings are noteworthy and it is clear that further research is required. The current study was designed to investigate the jump to conclusions bias amongst a sub-clinical sample.

Probability Estimation and the Jump to Conclusions Bias

It was confidently hypothesised by Hemsley et al. (1986) that individuals experiencing delusions suffered impairments involving hypothesis formation and probability estimation in particular. Due to this assumption, probability based tasks, such as the beads task, were presented to individuals experiencing delusions. As previously outlined, the beads task was
initially employed by Phillips et al. (1966) to investigate decision making amongst clinical, psychiatric and non-psychiatric control participants. The task presents participants with two jars of beads, one of which has a ratio of largely black compared to white beads (85:15) and the second has a ratio of largely white beads compared to black (15:85). The jars are hidden from view and participants are required to request as many or as few beads as they deem necessary in order to deduce from which of the two jars a sequence of beads is drawn.

The emergence of the jump to conclusions bias appeared to support the notion that delusional individuals struggle fundamentally with probability estimation, and hence it was presumed that probability errors contribute to delusion formation (Garety et al., 1991). A number of studies have since identified a poorer performance from delusional compared to non-delusional individuals on the Wason selection task and other various probability related tasks (Dudley, Young, John and Over, 1998; Linney et al., 1998). Furthermore, delusion prone individuals rated unusual and delusional narratives far more likely than low delusion prone individuals did (LaRocco et al., 2009; McGuire et al., 2001). The findings of such studies suggest that individuals experiencing delusions may have basic probability estimation impairments. It should be noted here that tasks designed to assess the emergence of the jump to conclusions bias consistently employed tasks with probability estimation dilemmas. It is possible that the nature of the task itself i.e. the mathematical elements of the task, may prime individuals with delusions to jump to conclusions if indeed they do struggle with probability calculation.

However, it has been argued that people with delusions do not possess a fundamental incapability to reason about probabilities (Dudley et al., 2003; Fine et al., 2007). Several studies observing a data gathering bias did not detect a general impairment in probability reasoning (Bentall et al., 1996; Colbert et al., 2002; Dudley et al., 1997a). Similarly, one study found that that performance on a range of probabilistic reasoning tasks, used to assess
the use of base rate information and vulnerability to the conjunction fallacy, did not predict paranormal belief (Dagnall et al., 2007).

Current dual process theories of reasoning and decision making may help us to understand why individuals experiencing delusional beliefs may still be able to reason reliably about probabilities. Evans (2010) distinguishes between the reflective and intuitive mind. The reflective mind is considered largely responsible for conscious processes and explicit memory whilst the intuitive mind is considered to be linked to a sub-set of unconscious systems. It is possible that individuals with delusions displaying specific reasoning biases may be perfectly capable of comprehending probabilities when their reflective mind is engaged. However, as Evans (2010) outlines, they may be instances, such as when individuals form beliefs, whereby the intuitive mind may control the executive mind even if it feels like the reflective mind is at play.

The current study aimed to assess probability reasoning amongst individuals scoring either high or low on measures of sub-clinical delusional ideation in order to investigate potential differences in probability estimation ability.

*Intelligence, Delusions and Jumping to Conclusions*

Individual differences in verbal intelligence could also contribute to a vulnerability to jump to conclusions when faced with abstract and probabilistic decision making tasks. It has been well recognised that those suffering with severe mental disorders, such as schizophrenia, experience a decline in pre-morbid IQ (Bora et al., 2009; Keefe et al., 2007; Woodberry et al., 2008). Interestingly, impaired verbal fluency has also been linked to negative and/or positive schizotypy (Cochrane et al., 2012; Ruiz et al., 2008).
Nevertheless, studies researching the relationship between intelligence and the emergence of the jump to conclusions bias in particular are surprisingly sparse. Whilst there are examples of studies that have measured intelligence as a control feature (Freeman et al., 2008), many have investigated the jump to conclusions bias and neglected to include measures of intellectual functioning (Lincoln et al., 2011; Rubio et al., 2011). Indeed, reduced verbal intelligence scores may also help to explain why individuals prone to delusions miscomprehend the task instructions thus promoting the jump to conclusions bias (Balzan et al., 2012).

In one rare example, differences in IQ amongst first episode psychosis patients and control participants completing the renowned beads task were identified (Falcone et al., 2010). The tendency to jump to conclusions was associated with reduced IQ scores. However, this tendency was not specific to clinical patients. It therefore appears necessary to test for individual differences in intelligence amongst individuals within the sub-clinical range who may be inclined to jump to conclusions on decision making tasks.

**Task Methodology**

As previously outlined, the jump to conclusions bias intimates that individuals reach final decisions abnormally early in the process of data gathering (Huq et al., 1988). Collectively, 40-70% of schizophrenic or delusional disorder patients decided after the first bead drawn (Freeman et al., 2004). Nevertheless, in a number of ways the design of the task can be criticised.

The ratio of beads has been manipulated in a number of studies in order to determine if a more difficult ratio will influence the rate of jumping to conclusions (Freeman, Pugh, Vorontsova, Antley and Slater, 2010). The more difficult version of the task, that implements
a ratio of 60:40 of prospective black and orange beads did not appear to influence the rate of jumping to conclusions when compared with an easier version (85:15) ratio (Ho-wai-So et al., 2015). As a result, a number of studies continue to implement the 60:40 ratio of black and orange beads in order to investigate the jump to conclusions bias (Warman, Lysaker, Martin, Davis and Haudenschield, 2007). Nevertheless, in a number of other ways the design of the task can be criticised. The evident irrelevance of the task in relation to belief formation is apparent. Indeed, delusions are defined as ‘beliefs based upon incorrect inference’ (American Psychiatric Association, 1994, p 765). The artificial nature of the task demands participants to make a decision, and fails to provide the opportunity for individuals to gather data for the purpose of generating an opinion or perspective.

It is clear that the content of the probability reasoning beads task is inappropriate. In essence, the task is a probability question rather than a measure of how individuals gather evidence to form a point of view or interpretation. It is possible that the artificial nature of the task itself may, in some way, encourage individuals to jump to conclusions. For example, when the design of the task had been manipulated by increasing ambiguity in the beads task (presenting four jars instead of two), the jump to conclusions effect was abolished (Moritz et al., 2007b).

It has also been demonstrated that participants perform more poorly on original abstract versions of the Wason selection task (Wason, 1960) in comparison with realistic adaptations that include moral, social and legal content (Evans and Over, 1996). Studies such as this demonstrate how the jump to conclusions response may be sensitive to the design of the task itself. Whilst the content of the task can be criticised, the draws to decision paradigm has received considerable support and reliability (see Fine et al., 2007 for a review). This contrasts with the draws to certainty approach whereby participants are encouraged to provide graded estimates and indications of certainty throughout the beads task. The draw to
The certainty paradigm has received considerably less support than its predecessor amongst studies of psychiatric patients (Peters and Garety, 2006; Young et al., 1997b).

The primary aim of the current study was to investigate the jump to conclusions bias amongst individuals high and low in sub-clinical delusional ideation from the healthy general population; employing a novel and more realistic version of the probabilistic reasoning beads task. The study aimed to observe how individuals classified as high and low in sub-clinical delusional thinking gather information when forming a point of view and investigate the potential influence of probability estimation ability and verbal intelligence upon the emergence of the jump to conclusions bias.

It was expected that probability estimation and verbal intelligence scores may differ between high and low scorers on measures of sub-clinical delusional ideation. More specifically, it was predicted that scores of probability estimation and verbal intelligence would be reduced amongst high PDI scorers (Peters Delusions Inventory; Peters et al., 1996) compared to low PDI scorers.

In addition it is also predicted that an interaction would be detected between probability estimation score group (low vs. high), verbal intelligence score group (low vs. high) and PDI group (low vs. high). It is anticipated that high PDI scorers with reduced verbal intelligence and probability estimation test scores would reveal a greater susceptibility to the jump to the jump to conclusions bias. It was also hypothesised that data gathering scores would be reduced amongst high PDI scorers completing a probability-framed task in comparison with a more realistically-framed version.
Method

Participants

An opportunity sample of sixty-seven Psychology students recruited from the University of Wolverhampton participated in the study between October 2010 and March 2011; of which precisely 52 were female and 14 were male (one participant failed to produce demographic information). The age range for the study was 33 years (M= 21.02 years, SD= 7.00 years). Out of the sixty-seven participants, sixty four participants provided useable data. Three incomplete datasets were identified and consequently eliminated from subsequent analyses. All sixty four participants completed the Peters et al. Delusions Inventory (Peters et al., 1996) measure of delusional ideation, the verbal reasoning section of the AH4 intelligence test (Heim, 1967) and a probability test. All sixty four participants completed a data gathering task. Participants were randomly assigned to complete a particular version of the task; 35 completed the probability version and 29 completed the viewpoint version. Participation in the investigation was conditional in exchange for participant pool credits.

Materials

Materials included a pen/ pencil, a calculator, an information form (Appendix 1), an informed consent sheet (Appendix 2) and an end of experiment debrief form (Appendix 3). Participants were asked to complete two psychometric questionnaires: the Peters et al. Delusions Inventory (Peters et al., 1996; Appendix 4) and the AH4 intelligence test (Heim, 1967). In addition, participants were instructed to complete two additional tasks: a data gathering task (Appendix 5.1 and 5.2) and a probability test (Appendix 6).
The Peters et al. Delusions Inventory (Peters et al., 1996)

The Peters et al Delusions Inventory (Peters et al., 1996; Appendix 4) is a 21 item measure of delusional ideation. Participants were asked to indicate if they have had experience of the given beliefs and mental experiences, and if so to indicate on three 5-point Likert scales (1) how distressing they found them to be \(1=\text{not at all distressing}\) to \(5=\text{very distressing}\), (2) how frequently they thought about the belief \(1=\text{hardly ever think about it}\) to \(5=\text{think about it all the time}\) (3) the extent to which they believed the belief to be true \(1=\text{don’t believe it’s true}\) to \(5=\text{believe it’s absolutely true}\). Below is an example question from the scale:

**Do you ever feel as if people are reading your mind?**

[Please circle choice: NO or YES]

**Not at all distressing**

\[
\begin{array}{cccccc}
1 & 2 & 3 & 4 & 5 \\
\end{array}
\]

**Hardly ever think about it**

\[
\begin{array}{cccccc}
1 & 2 & 3 & 4 & 5 \\
\end{array}
\]

**Don’t believe it’s true**

\[
\begin{array}{cccccc}
1 & 2 & 3 & 4 & 5 \\
\end{array}
\]

**Very distressing**

\[
\begin{array}{cccccc}
1 & 2 & 3 & 4 & 5 \\
\end{array}
\]

**Think about it all the time**

\[
\begin{array}{cccccc}
1 & 2 & 3 & 4 & 5 \\
\end{array}
\]

**Believe it is absolutely true**

\[
\begin{array}{cccccc}
1 & 2 & 3 & 4 & 5 \\
\end{array}
\]

---

**Do you ever feel as if you could read other people’s minds?**

[Please circle choice: NO or YES]

**Not at all distressing**

\[
\begin{array}{cccccc}
1 & 2 & 3 & 4 & 5 \\
\end{array}
\]

**Hardly ever think about it**

\[
\begin{array}{cccccc}
1 & 2 & 3 & 4 & 5 \\
\end{array}
\]

**Don’t believe it’s true**

\[
\begin{array}{cccccc}
1 & 2 & 3 & 4 & 5 \\
\end{array}
\]

**Very distressing**

\[
\begin{array}{cccccc}
1 & 2 & 3 & 4 & 5 \\
\end{array}
\]

**Think about it all the time**

\[
\begin{array}{cccccc}
1 & 2 & 3 & 4 & 5 \\
\end{array}
\]

**Believe it is absolutely true**

\[
\begin{array}{cccccc}
1 & 2 & 3 & 4 & 5 \\
\end{array}
\]
The AH4 intelligence test (Heim, 1967)

The AH4 intelligence test (Heim, 1967) is designed to assess general intelligence. The test comprises 65 items divided into two subscales to assess verbal and numeric intelligence. Participants were asked to complete the verbal sub scale of the test only. The AH4 intelligence test has been used widely, and the validity and reliability of the measure appears sound (Bates, Stough, Mangan and Pellet, 1995; Der and Deary, 2003).

The Data Gathering Tasks

The data gathering task was designed to assess the quantity of information that a participant would request prior to making a decision. There were two versions of the task: the probability condition (Appendix 5.1) and the perspective (realistic) condition (Appendix 5.2). The participant was randomly assigned to complete only ONE of these measures. The two tasks would allow for a comparison between the probability and perspective task measures and the degree of jump to conclusions bias. As a result, the study adopted a between-subjects design here. Both tasks presented participants with fictional comments from an imaginary survey regarding a fictional debate. Participants in the probability condition were asked to assess which of two surveys the comments were selected from by considering the percentages of for and against comments. Please see below for an example of the task instructions (Appendix 5.1 for full task materials):

A competitive business has been developing an all new remote controllable vacuum cleaner designed to reduce manual effort.
Two independent surveys were conducted to assess the popularity of the product for potential public release. Beforehand, participants had received a detailed written description of the vacuum, along with a 15 minute demonstration.

Participants were then asked to decide if they were in favour of or against the release of the vacuum cleaner for public purchase. Each participant was instructed to state whether they were in favour of or against the vacuum cleaner being made publicly available and to give a genuine reason for their viewpoint.

The results of Survey One revealed that 40% favoured the vacuum cleaner whilst the remaining 60% were against the release of the vacuum cleaner.

The results of the Survey Two revealed altogether different findings. Of the participants that took part 60% believed the vacuum cleaner should be made available to buy whilst the remaining 40% were against the sale of the vacuum.

You are about to read a series of comments from participants from only one of the two surveys. Each comment will express whether or not the participant believed the vacuum to be suitable for public release along with the reason for their view.

You are asked to read the comments carefully and to determine which survey the comments were drawn from; Survey One or Survey Two in relation to the prospective percentage that favoured the vacuum and those that did not.

- Survey One: 40% favoured the vacuum cleaner whilst the remaining 60% were against the release of the vacuum cleaner for public purchase.
- Survey Two: 60% believed the vacuum cleaner should be made available to buy whilst the remaining 40% were against the sale of the vacuum.

You can choose to read as many/ or as few comments as you wish until you feel you know which survey the comments are drawn from. When you feel you know the answer, please end the experiment.
In the perspective condition participants were instructed to adopt a point of view. Please see below for an example for the task instructions (Appendix 5.2 for full task materials):

*Hello and welcome to the experiment.*

*A competitive business has been developing an all new remote controllable vacuum cleaner designed to reduce manual effort.*

*An independent survey was conducted to assess the popularity of the product for public release. Beforehand, participants had received a detailed written description of the vacuum, along with a 15 minute demonstration.*

*Participants were then asked to decide if they were in favour of or against the release of the vacuum cleaner for public purchase. Each participant was instructed to state whether they were for or against the vacuum cleaner being made publicly available and to give a genuine reason for their viewpoint.*

*You will now be given the opportunity to read a selection of the participants’ comments provided in the survey. You are asked to read the comments carefully and to determine the viewpoint you agree with most: for or against the release of the vacuum cleaner.*

*You can choose to read as many/or as few participants comments as you wish. When you feel you confidently know which viewpoint you agree with most, please end the experiment.*

Both conditions of the task were completed via computer, keyboard and mouse using Superlab software. The data gathering score reflected the number of comments requested from the participant prior to (1) a decision being made in the probability condition (2) a point of view being reached in the perspective condition. The data gathering score could potentially reflect an individual’s susceptibility towards a jumping to conclusions bias.
The Probability Test

The probability test consisted of 15 probability related questions to assess the individuals’ ability to understand general probability totalling, conversion and expectancy. The questions were derived from online learning resources for standard GCSE Intermediate level mathematics: www.gcsemathstutor.com and www.mathsphere.co.uk. Participants were supplied with the question sheet and answer sheet along with an additional blank sheet for working out. Calculators were also provided to participants. Examples of the questions are included below:

**Q:** A machine in a factory makes 1900 perfect individual chocolates per hour. If the machine makes a 100 spoiled or imperfect chocolates in the same time

*a) What is the probability of making perfect chocolates? (to two decimal places)*

*b) How many imperfect chocolates will be produced in 4 days if the machine works 24-7?*

Design and Analyses

The study adopted a fully between-subjects design throughout; consisting of four independent measures analyses.

**Delusional Ideation by Probability Estimation**

The first analysis investigated probability between high and low scorers of delusional ideation using a one-way ANOVA statistical tests. The between-subjects, quasi factor was the
PDI score of delusional ideation and consisted of two groups, the high and the low group. The dependent variable was probability estimation score.

Next, a two-way independent factorial ANOVA was conducted to investigate data gathering scores between high and low scorers on the probability test and high and low scorers of delusional ideation. The two between-subjects, quasi-factors were: (1) delusional ideation score consisting of two levels, high and low group and (2) probability test score also consisting of two levels, high group and low group. The dependent variable was data gathering score; irrespective of the type task completed (probability vs. perspective).

Delusional Ideation by Verbal Intelligence

The next analysis investigated verbal intelligence test scores between high and low scorers of delusional ideation using a one-way ANOVA statistical test. The between-subjects, quasi factor was the PDI score of delusional ideation and consisted of two groups, the high and the low group. The dependent variable was verbal intelligence test score.

A two-way independent factorial ANOVA was conducted to investigate data gathering scores between high and low scorers on the verbal intelligence test and high and low scorers of delusional ideation. The two between-subjects, quasi-factors were: (1) delusional ideation score consisting of two levels, high and low group and (2) verbal intelligence test scores also consisted of two levels, high group and low group. The dependent variable was data gathering score.
Delusional Ideation by Task Version

Finally, mean data gathering scores were investigated between the high and low PDI groups and between the two types of task (probability vs. perspective) using a two-way, between subjects ANOVA.

Procedure

Participants were required to attend a 75 minute psychometric test session followed by an individual data gathering task session as part of the investigation. In part one of the study, sixty-four available and willing participants that provided usable data had initially responded to online advertised study timeslots, and therefore arrived at the laboratory classroom at an allocated time. Participants were then asked to enter the laboratory classroom, a sound proof, air conditioned laboratory environment and to sit at an available space where they were briefed upon the nature of the investigation. The information form highlighted important ethical considerations that would apply to them as participants. Each individual was provided with an informed consent sheet that emphasised any ethical issues in relation to the study. Participants were asked to read and sign the sheet if willing to partake in the research. Participants were asked to complete the Peters et al Delusions Inventory (Peters, Joseph and Garety, 1996), the verbal reasoning aspect of the AH4 intelligence test (Heim, 1967) and a probability test. Participants were asked to read instructions for each questionnaire carefully and to complete the measures in the order in which they are given to them; counterbalancing techniques were employed in the investigation. Participants were provided with the opportunity to ask questions before commencing with the study and supplied with any
necessary materials such as pens and/or calculators. Participants were then given 75 minutes to complete the experiment.

Following completion of part one, participants were invited to return on a pre-agreed allocated time to complete the data gathering task on a Superlab software installed computer. For both the probability and perspective versions of the task, participants were instructed to request information and to terminate the experiment once a final decision had been reached. Participants were asked to read the instructions for the task carefully, and were provided with the opportunity to ask questions before commencing with the experiment. Participants were given 15 minutes to complete the task.

Following completion, participants were verbally debriefed, awarded participant pool credits and thanked for contributing to the study. In the case of future contact and reference, participants were supplied with copies of the debrief form to take away with them as proof of participation.

Results

Delusional ideation score was measured using the (PDI) Peters et al. Delusions Inventory (Peters et al., 1996). Participants’ overall PDI scores were subject to a median split to divide participants into low and high delusional ideation group scorers (low group < 52, high group ≥ 52). An independent samples t-test did not detect significant differences in mean delusional ideation scores between male (M= 49.5; SD= 27.42) and female participants (M= 56.65, SD= 37.20; t (61) = 0.67, p= 0.507, r= 0.09). Likewise, no age differences were detected between the high (M= 19.97 years, SD= 5.51 years) and low groups (M= 22.45 years, SD= 8.38 years of sub-clinical delusional ideation (t (61) = 1.39, p = 0.168, r= 0.18).
Jumping to Conclusions

Only 1 participant jumped to conclusions and expressed a data gathering score of less than 2. Data gathering scores did not differ between the probabilistic and realistic versions of the data gathering task amongst individuals belonging to the high PDI group (t (31) = -1.383; p = 0.177; r = 0.26).

Delusional Ideation by Probability Estimation

A one-way between subjects ANOVA was conducted to investigate probability estimation scores i.e. the number of correct responses, amongst the high and low PDI groups. Analyses revealed a significant difference in the number of correct responses between the high and low PDI groups (F(1, 62) = 3.909, MSE= 63.938, p= 0.052; $\eta^2_p = 0.059$). Probability estimation scores were lower amongst the high PDI group (M= 6.00; SD= 4.22) compared to the low PDI group (M= 8.00; SD= 3.85).

A subsequent two-way between subjects ANOVA was conducted to investigate data gathering scores i.e. the quantity of information requested prior to a decision being reached, between high (> 7.00) and low group (≤ 7.00) of probability estimation scores and high and low group of PDI scores. The results did not yield significant differences in data gathering scores between the high and low groups of probability estimation groups ((F (1, 60) = 0.215, MSE= 6.623, p= 0.645; $\eta^2_p = 0.004$). Likewise differences in data gathering scores for the high and low PDI groups were non-significant (F (1, 60) = 0.659, MSE= 20.332, p= 0.420; $\eta^2_p = 0.011$). Furthermore no significant interaction was identified (F (1, 60) = 0.001, MSE= 0.021, p= 0.979; $\eta^2_p = 0.001$).
A one-way between subjects factorial ANOVA was conducted to investigate verbal intelligence scores i.e. the number of correct responses, amongst the high and low PDI groups. Analyses revealed a significant difference in the number of correct responses between the high and low PDI groups (F (1, 62) = 3314.881, MSE= 314.954, p= 0.018; \( \eta^2_p = 0.087 \)). Verbal intelligence scores were lower amongst the high PDI group (M= 50.30; SD= 8.26) compared to the low PDI group (M= 54.74; SD= 6.10).

A subsequent two-way between subjects ANOVA was conducted to investigate data gathering scores i.e. the quantity of information requested prior to a decision being reached, between high (> 54.00) and low groups (\( \leq 54.00 \)) of verbal intelligence scores and high and low groups of PDI scores. The results did not yield significant differences in data gathering scores between the high and low verbal intelligence groups ((F (1, 60) = 0.013, MSE= 0.397, p= 0.910; \( \eta^2_p = 0.004 \)). Likewise differences in data gathering scores for the high and low PDI groups were non-significant ((F (1, 60) = 0.701, MSE= 21.652, p= 0.406; \( \eta^2_p = 0.012 \)). Furthermore no significant interaction was identified ((F (1, 60) = 0.187, MSE=5.774, p= 0.667; \( \eta^2_p = 0.003 \)).

Finally, a subsequent two-way between-subjects ANOVA was conducted to investigate data gathering scores i.e. the quantity of information requested prior to a decision being reached, between high and low groups of PDI scores and type of task (probability vs. perspective).
The results did not yield significant differences in data gathering scores between the high and low PDI groups \((F (1, 60) = 0.069, \text{MSE}= 162.920, p= 0.837; \eta^2_p = 0.064)\).

Likewise differences in data gathering scores for the type of decision making task (probability vs. perceptive) were non-significant \((F (1, 60) = 0.054, \text{MSE}=162.920, p= 0.854; \eta^2_p = 0.051)\). However, a significant interaction was identified \((F (1, 60) = 5.779, \text{MSE}=28.190, p= 0.019; \eta^2_p = 0.088)\). Interestingly, with reference to Figure 2.1, data gathering scores were significantly reduced amongst low PDI scorers completing the probability- framed task in comparison with all other conditions. However, the overall effect size was small. Data gathering scores did not appear to differ largely between the High PDI Group for either task. For example, for the probability task the mean scores were 17.73 (SD= 5.02) and mean data gathering scores for the perspective task were 15.22 (SD= 5.33).
Discussion

Interestingly, the results indicated that those that scored highly on the measure of sub-clinical delusion (Peters et al., 1996) revealed reduced scores on the probability estimation test and the verbal intelligence test compared to those that scored low on the trait. The results support the hypotheses as well as previous findings that have concluded that individuals experiencing delusions suffer impairments involving probability estimation (Hemsley et al., 1986). Indeed, the findings of the current study support an array of studies that have identified poorer performance on various probability-framed tasks amongst delusional compared to non-delusional participants (Dudley et al., 1998; Linney et al., 1998).
In addition, the finding that verbal intelligence scores were reduced amongst the high sub-clinical delusional ideation group is consistent with studies that have identified a decline in pre-morbid IQ amongst patients suffering schizophrenia (Bora et al., 2009; Keefe et al., 2007; Woodberry et al., 2008). A reduction in verbal intelligence may also help to explain why individuals prone to delusions miscomprehend the task instructions (Balzan et al., 2012).

Surprisingly, only 1 participant jumped to conclusions. In simpler terms, the quantity of information requested by participants placed in the high PDI group did not differ from the low PDI group. Furthermore, participants who completed the probability version of the data gathering task did not statistically request more or less information than those participating the perspective version. In fact, lower scorers requested less information when completing the probability-framed task; conflicting with previous literature (Huq et al., 1988). However, the effect size was extremely small. Surprisingly, those scoring high on measures of sub-clinical delusional ideation requested comparative quantities of data for both versions of the data gathering task. However, it should be firmly noted that there was no true evidence of an emergence of the jump to conclusions bias. Unlike previous experiments on psychiatric patients, none of the participants decided after the first bead drawn (Fear et al., 1997; Freeman et al., 2004; Garety et al., 1991; Huq et al., 1988).

Nevertheless, the finding is somewhat surprising. It appears that the adjustments of the current task, that made it more realistic and less interrogative for participants (completing via computer and with more realistic content), eliminated the data gathering bias amongst higher scorers of delusional ideation when they were instructed to contemplate probabilities. Together with the earlier results that found that probability test scores were reduced amongst the high PDI group, it is apparent that subsequent data gathering was not influenced by this factor. In the current study, individuals classified as high in delusional ideation requested
comparative quantities of information when presented with a realistic and emotionally neutral probabilistic data gathering task.

There may be a number of potential explanations for this. Perhaps completing a probabilistic data gathering task on computer had a relaxing effect on the high delusional ideation scorers. In other words, participants may have felt less pressured and/or stressed or may have perceived that they had more time compared to previous studies whereby the task took place face to face (Phillips et al., 1966). Or perhaps the results were simply a product of the realistic content of the data gathering task. The scenario of the data gathering task may have been less abstract to the high PDI scorers than the original bead task (Phillips et al., 1966) and so they were prepared to engage in the task and gather more information before finalising a decision.

Worryingly however, the findings could suggest that the previously observed jump to conclusions phenomenon amongst patient groups may have been elicited as a result of negative symptomatology associated with schizophrenia, such as impairments of memory (Aleman et al., 1999; Heinrichs et al., 1998) and attention and executive function (Sharma et al., 2000). In addition, the findings support literature that implies that the presence of the bias also appears to be harder to detect amongst sub-clinical samples (Dudley et al., 2014).

An essential weakness of the study was that data gathering behaviour was not observed while participants completed the original beads task (Phillips et al., 1966). Whilst the study did include a task that involved probabilistic elements, the realistic framing of the task may have interfered with the abstract nature of the task. Thus it would be worthwhile to observe data gathering behaviour amongst participants completing the beads task as an abstract measure and to compare this to a realistically-framed measure (Phillips et al., 1966).
Summary

Those high and low in delusional ideation appeared to differ in their ability to process probability estimation and verbal intelligence problems. However, the jump to conclusions bias was not observed amongst high sub-clinical delusional ideation scorers in this instance. The present study supports that the design of the original data gathering beads task (Phillips et al., 1966) may have, in some way, encouraged the emergence of the jump to conclusions bias. By implementing an everyday probabilistic data gathering task, the jump to conclusions effect was eliminated amongst individuals engaging in sub-clinical delusional thinking.
CHAPTER III

A Study to Investigate the Jumping to Conclusions Bias Using an Abstract Decision Making Task

Introduction

In Chapter II, a potential jump to conclusions bias was investigated amongst a sample of subclinical delusional ideation participants. The jump to conclusions response was not observed despite extensive literature in the area that has identified the jump to conclusions bias amongst non-pathological samples in the past (Linney et al., 1998).

The findings were noteworthy i.e. that higher scorers of sub-clinical PDI scored lower on verbal intelligence and probability test scores in comparison with their lower-scoring counterparts. Nevertheless, the results revealed little as to how these tendencies may influence data gathering behaviour and thus belief formation as a whole.

It was discussed that the realistic nature and emotional neutral content of the task presented to participants may have eliminated the data gathering bias amongst higher scorers of delusional ideation. In addition, it was also considered that the means in which the task was presented to participants (via computerised technology as opposed to face to face) may have reduced the susceptibility to jump to conclusions in this instance.

Abstract Decision Making

The beads task, initially employed by Phillips et al., (1966) to investigate decision making amongst clinical, psychiatric and non-psychiatric control participants, is a frequently implemented task to measure the rate of jumping to conclusions (Bristow et al., 2014).
The Introduction to the current research programme criticised the use of the beads task as a methodological measure of the jump to conclusions bias (Chapter II). It was discussed that stress induced by the abstract nature of the task, could be responsible for the emergence of the reasoning bias (Chapter II).

Given that participants in the preceding study revealed reduced probability test and verbal intelligence test scores, it could be assumed that high PDI scorers may perceive the beads task to be somewhat stressful. It has been highlighted that factors such as Intolerance of Uncertainty (Freeman et al., 2008) and task miscomprehension i.e. misunderstanding task instructions (Balzan et al., 2012) could influence performance on tasks employed to measure the jump to conclusions bias. Whilst it has been found in some studies that worry induction, a concept comparable to stress, did not affect the rate of jumping to conclusions (Freeman et al., 2013) many other studies have identified an increase in jumping to conclusions in the presence of anxiety and/ or stress (Ellet et al., 2008; Lincoln et al., 2010; Keefe et al., 2011).

By way of association, higher levels of worry have also been related to more distressing and paranoid thoughts (Bassett, Sperlinger and Freeman, 2009; Morrison and Wells, 2007).

Previous findings in the research programme have tentatively indicated that the use of a more realistic task can lead to the elimination of such a bias occurring amongst individuals engaging in delusional thinking (Chapter II). In addition, it was concluded in the preceding study that higher scorers of sub-clinical delusional ideation in the PDI revealed reduced probability test and verbal intelligence test scores; factors that may influence data gathering behaviour and perceived stress when an abstract and probabilistic decision making task is introduced. Nevertheless, further research is required order to determine whether abstract decision making tasks, such as the beads task (Phillips et al., 1966), promote a jump to conclusions bias.
A further issue relates to the variation in the techniques employed to administer data gathering tasks to participants. Many earlier studies presented tasks to participants face to face (e.g. Huq, et al., 1988). This may be appraised as a far more interrogative scenario for participants compared to contemporary studies that now rely on computerised technology to present trials to participants (Rubio et al., 2011). However, the use of computerised technology may also induce anxiety for participants. It has been shown that in some instances gender, age, education and personality can impact upon computer anxiety (Powell, 2013). Indeed it has been concluded that computer knowledge, computer skills and acceptance of technology can have a significant negative relationship with computer anxiety (Shah, Hassan and Embi, 2012). However, lest we neglect the reverse, that an increase in computer confidence may give rise to a decrease in computer anxiety and perhaps an increase in the quantity of information selected. Given that participants in the previous study were young, undergraduate students it is possible that participants did not experience anxiety as a result of completing the data gathering task via computer (Chapter II). It is possible that the use of computerised technology in the previous study, may have influenced the emergence, or in this instance, the elimination of the jump to conclusions bias. Indeed it has been shown that adolescents who experienced more social anxiety (not comfortable talking to others face to face) were more likely to talk to others online or via text messaging (Pierce, 2009). In addition, according to a recent survey of young people’s use of the Internet, teens routinely communicate in chat rooms and more than 85% stated they use one or both on a daily basis (Hughes, 2006). Given this, it was anticipated that participants in the current study may experience more anxiety when completing the task face to face compared to computer, and
may be therefore more likely to demonstrate a jump to conclusion bias in a face to face scenario.

**Aims and Hypotheses of the Current study**

The aim of the present study was to detect a presence of the jump to conclusions bias amongst participants from a sub-clinical sample completing the abstract reasoning beads task; comparing data gathering behaviour between face to face or via computerised data collection methods.

It was expected that components of PDI scores (Peters et al., 1996) would predict data gathering scores i.e. the quantity of information requested prior to forming a final decision, amongst specific domain conditions. In line with previous studies investigating the jump to conclusions bias amongst clinical patients (Huq et al., 1988), it was anticipated that data gathering scores would reduce in high PDI scorers when completing the abstract beads task face to face leading to an increase in jumping to conclusions. Conversely, it was expected that data gathering scores would increase when completing the abstract task via computerised technology; thus implying a reduction in the rate of jumping to conclusions.

**Method**

**Participants**

An opportunity sample of 38 undergraduate Psychology students recruited from the University of Wolverhampton participated in the study between October 2013 and February
2014; of which 34 were female. The age range for the study was approximately 39 years (M=25.76 years, SD= 9.96 years).

All participants completed the Peters et al. Delusions Inventory (Peters et al., 1996) measure of delusional ideation and a data gathering task. A total of 19 participants completed the abstract data gathering task face to face whilst 19 participants also completed the abstract data gathering task via computerised technology. Participation in the investigation was conditional in exchange for participant pool credits.

Materials

Materials included a pen/ pencil, an information form (Appendix 7), an informed consent sheet (Appendix 8), and an end of experiment debrief form (Appendix 9). Participants were asked to complete the Peters et al. Delusions Inventory (Peters et al., 1996: Appendix 4) and an abstract data gathering task.

The Abstract Data Gathering Task: The Beads Task (Phillips et al., 1966)

The beads task was designed to assess the quantity of information a participant requests prior to making a decision. The task presented participants with two jars of beads, one that has a ratio of largely black compared to white beads (60:40), and in the other jar, the ratio was reversed respectively so that there were now fewer black beads compared to white (40:60). Participants were asked to request as many or as few beads as they deemed necessary in order to deduce from which jar a random sequence of beads was drawn. Please see below for an example of the task instructions (Appendix 10 for full task materials with answer sheet):
Hello and welcome to the experiment.

There are two jars of coloured beads. The first jar, Jar A, contains more black beads than white beads. In Jar A, 60% of the beads are black whilst the remaining 40% of beads are white.

However, in the second jar, Jar B, the percentage of coloured beads has reversed respectively; there are less black beads than there are white beads. In Jar B, 40% of the beads are black whilst the remaining 60% of beads are white.

Your task is to request beads, one at a time in order to determine which jar the researcher has selected: Jar A or Jar B by taking into account the prospective percentage of black and white beads that are listed in the sequence.

- Jar A: 60% of the beads are black and 40% of the beads are white
- Jar B: 40% of the beads are black and 60% of the beads are white

You can choose to request as many/ or as few as you wish until you feel you know which jar the sequence of beads is drawn. When you feel you know the answer, please end the experiment.

Please ask any questions to the researcher now if you do not understand the instructions for the experiment.

In the Computer condition, the task was completed via computer, keyboard and mouse using Superlab software. Task instructions *(Appendix 10a)* were provided on paper prior to the start of the experiment. At the end of the experiment, participants indicated from which jar
they believed the sequence of beads was drawn (Appendix 10b), on paper following a decision being reached.

In the Face to Face condition, the task was delivered with the researcher and participant sitting at opposite ends of a table. Task instructions (Appendix 10a) were read out verbally. Individual beads were provided to participants upon the participant’s request and at the end of the experiment, participants were instructed to verbally indicate their chosen jar following a decision being reached.

Coloured beads were selected randomly by the researcher in the face to face condition and randomly via computerised technology. Random selection was considered to be an ecologically valid method of information gathering; no pre-sequenced coloured beads were presented to participants in an effort to reduce the impact of order effects eliciting a jump to conclusions bias. In previous experimentation, beads have been presented to participants using pre-organised sequence. The example below will demonstrate how a pre organised sequence could lead participants to believe that the beads are from the incorrect jar.

**Example**

The researcher selects the jar that has 60% white beads and 40% black beads. There are 100 beads in the jar but the researcher is told to follow the following sequence and not to select more than 20 beads.

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As you can see, the participant would be justified in assuming that the jar selected is the jar possessing the ratio of 60% black and 40% white beads respectively using this sequence,
because the majority of the beads are black. However, in reality, the participant is wrong. The beads are in fact selected from the jar containing 60% white beads and 40% black beads. In addition, pre-organised sequences often deliberately present a number sequence of coloured beads in a row i.e. the first three beads are black. This, naturally will bias participants into opting for the predominantly black bead jar each and every time. Random selection of beads creates a random selection of information and reduces the impact of order effects.

It was anticipated that the task would take 10 minutes to complete. The data gathering score derived from the number of beads requested by the participant prior to a decision being made. The data gathering score reflected an individuals’ potential susceptibility towards a jumping to conclusions bias.

**Design and Analyses**

Hierarchical moderated, linear multiple regression analyses were conducted to investigate if a potential two-way interaction between the predictor variables (1) overall PDI score (2) PDI distress scores (3) PDI belief preoccupation scores (4) PDI belief conviction scores and task method (face to face vs. computer) could predict overall mean data gathering scores. The distinct components of the PDI measure (Peters et al., 1996) were not entered into the same analyses, but were investigated separately and in turn.

**Procedure**

Individuals who were available and willing to participate, and had responded to the participant pool study advertisement arrived at a laboratory space at an allocated time. They were then briefed upon the nature of the investigation. The brief highlighted important ethical
considerations that would apply to them as participants. Each individual was provided with an informed consent sheet and asked to read and sign the sheet carefully if willing to participate.

The participants were then asked to complete the Peters et al. Delusions Inventory (Peters et al., 1996) and a data gathering task in a randomised order; counterbalancing techniques were employed in the investigation.

Participants were kindly asked to read instructions for each questionnaire/task carefully and to complete the measures in the order in which they were given to them. Participants were provided with the opportunity to ask questions before commencing with the study and supplied with any necessary materials such as pens.

In the Computer condition, the data gathering task was completed via computer, keyboard and mouse using Superlab software. Task instructions were provided on paper prior to the start of the study. At the end of the study, participants indicated their chosen option on paper following a decision being reached.

In the Face to Face condition, the task was delivered face to face with the researcher and participant sitting at opposite ends of a table. Task instructions were read out verbally by the researcher. Individual beads were provided to participants, upon the participant’s request and subsequently hidden from view in a separate jar. At the end of the study, participants were instructed to verbally indicate their chosen option following a decision being reached. The researcher recorded the number of beads requested by the participant prior to the final decision.

Participants were given 20 minutes to complete the experiment. Following completion of the investigation, participants were verbally debriefed and thanked for contributing to the study.
Results

Statistical Method

A moderated, multiple regression analysis was performed using SPSS software to investigate the impact of (1) PDI Overall and (2) Task Method as single predictors on data gathering scores. PDI overall and Task Method were entered into the first hierarchy in the model. A second hierarchy was added to the model that multiplied the PDI predictor (using the standardised scores) and task method predictor together to create an interaction variable PDI x Task Method.

As PDI overall scores, PDI distress scores, PDI preoccupation scores and PDI conviction scores are derived from the same measure (Peters et al., 1996), they were not placed into the same moderator analysis model but were investigated distinctly using the method above.

Rate of Jumping to Conclusions

Only 1 participant jumped to conclusions and expressed a data gathering score of less than 2.
Moderator Analyses

![Diagram of Moderator Analyses]

Figure 3.1: A simple diagram to illustrate the moderator analysis variables under investigation

PDI Overall Scores as a Predictor of Data Gathering Score

The first model which incorporated the PDI Overall scores and the task method predictors was found to be significant ($F (2, 35) = 17.776; \text{MSE}= 0.505; p=0.001$). Likewise the second ($F (2, 34) = 12.572, \text{MSE}= 0.496; p=0.001$) was also statistically significant. With reference to Table 3.1, it can be seen that only task method was identified as a significant predictor in the model and accounted for 48% of the variance of data gathering scores. PDI overall scores did not predict data gathering scores and the interaction between PDI overall scores and task method was not significant.

A subsequent independent measures t-test revealed that mean data gathering scores for participants completing the task on computer ($M = 17.21; \text{SD}= 4.85$) were significantly greater compared to those completing the task face to face ($M= 8.53; \text{SD} = 3.96; (t (36) = \ldots$
6.045; p= 0.001; r= 0.71). This can be supported by the significant correlation identified in Table 3.1 between the face to face and computerised versions of the abstract task.

*Table 3.1: The Two-Way Moderated Multiple Regression Model Statistics Investigating Overall PDI Belief Scores and Task Method as Predictors of Data Gathering Scores*

<table>
<thead>
<tr>
<th>Model</th>
<th>Predictor</th>
<th>Beta (Unstandardized)</th>
<th>Standard Error Beta</th>
<th>Zero-order correlations</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>Constant</td>
<td>2.132</td>
<td>0.367</td>
<td></td>
<td>5.816**</td>
</tr>
<tr>
<td></td>
<td>PDI Overall</td>
<td>0.15</td>
<td>0.124</td>
<td>-0.028</td>
<td>0.117</td>
</tr>
<tr>
<td></td>
<td>Task Method</td>
<td>-1.376</td>
<td>0.231</td>
<td>-0.710</td>
<td>-5.958**</td>
</tr>
<tr>
<td>Model 2</td>
<td>Constant</td>
<td>2.200</td>
<td>0.367</td>
<td></td>
<td>5.985**</td>
</tr>
<tr>
<td></td>
<td>PDI Overall</td>
<td>0.452</td>
<td>0.369</td>
<td>-0.028</td>
<td>1.224</td>
</tr>
<tr>
<td></td>
<td>Task Method</td>
<td>-1.420</td>
<td>0.232</td>
<td>-0.710</td>
<td>-6.128**</td>
</tr>
<tr>
<td></td>
<td>PDI Overall x Task Method</td>
<td>-0.322</td>
<td>0.256</td>
<td>-0.040</td>
<td>-1.256</td>
</tr>
</tbody>
</table>

*PDI Belief Conviction Scores as a Predictor of Data Gathering Score*

The first model which incorporated the PDI Belief Conviction scores and the task method predictors was found to be significant (F (2, 39) = 29.324; MSE= 0.408; p=0.001). Likewise the second (F (2, 34) = 14.557, MSE= 0.458; p=0.001) was also statistically significant. However, the R² variance did not significantly change for model two (p= 0.682). With reference to Table 3.1, it can be seen that both PDI belief conviction scores and task method were identified as significant predictors and accounted for 56% of the variance of data.
gathering scores. Nevertheless, the interaction between belief conviction scores and task method was not significant.

Table 3.2: The Two-Way Moderated Multiple Regression Model Statistics Investigating Overall PDI Belief Conviction Scores and Task Method as Predictors of Overall Data Gathering Scores

<table>
<thead>
<tr>
<th>Model</th>
<th>Predictor</th>
<th>Beta (Unstandardized)</th>
<th>Standard Error Beta</th>
<th>Zero-order correlations</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>Constant</td>
<td>2.009</td>
<td>0.348</td>
<td>5.779**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conviction</td>
<td>-0.275</td>
<td>0.130</td>
<td>-0.371</td>
<td>-2.117*</td>
</tr>
<tr>
<td></td>
<td>Task Method</td>
<td>-1.283</td>
<td>0.221</td>
<td>-0.710</td>
<td>-5.796**</td>
</tr>
<tr>
<td>Model 2</td>
<td>Constant</td>
<td>2.011</td>
<td>0.352</td>
<td>5.714**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conviction</td>
<td>-0.439</td>
<td>0.419</td>
<td>-0.371</td>
<td>-1.049</td>
</tr>
<tr>
<td></td>
<td>Task Method</td>
<td>-1.290</td>
<td>0.225</td>
<td>-0.710</td>
<td>-5.742**</td>
</tr>
<tr>
<td></td>
<td>Conviction x</td>
<td>0.109</td>
<td>0.221</td>
<td>-0.354</td>
<td>0.413</td>
</tr>
</tbody>
</table>

With reference to Table 3.2 and Figure 3.2, it can be seen that as belief conviction scores increase, data gathering scores decrease outlining a negative correlation of -0.37.
No other significant predictors of data gathering were identified, with respect to PDI belief distress scores or PDI belief preoccupation scores.
Discussion

The results indicated that PDI belief conviction scores predicted data gathering scores when participants were instructed to complete the abstract decision making ‘beads task’ (Phillips et al., 1996). To elaborate, as belief conviction scores increased, the quantity of beads requested prior to finalising a decision reduced. In simpler terms, those that scored higher on the measure of PDI belief conviction were more prone to hastier decision making in this instance. However, it should be noted that no other discrete measure of PDI score (overall, distress or preoccupation scores) predicted data gathering behaviour. Nevertheless, the findings did indicate a general data gathering bias amongst individuals from the sub-clinical range of delusional ideation when completing the abstract decision making beads task; mirroring findings frequently observed amongst clinical and sub-clinical participants alike (Garety et al., 1999).

The results furthered the findings of the preceding study (Chapter II) that failed to identify any form of data gathering differences between high and low scorers of the PDI overall component of sub-clinical delusional thinking only. It appeared that delusional conviction in particular, may be more closely related to data gathering biases than delusional distress or preoccupation. Thus, the study supported previous literature that had identified links between delusional conviction and jumping to conclusions amongst clinical patients (Garety et al., 2005) and schizophrenia-spectrum psychosis (So, Freeman, Dunn, Kapur, Kuipers et al., 2012).

Task Methodology

It can only be tentatively concluded that the abstract nature of the beads task, may have in some way, encouraged a general data gathering bias amongst high belief conviction scorers.
Given that high PDI scorers revealed reduced probability test and verbal intelligence test scores in the initial study (Chapter II), this is a plausible explanation. The findings may also support subsequent studies that have suggested that a miscomprehension of the task instructions promotes hasty decision making (Balzan et al., 2012). The abstract nature of the beads task, together with a potential propensity for reduced skills of probability estimation and verbal comprehension, may have elicited the data gathering bias in this instance.

Whilst PDI scores did not significantly interact with task method (face to face vs. computer) to predict the quantity of information requested prior to finalising a decision, it was notable that participants requested more information when completing the abstract task via computer as opposed to face to face. This may make sense given the sample of undergraduate students that were recruited for the study. In the current technological era, information-gathering online for students is commonplace and a factor that often mediates academic success (Komissarov and Murray, 2016). The finding is noteworthy and may imply a general data gathering bias when participants are instructed to collate information via computerised systems. It appears that the method in which the task is presented to participants strongly predicts the quantity of information requested prior to finalising a decision and is therefore a vital and extremely relevant variable to investigate. Future studies will continue to observe the impact of task method upon data gathering behaviour and the emergence of the jump to conclusions bias.

**Summary**

Belief conviction scores predicted the quantity of information that was requested prior to decision formation when participants were instructed to complete the abstract decision making beads task (Phillips et al., 1966). In addition, face to face data gathering methods
yielded significantly reduced data gathering compared to computerised methods. It is not yet known whether the realistic nature of the task i.e. the emotional relevance of the task may influence data gathering behaviour and thus the propensity to jump to conclusions.
CHAPTER IV
A Study to Investigate the Impact of a Self-Referent Reasoning Task and Task Method Delivery on the Emergence of the Jump to Conclusions Bias

Introduction

Thus far in the research programme, the presence of a jump to conclusions bias had failed to materialise amongst sub-clinical samples of delusional ideation (Chapter II and III). In Chapter II, an emotional-neutral decision making task was presented to participants via computer. It was suggested that either the emotionally neutral nature of the task or method of task delivery could have been responsible for the absence of the jump to conclusions bias. Chapter III, presented participants with the abstract decision making beads task (Phillips et al., 1966) in order to determine whether the nature of the task could promote a data gathering bias. Whilst participants did not jump to conclusions per se (select fewer than two or less beads prior to decision making), a more subtle data gathering bias was detected amongst those with high conviction in their delusional ideas (Chapter III). The results somewhat supported literature that had identified the jump to conclusions bias using the abstract reasoning beads task (Baskak et al., 2015; Falcone et al., 2015; Huq et al., 1988). It was discussed that the artificial nature of the beads task i.e. the potential irrelevance in relation to every day belief formation could be responsible for the emergence the data gathering bias observed (Chapter III) rather than the probabilistic nature of task. Chapter II also included probabilistic material but failed to detect a data gathering bias despite a reduction amongst high PDI scorers on measures on probability estimation when an emotionally neutral task was presented (Chapter II).
In addition, it was found that there was a strong, general propensity for participants to request more information before decision making when the task was presented on computer compared to face to face. Nevertheless, no PDI or task method interactions were detected in this instance. In other words, decision making face to face or via computer was comparable between high and low PDI scorers of sub-clinical delusional ideation alike.

*Emotional Nature of the Decision Making Task*

Whilst previous studies in this research programme did investigate the impact of an everyday reasoning task (Chapter II), it was argued that the task itself may not have been particularly emotive or self-referent for the participants. The previous realistic task presented participants with a fictional probabilistic problem concerning the potential release of a new household appliance. It was easy to appreciate why many participants may have found this particular task unstimulating. This may have been a potential reason why the jump to conclusions bias was not observed. Indeed it has been shown that those that engage in sub-clinical delusional thinking exhibit a self-reference bias in every day reasoning (Galbraith et al., 2008) and are particularly vulnerable to data gathering biases when the content of the task is self-referent (Dudley et al., 1997b) or principally emotional (Kemp, Chua, McKenna, & David, 1997; Mujica-Parodi, Malaspina, & Sackeim, 2000). It was possible that a data gathering bias amongst those prone to delusional thinking may be detected when the emotional nature of the task is self-referent.
**Aims and Hypotheses of the Current Study**

The aim of the present study was to potentially replicate findings of studies that had detected data gathering biases using self-referent materials (Dudley et al., 1997b; Kemp et al., 1997; Mujica-Parodi et al., 2000). Furthermore, a novel reasoning task was designed to assess data gathering behaviour. The self-referent task was presented to participants either face to face or via computer technology.

It was expected that the discrete components of PDI scores i.e. PDI distress, preoccupation and conviction scores (Peters et al., 1996) would predict data gathering scores i.e. the quantity of information requested prior to forming a final decision. In line with previous studies investigating the jump to conclusions bias amongst sub-clinical participants (Linney et al., 1998), it was anticipated that PDI scores would be negatively associated with data-gathering the face to face self-referent task but not in the computerised self-referent task.

**Method**

**Participants**

An opportunity sample of 43 undergraduate Psychology students recruited from the University of Wolverhampton participated in the study between October 2013 and February 2014; of which precisely 37 were female. The age range for the study was approximately 29 years (M= 22.95 years, SD= 7.57 years).

All participants completed the Peters et al. Delusions Inventory (Peters, et al., 1996) measure of delusional ideation and a data gathering task. A total of 23 participants completed the self-referent data gathering task face to face whilst 20 participants completed the self-referent data
gathering task on computer. Participation in the investigation was conditional in exchange for participant pool credits.

Design and Analyses

Hierarchical moderated, linear multiple regression analyses were conducted to investigate if a potential two-way interaction between the predictor variables (1) overall PDI score (2) PDI distress scores (3) PDI belief preoccupation scores (4) PDI belief conviction scores and task method (face to face vs. computer) could predict overall mean data gathering scores. The distinct components of the PDI measure (Peters et al., 1996) were not entered into the same analyses, but were investigated separately and in turn. Please refer to the outline of the analysis procedure detailed in the Chapter III results section.

Materials and Procedure

Materials included a pen/pencil, an information form (Appendix 7), an informed consent sheet (Appendix 8), an end of experiment debrief form (Appendix 9). Participants were asked to complete the Peters et al. Delusions Inventory (Peters et al., 1996: Appendix 4) and a self-referent data gathering task.

The Self-Referent Probabilistic Data Gathering Task

The self-referent data gathering task presented participants with fictional comments from an imaginary survey regarding a fictional problem. The data gathering task was designed to be self-referent whereby the subject in the problem is an undergraduate student attending an
interview selection process. Participants were asked to indicate from which one of two panels of interviewers a series of comments were drawn. Interview panel one presented more favourable comments than unfavourable comments with a ratio of (60:40), whilst interview panel two presented more unfavourable comments than favourable comments (40:60). Participants were asked to request as many or as few comments as they deemed necessary in order to deduce which interview panel the comments were selected.

In the Computer condition, the task was completed via computer, keyboard and mouse using Superlab software. Task instructions (Appendix 11) were provided on paper prior to the start of the experiment. At the end of the experiment, participants were asked to indicate their chosen interview following a decision being reached. Below is an example of the task instructions:

_Hello and welcome to the experiment._

_A University student has recently completed their undergraduate degree and applied for a full time employment position with a reputable organisation._

_After completing the job application form, the individual was invited to an interview selection process with the organisation. As a candidate for the position available, the individual was required to complete a skills ability test before attending two formal interviews each in front of a panel of interviewers._

_Following the completion of the interview, the two panels of judges were asked to right down their comments regarding the candidate’s performance during the interview selection process._

_The first panel of judges from the first interview provided comments of which 60 % of the comments were positive and favourable of the candidate’s performance at interview, whilst_
the remaining 40% of overall comments were negative and unfavourable of the candidate’s performance.

However, the comments from the second panel of interviewers from the second interview revealed altogether different findings. 40% of their comments were positive and favourable of the candidate’s performance, whilst only 60% of their overall comments were negative and unfavourable of the candidate’s performance.

You are about to read a series of comments that came from only one of the two panels of judges. Each comment will express either a positive or negative aspect of the candidate’s performance at interview.

You are asked to read the comments carefully and to determine which panel of interviewers the comments were selected; Panel One or Panel Two in relation to the prospective percentage of comments that was favourable/unfavourable towards the candidate’s performance.

- **Panel One**: 60% of comments favoured the candidate’s performance whilst the remaining 40% criticised the candidate’s performance.
- **Panel Two**: 40% of comments favoured the candidate’s performance whilst the remaining 60% criticised the candidate’s performance.

You can choose to read as many/or as few comments as you wish until you feel you know which one the two panels the comments are selected. When you feel certain of your answer, please end the experiment.

**Please ask any questions to the researcher now if you do not understand the instructions for the experiment.**
In the Face to Face condition, the task was delivered face to face with the researcher and participant sitting at opposite ends of a table. Task instructions (Appendix 11) were read out verbally. Individual comments from the fictional problem were provided to participants upon the participant’s request and at the end of the experiment, participants were instructed to verbally indicate their chosen interview panel following a decision being reached. It was anticipated that the task would take 10 minutes to complete. The data gathering score derived from the number of comments requested prior to reaching a decision in the self-referent probabilistic task. The data gathering score reflected an individual’s potential susceptibility towards a jumping to conclusions bias.

Comments from the surveys were entirely fictional and were selected randomly by the researcher in the face to face condition and randomly via computerised technology. Random selection was considered to be an ecologically valid method of information gathering; no pre-sequenced comments were presented to participants in an effort to reduce the impact of order effects.

Individuals that were available and willing to participate, and had responded to the participant pool study advertisement arrived at a laboratory space at an allocated time. They were then briefed upon the nature of the investigation. The brief highlighted important ethical considerations that would apply to them as participants. Each individual was provided with an informed consent sheet and asked to read and sign the sheet carefully if willing to participate.

Participants were given 20 minutes to complete the experiment. Following completion of the investigation, participants were verbally debriefed and thanked for contributing to the study.
Results

Hierarchical moderated, linear multiple regression analyses were conducted to investigate if a potential two-way interaction between the predictor variables (1) overall PDI score (2) PDI distress scores (3) PDI belief preoccupation scores (4) PDI belief conviction scores and task method (face to face vs. computer) could predict overall mean data gathering scores.

Rate of Jumping to Conclusions

Only 2 participants jumped to conclusions and expressed a data gathering score of less than 2.

Moderator Analyses

![Figure 4.1: A simple diagram to illustrate the moderator analysis variables under investigation](image)

**Predictor**
PDI Score
Overall and each component of PDI score distinctly and in separate analyses i.e. PDI distress, preoccupation and conviction

**Moderator**
Task Method
(Face to Face vs. Computer)

**Outcome**
Data Gathering Scores
Statistical Method

A moderated, multiple regression analysis was performed using SPSS software to investigate the impact of (1) PDI Overall and (2) Task Method as single predictors on data gathering scores. A second hierarchy was added to the model that multiplied the PDI predictor (using the standardised scores) and task method predictor together to create an interaction variable PDI x Task Method. As PDI overall scores, PDI distress scores, PDI preoccupation scores and PDI conviction scores are derived from the same measure (Peters et al., 1996), they were not placed into the same moderator analyses model but were investigated distinctly.

PDI Overall Scores as a Predictor of Data Gathering Score

The first model which incorporated the PDI Overall scores and the task method predictors was found to be significant (F (2, 39) = 13.215; MSE= 0.658; p=0.001). Likewise the second (F (2, 38) = 8.705, MSE= 0.672; p=0.001) was also statistically significant. With reference to Table 4.1, it can be seen that only task method was identified as significant predictor in the model and accounted for 36% of the variance of data gathering scores. PDI overall scores did not predict data gathering scores and the interaction between PDI overall scores and task method was not significant.

However, an independent measures t-test (t (40) = 4.967; p= 0.001; r=0.62) identified highly significant differences in the quantity of information selected prior to finalising a decision face to face (M= 8.48; SD= 4.83) in comparison with computer (M= 16.42; SD= 5.53). The mean data gathering score was significantly higher for the computer condition compared to the face to face condition.
Table 4.1: The Two-Way Moderated Multiple Regression Model Statistics Investigating Overall PDI Belief Scores and Task Method as Predictors of Data Gathering Scores

<table>
<thead>
<tr>
<th>Model</th>
<th>Predictor</th>
<th>Beta (Unstandardized)</th>
<th>Standard Error Beta</th>
<th>Zero-order correlations</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 1</td>
<td>Constant</td>
<td>1.955</td>
<td>0.413</td>
<td></td>
<td>4.734**</td>
</tr>
<tr>
<td></td>
<td>PDI Overall</td>
<td>-0.149</td>
<td>0.123</td>
<td>-0.089</td>
<td>-1.213</td>
</tr>
<tr>
<td></td>
<td>Task Method</td>
<td>-1.287</td>
<td>0.253</td>
<td>-0.618</td>
<td>-5.090**</td>
</tr>
<tr>
<td>Model 2</td>
<td>Constant</td>
<td>1.917</td>
<td>0.425</td>
<td></td>
<td>4.509**</td>
</tr>
<tr>
<td></td>
<td>PDI Overall</td>
<td>0.032</td>
<td>0.406</td>
<td>-0.089</td>
<td>0.078</td>
</tr>
<tr>
<td></td>
<td>Task Method</td>
<td>-1.266</td>
<td>0.259</td>
<td>-0.618</td>
<td>-4.883**</td>
</tr>
<tr>
<td></td>
<td>PDI Overall x Task Method</td>
<td>-0.116</td>
<td>0.249</td>
<td>-0.136</td>
<td>-0.467</td>
</tr>
</tbody>
</table>

Note: adjusted R²= 0.36 for Model 1; adjusted R²= 0.47 for Model 2 (** p <0.001; * p< 0.05).

PDI Belief Preoccupation Scores as a Predictor of Data Gathering Score

The first model, that incorporated the PDI Preoccupation scores and the task method predictors, was found to be significant (F (2, 39) = 12.953; MSE= 0.664; p=0.001). Likewise the second model (F (3, 38) = 13.005, MSE= 0.559; p=0.001) was also statistically significant. In addition, the R² variance did significantly change for model two (p= 0.007).

With reference to Table 4.1, it can be seen that PDI belief preoccupation scores and task method were identified as significant predictors and accounted for 36.8% of the variance of data gathering scores. In addition, the interaction between belief preoccupation scores and
task method was also significant (p=0.007) and increased the percentage that the predictors predicted data gathering scores to 46.8% (Figure 4.2).

\textit{Table 4.2: The Two-Way Moderated Multiple Regression Model Statistics Investigating Overall PDI Belief Preoccupation Scores and Task Method as Predictors of Overall Data Gathering Scores}

<table>
<thead>
<tr>
<th>Model</th>
<th>Predictor</th>
<th>Beta (Unstandardized)</th>
<th>Standard Error Beta</th>
<th>Zero-order Correlations</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>Constant</td>
<td>1.973</td>
<td>0.419</td>
<td></td>
<td>4.712**</td>
</tr>
<tr>
<td></td>
<td>Preoccupation</td>
<td>0.839</td>
<td>0.349</td>
<td>-0.009</td>
<td>2.400*</td>
</tr>
<tr>
<td></td>
<td>Task Method</td>
<td>-1.311</td>
<td>0.258</td>
<td>-0.618</td>
<td>-5.089**</td>
</tr>
<tr>
<td>Model 2</td>
<td>Constant</td>
<td>1.815</td>
<td>0.388</td>
<td></td>
<td>4.674**</td>
</tr>
<tr>
<td></td>
<td>Preoccupation</td>
<td>-0.121</td>
<td>0.113</td>
<td>-0.009</td>
<td>-1.071*</td>
</tr>
<tr>
<td></td>
<td>Task Method</td>
<td>-1.311</td>
<td>0.258</td>
<td>-0.618</td>
<td>-5.278**</td>
</tr>
<tr>
<td></td>
<td>Preoccupation x Task Method</td>
<td>-0.606</td>
<td>0.211</td>
<td>-0.121</td>
<td>-2.877*</td>
</tr>
</tbody>
</table>

Note: adjusted $R^2= 0.37$ for Model 1; adjusted $R^2= 0.47$ for Model 2 (** $p < 0.001$; * $p < 0.05$).

The significant negative correlation between PDI preoccupation scores and data gathering scores was negligible ($r= -0.009$) as shown in Table 4.2. With reference to Table 4.2 and Figure 4.2; a significant two-way interaction was identified between PDI belief preoccupation scores and task method.
Figure 4.2: The Significant Two-Way Interaction between PDI Belief Preoccupation Scores and Task Method

When participants completed the self-referent task face to face a significant moderate positive correlation was identified ($r = 0.29$). As PDI preoccupation scores increased, data gathering scores also increased. Conversely, when participants completed the task via computer a significant negative correlation was identified ($r = 0.57$). Interestingly, as PDI preoccupation scores increased, data gathering scores decreased. No significant findings were detected with regard to PDI belief distress and conviction scores.
Discussion

Once again, there was no evidence of a jump to conclusions bias amongst participants vulnerable to delusional thinking; only two participants essentially jumped to conclusions and decided after the first bead drawn. Nevertheless, general data gathering differences were identified.

Content of Task and Task Delivery

The results identified a significant interaction between PDI belief preoccupation scores and task method when participants were asked to complete a self-referent but probabilistic reasoning task. When participants completed the task face to face, preoccupation was positively related to data-gathering. This finding is somewhat surprising and conflicts with the hypotheses and studies that have identified a tendency to jump to conclusions when emotionally salient materials are used (Dudley et al., 1997b). It is also surprising that participants reacted this way in the face to face condition, given that the jump to conclusions bias has been so frequently observed when tasks have been presented this way (Baskak et al., 2015; Huq et al., 1988). And interestingly, there was a general propensity to collect less information prior to decision making on computer, and more information face to face when self-referent materials were used. This conflicts with findings of the previous study that identified the reverse with an abstract decision making task (Chapter III).

Conversely, when the self-referent task was completed on computer preoccupation was negatively related to data-gathering, somewhat supporting the hypotheses. In simpler terms, it appeared that those prone to delusional thinking were vulnerable to a general data gathering bias when the self-referent task was completed on computer. The strong negative correlation
implies that this may a robust finding. The findings are somewhat surprising as no data
gathering differences were identified in tasks completed via computer in previous studies
(Chapter II and Chapter III). Nevertheless, they do indicate that task delivery may influence
the emergence of a data gathering bias amongst individuals scoring highly on measures of
sub-clinical delusional belief preoccupation when a self-referent task is presented.
It appears that the dimensions of sub-clinical ideation may have different relationships with
data gathering behaviour. Whilst the previous study (Chapter II) identified a data gathering
bias amongst delusion conviction and the abstract beads task, the present study identified
links between delusion preoccupation and self-referent materials. Simplifying delusional
belief to an overall score, which ignores the distinct dimensions of the measure, may miss
important effects that may be prevalent, should the dimensions be studied distinctly. In
addition, the findings imply that the type of task and the method of task delivery may promote
the emergence of a data gathering bias amongst those prone to sub-clinical delusional
thinking.
Thus far, data gathering biases have been detected amongst the components of the PDI
measure (Peters et al., 1996) when participants have completed an abstract decision making
task (Chapter III) and a self-referent reasoning task (albeit under specific task delivery
methods). No data gathering biases were identified when participants completed an
emotionally neutral decision making task (Chapter II). However, the types of tasks presented
to participants have yet to be compared directly. Future investigation will attempt to increase
power and investigate the jump to conclusions bias amongst sub-clinical participants.
Initially, studies will also compare data gathering behaviour amongst participants presented
with neutral and self-referent decision making tasks i.e. the realistically framed measures in
the research programme before comparing directly with the abstract reasoning beads task
(Phillips et al., 1966).
Summary

It appears that the dimensions of sub-clinical ideation may have different relationships with data gathering behaviour. Sub-clinical delusional preoccupation and the form of task delivery appeared to predict data gathering with self-referent material presented via computer technology. In contradiction with the previous study, participants demonstrated a general propensity to request more information prior to decision making when completing the task face to face compared to computerised delivery. Future investigation would attempt to compare data gathering between and emotionally-neutral and self-referent reasoning tasks.
CHAPTER V

A Study to Investigate the Impact of Task Content on the Emergence of the Jump to Conclusions Bias

Introduction

Previous studies had shown that the content of a task presented to participants can influence the quantity of information requested prior to decision making (Chapter II, III and IV). In Chapter II, an emotionally-neutral task failed to elicit a jump to conclusions bias amongst individuals prone to delusional thinking. In Chapter III, an abstract task and probabilistic task were presented to participants. As expected, belief conviction predicted the quantity of information requested. Those scoring higher on measures of sub-clinical delusional ideation demonstrated a data gathering bias when completing the beads task (Phillips et al., 1966). Subsequently, Chapter IV illustrated that belief preoccupation could predict data gathering behaviour when the task was self-referent in content and presented on computer. It appeared that the type of task and method of task delivery predicted data gathering amongst those prone to delusional thinking. Nevertheless, in all three studies there was no clear evidence of a jump to conclusions bias. It had been discussed that findings could have been influenced by low statistical power and/or a general lack of jumping to conclusions amongst non-pathological samples (Dudley et al., 2014).

Aims and Hypotheses of the Current Study

Whilst the presence of a data gathering bias with the use of the abstract beads task (Phillip et al., 1966) is well documented (Fine et al., 2007), the novel emotionally-neutral and self-referent tasks required further investigation. It was the aim of the present study to increase
statistical power and observe data gathering amongst individuals prone to delusional thinking when completing the two aforementioned tasks on computer only. It was expected that PDI scores (or any of the subscales) would not predict data gathering scores when a neutral decision making task was presented; mirroring the findings presented in Chapter II. However, it was anticipated that PDI scores, specifically PDI preoccupation scores, would be negatively correlated with data gathering scores for the emotional and self-referent task thus replicating findings outlined in Chapter IV.

**Method**

**Participants**

An opportunity sample of 99 undergraduate Psychology students recruited from the University of Wolverhampton participated in the study in November 2015; of which approximately 75 were female. There were 12 incomplete datasets. However, they were still included in subsequent analyses. The age range for the study was approximately 26 years (M= 22.63 years, SD= 6.06 years). All participants completed the Peters et al. Delusions Inventory (Peters, et al., 1996) measure of delusional ideation and two versions of a computerised decision making task.

**Materials**

Materials included an information form (Appendix 12), an informed consent sheet (Appendix 13), an end of experiment debrief form (Appendix 14), all of which were displayed online on computer. Participants were asked to complete the Peters et al Delusions
Inventory (Peters et al., 1996: Appendix 4) and the self-referent task as used in Chapter IV (Appendix 11) and an emotionally-neutral decision making task as implemented in Chapter II (Appendix 5.1). It should be noted that both decision making tasks included an evaluation of probabilistic ratios. Both tasks were completed on computer using online survey software.

*Design and Analyses*

Two linear regression analyses were used to determine potential correlations between each of the PDI measure components upon data gathering scores for the (1) neutral decision making task and (2) the self-referent reasoning task. Each PDI (Peters et al., 1996) component i.e. distress, preoccupation and conviction scores were analysed separately and in turn.

*Procedure*

Individuals that were available and willing to participate arrived at a laboratory space at an allocated time. They were then briefed upon the nature of the investigation online. The brief highlighted important ethical considerations that would apply to them as participants. Participants were provided with the opportunity to provide informed consent. The participants were then asked to complete the Peters et al. Delusions Inventory (Peters et al., 1996) and two decision making tasks. Participants were kindly asked to read instructions for each questionnaire/ task carefully and to complete the measures in the order in which they were displayed on screen. Participants were provided with the opportunity to ask questions before commencing with the study. Participants were given 30 minutes to complete the experiment. Following completion of the investigation, participants were verbally debriefed and thanked for contributing to the study.
**Results**

**Rate of Jumping to Conclusions**

Numerous participants jumped to conclusions i.e. requested 2 or fewer pieces of information prior to decision making. Approximately 28 participants jumped to conclusions when completing the emotionally neutral decision making task and 24 participants jumped to conclusions when completing the self-referent reasoning task. Nevertheless, a one-way independent groups ANOVA did not reveal significant differences in PDI score between those that did and did not JTC on either task (t (86)= 0.118; p= 0.906). Mean PDI scores were similar for those who jumped to conclusions (M= 7.21; SD= 3.73) compared to those who did not (M= 7.31; SD= 3.62).

**Neutral Task and PDI Scores**

A linear regression analysis was performed to investigate PDI overall scores as a predictor of data gathering scores in the neutral decision making task. The model was significant (F (1, 99) = 5.078; MSE= 8.424; p=0.026) but accounted for only 0.04% of the variance of data gathering scores. A significant positive correlation was identified; as PDI scores increased, so did the quantity of data request prior to decision making (r=0.22; β= 0.026). Likewise, belief preoccupation scores also significantly predicted data gathering scores (F (1, 99) = 3.759; MSE= 16.040; p=0.055). Once again, as PDI belief preoccupation increased, data gathering scores also increased (r=0.19; β= 0.074). In addition, belief conviction scores demonstrated the same pattern and predicted data gathering scores (F (1, 99) = 6.988; MSE= 15.552; p=0.010). With reference to Figure 5.1, it can be seen that as belief conviction scores
increase, so do data gathering scores on the neutral decision making task ($r = 0.26; \beta = 0.077$).

No significant correlation was identified for belief distress scores and data gathering scores.

![Figure 5.1: The Significant Positive Correlation between Mean Data Gathering Scores and PDI Conviction Scores completing the neutral decision making task](image)

**Emotional Self-referent Task and PDI Scores**

A linear regression analysis was performed to investigate PDI overall scores as a predictor of data gathering scores in the emotional and self-referent decision making task. The model was significant ($F (1, 99) = 4.543; \text{MSE}= 24.996; \ p=0.036$) but accounted for only $0.03\%$ of the variance of data gathering scores. A significant positive correlation was identified: as PDI
scores increased, so did the quantity of data request prior to decision making ($r=0.21; \beta=0.030$). Likewise, belief conviction scores also significantly predicted data gathering scores ($F(1, 99) = 5.791; \text{MSE}= 24.699; p=0.018$). Once again, as PDI belief conviction scores increased, data gathering scores also increased ($r=0.26; \beta=0.088$). Significant correlations were not identified for belief distress scores or belief preoccupation scores. With reference to Figure 5.2, it can be seen that as belief conviction scores increase, so do data gathering scores on the emotional and self-referent decision making task.

Figure 5.2: The Significant Positive Correlation between Mean Data Gathering Scores and PDI Conviction Scores completing the Self-Referent Decision Making Task
**Discussion**

The study investigated the jump to conclusions bias amongst a sub-clinical sample completing an emotionally-neutral and a self-referent decision making task on computer. Interestingly, 28 participants jumped to conclusions and revealed a data gathering score of ≤ 2 units of information. This was in stark contrast to previous studies (Chapter II, III and IV) whereby less than 10 participants displayed the bias. Nevertheless, whilst the bias was present there did not appear to be any differences on measures of sub-clinical delusional thinking between those did and did not jump to conclusions. This conflicted with research that had identified the jumped to conclusions bias amongst sub-clinical samples (Orenes et al., 2012; Zawadzski et al., 2012). However, the findings supported suggestions that the jump to conclusions bias may not be prevalent amongst non-pathological samples (Dudley et al., 2014), as those scoring low on the trait were also prone to the bias. It was not clear why there was such an increase in the presence of the bias in this experiment in comparison with previous studies in the research programme. It was possible that participants may have felt more hurried in their decision making as the experiment was completed in mass groups of around 40 participants per computer session, with participants only allowed to leave the room once all participants had completed the experiment. This explanation is a plausible one and can be supported by literature that has suggested that participants are more likely to jump to conclusions if they feel particularly rushed or hurried in their decision making (White et al., 2009).
Task Content: Emotionally Neutral vs. Self-Referent Tasks

As previously outlined, the emotionally-neutral task designed in Chapter II did not yield significant differences in the quantity of data gathered prior to decision making between high and low scorers of sub-clinical delusional ideation (Peters et al., 1996). However, in Chapter IV, increased belief preoccupation scores correlated with reduced data gathering scores when a self-referent task was completed on computer. The results of the present study conflict with previous findings and the hypotheses; data gathering was enhanced during the emotionally-neutral task amongst those scoring particularly high on measures PDI preoccupation and conviction. In addition, a similar trend was observed for the self-referent reasoning task, with high PDI belief conviction scorers requesting more information prior to decision making. The findings somewhat conflict with the results of the previous study (Chapter IV); that identified the reverse with high scorers of PDI belief preoccupation. The results somewhat conflict with literature that had identified an increased propensity to jump to conclusions when delusion prone individuals are presented with emotionally-salient materials (Dudley et al., 1997b). Nevertheless, it appears that the delusional belief is multi-dimensional (Peters et al., 1996) and that the discrete sub-scales of the PDI measure do predict data gathering behaviour very differently, in different scenarios and conditions. In particular, belief conviction scores appear to be sensitive to changes in task. In Chapter III, information gathering was strongly, and negatively, associated with belief conviction scores when an abstract task was presented. However, the introduction of a neutral and/or self-referent task appeared to reverse this correlation. In a sense, this is a plausible finding. Those who hold strong convictions in their beliefs may seek more information in order to strengthen their conviction when the situation is realistic and self-relevant.
However, the findings regarding belief preoccupation scores are mixed, with the preceding study highlighting a negative correlation between belief preoccupation scores and information gathering. Yet once again we see distinct information gathering differences between the components of the PDI measure and contrasting information-gathering tasks. It is an intention of the research programme to investigate data gathering using life-like reasoning dilemmas. As previously discussed, current methodologies continue to fail to provide the opportunity for individuals to gather data for the purpose of developing a belief or viewpoint and almost always include an evaluation of probabilistic ratios; a factor that could potentially increase the perceived demands of the task.

The importance of investigating real-life decision making dilemmas has been recognised (Galbraith et al., 2008; Galotti et al., 2006; Weinstock, 2009; Weinstock and Flaton, 2004). Such studies emphasise the importance of understanding the forms of thinking people implement when considering argument and/or debate in the everyday context. It was therefore necessary to investigate the jump to conclusions bias amongst more real-life decision making tasks that may differ in content i.e. emotionally-neutral vs. self-referent but present an opportunity for the participants to develop an opinion or viewpoint.

**Summary**

The study compared data gathering amongst participants completing an emotionally-neutral and self-referent reasoning task on computer. A neutral and/or self-referent reasoning task appeared to promote data gathering amongst those scoring highly on belief conviction, eliminating the data gathering bias observed when presented with the abstract beads task (Chapter II). It was concluded that information gathering should be observed amongst tasks that promote individuals to generate a genuine view-point or perspective in further study.
CHAPTER VI A

A Study Investigating the Impact of Task Content upon the Prevalence of the Jump to Conclusions Bias

Introduction

Thus far, the emergence of the jump to conclusions bias amongst sub-clinical samples of delusional ideation has been scarce. Insofar, that only one study of four provided clear evidence of the jump to conclusions bias (Chapter IV). The previous studies had investigated numerous reasons for this including the type of task presented to participants as well as the method of task delivery. As well as considering the possibility that the bias may not be quite as profound amongst non-pathological samples as previous literature had implied (Orenes et al., 2012; Zawadzki et al., 2012), thus supporting propositions outlined by current cognitive psychologists (Dudley et al., 2014).

Aims and Hypotheses of the Present Study

The current study aimed to once again observe the potential emergence of the jump to conclusions bias amongst a sub-clinical sample of delusion proneness. Should a data gathering bias be detected, it was predicted that increased PDI scores would be negatively associated with data gathering scores, as previously detected in Chapter III. It was also anticipated that there would be discrete differences amongst the sub-scales of the PDI measure; with PDI conviction scores negatively correlating with data gathering scores amongst the abstract decision making task (Chapter III) but positively associated with data gathering scores for the self-referent and neutral decision making tasks, replicating the findings of Chapter V. Previous findings regarding PDI preoccupation scores have been
mixed i.e. negative correlations identified in Chapter IV but positive correlations with data gathering scores identified in Chapter V. The current study intended to investigate the relationship between PDI preoccupation and data scores further and thus predicted that a significant correlation would be evident. However, it remained to be seen whether the results would support the conflicting findings reported in Chapter IV or Chapter V.

*Task Version (Abstract vs. Realistic Self-Referent vs. Realistic Neutral)*

Subsequent studies had also demonstrated that the quantity of information requested prior to decision making was sensitive to the type of task presented to the participants. Data gathering biases did not seem to materialise when the content of the task was probabilistic and neutral in nature (Chapter II and Chapter V). However, when the beads task (Phillips et al., 1966) was presented to participants, a general data gathering bias appeared to emerge: participants higher on the scale of delusion proneness, specifically belief conviction, requested less information prior to decision making in this instance (Chapter III). When a self-referent task was implemented, similar findings were observed (Chapter IV): participants scoring higher on measures of sub-clinical belief preoccupation also demonstrated this bias. However, findings reported in Chapter V did not confirm previous conclusions and did not detect a general data gathering bias for the neutral task. In fact, those scoring highly on delusional conviction and preoccupation requested more information when the content of the task was self-referent. The findings conflict with previous research that has identified a jump to conclusions bias when using emotional and self-referent materials (Dudley et al., 1997b). However, it was noted that the tasks used still included probabilistic ratios, and in this manner, may still be considered different from everyday dilemmas. It was the aim of the present study to (1) not only compare all three tasks but to (2) present participants with
dilemmas that would present them with the opportunity to gather information for the purpose of generating a genuine point of view or perspective.

It was hypothesised that the increased realistic nature of the tasks may eliminate the data gathering biases previously observed. As previously detected in Chapter II, whereby participants revealed reduced scores in probability reasoning, tasks that present probabilistic ratios may increase cognitive demands and may be perceived as potentially stressful to participants. It was therefore predicted that in the abstract beads task (Phillips et al., 1966) data gathering scores would be negatively related with PDI scores, specifically belief conviction scores and, in the realistic tasks (both self-referent and neutral), PDI conviction scores in particular would be positively related to data gathering scores; thus eliminating a data gathering bias.

Method

Participants

An opportunity sample of 106 undergraduate Psychology students recruited from the University of Wolverhampton participated in the study in August-December 2015; of which approximately 90 were female. The age range for the study was approximately 41 years (M= 25.99 years, SD= 9.87 years). All participants completed the Peters et al. Delusions Inventory (Peters, et al., 1996) measure of delusional ideation and only one version of three computerised decision making tasks online.
Materials

Materials included an information form (Appendix 15), an informed consent sheet (Appendix 16), an end of experiment debrief form (Appendix 17), all of which were displayed online on computer. Participants were asked to complete the Peters et al Delusions Inventory (Peters et al., 1996: Appendix 4) and either an adapted self-referent (Appendix 18), emotionally neutral decision making task (Appendix 19) or abstract decision making task (the beads task; Phillips et al. 1966; Appendix 10a). It should be noted that only the abstract decision making task included an evaluation of probabilistic ratios. The self-referent and neutral tasks were adapted in order to present the participants with the opportunity to generate a point of view. All tasks were completed online using survey software.

The Realistic Self-Referent Reasoning Task

Unlike previous versions of the self-referent task, the present task presented participants with a fictional dilemma and instructed participants to gather information for the purpose of generating a point of view.

Example of the Perspective Self – Referent Reasoning Task

Hello and welcome to the experiment.

A University student has recently completed their undergraduate degree and applied for a full time employment position with a reputable organisation.

After completing the job application form, the individual was invited to an interview selection process with the organisation. As a candidate for the position available, the
individual was required to complete a skills ability test before attending a formal interview in front of a panel of interviewers.

Following the completion of the interview, the panel of judges were asked to write down their comments regarding the candidate’s performance during the interview selection process.

You will now be given the opportunity to read a selection of the comments the interviewers provided following the candidate’s interview. You are asked to read the comments carefully and to determine whether or not you feel the candidate should be offered the position available with the organisation.

You can choose to read as many/ or as few participants comments as you wish. When you feel you have confidently decided whether or not you feel the candidate should be offered the position, please end the experiment.

Please ask any questions to the researcher now if you do not understand the instructions for the experiment.

Thank you

The Perspective Neutral Reasoning Task

Example of the Perspective Neutral Reasoning Task

A competitive business has been developing an all new modern vacuum cleaner designed to reduce manual effort.

An independent survey was conducted to assess the popularity of the product for public release. Beforehand, participants had received a detailed written description of the vacuum, along with a 15 minute demonstration.

Participants were then asked to decide if they were in favour of or against the release of the vacuum cleaner for public purchase. Each participant was instructed to state whether they
were for or against the vacuum cleaner being made publicly available and to give a genuine reason for their viewpoint.

You will now be given the opportunity to read a selection of the participants’ comments provided in the survey. You are asked to read the comments carefully and to determine the viewpoint you agree with most: for or against the release of the vacuum cleaner.

You can choose to read as many/ or as little participants comments as you wish. When you feel you confidently know which viewpoint you agree with most, terminate the experiment.

All tasks were completed on computer using online survey software.

Design and Analyses

Hierarchical moderated, linear multiple regression analyses were conducted to investigate if a potential two-way interaction between the predictor variables (1) overall PDI score (2) PDI distress scores (3) PDI belief preoccupation scores (4) PDI belief conviction scores and task version (abstract vs. realistic self-referent vs. realistic neutral) could predict overall mean data gathering scores. As with previous studies, the components of the PDI measure (Peters et al., 1996) were entered into separate analyses and were investigated in turn.

Procedure

Individuals that were available and willing to participate were briefed upon the nature of the investigation online. The brief highlighted important ethical considerations that would apply to them as participants. Participants were provided with the opportunity to provide informed consent.
The participants were then asked to complete the Peters et al. Delusions Inventory (Peters et al., 1996) and one of three decision making tasks. Participants were kindly asked to read instructions for each questionnaire/task carefully and to complete the measures in the order in which they were displayed on screen. Participants were provided with the opportunity to ask questions before commencing with the study. Participants were given 30 minutes to complete the experiment. Following completion of the investigation, participants were debriefed and thanked for contributing to the study.

**Results**

*Rate of Jumping to Conclusions*

Numerous participants jumped to conclusions i.e. requested 2 or fewer pieces of information prior to decision making. Approximately 29 participants jumped to conclusions. Interestingly, 22 participants jumped to conclusions when completing the abstract decision making task, 5 jumped to conclusions completing the self-referent task and 2 jumped to conclusions completing the neutral decision making task. As the data was skewed and did not approximate a normal distribution, a Mann-Whitney U Test was performed to determine if there were significant differences in overall PDI scores between those that did and did not jump to conclusions. The results were significant (U (N1=29:N2=77) = 384.5; p=0.001). Mean PDI scores were lower in those that jumped to conclusions (M= 26.93; SD= 45.74) compared to those that did not (M= 81.87; SD= 52.54).
**Moderator Analyses**

Hierarchical moderated, linear multiple regression analyses were conducted to investigate if a potential two-way interaction between the predictor variables (1) overall PDI score (2) PDI distress scores (3) PDI belief preoccupation scores (4) PDI belief conviction scores and task version (abstract vs. realistic self-referent vs. realistic neutral) could predict overall mean data gathering scores.

![Diagram](image)

**Figure 6.1: A simple diagram to illustrate the moderator analyses under investigation**

**Statistical Method**

The standardized scores for PDI overall, PDI distress, preoccupation and conviction scores were calculated. In addition, the standardized score for the criterion variable of data gathering score was also calculated. Task version, given the three levels, was dummy coded into three
distinct variables i.e. self-referent vs. abstract and neutral, neutral vs. abstract and self-referent and abstract vs. neutral and self-referent. Secondly, interaction variables were computed by multiplying the task version variables with the standardized PDI scores. A hierarchal moderated multiple regression analyses then performed. For the first analyses, the standardized PDI overall scores, and the distinct task version levels were entered into the model. The interaction variables were also then entered into model two. To investigate PDI distress scores, the process was replicated respectively.

**PDI Overall Scores as a Predictor of Data Gathering Score**

The first model, that incorporated the PDI overall scores and the task version predictors, was found to be non-significant (F (2, 71) = 2.125; MSE= 0.957; p=0.127). Likewise the second model (F (3, 70) = 1.443, MSE= 0.969; p=0.238) was also statistically non-significant. With reference to Table 6.1, it can be seen that PDI overall scores were a significant predictor in the model (p= 0.043) but differences in task version (self-referent vs. neutral and abstract) were not identified as significant predictors of data gathering scores. In addition, the interactions between overall PDI scores and task version were not significant. A subsequent linear regression analyses between overall PDI scores and data gathering scores were none significant (F (1, 104) = 0.538; MSE= 0.985; p=0.465).

**PDI Belief Preoccupation Scores as a Predictor of Data Gathering Score**

The first model, that incorporated the PDI preoccupation scores and the task method predictors, was found to be significant (F (2, 71) = 29.159; MSE= 0.678; p=0.001). Likewise the second model (F (3, 70) = 13.183, MSE= 0.688; p=0.001) was also statistically
significant. In addition, the $R^2$ variance did significantly changed for model two ($p= 0.001$).

With reference to Table 6.1, it can be seen that PDI belief preoccupation scores and task version (self-referent and neutral vs. abstract) were identified as significant predictors and accounted for 42.7% of the variance of data gathering scores. However, no significant interactions between belief preoccupation scores and task version were detected.

**Table 6.1: The Two-Way Moderated Multiple Regression Model Statistics Investigating Overall PDI Belief Preoccupation Scores and Task Version as Predictors of Overall Data Gathering Scores**

<table>
<thead>
<tr>
<th>Model</th>
<th>Predictor</th>
<th>Beta (Unstandardized)</th>
<th>Standard Error Beta</th>
<th>Zero-order correlations</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>Constant</td>
<td>0.647</td>
<td>0.131</td>
<td>0.001**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PDI Preoccupation</td>
<td>0.220</td>
<td>0.104</td>
<td>0.439</td>
<td>2.104*</td>
</tr>
<tr>
<td></td>
<td>Self-Referent vs Abstract and Neutral</td>
<td>-1.235</td>
<td>0.210</td>
<td>-6.466</td>
<td>-5.872**</td>
</tr>
</tbody>
</table>

| Model 2   | Constant                                       | 0.646                  | 0.133               | 4.953**                 |       |
|           | PDI Preoccupation                              | 0.226                  | 0.131               | 0.429                   | 1.724 |
|           | Self-Referent vs Abstract and Neutral          | -1.241                 | 0.222               | -0.646                  | 4.866**|
|           | PDI Preoccupation x Task Version (as above)   | -0.017                 | 0.220               | 0.398                   | -0.076|

Note adjusted $R^2= 0.44$ for Model 1; adjusted $R^2= 0.43$ for Model 2 (** $p <0.001$; * $p < 0.05$). All other variables and interaction variables were automatically excluded during analysis.
With reference to the Table 6.1, it can be seen that as PDI preoccupation scores increased, data gathering scores also increased \((r = 0.44)\). This trend was also found for belief conviction scores \((p = 0.023; r = 0.44; \beta = 0.231)\). In addition, with reference to Figure 6.2, a subsequent one-way ANOVA revealed that mean data gathering scores were significantly greater when participants were completing the realistically, framed self-referent reasoning task \((M = 13.90; \ SD = 7.34)\) compared to the abstract \((M = 3.42; \ SD = 4.51)\) and neutral \((M = 7.62; \ SD = 5.37)\) tasks \((F(2, 103) = 28.717; \ MSE = 35.953; p = 0.001; \eta^2_p = 0.662)\). However, none of the components of PDI score interacted with task version in the regression models.

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**Figure 6.2: The Significant Difference in Mean Data Gathering Score between Decision Making Tasks**
**Discussion**

The study aimed to compare the quantity of information requested prior to decision making amongst the sub-clinical delusional ideation sample presented with either an abstract, self-referent or neutral decision making task. Unlike previous experiments, the self-referent and neutral tasks did not contain probabilistic ratios and presented participants with a dilemma that would encourage participants to generate a point of view.

Twenty-nine participants jumped to conclusions, with the majority jumping to conclusions on the abstract beads task (Phillips et al., 1966). The finding is noteworthy and may support earlier discussions in the Introduction that elements of the task may promote hasty decision making. However, the tendency to jump to conclusions was not exclusive to high PDI scorers, conflicting with previous findings that have shown that increased delusion proneness is associated with an increased propensity to jump to conclusions (Huq et al., 1988; Orenes et al., 2012; Zawadzski et al., 2012).

Two-way moderated multiple regression analyses failed to identify significant *interactions* between the type of task presented and components of PDI score upon data gathering behaviour. It is possible, that the elimination of probabilistic ratios included in the task instructions, prevented task-related data gathering biases. In this instance, surprisingly, as PDI preoccupation and conviction scores increased, so did the quantity of information requested prior to decision making, thus mirroring the results of Chapter V. It appears that the adapted decision making tasks, that required participants to select information in order to form a more-realistic viewpoint, may have eliminated the propensity for hastier decision making amongst higher scorers on measures of sub-clinical delusional thinking. In addition, there was a general tendency for all participants, irrespective of PDI score, to request more information before deciding on the realistic and self-referent decision making task. This
finding may indicate that the emotional relevance of a task is important to the quantity of information that will be requested prior to decision making.

The findings implied that the type of task presented to participants within the sub-clinical range of delusion proneness was particularly influential to the quantity of information requested prior to decision making.
CHAPTER VI B

A Study Investigating the Impact of Task Delivery upon the Prevalence of the Jump to Conclusions Bias

Introduction

Chapter VI A failed to detect a data gathering bias amongst participants completing the abstract beads task (Phillips et al., 1966) when completed online, using online survey software. Whilst previous studies did not detect a difference in information gathering between computerised and face to face delivery (Chapter III), it has been consistently demonstrated that participants, generally, are more likely to request more units of information when the task in present via computer (Chapter III and IV).

Aims and Hypotheses of Present Study

The core aim of the present study was to determine if a jump to conclusions bias, or general data gathering bias, emerged when participants completed the abstract reasoning beads task (Phillip et al., 1966), face to face with a researcher. It was predicted that the results would mirror the wealth of literature that has identified a data gathering bias using this task (Huq et al., 1988) i.e. as scores of the components of PDI increase, the quantity of information requested prior to a final decision would decrease.
Method

Participants

An opportunity sample of 101 undergraduate Psychology students recruited from the University of Wolverhampton participated in the study in November 2015; of which approximately 75 were female. The age range for the study was approximately 45 years (M= 20.84 years, SD= 8.46 years). All participants completed the Peters et al Delusions Inventory (Peters, et al., 1996) measure of delusional ideation and the abstract reasoning beads task face to face with a researcher.

Materials

Materials included an information form (Appendix 15), an informed consent sheet (Appendix 16), an end of experiment debrief form (Appendix 17), all of which were displayed online on computer. Participants were asked to complete the Peters et al. Delusions Inventory (Peters et al., 1996: Appendix 4) and the abstract reasoning beads task face to face (refer to Appendix 10a for task instructions). It should be noted that the abstract decision making task included an evaluation of probabilistic ratios. The task was delivered face to face with the researcher and participant sitting at opposite ends of a table. Task instructions (Appendix 10a) were read out verbally. Individual beads were provided to participants upon the participant’s request and at the end of the experiment, participants were instructed to verbally indicate their chosen jar following a decision being reached.
Design and Analyses

Multiple linear regression analyses were conducted to determine if overall PDI scores, PDI distress, PDI preoccupation and PDI conviction scores could predict data gathering scores when the abstract decision making beads task was presented to participants face to face. Once again, the components of the PDI measure were studied distinctly.

Procedure

Individuals that were available and willing to participate, and had responded to the participant pool study advertisement, arrived at a laboratory space at an allocated time. They were then briefed upon the nature of the investigation. The brief highlighted important ethical considerations that would apply to them as participants. Each individual was provided with an informed consent sheet and asked to read and sign the sheet carefully if willing to participate.

The participants were then asked to complete the Peters et al. Delusions Inventory (Peters et al., 1996) and a data gathering task in a randomised order; counterbalancing techniques were employed in the investigation.

The decision making task was delivered face to face with the researcher and participant sitting at opposite ends of a table. Task instructions were read out verbally by the researcher. Individual beads were provided to participants, upon the participant’s request and subsequently replaced back into the jar of beads. At the end of the study, participants were instructed to verbally indicate their chosen option following a decision being reached. The researcher recorded the number of beads requested by the participant prior to the final decision.
Participants were given 20 minutes to complete the experiment. Following completion of the investigation, participants were verbally debriefed and thanked for contributing to the study.

**Results**

*Rate of Jumping to Conclusions*

Only 8 participants jumped to conclusions. An independent measures t-test failed to identify significant differences in PDI scores between those that did and did not jump to conclusions (t (87) = 0.396; p= 0.693).

*Regression Analyses*

A simple linear regression analysis was conducted to determine if overall PDI scores could predict data gathering scores when the abstract decision making beads task was presented to participants face to face. The regression model was significant (F (1, 99) = 12.386; MSE=93693.143; p=0.001). A significant negative correlation was evident (r= -0.33; β = -3.074). As PDI overall scores increased, data gathering scores decreased. The model accounted for 10% of the variance in the data gathering scores.

*PDI Scores as a Predictor of Data Gathering Score*

The model, that incorporated the components of PDI scores as predictors, was found to be significant (F (3, 97) = 6.346; MSE= 89937.481; p=0.001). With reference to Table 6.2, it can be seen that overall PDI scores and belief preoccupation scores were identified as significant predictors and accounted for 13.8% of the variance of data gathering scores.
**Table 6.2: The Multiple Regression Model Statistics Investigating Components of PDI scores as Predictors of Overall Data Gathering Scores**

<table>
<thead>
<tr>
<th>Model</th>
<th>Predictor</th>
<th>Beta (Unstandardized)</th>
<th>Standard Error Beta</th>
<th>Zero-order correlations</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>Constant</td>
<td>320.756</td>
<td>55.50</td>
<td></td>
<td>5.779**</td>
</tr>
<tr>
<td></td>
<td>PDI Distress</td>
<td>-2.328</td>
<td>4.074</td>
<td>-0.300</td>
<td>-0.571</td>
</tr>
<tr>
<td></td>
<td>PDI Preoccupation</td>
<td>13.647</td>
<td>7.345</td>
<td>-0.269</td>
<td>1.858</td>
</tr>
<tr>
<td></td>
<td>PDI Conviction</td>
<td>-16.574</td>
<td>5.728</td>
<td>-0.366</td>
<td>-2.893*</td>
</tr>
</tbody>
</table>

Note adjusted R²= 0.14 for Model 1 (** p <0.001; * p< 0.01).

With reference to the Table 6.2, it can be seen that as PDI conviction scores increased, data gathering scores decreased (r= -0.37). A highly significant negative correlation was identified in this instance.

**General Discussion**

The present studies investigated the impact of both the type of task and method of task delivery upon the emergence of the jump to conclusions bias.

Chapter VI B demonstrated that overall PDI scores and PDI conviction were associated with a propensity to request less information prior to finalising a decision. The findings support the hypotheses, previous studies (Chapter II, III and IV) and literature that has consistently identified a data gathering bias amongst non-pathological samples (Linney et al., 1998).

Nevertheless, the study was conducted in strict conditions, with a specific decision making task i.e. the task was abstract and probabilistic and presented face to face with participants. Probabilistic and self-referent tasks yielded similar findings (Chapter IV and V), mirroring findings that have identified a self-reference bias in everyday reasoning (Galbraith et al.,
However, when the task was neutral and mundane in nature, delusional thinking did not appear to predict information gathering (Chapter I and V and VI A). And most interestingly, when the tasks were realistic and self-referent or neutral, increased data gathering was promoted, specifically amongst high PDI belief conviction scorers (Chapter VI and VI A). It appears that when presented with the opportunity to gather information that does not include overly complicated or mathematical dilemmas, those prone to delusional thinking will gather more information when the task involves forming a point of view.

In addition, we must also consider the method by which the task was presented to participants. Generally, participants were more likely to request more information by computer than face to face (Chapter III and IV), and more information for realistic and self-referent tasks compared to abstract or neutral tasks (Chapter VI A).

As previously discussed in the Introduction, it is possible that trait stress or the perceived demands of the task may influence data gathering, specifically amongst those that possess strong conviction in their beliefs. Whilst studies have consistently linked the presence of anxiety and/or stress to an increased tendency to jump to conclusions (Ellet et al., 2008; Lincoln et al., 2009; Keefe et al., 2011), few studies have investigated and appreciated the stress that may arise as a result of completing the very decision making task used to measure the jump to conclusions bias itself. Future investigation will attempt to measure general perceived stress, and specific task stress amongst participants and the impact this may have upon the emergence of the jump to conclusions bias.

**Summary**

The impact of task content and task delivery upon the emergence of the jump to conclusions bias was investigated. Hasty decision making was observed amongst those with stronger
belief conviction completing the abstract beads task face to face. The modified self-referent and neutral decision making tasks, that provided participants with the opportunity to gather information for the purpose of generating a point of view, appeared to encourage increased data gathering amongst those possessing a greater degree of delusional conviction.
CHAPTER VII A

A Study Investigating General Perceived Life Stress and its Link to the Jump to Conclusions Bias

Introduction

It was fair to conclude that the research studies thus far had indicated that sub-clinical delusional thinking, the specific decision task presented and the method of task delivery could influence the quantity of information gathered prior to decision making (Chapter III, IV, V and VI A & B). It was also fair to imply that the tendency for hastier decision making was sensitive to specific conditions and tasks (Chapter III, IV, V and VIA & B). Whilst it had been demonstrated that higher scorers of sub-clinical delusional thinking did make decisions more promptly (Chapter III), this effect did not appear to be robust or consistent (Chapter II). It appeared that decision making was influenced by the situation or task in hand and this trend has been shown in the previous empirical studies (Chapter IV, V and VI). Varying tasks may have placed contrasting demands upon participants that may, in turn, have influenced the propensity to jump to conclusions. One such demand that may have appeared to differ between the abstract, self-referent and neutral tasks investigated was that of perceived stress.

Negative Emotional States and Delusions

There exists a multitude of theories of delusional belief formation: see Bell et al., (2006) and Bortolotti (2010) for an outline such conceptions. Of particular interest are motivational models of delusional belief. Motivational models imply that delusions serve as a defence mechanism, employed to reduce distress and anxiety. McKay, Langdon and Coltheart (2007) have emphasised motives as potentially important causal forces to delusion formation and additional studies have investigated the impact of delusions upon implicit and explicit self-
esteem (MacKinnon, Newman-Taylor and Stopa, 2011). Motivational accounts of the paranormal and persecutory delusions have been investigated (Bentall et al., 1996; Kinderman et al., 1996, 1997), largely due to the seemingly apparent role of affective experience in those particular delusional sub-types. Motivational models, or self-deceptive delusions, are interesting but do not explain why many individuals experiencing delusions often experience extreme states of stress and anxiety despite such drastic attempts to avoid these feelings. Previous research has shown that those that engage in delusional thinking may be vulnerable to negative states such as anxiety, depression and stress in the everyday context (Kesting, Bredenpohl, Klenke, Westermann and Lincoln, 2013; Saha, Scott, Varghese and Mcgrath, 2011; Startup, Freeman and Garety, 2007). Thus supporting diathesis-stress models of psychosis (as outlined by Jones and Ferneyhough, 2007) that propose that stress in everyday life may play a pivotal role in the subsequent development of hallucinations and delusions. Not only do patients experiencing schizophrenia experience negative states of emotion, but they also display a heightened inclination to recall aversive events and increased social avoidance (Moutoussis, Williams, Dayan and Bentall, 2007). In addition, individuals experiencing persecutory delusions in particular reveal enhanced neural processing of threatening stimuli and decreased processing of safety cues (Perez et al., 2015). And more precisely it has been shown that anxiety can mediate the relationship between hallucinations and paranoid beliefs amongst adolescents (Galbraith, Manktelow, Chen-Wilson, Harris and Nevill, 2014). Research such as this supports earlier theories that have implied that patients with delusions possess a hyper-vigilance towards threat and threatening stimuli (Dudley et al., 2003). And most specifically, those experiencing schizoaffective disorder possess a general heightened awareness of emotion that is subsequently associated with a more severe delusional experience (D’Antonio, Kahn, McKlevey, Berenbaum and Serper, 2015). Alternatively, it has been demonstrated that positive imagery can help reduce negative affect
and anxiety amongst people with non-clinical paranoia (Bullock, Newman-Taylor and Stopa, 2016). Negative emotional states appear to be consistently observed amongst those experiencing delusions amongst clinical (Perez et al., 2015) and sub-clinical samples alike (Greer et al., 2016).

*General Perceived Stress and Decision Making*

If indeed those with delusions are prone to negative emotional states such as anxiety and depression (Greer et al., 2016), this could impact upon how they gather information prior to decision making. As highlighted by Roets et al. (2008), it has been widely recognised that stressors in our environment, such as time pressure (Payne et al., 1996), can negatively influence performance on cognitive tasks and even contribute to an over-reliance on short-cut decision tactics (van Hiel et al., 2007), whereby decision making under situations of stress, ‘becomes rigid with fewer alternatives scanned’ (Staal, 2004, p68). From an evolutionary perspective, this makes perfect sense. In situations of potential danger and threat, it would serve no use to ponder on the best possible action to take. To ponder is to waste time and energy. Hasty decisions ensure speedy action and a swift response, and as highlighted by Sutherland (1992, p137): ‘It is better to be wrong than eaten’. Hastiness in decision making may reflect an adaptive response to perceived stressors and may promote the generation of efficient and speedy decisions, free from the interference of our emotional forecasting and deliberation. Indeed, this concept is certainly not a new one. It has long been suggested that humans can generate accurate probability judgements quickly in response to cues from the environment (Gigerenzer and Goldstein, 1996).
It is possible that the jump to conclusions effect observed amongst patients with delusions is merely a response action to a heightened sense of negative emotion and perceived threat (Dudley et al., 2003). In addition, the proposition that patients with delusions jump to conclusions in an attempt to escape threat can be further supported by a recent study that concluded that those experiencing distressing delusions exhibit a tendency to display experiential avoidance (Goldstone et al., 2011). Experiential avoidance is described as a psychological coping mechanism whereby an individual who entertains negative evaluations of thoughts, feelings and sensations will reveal an unwillingness or avoidance to experience these cognitions and, in so doing, will contemplate efforts that will allow them to escape (Hayes et al., 1999).

Aims and Hypotheses of the Current Study

The aim of the present study was to investigate a relationship between general perceived life stress and levels of sub-clinical delusional thinking. The secondary aim was to determine if general perceived stress may be associated with an inclination to jump to conclusions in specific task conditions and delivery. It was anticipated that general perceived stress would be positively associated with components of PDI scores, i.e. as general perceived life stress increases so would measures of sub-clinical delusional thinking. It was also predicted that general perceived stress would predict the quantity of information requested prior to decision making under specific task conditions and methods. To elaborate, less information would be requested amongst abstract tasks presented face to face amongst individuals experiencing increased general perceived life stress (mirroring findings of Chapter VI B).
Method

Participants

An opportunity sample of 227 undergraduate Psychology students recruited from the University of Wolverhampton participated in the study between January 2012 and February 2015; of which 196 were female. The age range for the study was approximately 40 years (M= 23.51 years, SD= 8.33 years). All participants completed the Peters et al. Delusions Inventory (Peters et al., 1996) measure of delusional ideation, the General Perceived Life Stress Scale (Cohen and Williamson, 1988) and either an abstract or realistic decision making task. 97 participants completed the abstract reasoning beads task; 60 face to face and 37 via computer. A further 130 participants completed the realistic task; 60 participants face to face and 70 participants via computer.

Materials

Materials included an information form (Appendix 20), an informed consent sheet (Appendix 21), and an end of experiment debrief form (Appendix 22), all of which were displayed on paper. Participants were asked to complete the Peters et al. Delusions Inventory (Peters et al., 1996: Appendix 4), the General Perceived Stress Scale (Cohen et al., 1988; Appendix 23) and either an adapted self-referent (Appendix 18), emotionally neutral decision making task (Appendix 19) or abstract decision making task (the beads task; Phillips et al., 1966; Appendix 10a). It should be noted that only the abstract decision making task included an evaluation of probabilistic ratios. The self-referent and neutral tasks were adapted in order to present the participants with the opportunity to generate a point of
view; thus making them more realistic in nature (as previously implemented in Chapter VI A).

The Realistic Self-Referent Reasoning Task

Unlike previous versions of the self-referent task, the present task presented participants with a fictional dilemma and instructed participants to gather information for the purpose of generating a point of view.

Example of the Perspective Self-Referent Reasoning Task

Hello and welcome to the experiment.

A University student has recently completed their undergraduate degree and applied for a full time employment position with a reputable organisation.

After completing the job application form, the individual was invited to an interview selection process with the organisation. As a candidate for the position available, the individual was required to complete a skills ability test before attending a formal interview in front of a panel of interviewers.

Following the completion of the interview, the panel of judges were asked to write down their comments regarding the candidate’s performance during the interview selection process.

You will now be given the opportunity to read a selection of the comments the interviewers provided following the candidate’s interview. You are asked to read the comments carefully and to determine whether or not you feel the candidate should be offered the position available with the organisation.
You can choose to read as many/ or as few participants comments as you wish. When you feel you have confidently decided whether or not you feel the candidate should be offered the position, please end the experiment.

Please ask any questions to the researcher now if you do not understand the instructions for the experiment.

Thank you

The Perspective Neutral Reasoning Task

Example of the Perspective Neutral Reasoning Task

A competitive business has been developing an all new modern vacuum cleaner designed to reduce manual effort.

An independent survey was conducted to assess the popularity of the product for public release. Beforehand, participants had received a detailed written description of the vacuum, along with a 15-minute demonstration.

Participants were then asked to decide if they were in favour of or against the release of the vacuum cleaner for public purchase. Each participant was instructed to state whether they were for or against the vacuum cleaner being made publicly available and to give a genuine reason for their viewpoint.

You will now be given the opportunity to read a selection of the participants’ comments provided in the survey. You are asked to read the comments carefully and to determine the viewpoint you agree with most: for or against the release of the vacuum cleaner.

You can choose to read as many/ or as little participants comments as you wish. When you feel you confidently know which viewpoint you agree with most, terminate the experiment.
The General Perceived Stress Scale (Cohen and Williamson, 1988)

The Perceived Stress Scale (Cohen et al., 1988) is a 10 item measure of an individual’s current perception of stress. Participants were asked to indicate how frequently they have felt or thought a certain way during the past month and to indicate their response on a 5-point Likert scale 0 = Never to 4= Very Often. It was anticipated the scale would take no longer than 10 minutes to complete. Scores of perceived stress were calculated by adding up all responses from each individual, accounting for reversed scored items. Please refer to Appendix 26 for the full version of the measure.

Example

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

1. In the last month, how often have you been upset because of something that happened unexpectedly?................................. 0 1 2 3 4

Design and Analyses

A linear regression analysis was conducted to determine overall PDI scores as a potential predictor of general perceived life stress scores. Next, the three components of the PDI measure i.e. PDI distress, preoccupation and conviction scores (Peters et al., 1996) were entered into a multiple linear regression model to observe potential correlation between the components of PDI and general perceived stress scores.

Thirdly, hierarchal moderated, linear multiple regression analyses were conducted to investigate whether a potential three-way interaction between general perceived stress, task delivery (face to face vs. computer) and task version (abstract vs. realistic) could predict overall mean data gathering scores.
Procedure

Individuals that were available and willing to participate were briefed upon the nature of the investigation on paper. The brief highlighted important ethical considerations that would apply to them as participants. Participants were provided with the opportunity to give informed consent and ask questions before commencing with the study.

The participants were then asked to complete the Peters et al. Delusions Inventory (Peters et al., 1996), the General Perceived Stress Scale (Cohen et al., 1988) and one of three decision making tasks in randomised order. Participants were kindly asked to read instructions for each questionnaire/ task carefully and to complete the measures in the order in which they were given to them. For decision making tasks completed via computer, previous procedures were replicated. Participants were provided with written instructions and asked if they had any questions before beginning the study. Responses to the task were written down following completion of the study. Face to face tasks took place one to one in a separate laboratory space with a researcher. Task instructions were read aloud to the participants and participants were provided with the opportunities to ask questions before starting the study. Following completion, the participant’s response was recorded by the researcher.

Participants were given 30 minutes to complete the experiment. Following completion of the investigation, participants were debriefed and thanked for contributing to the study.

Results

Rate of Jumping to Conclusions

Only 10 of the 227 participants jumped to conclusions i.e. requested 2 or fewer pieces of information prior to decision making. Only 1 participant jumped to conclusions when
completing the abstract task; whilst 9 participants jumped to conclusions completing the realistic versions of the decision making task. In addition, 6 participants jumped to conclusions completing the tasks face to face whilst 4 participants jumped to conclusions whilst completing the task on computer. A one-way independent groups ANOVA did not reveal significant differences in overall PDI score between those that did and did not JTC (F(1, 214)= 1.050; p= 0.307). In addition, general perceived stress scores did not differ between individuals that did and did not jump to conclusions (F (1,214) = 0.186, p= 0.666).

**PDI Overall as a Predictor of General Perceived Stress**

A simple linear regression analysis was performed between PDI overall scores and general perceived stress scores. The model that incorporated the components of overall PDI scores as predictors of general perceived stress was found to be significant (F (1, 214) = 64.708; MSE= 40.172; p=0.001). A significant positive correlation was identified between PDI scores and general perceived stress scores (r= 0.48; β = 0.087). As overall PDI scores increased so did scores of general perceived stress. The results were highly significant and account for 23% in the variance of perceived stress scores.

**Components of PDI scores as Predictors of General Perceived Stress**

A multiple regression analysis was performed. The predictor variables were PDI distress, preoccupation and conviction scores and the criterion variable was general perceived stress scores. The model that incorporated the components of PDI scores as predictors of general perceived stress was found to be significant (F (3, 212) =27.300; MSE= 1040.029; p=0.001).
With reference to Table 7.1, it can be seen that PDI distress (p= 0.001) and PDI preoccupation scores (p=0.013) were significant predictors in the model and accounted for 26.8% of the variance in perceived stress scores. In both instances a positive correlation was identified: as scores of distress and preoccupation scores increased, so did scores of perceived life stress.

Table 7.1: The Multiple Regression Model Statistics Investigating Components of PDI scores as Predictors of Perceived Stress Scores

<table>
<thead>
<tr>
<th>Model</th>
<th>Predictor</th>
<th>Beta (Unstandardized)</th>
<th>Standard Error Beta</th>
<th>Zero-order correlations</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>9.408</td>
<td>1.546</td>
<td></td>
<td>6.085**</td>
</tr>
<tr>
<td></td>
<td>PDI Distress</td>
<td>2.738</td>
<td>0.600</td>
<td>0.505</td>
<td>4.564**</td>
</tr>
<tr>
<td></td>
<td>PDI Preoccupation</td>
<td>1.887</td>
<td>0.751</td>
<td>0.455</td>
<td>2.500*</td>
</tr>
<tr>
<td></td>
<td>PDI Conviction</td>
<td>-0.244</td>
<td>0.568</td>
<td>0.258</td>
<td>-0.429</td>
</tr>
</tbody>
</table>

Note adjusted $R^2= 0.27$ for Model 1 (** p <0.001; * p< 0.01).

Moderator Analyses

Hierarchical moderated, linear multiple regression analyses were conducted to investigate if a potential three-way interaction between general perceived stress, task delivery (face to face vs. computer) and task version (abstract vs. realistic) could predict overall mean data gathering scores.
Statistical Method

The standardized scores for perceived stress scores were calculated. In addition, the
standardized score for the criterion variable of data gathering score was also calculated. Task
version was the second predictor variable and consisted of two levels, abstract vs. realistic.
Task delivery was the third variable and had two levels, face to face vs. computer. For model
one, perceived stress scores were entered along with task version and task delivery. Two-way
interaction variables were computed by multiplying the task version variables with the
standardized perceived stress scores and were entered into the second model of the analysis.
Finally, three-way interaction variables were computed by multiplying the standardised
perceived stress scores, task version and task delivery variables and were entered into the
third model.

Perceived Stress Scores, Task Version and Task Delivery as Predictors of Data Gathering
Scores

The first model, which incorporated perceived stress, task version and task method
predictors, was found to be significant (F (3, 220) = 59.781; MSE= 0.557; p=0.001).
Likewise, the second model (F (5, 218) = 35.711, MSE= 0.561; p=0.001) and (F (6, 217) =
29.746, MSE= 0.562; p=0.001) third models were also statistically significant. However, the
R² variance did not significantly change for model two (p= 0.794) or three (p=0.523). With
reference to Table 7.2, it can be seen that version (abstract vs. realistic) and task method (face
to face vs computer) were identified as significant predictors and accounted for 44.2% of the
variance of data gathering scores. However, general perceived stress did not significantly
predict data gathering scores (p= 0.743) and no significant interactions were identified.
Table 7.2: The Multiple Regression Model Statistics Investigating General Perceived Stress, Task Version and Task Delivery as Predictors of Overall Data Gathering Scores

<table>
<thead>
<tr>
<th>Model</th>
<th>Predictor</th>
<th>Beta (Unstandardized)</th>
<th>Standard Error Beta</th>
<th>Zero-order correlations</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>Constant</td>
<td>-1.434</td>
<td>0.239</td>
<td>-6.003**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Perceived Stress Score</td>
<td>0.013</td>
<td>0.050</td>
<td>0.017</td>
<td>0.263</td>
</tr>
<tr>
<td></td>
<td>Task Version</td>
<td>-0.355</td>
<td>0.101</td>
<td>-0.228</td>
<td>-3.507**</td>
</tr>
<tr>
<td></td>
<td>Task Method</td>
<td>1.270</td>
<td>0.101</td>
<td>0.647</td>
<td>12.579**</td>
</tr>
<tr>
<td>Model 2</td>
<td>Constant</td>
<td>-1.436</td>
<td>0.240</td>
<td>-5.982**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Perceived Stress Score</td>
<td>-0.036</td>
<td>0.226</td>
<td>0.017</td>
<td>-0.157</td>
</tr>
<tr>
<td></td>
<td>Task Version</td>
<td>-0.353</td>
<td>0.102</td>
<td>-0.228</td>
<td>-0.347**</td>
</tr>
<tr>
<td></td>
<td>Task Method</td>
<td>1.270</td>
<td>0.101</td>
<td>0.647</td>
<td>12.526**</td>
</tr>
<tr>
<td></td>
<td>Perceived Stress * Task Version</td>
<td>-0.033</td>
<td>0.101</td>
<td>0.007</td>
<td>-0.332</td>
</tr>
<tr>
<td></td>
<td>Perceived Stress* Task Method</td>
<td>0.062</td>
<td>0.103</td>
<td>0.025</td>
<td>0.608</td>
</tr>
<tr>
<td>Model 3</td>
<td>Constant</td>
<td>-1.446</td>
<td>0.241</td>
<td>-6.003**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Perceived Stress Score</td>
<td>-0.356</td>
<td>0.550</td>
<td>0.017</td>
<td>-0.647</td>
</tr>
<tr>
<td></td>
<td>Task Version</td>
<td>-0.352</td>
<td>0.102</td>
<td>-0.228</td>
<td>-3.453**</td>
</tr>
<tr>
<td></td>
<td>Task Method</td>
<td>1.274</td>
<td>0.102</td>
<td>0.648</td>
<td>12.525**</td>
</tr>
<tr>
<td>Perceived Stress * Task Version</td>
<td>0.177</td>
<td>0.345</td>
<td>0.007</td>
<td>0.514</td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>Perceived Stress * Task Method</td>
<td>0.263</td>
<td>0.331</td>
<td>0.025</td>
<td>0.796</td>
<td></td>
</tr>
<tr>
<td>Perceived Stress* Task Version * Task Method</td>
<td>-0.132</td>
<td>0.206</td>
<td>0.015</td>
<td>-0.639</td>
<td></td>
</tr>
</tbody>
</table>

Note adjusted R² = 0.44 for Model 1; adjusted R² Model 2 = 0.44; adjusted R² for Model 3 = 0.44 (** p <0.001; * p< 0.01).

With reference to Figure 7.1, it can be seen that more information was selected for the computerised condition, in comparison with the face to face condition. A subsequent independent measures t-test identified significant differences for the quantity of information gathered face to face (M= 7.28; SD= 4.29) compared to computerised task delivery (M= 15.64; SD= 5.46; t (225) = -12.473; p= 0.001; r= 0.64). In addition, more data was gathered for the abstract reasoning task (M= 13.82; SD= 6.19) compared to the realistic reasoning task (M= 10.75; SD= 6.41; t (225) = 3.624; p= 0.001; r= 0.23) albeit the effect size was small.
Discussion

The aim of the initial study was to observe the relationship between general perceived life stress and components of PDI score, in addition to observing the potential interaction between general perceived life stress, decision making tasks and contrasting methods of task delivery upon the quantity of information requested prior to decision making. Once again, there was no clear or strong evidence of a jump to conclusions bias, with only ten participants selecting two of fewer units of information before final decision making. Nevertheless, the findings supported the hypotheses: PDI score, PDI distress and PDI preoccupation scores were strongly and positively associated with increased general
perceived life stress, thus supporting a wealth of literature that has linked negative emotional states to sub-clinical delusional thinking (Kesting et al., 2013; Saha et al., 2011). Once again, task delivery appeared to have a strong association with the quantity of information requested prior to decision making, with more information requested via computerised tasks in comparison with tasks completed face to face with a researcher. The findings mirror those identified on numerous occasions throughout the research programme (Chapter III and IV). Whilst general perceived life stress was strongly associated with sub-clinical delusional thinking scores, general perceived stress did not predict data gathering behaviour. So, whilst previous studies in the research programme have linked increased PDI, specifically belief conviction scores, in abstract conditions, task delivery and task method to an increased propensity for hastier decision making (Chapters III, IV, V, VI A and B), the current study implies that the findings are not associated with general perceived stress experienced by participants. However, whilst the present study measured a general sense of overall life stress, it neglected to measure stress that may be induced by the decision making tasks implemented in the experiment. The subsequent study intended to investigate the impact of subjective task stress upon the emergence of the jump to conclusions bias.
CHAPTER VII B

A Study Investigating Subjective Task Stress upon the Emergence of the Jump to Conclusions Bias

Introduction

The subsequent study demonstrated a strong and positive correlation between general perceived life stress and measures of sub-clinical delusional thinking including PDI overall scores, PDI distress and PDI preoccupation scores (Chapter VII A). Nevertheless, general life stress did not appear to influence the tendency for hastier decision making that has been observed in previous studies (Chapters III and IV). Yet it was clear that contrasting tasks and situations appeared to influence the quantity of information that those from the sub-clinical range of delusional thinking would request prior to formalising a decision (Chapter II, III, IV, V and VI A and B). It was possible that the subjective demands of the task, determined by the type of task and method of task delivery, may have influenced the susceptibility to jump to conclusions.

In support of this theory, it had been shown that individuals belonging to the sub-clinical range of delusional thinking display a tendency to jump to conclusions in scenarios that induce a sense of feeling rushed (White et al., 2009). And in a similar instance, it has been found that delusion prone individuals report greater confidence in their ideas when they encounter a stressful situation or feel particularly hurried in their decision making (Keefe et al., 2011). This research may suggest that the design of any task that attempts to measure hastiness in decision making could in fact, paradoxically, promote to its emergence.

It is easy to appreciate why participants may become flustered or stressed when completing data gathering tasks such as the beads task, the task so frequently implemented to infer the presence of a jump to conclusions bias (Huq et al., 1988; Phillips et al., 1966). Participants
enter a room with a researcher and are informed that there are two jars of coloured beads
hidden beneath the table. The two jars contain contrasting ratios of the coloured beads and
they need to decide, whilst the researcher presents a sequence of beads to them one at a time,
from which of the two jars the beads are drawn whilst taking into account the prospective
ratio of coloured beads in each jar. Before they begin the experiment, they realise they are
going to need to remember the colour of each bead that the researcher presents and then hides
from view, in order to add up the number of each of the coloured beads they see, to work out
the most likely ratio - and then there is the possibility that they may still get the answer
wrong. Perhaps, it is a far more rational option to avoid the stress and to take a guess at it
after the first bead drawn, and consequently jump to conclusions; after all the odds are 50:50
that you will select the correct jar out of the two jars of beads (Jar A or Jar B). The alternative
is to invest time and effort and, whilst the chance of getting the answer correct is increased,
you still run the risk of getting the answer wrong, which by your own evaluation, may leave
you feeling a little silly after such an investment. It is possible that such an explanation may
account for the results previously observed, whereby participants that scored higher on
measures of sub-clinical delusional thinking conviction have displayed hastier decision
making when completing abstract tasks (Chapter III and VI B).
Indeed, the influence of stress upon the jump to conclusions bias has been recognised (Ellet et
al., 2008). It has been shown that manipulating the situation (stressful vs. mindful) can impact
upon subsequent decision making (Ellet et al., 2008). Those exposed to stress earlier in the
study requested fewer stimuli before finalising a decision than individuals exposed to the
calmer, mindful condition. Whilst studies have consistently linked the presence of anxiety
and/ or stress to an increased tendency to jump to conclusions (Ellet et al., 2008; Lincoln et
al., 2010; Keefe et al., 2011), many have focussed heavily upon stress that may be induced
prior to the decision making task/s. Few studies have investigated and appreciated the stress
that may arise as a result of completing the very decision making task used to measure the jump to conclusions bias itself. It is possible that the jump to conclusions effect observed amongst patients with delusions, and healthy individuals from the sub-clinical range, is merely a response action to the perceived threat and/or stress of the data gathering task itself. Thus supporting propositions that those vulnerable to delusions are heightened to perceive threat (Dudley et al., 2003).

*Aims and Hypotheses of the Current Study*

The aim of the current study was to observe the association between components of PDI score and subjective task stress scores; it was predicted that subjective task stress scores would be positively correlated with PDI scores i.e. as PDI scores increased so would scores of subjective task stress. It was subsequently predicted that subjective task stress scores would positively correlate with data gathering scores i.e. as subjective task stress scores increased so would data gathering scores.

The secondary aim of the study was to observe differences in subjective stress between the abstract and realistic version of the decision making tasks, in addition to potential differences in subjective task stress scores amongst face to face tasks vs. computerised tasks. It was anticipated, given previous findings in the emergence of reduced data gathering in previous studies (Chapters III, IV and VI B) that participants would experience more stress in the face to face tasks compared to computerised tasks. Furthermore, it was expected that subjective task stress scores would be higher for abstract decision making tasks compared to realistic tasks due to perceived contrasting tasks demands. Finally, it was anticipated that there would be a two-way interaction between task delivery and task version: subjective task stress scores
would be greater for abstract tasks completed face to face compared to realistic tasks completed on computer.

**Method**

**Participants**

An opportunity sample of 213 undergraduate Psychology students recruited from the University of Wolverhampton participated in the study between January 2012 and February 2015, of which 185 were female. The age range for the study was approximately 40 years (M= 23.55 years, SD= 8.31 years). All participants completed the Peters et al. Delusions Inventory (Peters et al., 1996) measure of delusional ideation, a subjective task stress form and either an abstract or realistic decision making task. 80 participants completed the abstract reasoning beads task; 40 face to face and 40 via computer. A further 133 participants completed the realistic task; 83 participants face to face and 50 participants via computer.

**Materials**

Materials included an information form (Appendix 24), an informed consent sheet (Appendix 25), and an end of experiment debrief form (Appendix 26). Participants were asked to complete the Peters et al. Delusions Inventory (Peters et al., 1996: Appendix 4) and either an adapted self-referent (Appendix 18), emotionally-neutral (Appendix 19) or abstract decision making task (the beads task; Phillips et al., 1966; Appendix 10a) and a subjective task stress form (Appendix 27). It should be noted that only the abstract decision making task included an evaluation of probabilistic ratios. The self-referent and neutral tasks were adapted
in order to present the participants with the opportunity to generate a point of view, thus making them more realistic in nature as used in previous studies (Chapter VI A).

**Subjective Task Stress Form**

The subjective task stress form was completed at the end of the decision making task. The task reflection survey was a 7 item measure of an individual’s perception of task stress. Participants were asked to indicate the degree to which they agreed with statements relating to their participation in the data gathering task and to indicate their response on a 5-point Likert scale 1 = Strongly Disagree to 5 = Strongly Agree. It was anticipated the scale would take no longer than 5 minutes to complete. Scores of perceived task stress were calculated by adding up all responses from each individual, accounting for reversed scored items.

**Example**

**Task Reflection Survey**

*Please take time to reflect upon the task that you have participated in before indicating the degree to which you agree with the following statements.*

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Not Sure</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>1. I felt under pressure to complete the task quickly…</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. I did not feel that I was being judged on my performance on the task…</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. I was concerned that my decision could be wrong…</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. I felt that I was being observed throughout the task…</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. I struggled to remember some of the comments that may have influenced my decision…</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
6. I enjoyed taking part in the task…

7. I found the task easy…

Design and Analyses

Firstly, a linear regression analysis was performed between overall PDI scores and subjective task stress scores. Secondly, a multiple regression analysis was performed between the discrete components of PDI score (distress, preoccupation and conviction) and subjective task stress scores. Thirdly, a linear regression was performed to determine subjective task stress scores as a potential predictor of data gathering scores.

Due to the between-subjects nature of the task versions (abstract vs. realistic) and task method, a two-way ANOVA was performed to detect potential differences in subjective task stress scores between the abstract and realistic tasks performed face to face or via computer.

Procedure

Individuals that were available and willing to participate were briefed upon the nature of the investigation on paper. The brief highlighted important ethical considerations that would apply to them as participants. Participants were provided with the opportunity to give informed consent and ask questions before commencing with the study.

The participants were then asked to complete the Peters et al. Delusions Inventory (Peters et al., 1996) and one of three decision making tasks in randomised order. Participants were kindly asked to read instructions for each questionnaire/task carefully and to complete the measures in the order in which they were given to them. For decision making tasks completed via computer, previous procedures were replicated. Participants were provided with written
instructions and asked if they had any questions before beginning the study. Responses to the
task were written down following completion of the study. Face to face tasks took place one
to one in a separate laboratory space with a researcher. Task instructions were read aloud to
the participants and participants were provided with the opportunities to ask questions before
starting the study. Following completion, the participants’ response was recorded by the
researcher. At the end of the decision making task, the subjective task stress form was
completed.
Participants were given 30 minutes to complete the experiment. Following completion of the
investigation, participants were debriefed and thanked for contributing to the study.

**Results**

*Rate of Jumping to Conclusions*

Only 11 of the 225 participants jumped to conclusions i.e. requested 2 or fewer pieces of
information prior to decision making. Only 1 participant jumped to conclusions when
completing the abstract task face to face, whilst 7 participants jumped to conclusions
completing the realistic versions of the task face to face. Finally, only 3 participants jumped
to conclusions completing the realistic tasks on computer. A one-way independent groups
ANOVA did not reveal significant differences in overall PDI score between those that did
and did not JTC (F (1, 201) = 2.791; p= 0.096.) In addition, subjective task stress scores did
not differ between individuals that did and did not jump to conclusions (F (1,201) = 0.001, p=
0.973).
PDI score as a Predictor of Subjective Task Stress

A linear regression model was conducted between overall PDI scores and subjective task stress scores. The model that incorporated the overall PDI scores as predictors of subjective task stress was found to be significant (F (1, 202) = 9.075; MSE= 18.855; p=0.003). A significant positive correlation was identified for PDI scores overall but only accounted for 0.04% of the variance in subjective task stress scores. A positive correlation was identified: as overall PDI scores (r= 0.207; β = 0.022) increased, so did scores of subjective task stress.

Components of PDI Score as a Predictor of Subjective Task Stress

A multiple regression model was conducted between the components of PDI scores and subjective task stress scores. The model that incorporated the overall PDI scores as predictors of subjective task stress was found to be significant (F (3, 200) = 3.454; MSE= 18.918; p=0.018) but only accounted for 0.04% of the variance in subjective task stress scores. Whilst the model was significant, PDI distress scores (p= 0.063; β = 0.814) did not reach levels of significance. However, PDI conviction scores were a significant predictor of subjective task stress scores (p = 0.051; r = -0.030; β = -0.810). A weak negative correlation was identified: as scores of PDI conviction increased, subjective task stress scores decreased.

Subjective Task Stress as a Predictor of Data Gathering Scores

A simple linear regression between subjective task stress scores and data gathering scores was non- significant (p= 0.905). As subjective task stress scores increased, data gathering did not appear to differ.
Investigating Subjective Task Stress Scores between Task Version and Task Method

A two-way between-subjects ANOVA was conducted to investigate subjective task stress scores between task version (abstract vs. realistic) and task method (face to face vs. realistic). The main effects of task version (F (1, 209) = 0.00; MSE= 18.633; p = 0.995) and task method (F (1, 209) = 0.091; MSE= 18.633; p = 0.763) were non-significant. However, a significant two-way interaction between task version and task method was identified (F (1, 209) = 7.663; MSE= 18.633; p = 0.006; $\eta^2_p = 0.035$). With reference to Figure 7.2, it can be seen that subjective scores were higher for the abstract task completed on computer but reduced on the realistic tasks. Furthermore, mean subjective task stress scores peaked for realistic tasks completed face to face.
Figure 7.2: The Significant Two-Way Interaction between Task Version and Task Method with respect to Subjective Task Stress Scores

Discussion

The aim of the study was to test the relationship between subjective task stress scores on components of PDI score in addition to testing the differences in subjective stress between contrasting task methods (face to face vs. computer) and task versions (abstract vs. realistic). Once again, there was no clear presence of the jump to conclusions bias, as only 11 participants requested two or fewer units of information prior to finalising a decision. The findings somewhat supported the hypotheses, in that PDI scores were somewhat positively correlated with subjective task stress. The findings were extremely tentative but implied that
as sub-clinical delusional thinking scores increase, so do the perceived subjective demands of the task. These findings help to support literature that has linked negative affect to the experience of delusions (Kesting et al., 2013; Saha et al., 2011). The findings also supported findings of the previous study that identified a positive association between general perceived life stress and PDI scores (Chapter VII A).

Disappointingly, subjective task stress scores did not predict data gathering scores. Therefore, assumptions that an increase in perceived demands of the task could explain the jump to conclusions bias were not supported. In turn, suppositions that claim that those scoring higher on measures of sub-clinical delusional thinking are hyper-vigilant to threat were also not supported in this instance (Dudley et al., 2003). Nevertheless, a significant two-way interaction between task version and task method was identified. Subjective task stress scores were higher for abstract tasks completed via computer and for realistic tasks completed face to face, but reduced amongst the reverse conditions. The findings supported the idea that contrasting tasks and form of delivery influenced perceived task demands and subsequent subjective task stress, as identified in previous experiments (Chapters III, IV and V). This is a noteworthy finding. Whilst the sub-clinical delusional ideation link to subjective task stress may not influence data gathering per se, there may be other channels that may induce hastier decision making i.e. reasoning style differences cued by affective responses amongst those prone to delusional thinking. Interestingly, it has been suggested that the experience of certain emotions can influence specific reasoning style preferences. Negative emotional states, such as stress and anxiety have been linked to an experiential reasoning style (Laborde et al., 2010). It is possible that increased subjective task stress, shown to be associated with overall PDI scores in the present study, may in turn cue an experiential reasoning style that may enhance the susceptibility to jump to conclusions.
Furthermore, whilst the negative correlation between PDI conviction scores and subjective task stress scores was extremely weak, it may tentatively explain why, in previous studies, those displaying increased belief conviction were prone to *increased* data gathering in neutral and/or self-referent scenarios (Chapter VI A). In other words, those experiencing increased delusional conviction may experience reduced subjective task stress in certain situations, thus reducing the tendency for hastier decision making.

Whilst the current study measured subjective stress, it neglected to measure any form of physiological arousal that may have been induced as a result of completing the decision making tasks. As a result, participant stress may not have been consciously or subjectively noted. The subsequent study aimed to investigate differences in pulse rate before and after the decision making tasks as a measure of participant stress, in order to determine the impact of physiological stress upon the emergence of the jump to conclusions bias.
CHAPTER VII C

A Study Investigating Physiological Stress upon the Emergence of the Jump to Conclusions Bias

Introduction

General perceived life stress and subjective task stress appear to be associated with sub-clinical delusional thinking (Chapter VII A and B). Nevertheless, the variables do not appear to be linked to any form of hurried decision making despite the association between high delusional ideation and hastier decision making compared to those lower in the trait (Chapters III, IV, V and VI B). Variations in the type of decision making task (abstract vs. realistic) and task delivery (computer vs. face to face) have been shown to influence this susceptibility to hastier decision making. Whilst the results are somewhat mixed, it generally appears that those higher on sub-clinical measures of delusional thinking, specifically belief conviction, will make quicker decisions when the task is abstract in nature (Chapters III and VI B), or self-referent and completed via computer (Chapter IV). In addition, it has been shown that realistic but mundane tasks can eliminate hastier decision making in some instances (Chapter II and V) but can decrease speedy decisions and even increase information-gathering if the task is self-referent but requests a particular viewpoint or perspective (Chapter V and VI A).

It is not clear why these differences occur. Whilst general perceived life stress is strongly associated with PDI scores, it does not influence subsequent decision making (Chapter VII A). Furthermore, whilst subjective task stress does differ between tasks, i.e. subjective task stress scores were higher for abstract tasks completed via computer and for realistic tasks completed face to face, subjective task stress failed to correlate with data gathering behaviour.
It was discussed in the previous study that physiological stress may be a factor influencing decision making amongst people prone to sub-clinical delusional ideation. Therefore, the aim of the current study was to observe the difference in pulse rate (Pulse after Task - Pulse before Task) between high and low PDI scorers completing the abstract vs. realistic tasks and the tasks delivered face to face vs. computer. It was predicted that increased overall PDI scores would be associated with greater pulse rate differences; i.e. pulse rate would increase throughout the tasks. This would signal physiological arousal, potentially stress, and thus support the findings of Chapter VII A and B that have recognised increased general perceived life stress and subjective task stress amongst high PDI scorers.

It was predicted that pulse rate would elevate amongst high PDI scorers completing the abstract task compared to the realistic task, signalling physiological arousal and thus mirroring the propensity for hasty decision making in Chapter III and Chapter VI B. It was also predicted that pulse rate would elevate amongst high PDI scorers completing the tasks face to face compared to computer given that the jump to conclusions bias has been so frequently observed under these conditions (Huq et al., 1988; Chapter III and IV). It was also anticipated that a greater difference in pulse rate would emerge for high PDI scorers compared to lower scorers given the strong association between sub-clinical ideation and general perceived stress and subjective task stress (Chapter VII A and B) and numerous associations with negative emotional states (Kesting et al., 2013; Saha et al., 2011). Given that PDI overall was linked to increased general perceived stress and subjective task stress, only overall PDI scores were investigated in the present study.
**Method**

**Participants**

An opportunity sample of 213 undergraduate Psychology students recruited from the University of Wolverhampton participated in the study between January 2012 and February 2015; of which 185 were female. The age range for the study was 40 years (M= 23.55 years, SD= 8.31 years). All participants completed the Peters et al Delusions Inventory (Peters et al., 1996) measure of delusional ideation and either an abstract or realistic decision making task. Pulse rate was measured at three distinct intervals: at the beginning of the session, prior to the decision making task and immediately after the decision making task. 80 participants completed the abstract reasoning beads task; 40 face to face and 40 via computer. A further 133 participants completed the realistic task; 83 participants face to face and 50 participants via computer. The sample also took part in the previous study.

**Design and Analyses**

Due to the variables concerned being between-groups, a two-way ANOVA was performed to investigate differences in pulse rate between high and low PDI group scorers and task version i.e. abstract vs. realistic. A second two-way ANOVA was conducted to investigate differences in pulse rate between high and low PDI group scorers and task delivery i.e. face to face vs. computer.
Materials and Procedure

Materials included an information form (Appendix 28), an informed consent sheet (Appendix 29), and an end of experiment debrief form (Appendix 30). Participants were asked to complete the Peters et al. Delusions Inventory (Peters et al., 1996: Appendix 4) and either an adapted self-referent (Appendix 18), emotionally neutral (Appendix 19) or abstract decision making task (the beads task; Phillips et al., 1966: Appendix 10a). It should be noted that only the abstract decision making task included an evaluation of probabilistic ratios. The self-referent and neutral tasks were adapted in order to present the participants with the opportunity to generate a point of view, thus making them more realistic in nature. The procedure mirrored that of Chapter VI A but with pulse rate measured at three distinct intervals: at the beginning of the session, prior to the decision making task and immediately after the decision making task using a pulse rate monitoring device. The first and second measure created an average baseline pulse rate score. Pulse rate difference was calculated by Pulse After minus Baseline Before.

Results

Rate of Jumping to Conclusions

Only 11 of the 213 participants jumped to conclusions i.e. requested 2 or fewer pieces of information prior to decision making. Only 1 participant jumped to conclusions when completing the abstract task face to face, whilst 7 participants jumped to conclusions completing the realistic versions of the task face to face. Finally, only 3 participants jumped to conclusions completing the realistic tasks on computer. A one-way independent groups ANOVA did not reveal significant differences in overall PDI score between those that did
and did not JTC (F(1, 210)= 2.791; p= 0.096.). In addition, there was no difference in pulse rate difference between those that did and did not JTC (F (1, 210) = 1.689; p= 0.195).

Interactions between PDI Group and Task Version (Abstract vs. Realistic)

A two-way between subjects ANOVA was conducted to detect differences in pulse rate difference between high and low groups of PDI score (subject to a median split; low = < 51.00 and high group ≥ 51.00) and task version. The main effect of PDI Group was non-significant (F (3, 200) = 0.481; MSE= 369.153; p = 0.489). Differences in pulse rate did not differ between the high and low PDI Groups. The main effect of Task Version was also statistically non-significant (F (3, 200) = 0.813; MSE = 369.153; p = 0.368). Likewise the interaction between PDI Group and Task Version was also non-significant F (3, 200) = 0.441; MSE = 369.153; p = 0.507). Pulse rate differences did not appear to change between contrasting task versions or between high and low PDI group scorers.

Interactions between PDI Group and Task Delivery (Face to Face vs. Computer)

A two-way between subjects ANOVA was conducted to detect differences in pulse rate difference between high and low groups of PDI score (subject to a median split; low = < 51.00 and high group ≥ 51.00) and task delivery. The main effect of task delivery was significant (F (3, 200) = 3.742; MSE= 360.679; p= 0.054; η²_p = 0.018). The mean pulse rate difference for the face to face condition was significantly higher (M= 1.98; SD= 19.62) than the mean for the computerised condition (M= -3.13; SD= 18.25). It appears that pulse rate increased throughout when the task was completed face to face but decreased when the task was completed via computer. The main effect of PDI group and the interaction effect were
non-significant \((F (3, 200) = 0.597; \text{MSE}= 360.679; p= 0.441)\); \((F (3, 200) = 2.133; \text{MSE}= 360.679; p= 0.146)\) respectively.

**General Discussion**

The previous three studies were intended to observe the impact of general perceived life stress, subjective task stress and physiological stress upon the emergence of the jump to conclusions bias. Once again, and as consistently shown in the preceding studies, a jump to conclusions bias was not highly prevalent amongst a sub-clinical sample. Delusional ideation was strongly associated with general perceived stress in life (Chapter VII A) consistent with expectations and previous literature (Kesting et al., 2013; Saha et al., 2011). Nevertheless, life stress did not appear to influence the propensity for hastier decision making in this instance. Interestingly, subjective task stress was tentatively linked to delusional thinking (Chapter VII B) but did not predict the subsequent quantity of information selected prior to decision making. Nevertheless, and in support of the experimental design, contrasting tasks and methods of task delivery did produce differences in perceived demand (Chapter VII B), with computerised abstract tasks and face to face realistic tasks resulting in increased subjective task stress scores.

It was discussed that participants may not be consciously aware of any perceived stress and so physiological arousal measures were monitored between tasks and between sub-clinical delusional ideation groups. Pulse rate was not linked with sub-clinical delusional thinking but was influenced by task delivery, with elevated pulse measures arising in face to face conditions (Chapter VII C). An increase in pulse rate difference in this instance may imply an increase in physiological arousal when tasks are presented face to face. This may explain why
participants have demonstrated hastier decision making in previous studies when tasks have been presented this way (Chapter III, VI B).

Whilst the current studies did identify links between delusional thinking and perceived life stress and subjective task stress, the association did not appear to influence decision making. Nevertheless, it was possible that this experience of stress may cue particular reasoning styles thus contributing to data gathering biases previously observed (Chapters III, IV and VI B). Thus further studies attempted to observe differences in reasoning style preferences i.e. rational vs. experiential amongst those scoring highly on measures of sub-clinical delusional thinking.

Summary

General perceived life stress was strongly and positively associated with sub-clinical delusional thinking but did not impact upon subsequent decision making. In addition, delusional thinking was tentatively associated with subjective task stress and contrasting methods and task versions impacted upon perceived stress and demand. Likewise, physiological arousal also appeared evident amongst tasks completed face to face in comparison with computer. However, none of the measures of stress included could account for hastier decision making amongst those exhibiting sub-clinical delusional thinking.
CHAPTER VIII

A Study Investigating the Link between Cognitive Reasoning Style Preferences and the Jumping to Conclusions Bias amongst Sub-Clinical Delusional Thinking

Introduction

Throughout the research programme, the abstract and probabilistic reasoning ‘beads’ task (Phillips et al., 1966) has been criticised as a somewhat artificial measure of the jump to conclusions bias. Consequently, decision making tasks were adapted to allow the participant gather information for the purpose of generating a genuine belief (Chapter VI A). The results were intriguing. When participants took part in an emotionally-mundane or realistic self-referent task, data gathering was enhanced amongst those that score highly on measures of belief conviction (Chapter VI A). This is in stark contrast to data gathering behaviour observed when the abstract beads task was presented to participants i.e. hastier decision making was observed (Chapter III and VI B). It was hypothesised that the stress experienced during the task could explain the differences in data gathering behaviour (Chapter VII).

Stress and Decision Making

In this research programme, a positive correlation between general perceived life stress and delusional thinking scores has been identified (Chapter VII): those that engage in delusional thinking are also more likely to experience increased scores of general perceived life stress. The findings support suppositions that suggest that those that engage in delusional thinking may be vulnerable to negative states such as anxiety, depression and stress in the everyday context (Kesting et al., 2013; Saha et al., 2011). Thus supporting diathesis-stress models of psychosis (as outlined by Jones et al., 2009) that propose that stress in everyday life may play
a pivotal role in the subsequent development of hallucinations and delusions. In addition, delusional thinking was tentatively associated with subjective task stress and contrasting methods and task versions impacted upon perceived stress and demand (Chapter VII). Nevertheless, perceived stress and physiological stress did not predict hastier decision making. It is possible that delusional thinking and perceived stress may be associated with a particular reasoning style preference. For example, those displaying delusions may rely upon an intuitive reasoning style in stressful situations. This explanation is a plausible one and may explain why those scoring highly on sub-clinical delusional belief react differently to different tasks in different situations. In other words, it may not be the stress experienced that cues hastier decision making, as illustrated in Chapter VII but the reasoning style adopted as a result of the affective response.

**Individual Differences in Reasoning Style Preference**

Individual differences in specific reasoning style preferences could possibly account for variations in the emergence of the jump to conclusions bias. Dual processes in decision making have been extremely well documented (Evans, 2006; 2008; Kahneman, 2003; Stanovich, 2004). The inherent postulation of the generic dual process theory employed by Kahneman et al., (2002, 2005) is the existence of two mental systems labelled System 1 and System 2 (Stanovich, 1999). System 1 is described as a default mechanism that produces quick, automatic and intuitive answers to decision making dilemmas; comparable to a jump to conclusions response. In contrast, System 2 is far more analytical in its approach to the decision making task and has been associated with conscious activation and operation.
In contrast to initial dual process approaches to decision making (Kahneman et al., 2002, 2005) Rational-Experiential Theory (Epstein, 1994; Epstein et al., 1999) was one of the first dualist approaches to investigate cultural, individual and dispositional differences in reasoning style with the implementation of the Rational-Experiential Inventory (REI) measure (Epstein et al., 1996).

Cognitive-Experiential Self Theory of Personality (Epstein, 2003), otherwise known as CEST, attempted to incorporate emotional experience into a dual process approach to the decision making process. Epstein (2003) described the presence of two distinct systems involved in the decision making process: the rational and experiential system. The experiential system was described as rapid, effortless, automatic and minimally demanding of cognitive resources whilst the rational system was considered to be conscious, analytical, relatively slow and cognitively demanding.

Whilst psychological investigation has highlighted that the experiential and rational scales of the REI measure are uncorrelated (Handley et al., 2000; Pacini et al., 1999b) an individual predominance or preference to execute one particular system more than another appears to exist (Epstein, 1985; Strack et al., 2004). For example, age related differences have been identified, with older adolescents employing a rational decision making style most frequently, and an intuitive style less frequently in comparison with younger teenagers (Baiocco et al., 2009).

Reasoning Style Preferences and Emotion

Interestingly, it has been suggested that the experience of certain emotions can influence specific reasoning style preferences. A review of the literature suggests that positive emotional traits such as openness to experience, conscientiousness and open minded thinking
are indicative of a rational reasoning style adoption (Handley et al., 2000; Marks et al., 2008; Toyosawa et al., 2004). This may help to explain why increases in positive affect have been associated with a reduction in the jump to conclusion bias (Lee et al., 2011).

Similarly, an intuitive or experiential reasoning style has been linked to negative affect (Laborde et al., 2010). A possible reliance on an experiential reasoning style preference may be associated with the experience of anxiety, which has in some instances been linked to an increased susceptibility to jump to conclusions (Lincoln et al., 2010), although not always (So et al., 2008).

However, the results are mixed. In some instances, positive affect has been linked to intuitive or experiential thinking and consequent referential thinking (King et al., 2009). Referential thinking, like delusional thinking, involves a certain misinterpretation of experiences whereby ‘an idea that events, objects, or other people in the person’s immediate environment have a particular and unusual meaning specifically for him or her’ (American Psychiatric Association, 1987, p. 399). In addition, whilst peculiar beliefs have been associated with intuitive thinking and negative affect distinctly, an interaction between the two was not identified (Boden, Berenbaum and Topper, 2012).

Whilst there is considerable support that positive affective states are linked with rational reasoning style preferences and negative affective states are linked with experiential reasoning, the findings are not always replicated. Nevertheless, a reduction in analytical reasoning is consistently observed amongst individuals with paranormal/ superstitious and/or peculiar beliefs (Pennycook, Cheyne, Koehler and Fugelsang, 2013; Shenhav, Rand and Greene, 2011) whilst an intuitive reasoning style has been linked with the presence of such beliefs (Aarnio et al., 2005; Genovese, 2005; Sadler-Smith, 2011). Interestingly, it has been suggested elsewhere, that it is the combination of high experiential reasoning but low rational reasoning that was associated with persecutory ideation (Freeman et al., 2012).
Given the apparent contradictory research, it is clear that further investigation is required to study possible reasoning style preferences amongst individuals within the sub-clinical range. Whilst investigating a possible link between reasoning style preferences, stress and the subsequent susceptibility to a jump to conclusions bias.

*Aims and Hypotheses of the Current study*

The aim of the present study was to extend investigation into delusional belief and thinking style amongst participants to observe potential associations between a) PDI scores and scores of rational and experiential reasoning style; b) perceived stress scores and rational and experiential scores.

*Components of PDI Scores as Predictors of Rational and Experiential Reasoning Scores*

The study would also aim to measure whether components of PDI score (belief distress, preoccupation and conviction) would correlate with rational and/ or experiential scores. It was predicted that PDI scores would be negatively associated with rational reasoning scores i.e. as PDI scores increase, scores of rational reasoning would decrease. Thus, complementing the results of the first study that observed reduced verbal intelligence and probability estimation in high PDI scorers (Chapter II). However, given that high PDI conviction scorers demonstrated increased data gathering in neutral or self-referent scenarios (Chapter V and VI A), it was anticipated that PDI conviction may be associated with increased rational reasoning scores.
Conversely, it was expected that PDI scores would therefore be positively associated with experiential reasoning scores as demonstrated by Freeman et al. (2012).

*Reasoning Style Scores as Predictors of Perceived Stress Scores*

In addition, it was expected that experiential reasoning scores would be positively correlated with general perceived life stress, given that an experiential reasoning style preference may be associated with the experience of anxiety, which has in some instances been linked to an increased susceptibility to jump to conclusions (Lincoln et al., 2010). Furthermore, it was predicted that rational reasoning scores would be associated with decreased general perceived stress scores given that increases in positive affect have been associated with a reduction in the jump to conclusion bias (Lee et al., 2011).

*Method*

*Participants*

An opportunity sample of 79 undergraduate Psychology students recruited from the University of Wolverhampton participated in the study between November 2013 and March 2014; of which 86.1% were female. The age range for the study was approximately 39 years (M= 24.42 years, SD= 9.42 years).

All participants completed the Peters et al. Delusions Inventory (Peters et al., 1996) measure of delusional ideation, the Perceived Stress Scale (Cohen et al., 1988) and the Rational-Experiential Inventory (Pacini et al., 1999b). Participation in the investigation was conditional in exchange for participant pool credits.
Materials

Materials included a pen/pencil, an information form (Appendix 31), an informed consent sheet (Appendix 32), and an end of experiment debrief form (Appendix 33). Participants were asked to complete three psychometric questionnaires: the Peters et al. Delusions Inventory (Peters et al., 1996: Appendix 4), the Perceived Stress Scale (Cohen et al., 1988: Appendix 23) and the Rational-Experiential Inventory (Pacini et al., 1999b; Appendix 34).

The Rational-Experiential Inventory (Pacini and Epstein, 1999b)

The Rational-Experiential Inventory (Pacini et al., 1999b) is a 40 item measure of rational and experiential reasoning adoption. Participants were asked to indicate how representative each statement was of themselves using a 5-point Likert scale: 1 = completely false to 5 = completely true. It was anticipated that the scale would take no longer than 10 minutes to complete. Scores of rational and experiential reasoning were calculated separately, adding up all relevant responses and accounting for reversed scores items.

Design and Analyses

A multiple regression analysis was performed to investigate PDI belief distress, preoccupation and conviction as predictors of firstly rational reasoning scores and secondly experiential reasoning scores.
Secondly, a multiple regression analysis was conducted to investigate potential correlations between rational and experiential reasoning scores in relation to general perceived life stress scores.

Procedure

Individuals that were available and willing to participate, and had responded to the participant pool study advertisement arrived at a laboratory space at an allocated time. They were then briefed upon the nature of the investigation. The brief highlighted important ethical considerations that would apply to them as participants. Each individual was provided with an informed consent sheet and asked to read and sign the sheet carefully if willing to participate.

Participants were kindly asked to complete the Perceived Stress Scale (Cohen et al., 1988), the Peters et al Delusions Inventory (Peters et al., 1996) and the Rational-Experiential Inventory (Pacini et al., 1997b).

Participants were kindly asked to read instructions for each questionnaire/task carefully and to complete the measures in the order in which they were given to them. Participants were provided with the opportunity to ask questions before commencing with the study and supplied with any necessary materials such as pens.

Participants were given 30 minutes to complete the experiment. Following completion of the investigation, participants were verbally debriefed and thanked for contributing to the study.
Results

PDI and Rational Reasoning Scores

A multiple regression analysis was conducted to investigate whether the predictor variables: PDI distress, PDI belief preoccupation and PDI belief conviction scores could predict the criterion variable of rational reasoning score.

The model was significant (F (3, 68) = 4.947; MSE= 0.857; p= 0.004) and accounted for 14.3% of the variance. Belief distress scores did not significantly contribute to the model (p = 0.189; β = -0.206). Likewise, belief preoccupation did were not significant predictors of rational reasoning scores (p=0.137; β = -0.206). Interestingly, PDI belief conviction were significant predictors of rational reasoning scores (r = 0.181; p = 0.003; β = 0.403). A significant positive correlation was detected between PDI conviction scores and rational reasoning scores. With reference to Figure 8.1, it can be seen that as PDI conviction scores increased, rational reasoning scores also increased.
Figure 8.1: The Significant Positive Correlation between PDI Conviction Scores and Rational Reasoning Scores

PDI and Experiential Reasoning Scores

An additional multiple regression analysis was conducted to investigate whether the predictor variables: PDI distress, PDI belief preoccupation and PDI belief conviction scores could predict the criterion variable of experiential reasoning score. The model was not significant (F (3, 68) = 0.903; MSE= 1.004; p= 0.445) and accounted for a weak 0.01% of the variance in the experiential reasoning scores.
Reasoning Scores as Predictors of Perceived Stress Scores

A multiple linear regression analysis was conducted to investigate whether rational reasoning scores and experiential reasoning scores could predict general perceived stress scores. The model was non-significant (F (1, 67) = 1.771; MSE= 0.928; p=0.178) and accounted for only 0.02% of the variance in perceived stress scores. Rational reasoning scores nor experiential reasoning predicted perceived stress scores.

Discussion

Multiple regression analyses were conducted upon the data to investigate components of PDI as predictors of rational and experiential reasoning. Subsequently, potential links between reasoning style and general perceived life stress were investigated. As previously shown, general perceived stress were strongly associated with PDI scores (Chapter VII A). As PDI belief scores increased, general perceived stress scores also increased. The findings therefore supported literature that has shown that those that engage in delusional thinking may be vulnerable to negative states such as anxiety, depression and stress in the everyday context (Kesting et al, 2013; Saha et al, 2011). Nevertheless, general perceived stress did not correlate with data gathering scores (Chapter VII A). It was discussed that stress may cue a particular reasoning style amongst some, but not all components of the PDI measure.

Delusional Thinking and Rational Reasoning

Interestingly, no significant correlations were identified between PDI belief distress scores and PDI preoccupation scores in relation to rational reasoning scores. Given that participants
in Chapter II demonstrated reduced probability estimation ability and verbal reasoning, this is surprising and conflicts with the hypotheses. However, Chapter II neglected to investigate components of the PDI measure distinctly. Interestingly, a positive correlation between belief conviction scores and rational reasoning scores was identified in the present study. This is a striking finding and may help to explain why increased data gathering has been observed amongst high PDI conviction scorers completing neutral and/or self-referent tasks (Chapter V and VI A). Nevertheless, we must consider the limitations of the REI measure of rational reasoning and experiential reasoning (Pacini et al., 199b). Essentially, the psychometric questionnaire is based upon personal perception i.e. I think that I am more analytical in my decision making. It is possible that participants displaying increased delusional conviction are more convinced of their rational and analytical abilities. Therefore, they may not think rationally but simply believe that they do. This may help to explain why, when presented with abstract and probabilistic tasks, those scoring higher on belief conviction display hastier decision making (Chapter III and VI B). When confronted with a task that may demand analytical and rational reasoning, they opt for a reduced information gathering strategy; perhaps a signal that they in fact do not engage in rational and analytical thinking.

**Delusional Thinking and Experiential Reasoning**

PDI scores were not correlated with experiential reasoning scores, conflicting with predictions. Thus the findings somewhat conflict with the literature that has found that an intuitive reasoning style is associated with paranormal/ superstitious and/or peculiar beliefs (Aarnio et al., 2005; Genovese, 2005; Sadler-Smith, 2011). Likewise, neither rational reasoning nor experiential reasoning scores were associated with increased general perceived stress scores, conflicting with prior expectations. Literature that has linked negative emotions
to an experiential reasoning style pattern (Laborde et al., 2010) was not supported in this instance. Conversely, literature that has emphasised a link between positive emotional traits and a rational reasoning style adoption (Handley et al., 2000; Marks et al., 2008; Toyosawa et al., 2004) was not supported by the present findings.

Whilst there are notable links between PDI score, general perceived stress score and reasoning scores the criterion variables did not predict one another. In other words, general perceived stress, whilst associated with PDI score, was not associated with rational or experiential reasoning scores.

**Summary**

To conclude, reasoning style differences were evident amongst individuals engaging in delusional thinking. Belief conviction scores were associated with increased rational reasoning scores. However, it was discussed that this could be a product of their delusion conviction. However, it was noteworthy that those engaging in delusional belief conviction do collect information differently under different tasks and scenarios (Chapter III, IV, IV, VI A and B). Nevertheless, these differences could not be attributed to perceived stress or task demands or differences particular reasoning style preferences.
CHAPTER IX

General Discussion

Patients with delusions jump to conclusions. An array of experimental studies have reached this conclusion (Dudley et al., 1997a, 1997b; Huq et al., 1988; Peters et al., 1997) and, as a result, many meta-cognitive training programmes designed to treat patients with delusions specifically aspire to reduce the rate of this jump to conclusions bias (Moritz et al., 2011; Waller et al., 2011; Warman et al., 2013). The jump to conclusions response action has also been observed amongst the sub-clinical range of delusional ideation (Orenes et al., 2012; Zawadzski et al., 2012), amongst individuals from the general, healthy population. Upon the surface, the picture appears fairly clear-cut should one not question and/or investigate the findings that are a contradiction to the ‘rule’.

As previously outlined, studies indicate that only around 40-70% of patients exhibit the jump to conclusions reasoning style (Dudley et al., 2011) and as highlighted by Freeman et al., (2008) around 20% without delusions display the data gathering bias. Some studies observed the reasoning bias amongst only 4% of patients with schizophrenia (Rossell et al., 2008) whilst other studies failed to detect the emergence of a jump to conclusions bias entirely amongst participants without current and/or remitted delusions (Colbert et al., 2010). Additional studies concluded that delusion-proneness did not significantly influence the emergence of the jump to conclusions bias even when hasty decision making was demonstrated (Balzan et al., 2012).

It appears that patients with delusions do not always jump to conclusions, Whilst some individuals without delusions do display the data gathering bias. The aim of the current research programme was to investigate the potential factors that may moderate the emergence of the jump to conclusions bias amongst people with sub-clinical delusional thinking in order to enrich our understanding of delusion formation and maintenance further. In addition, it
was stressed in the Introduction that delusional belief is multidimensional. Indeed, the PDI measure (Peters et al., 1996) includes three distinct sub-scales that have been very rarely been studied in isolation. It was the intention of the research programme to investigate the components of delusional belief: belief distress, belief preoccupation and belief conviction. Numerous studies were conducted to investigate the potential emergence of the jump to conclusions bias amongst those from the sub-clinical range of delusion proneness. A vital note was made, in that the classic jump to conclusions response of requesting two or fewer units of information prior to decision making was rarely observed throughout (Chapters II – VIII). The finding conflicted with numerous research studies that have found the presence of the bias amongst non-clinical samples (Gaweda et al., 2015; Winton-Brown et al., 2015; Zawadzki et al., 2012).

However, the supposition that the jump to conclusions bias may not be as prevalent as previously implied was supported (Dudley et al., 2011). The current research programme supported the proposition that non-pathological delusional proneness may not be strongly related to a propensity to jump to conclusions. Nevertheless, variations in the quantity of information requested prior to final decision making did vary between those prone to delusional thinking and those that were not. This inclination for hastier decision making appeared to be influenced by the type of task presented to participants as well as the form of task delivery and the distinct components of the PDI measure: distress, preoccupation or conviction.

*Decision Making Tasks*

It appeared that the jump to conclusions bias i.e. the inclination to form a decision based upon limited information, was somewhat difficult to measure. Whilst the presence of the bias had
been frequently observed using the beads task (Phillips et al., 1966), the present research questioned the task design as a reliable measure of data gathering (Chapter I). The beads task, if for want of a description, is somewhat confusing and off-putting for many. In essence, it is a probabilistic dilemma and one that people can struggle to comprehend (Balzan et al., 2012). As previously discussed, the beads task does not include the evaluation of everyday beliefs or delusional narratives and is primarily focussed upon belief formation, not maintenance. The paradigm is extremely restricted for the study of delusional thinking.

In accordance with previous research (Baskak, et al., 2015; Falcone, et al., 2015), the current research programme also identified hastier decision making amongst those scoring higher on measures of sub-clinical delusional thinking when completing this particular task (Chapter III and VI B). Regardless of the method of task delivery, either face to face or computerised, the task elicited a data gathering bias amongst those scoring highly on measures of belief conviction. The results supported the original findings that identified a data gathering bias amongst clinical patients (Huq et al., 1988; Phillips et al., 1966; Winton-Brown et al., 2015). However, the type of task presented appeared to eliminate this bias in some instances. When the task included neutral and emotionally-unstimulating material, a data gathering bias was either not observed (Chapter II) or the data gathering was, in fact, enhanced amongst those with high belief conviction. On numerous occasions, when a neutral or self-referent task was presented, data gathering *increased* amongst individuals displaying high belief conviction. It appears that adjusting tasks to appear realistic, and to request a genuine viewpoint or perspective, can encourage cautious decision making amongst those scoring highly on belief conviction – a finding that may well have been overlooked should the dimensions of delusional belief had not been studied distinctly. The findings also mirrored earlier research that identified a jump to conclusions bias using emotionally salient and self-referent material (Dudley et al., 1997b). Of particular interest were the circumstances whereby the bias did *not*
emerge. Those scoring higher on measures of sub-clinical delusional thinking did not differ in their decision making when completing an emotionally-mundane task (Chapters II, V and VI) and hastier decision making was particularly prevalent when abstract or emotionally stimulating tasks were completed (Chapter III, IV, V and VI). These findings are extremely noteworthy and imply that those experiencing delusions will collect information differently depending upon the emotional and/or abstract nature of the decision under question. There was also a general but strong inclination for individuals to request fewer units of information when completing the task face to face with a researcher in comparison with computerised versions (Chapter II, IV and V). This finding is also notable and implies that our decision making can differ when information is presented in contrasting formats. As a result, reasons why different tasks should elicit contrasting data gathering behaviour amongst those within the sub-clinical range were investigated.

**Intelligence**

It was predicted that individuals experiencing delusions may exhibit reduced verbal intelligence in comparison with lower scorers of the trait. The findings supported the hypothesis and reduced verbal reasoning scores were identified (Chapter II) – supporting previous literature that has identified reduced IQ scores amongst those suffering schizophrenia (Bora, et al., 2009; Keefe et al., 2007; Woodberry et al., 2008) and impaired verbal fluency amongst negative and/or positive schizotypy (Cochrane et al., 2012; Ruiz, et al., 2008). Whilst reduced verbal intelligence was only identified in one particular study in the research programme (Chapter II), it was considered a potential contributing factor for hastier decision making that was apparent in the abstract ‘beads task’ (Phillips et al., 1966).
Indeed, preceding research had also identified a potential for miscomprehension of the task instructions when completing this task in particular (Balzan et al., 2012).

**Probability Estimation**

It was also hypothesised that probability estimation ability may impact upon the emergence of the jump to conclusions bias. There exists on-going debate as to whether those with delusions suffer a general impairment of probability reasoning that may contribute to delusion formation and maintenance (Hemsley et al., 1986). A number of studies have since identified a poorer performance from delusional compared to non-delusional individuals on probability related tasks (Dudley et al., 1998; Linney et al., 1998). Furthermore, delusion prone individuals rated unusual and delusional narratives as far more likely than low delusion prone individuals (LaRocco et al., 2009; McGuire et al., 2001). However, it has been argued that people with delusions do not possess a fundamental incapability to reason about probabilities (Dudley et al., 2003; Fine et al., 2007).

The research programme did identify reduced probability estimation scores amongst those from the sub-clinical range of delusional ideation (Chapter II), thus supporting the notion that those with delusions struggle with probability reasoning, which may contribute to the emergence of the jump to conclusions bias. However, high delusional thinking scorers did not jump to conclusions or exhibit hastier decision making in this instance (Chapter II). Nevertheless, an emotionally-mundane task was used and has been subsequently found to limit the presence of the bias (Chapter V). It appeared that a general lack of ability to process probabilities may interfere with decision making if the task presented is perceived as somewhat abstract and cognitively demanding. Thus, a reduced capability to calculate probabilities could be a potential explanation for the jump to conclusions bias amongst those
from the sub-clinical range completing abstract decision making tasks such as the beads task (Phillips et al., 1966).

*Stress and Data Gathering*

As previously discussed, it had been implied that those that experience delusions possess a hyper-vigilance towards threat and threat-related material (Dudley et al., 2003). By way of reminder, it has been shown that those that experience paranoia are more likely to recall threat-related words compared to positive words (Greer et al., 2016). Most recently, and indeed most interestingly, it has been proposed that individuals belonging to the sub-clinical range of delusional thinking display a tendency to jump to conclusions in scenarios that induce a sense of feeling rushed (White et al., 2009). And in a similar instance, it has been found that delusion-prone individuals report greater confidence in their ideas when they encounter a stressful situation or feel particularly hurried in their decision making (Keefe et al., 2011). Thus it was hypothesised in the Introduction that the stress of the decision making task itself may contribute to hastier decision making (Chapter I).

The research programme identified hastier decision making amongst abstract and emotionally-stimulating tasks (Chapter III, IV, V and VI). However, the findings occurred for only specific components of the PDI measure and it was not apparent why these findings were observed. It was predicted that a general perception of increased life stress, subjective task stress and increased physiological stress during the task could be correlated with sub-clinical delusional thinking and subsequent data gathering behaviour (Chapter VII A, B and C). As expected, general perceived life stress was strongly and positively correlated with sub-clinical delusional thinking. This finding supports literature that has linked delusions to negative emotional states (Kesting et al., 2013; Saha et al., 2011). However, general life
stress did not appear to influence information gathering. Thus, it could not be concluded that increased life stress increased the tendency to jump to conclusions amongst sub-clinical delusion proneness (Chapter VII A). It appears that general perceived life stress, delusional thinking and information gathering remain independent of each other.

Likewise, subjective task stress, the conscious perception of the stress of the decision making task, did not correlate with data gathering scores. However, subjective demands of the task did differ between type of task and form of task delivery. Subjective task stress scores were higher for abstract decision making tasks completed via computer and for realistic tasks completed face to face, but reduced amongst the reverse conditions. The findings are extremely noteworthy and do imply a psychological difference in the perceived demands of the task. In support of this, physiological differences in pulse rate were evident for face to face conditions, with pulse rate readings rising throughout the task (Chapter VII C).

Nevertheless, there were only very tentative associations made between subjective task stress and sub-clinical delusional thinking and, as previously highlighted, none of the measures impacted upon subsequent data gathering. Nevertheless, whilst a clear explanation for the data gathering differences observed was not clearly identified, it was clear that variations in the type of decision making tasks presented may influence subsequent decision making amongst those from the sub-clinical range of delusion proneness. It was predicted that reasoning style differences, potentially cued by emotional state, could account for the data gathering biases observed (Chapter VIII).

**Reasoning Style**

Interestingly, it was shown that high belief conviction scorers displayed increased rational reasoning scores. This was a noteworthy finding and may help to explain why increased data
gathering was been observed amongst high PDI conviction scorers completing neutral and/or self-referent tasks (Chapter V and VI A). Nevertheless, it was emphasised that the limitations of the REI measure of rational reasoning and experiential reasoning (Pacini et al., 1999b) should be taken into consideration. Essentially, the psychometric questionnaire is based upon personal perception i.e. I think that I am more analytical in my decision making. It was possible that participants displaying increased delusional conviction were more convinced of their rational and analytical abilities. Therefore, they may not think rationally but simply believe that they do. This may help to explain why, when presented with abstract and probabilistic tasks, those scoring higher on belief conviction displayed hastier decision making (Chapter III and VI B). When confronted with a task that demanded analytical and rational reasoning, i.e. the beads task (Chapter III and VI B), they opted for a reduced information gathering strategy; perhaps a signal that they in fact do not engage in rational and analytical thinking.

**Predicting a Data Gathering Bias**

In summary, hastier decision making was sensitive to the distinct components of the PDI measure (Peters et al., 1996). Delusional belief conviction scores predicted hastier decision making when presented with abstract and probabilistic tasks (Chapter III and VI B) but enhanced data gathering when presented with neutral or self-referent and realistic materials (Chapter V and VI A).

The subjective demands of the task may go part-way to explaining these differences, as a tentative link between subjective task stress and delusional thinking was identified. Additionally, subjective task stress scores were higher for abstract decision making tasks completed via computer and for realistic tasks completed face to face. This trend for
delusional thinking to be associated with subjective stress, and for subjective stress to further predict data gathering under specific task conditions may be a pivotal explanation for the variances in data gathering amongst those experiencing delusional thinking. Reduced probability estimation ability and verbal intelligence may be factors that, in turn, influence the subjective demands of the task. What was vital, was that those scoring more highly on belief conviction believed themselves to be more rational (Chapter VIII). However, performance on the contrasting tasks did not support this. Abstract and probabilistic tasks cued hastier decision making whilst realistic and self-referent task cued enhanced data gathering. It is essential that components of the PDI measure are considered distinctly and as distinct constructs that may ultimately influence belief formation and maintenance in different ways depending upon the situation or conditions at the time of decision making.

Evaluation of the Research Programme

Upon reflection, there were a number of potential limitations of the research. A decision was made very early on that participants would not be presented with pre-determined sequences of requested information (Chapter III). Many previous studies have always included pre-organised sequences of ‘beads’ (Huq et al., 1988; Phillips et al., 1966). A core aim of the research programme was to introduce tasks that were as realistic as possible to participants. Therefore, participants were told that they were requesting information from two sets of items, from which the experimenter selected randomly. The design of the study supported this notion in order to remain ecological and life-like. Random selection was considered to be an ecologically valid method of information gathering. However, it was possible that random selection may have resulted in the reduction in the rate of the jump to conclusions bias. Whilst the current research still supports the design that was used, an earlier pilot study could
have determined if current methods (Winton-Brown et al., 2015), which employ pre-
organised sequences, do in fact influence order effects and promote a jump to conclusions
response.

In addition, in contrast to studies within the literature that investigate delusion-proneness as a
singular construct (Orenes et al., 2012; Zawadzski et al., 2012), the studies in the research
programme investigated belief distress, belief preoccupation and belief conviction scores
separately. Whilst all three scores do indeed concern delusional beliefs, the three
psychological constructs are very different. It was possible that the significant differences
identified might not have been found if the data had not been analysed this way. However,
the research did intend to explore these three constructions separately, as explained in the
Introduction. Thus it was concluded that investigating delusional belief distress,
preoccupation and conviction separately strengthened the validity of the research.

A final and theoretical consideration relates to the suppositions surrounding the jump to
conclusions bias amongst those prone to delusional thinking. It is evident when reading the
wealth of literature investigating delusional thinking that the beads task is still a frequently
used and implemented measure of the jump to conclusions bias. In fact the task, designed in
1966 by Phillips and Edwards, is still used 50 years on (Winton-Brown et al., 2015). The
task, and the supposition that those prone to delusions are vulnerable to hasty and flawed
reasoning (Garety et al., 1999), has withstood the test of time.

One essential and basic flaw remains: it is implied that hasty decision making is perceived as
flawed reasoning. There is little evidence to suggest that those that did jump to conclusions
got the answer wrong. And, imbedded within the literature, if you look hard enough for it, it
can even be found that there were no differences in the rate of accuracy of decision making
between those experiencing delusions and those that did not (Huq et al., 1988). Indeed,
reasoning based upon the use of heuristics and cognitive short-cuts is extremely well-
documented (Kahneman et al., 2005).

Gerd Gigerenzer was one of the first psychologists to emphasise the importance of fast and
frugal heuristics (Gigerenzer et al., 1996). A fast and frugal heuristic is essentially ‘a strategy,
conscious or unconscious, that searches for minimal information’ (Gigerenzer, 2008, p22).
Gigerenzer (2008) stressed that heuristics, our cognitive short cuts, could produce good
solutions to an array of complex decisions in life including whom we choose to marry, which
job offer to accept and which chess piece to move next.

To rely on your intuitions in scenarios such as this, and to consequently jump to conclusions,
may make perfect evolutionary sense. In situations of perceived potential danger and stress, it
would serve no use to engage our reflective rationality and to ponder on the best possible
action to take. To ponder is to waste time and prolong exposure to stress. Hasty decisions
ensure speedy action and a swift response, and as highlighted by Sutherland (1992, p137) ‘It
is better to be wrong than eaten’.

Hastiness in decision making may reflect an adaptive response to perceived stressors and may
promote the generation of efficient and speedy decisions, free from the interference of our
analytical deliberation. Thus jump to conclusions may not be a cognitive impairment at all,
but an effective adaptation. Future research in the field of delusional thinking, clinical or
otherwise, could investigate not only the speed of the decisions made, but ultimately the
accuracy of those decisions.

Conclusion

It is clear, given the enormous wealth of literature in the area, that patients with delusions
possess a propensity to jump to conclusions (Dudley et al., 1997a, 1997b; Fear et al., 1997;
Freeman, 2007); a finding also evident amongst individuals from the sub-clinical range of delusion-proneness (Orenes et al., 2012; Zawadzki et al., 2012). However, the current research programme failed to support this general notion and has supported propositions that suggest that jumping to conclusions is not always present amongst non-pathological samples (Dudley et al., 2011). Nevertheless, hastier decision making was identified amongst those scoring more highly on the trait when completing abstract and/or emotionally stimulating tasks. The findings may suggest that previous methodologies that have been designed to investigate the jump to conclusions bias may have, paradoxically, promoted its emergence. Potential explanations for this behaviour were investigated and included differences in verbal intelligence, probability estimation ability, cognitive reasoning style and subjective and physiological stress and the distinct components of delusional belief (Peters et al., 1996).

Nevertheless, it was clear that variations in the type of decision making tasks presented may influence subsequent decision making amongst those from the sub-clinical range of delusion proneness, and that this inclination may be related to the perceived demands of the task.

Whilst delusional thinking appears to be associated with hasty decision making, some of the time, the present research has demonstrated that enhanced data gathering can be encouraged with use of self-referent and realistically framed task measures. The relationship between these distinct trait and state variables is no doubt a complex one but understanding exactly how these variables influence one another, in a variety of contrasting situations, may help to inform treatment programmes for patients suffering with delusional beliefs in the future.
References


https://www.researchgate.net/publication/305352849_Beads_Task_vs_Box_Task_The_specificity_of_the_Jumping_to_Conclusions_bias


Appendices
Appendix 1: Information Form

Individual Differences in Cognitive Thinking and Reasoning Style

You are invited to participate in a study investigating individual differences in cognitive thinking and reasoning style.

The study is being conducted by Stephanie Rhodes (<stephanie.rhodes@wlv.ac.uk>) under the supervision of Dr. Niall Galbraith (Tel: 01902 321362; Email: n.galbraith@wlv.ac.uk). The completion of the study is part of a Doctor of Philosophy (PhD) programme.

You will be provided with a psychometric questionnaire, an intelligence test and a probability problem test. You will be kindly to read the instructions at the top of each questionnaire carefully and fill out the questionnaires in the order in which they were given to you. If at any point during the experiment, you feel uncomfortable with any of the questions you are being asked do not enter your response.

Each questionnaire should take no longer than 10 minutes to complete. It is estimated that the verbal intelligence test should take 25 minutes and the probability problem test should take no longer than 35 minutes. The experiment should take no longer than 1 hour 15 minutes in total. Following data collection you will be verbally debriefed.

As a participant in the study, you will be fully protected by the British Psychological Society ethical guidelines. Any information or personal details gathered in the course of the study will remain anonymous and the data gathered will be identifiable by participant number only. Questionnaires/tests and consent forms will be stored separately and securely. Please note that anonymous data cannot be withdrawn after data collection. After the conclusion of the research project in October 2014, all electronic data will be deleted and questionnaires and consent forms returned to the project supervisor for secure storage in line with the University of Wolverhampton’s data protection legislation.
A summary of the findings will be available from July 2011 from the project supervisor upon request.

If you would like more information about the study before providing consent, ask any questions to the researcher named above.

If you do decide to participate, you are free to withdraw at any time during the experiment without the need to provide a reason. If you are prepared to participate, sign the consent form and return it to a researcher.

Thank you.
Appendix 2: Informed Consent Sheet

Individual Differences in Cognitive Thinking and Reasoning Style

- I confirm that I have read and understand the information sheet inviting me to take part in the study.

- I understand that I will complete two psychometric tests, a probability problem test and a data gathering task in a random order.

- I understand that data collected will be collated with responses from other participants.

- I understand that the data I provide will remain confidential and will be anonymous.

- I appreciate that anonymous data cannot be withdrawn after data collection.

- I understand that I can contact the researcher and/or the research supervisor to request a summary of the findings upon completion of the investigation.

- I can confirm that my participation is voluntary and that I am free to withdraw from the study at any time without the need to provide a reason.

I agree to participate in the study:

Age: 
Gender: 
Date: 
Participant Pool Number:
Appendix 3: Debrief Form

Individual Differences in Cognitive Thinking and Reasoning Style

Thank you for participating in the study investigating individual differences in cognitive thinking and reasoning style. The aim of the current study is to investigate personality factors and reasoning.

As a result of participating in the study, you will be fully protected by the British Psychological Society ethical guidelines. Any information or personal details that have been gathered during the course of the study will remain anonymous and the data gathered will be identifiable by participant number only. Questionnaires and consent forms will be stored separately. Please note that anonymous data cannot be withdrawn after data collection.

A summary of the findings will be available from July 2011 from the project supervisor upon request (Dr. Niall Galbraith (Tel: 01902 321362: Email: n.galbraith@wlv.ac.uk ). If you would like more information about the study, please ask any questions to the researcher (stephanie.rhodes@wlv.ac.uk).

Thank you.
Appendix 4: The Peters et al Delusions Inventory (Peters, Day and Garety, 1996)

This questionnaire is designed to measure beliefs and vivid mental experiences. We believe that they are much more common than has previously been supposed, and that most people have had some such experiences during their lives. Please answer the following questions as honestly as you can. There are no right or wrong answers, and there are no trick questions.

Please note that we are NOT interested in experiences people may have had when under the influence of drugs.

**IT IS IMPORTANT THAT YOU ANSWER ALL QUESTIONS.**

For the questions you answer YES to, we are interested in:
(a) how distressing these beliefs or experiences are
(b) how often you think about them; and
(c) how true you believe them to be.

On the right hand side of the page we would like you to circle the number which corresponds most closely to how distressing this belief is, how often you think about it, and how much you believe that it is true.

If you answer NO please move on to the next question.

Examples:

Do you ever feel as if people are reading your mind?

<table>
<thead>
<tr>
<th>No</th>
<th>Yes</th>
<th>Not at all distressing</th>
<th>Very distressing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hardly ever think about it</td>
<td>Think about it all the time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 2 3 4 5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Don't believe it's true</td>
<td>Believe it is absolutely true</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
</tbody>
</table>

Do you ever feel as if you could read other people's minds?

<table>
<thead>
<tr>
<th>No</th>
<th>Yes</th>
<th>Not at all distressing</th>
<th>Very distressing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 2 3 4 5</td>
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<td></td>
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<td>Hardly ever think about it</td>
<td>Think about it all the time</td>
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<td></td>
<td>Don't believe it's true</td>
<td>Believe it is absolutely true</td>
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<td>1 2 3 4 5</td>
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</tbody>
</table>
Now please turn the page and begin.

<table>
<thead>
<tr>
<th>Age:</th>
<th>Gender:</th>
</tr>
</thead>
</table>

1) Do you ever feel as if people seem to drop hints about you or say things with a double meaning?

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<th>NO</th>
<th>YES</th>
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<th>Not at all distressing</th>
<th>Very distressing</th>
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2) Do you ever feel as if things in magazines or on TV were written especially for you?

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3) Do you ever feel as if some people are not what they seem to be?

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4) Do you ever feel as if you are being persecuted in some way?

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5) Do you ever feel as if there is a conspiracy against you?

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6) Do you ever feel as if you are, or destined to be someone very important?

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7) Do you ever feel that you are a very special or unusual person?

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<td>8) Do you ever feel that you are especially close to God?</td>
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<td>NO      YES (please circle)</td>
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<td>9) Do you ever think people can communicate telepathically?</td>
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<td>NO      YES (please circle)</td>
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<td>10) Do you ever feel as if electrical devices such as computers can influence the way you think?</td>
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<td>11) Do you ever feel as if you have been chosen by God in some way?</td>
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<td>NO      YES (please circle)</td>
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<td>12) Do you believe in the power of witchcraft, voodoo or the occult?</td>
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<td>NO</td>
<td>YES</td>
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<thead>
<tr>
<th>13) Are you often worried that your partner may be unfaithful?</th>
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<tbody>
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<td>NO</td>
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<th>14) Do you ever feel that you have sinned more than the average person?</th>
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<td>NO</td>
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<th>15) Do you ever feel that people look at you oddly because of your appearance?</th>
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<td>NO</td>
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16) Do you ever feel as if you had no thoughts in your head at all?

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<th>Action</th>
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<tr>
<td>Think about it all the time</td>
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| Don't believe it's true | 1 | 2 | 3 | 4 | 5 |
| Believe it is absolutely true | 5 | 4 | 3 | 2 | 1 |

17) Do you ever feel as if the world is about to end?

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18) Do your thoughts ever feel alien to you in some way?

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19) Have your thoughts ever been so vivid that you were worried other people would hear them?

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20) Do you ever feel as if your own thoughts were being echoed back to you?

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21) Do you ever feel as if you are a robot or zombie without a will of your own?

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</table>
Hello and welcome to the experiment.

A competitive business has been developing an all new remote controllable vacuum cleaner designed to reduce manual effort.

Two independent surveys were conducted to assess the popularity of the product for potential public release. Beforehand, participants had received a detailed written description of the vacuum, along with a 15 minute demonstration.

Participants were then asked to decide if they were in favour of or against the release of the vacuum cleaner for public purchase. Each participant was instructed to state whether they were in favour of or against the vacuum cleaner being made publicly available and to give a genuine reason for their viewpoint.

The results of Survey One revealed that 40% favoured the vacuum cleaner whilst the remaining 60% were against the release of the vacuum cleaner.

The results of the Survey Two revealed altogether different findings. Of the participants that took part 60% believed the vacuum cleaner should be made available to buy whilst the remaining 40% were against the sale of the vacuum.

You are about to read a series of comments from participants from only one of the two surveys. Each comment will express whether or not the participant believed the vacuum to be suitable for public release along with the reason for their view.

You are asked to read the comments carefully and to determine which survey the comments were drawn from; Survey One or Survey Two in relation to the prospective percentage that favoured the vacuum and those that did not.
Survey One: 40% favoured the vacuum cleaner whilst the remaining 60% were against the release of the vacuum cleaner for public purchase.

Survey Two: 60% believed the vacuum cleaner should be made available to buy whilst the remaining 40% were against the sale of the vacuum.

You can choose to read as many/ or as few comments as you wish until you feel you know which survey the comments are drawn from. When you feel you know the answer, please end the experiment.

Please ask any questions to the researcher now if you do not understand the instructions for the experiment.

Thank you

Comments presented via Superlab

Survey One 40:60 of For and Against Comments

Realistically you’ve got to release the cleaner onto the market. It’s not as expensive as you would think and is far better than the one I have at the moment.

I think the fact that the vacuum can be controlled by remote control makes it a winner!

I absolutely loved it! It has moved on in terms of technological advance.

I would definitely buy this vacuum. It needs to be made available for the simple reason I haven’t got to push it around.

So many women would appreciate the marvellous technology of this vacuum– I know my mother would certainly appreciate it.

It’s the dream cleaner isn’t it? A vacuum that goes around on its own – it has been a long time coming!
I think the vacuum would be really popular – it would be brilliant for the elderly who perhaps
would benefit the most from the remote control operation.

I’m in favour of the vacuum – it was efficient and very modern.

I’m not sure about the whole remote control thing – it would make people very lazy. I’m not
sure something like that should be widely available.

Well it would be fantastic but I think they have made it too complex – look at all the things
that could go wrong! I would want something simpler.

Have you seen the price tag? Way too expensive for me.

To be honest, I think that if it was released people would find it disappointing. I don’t think
it’s right for the market.

Definitely a No! I’m not that incapable I can’t push a hoover around.

I’m not that excited about it actually – it’s quite pricey. Not for me.

Another excuse for people not to exercise - I think we’ve got too much of that already. It is a
No from me.

I don’t think I quite support the idea. The suction wasn’t brilliant to be honest.

I don’t think it would sell all too well. It is quite expensive.

It is just a bit too technical for a hoover. I think it would take longer to do the cleaning by
remote than if you just got off your bum and pushed it around.

I didn’t like it. It wasn’t very good at sucking up dust.

It’s a good idea but I think there are too many features on it – I could see it breaking down
quite often.

I’m not a fan – it would take a while to get used to the remote control so the cleaning would
take longer.
Survey Two: 60:40 of For and Against comments

Realistically you’ve got to release the cleaner onto the market. It’s not as expensive as you would think and is far better than the one I have at the moment.

I think the fact that the vacuum can be controlled by remote control makes it a winner!

I absolutely loved it! It has moved on in terms of technological advance.

I would definitely buy this vacuum. It needs to be made available for the simple reason I haven’t got to push it around.

So many women would appreciate the marvellous technology of this vacuum— I know my mother would certainly appreciate it.

It’s the dream cleaner isn’t it? A vacuum that goes around on its own – it has been a long time coming!

I think the vacuum would be really popular – it would be brilliant for the elderly who perhaps would benefit the most from the remote control operation.

I liked the vacuum because the man who delivered the demonstration sold it to me completely. Brilliant!

I’m in favour of the vacuum— it was efficient and very modern.

My vote goes in favour of the cleaner – it’s a real advancement as far as vacuum cleaners go.

Apart from the fact it was operated by remote control it also had some extra cool features to it – I would definitely want one!

I think it would sell – there would be a fantastic demand for it.

I’m not sure about the whole remote control thing – it would make people very lazy. I’m not sure something like that should be widely available.

Well it would be fantastic but I think they have made it too complex – look at all the things that could go wrong! I would want something simpler.

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Definitely a No! I’m not that incapable I can’t push a hoover around.

It’s a good idea but I think there are too many features on it – I could see it breaking down quite often.

I’m not that excited about it actually – it’s quite pricey. Not for me.

Another excuse for people not to exercise - I think we’ve got too much of that already. It is a No from me.
Appendix: 5.2

The Perspective ‘Realistic’ Version of the Data Gathering Task

Hello and welcome to the experiment.

A competitive business has been developing an all new remote controllable vacuum cleaner designed to reduce manual effort.

An independent survey was conducted to assess the popularity of the product for public release. Beforehand, participants had received a detailed written description of the vacuum, along with a 15 minute demonstration.

Participants were then asked to decide if they were in favour of or against the release of the vacuum cleaner for public purchase. Each participant was instructed to state whether they were for or against the vacuum cleaner being made publicly available and to give a genuine reason for their viewpoint.

You will now be given the opportunity to read a selection of the participants’ comments provided in the survey. You are asked to read the comments carefully and to determine the viewpoint you agree with most: for or against the release of the vacuum cleaner.

You can choose to read as many/ or as few participants comments as you wish. When you feel you confidently know which viewpoint you agree with most, please end the experiment.

Please ask any questions to the researcher now if you do not understand the instructions for the experiment.

Thank you

Comments presented via Superlab. 50:50 of For and Against Comments

Realistically you’ve got to release the cleaner onto the market. It’s not as expensive as you would think and is far better than the one I have at the moment.

I think the fact that the vacuum can be controlled by remote control makes it a winner!
I absolutely loved it! It has moved on in terms of technological advance.

I would definitely buy this vacuum. It needs to be made available for the simple reason I haven’t got to push it around.

So many women would appreciate the marvellous technology of this vacuum— I know my mother would certainly appreciate it.

It’s the dream cleaner isn’t it? A vacuum that goes around on its own – it has been a long time coming!

I think the vacuum would be really popular – it would be brilliant for the elderly who perhaps would benefit the most from the remote control operation.

I’m in favour of the vacuum— it was efficient and very modern.

My vote goes in favour of the cleaner – it’s a real advancement as far as vacuum cleaners go.

Apart from the fact it was operated by remote control it also had some extra cool features to it – I would definitely want one!

I’m not sure about the whole remote control thing – it would make people very lazy. I’m not sure something like that should be widely available.

Well it would be fantastic but I think they have made it too complex – look at all the things that could go wrong! I would want something simpler.

Have you seen the price tag? Way too expensive for me.

To be honest, I think that if it was released people would find it disappointing. I don’t think it’s right for the market.

Definitely a No! I’m not that incapable I can’t push a hoover around.

It’s a good idea but I think there are too many features on it – I could see it breaking down quite often.

I’m not that excited about it actually – it’s quite pricey. Not for me.
Another excuse for people not to exercise- I think we’ve got too much of that already. It is a No from me.

I don’t think I quite support the idea. The suction wasn’t brilliant to be honest.

I don’t think it would sell all too well because of how expensive it is.

It is just a bit too technical for a hoover. I think it would take longer to do the cleaning by remote than if you just got off your bum and pushed it around.
Appendix 6: The Probability Test

Below are a series of nine probability related questions. Be sure to read the questions carefully before attempting to answer them. There is no time limit for the completing the questions- take as much or as little time as you need. You are free to use a calculator if necessary and any working out can be completed on the blank sheet of paper provided. Please enter your response for each question on the separate answer sheet provided.

1) There are 400 marbles in a box. Eighty are red. If one is drawn out at random, what is the probability of selecting a red one?

2) Joan plays tennis with her friends Jill and Angela. If she has a probability of 0.7 of beating Angela and a probability of 0.4 of beating Jill, what is the probability of Jill beating Joan?

3) What is the probability of each of the following happening:
   a) Drawing the six of hearts from a pack of playing cards
   b) Tossing two coins and obtaining two heads
   c) Drawing any heart from a pack of playing cards

4) A machine in a factory makes 1900 perfect individual chocolates per hour. If the machine makes a 100 spoiled or imperfect chocolates in the same time
   c) What is the probability of making perfect chocolates? (to two decimal places)
   d) How many imperfect chocolates will be produced in 4 days if the machine works 24-7?

5) Soldiers at a rifle range have the following probabilities of achieving a score:
   probability 0.23 score ≥ 250, probability 0.67 ≥ 150, probability 0.89 ≥ 50.
   a) What is the probability of achieving a score less than 250?
   b) What is the probability of achieving a score less than 50?

6) An airline boasts that each flight on average has a probability of 0.625 of being on time. If there are 24 flights per day, how many flights will be late in one week?

7) The medical centre in a large factory keeps a record of accidents happening in the factory. When the statistics are analysed, they reveal that the probability of a serious accident happening on any given day is 0.02 but this falls to 0.015 for the two or three days immediately following an accident. This is thought to be due to the fact that people are more careful for a short while after an accident.
   a) What is the probability of two consecutive days with no serious accidents?
   b) What is the probability of their being no serious accidents on the first day and a serious accident on the second day?
8) A football team with a probability of 0.8 of winning a match plays 50 matches in a season.

   a) What is the probability of the team losing a match?
   b) How many matches would the team expect to lose in the first half of the season?

9) A box contains a large number of blue counters, green counters and orange counters. One counter is chosen at random. The probability of choosing a blue counter is $\frac{3}{5}$ and the probability of choosing a green is $\frac{3}{10}$. What is the probability of choosing an orange counter?
Appendix 7: Information Form

Decision Making and Belief

You are invited to participate in a study investigating psychological beliefs and decision making.

The study is being conducted by Stephanie Rhodes (Tel: 01902 325754 Email: stephanie.rhodes@wlv.ac.uk) under the supervision of Dr. Niall Galbraith (Tel: 01902 321362: Email: n.galbraith@wlv.ac.uk). The completion of the study is part of a Doctor of Philosophy (PhD) programme.

You will be provided with a psychometric questionnaire and a decision making task. You will be kindly asked to read the instructions for each questionnaire/task carefully. If at any point during the experiment, you feel uncomfortable with any of the questions/tasks you are being asked to complete do not enter your response.

The questionnaire should take no longer than 10 minutes to complete. It is estimated that the decision making task should take no longer than 10 minutes. The experiment should take no longer than 20 minutes in total. Following data collection you will be verbally debriefed.

The study will adhere to ethical guidelines outlined by the British Psychological Society. Any information or personal details gathered in the course of the study will remain anonymous and the data gathered will be identifiable by participant number only. Questionnaires and consent forms will be stored separately and securely at the University of Wolverhampton Psychology Demonstrator office MC116. Please note that anonymous data cannot be withdrawn after data collection. After the conclusion of the research project in October 2014, all electronic data will be deleted and questionnaires and consent forms returned to the project supervisor for secure storage in line with the University of Wolverhampton’s data protection legislation.
A summary of the findings will be available from July 2013 from the project researcher upon request.

If you would like more information about the study before providing consent, ask any questions to the researcher named above. If you do decide to participate, you are free to withdraw at any time during the experiment without the need to provide a reason. If you are prepared to participate, please sign the consent form and return it to a researcher.

Thank you.
Appendix 8: Informed Consent

Decision Making and Belief

- I confirm that I have read and understand the information sheet inviting me to take part in the study. I understand that I will complete a psychometric tests and a decision making task in a random order.

- I understand that data collected will be collated with responses from other participants and will remain confidential and will be anonymous.

- I appreciate that anonymous data cannot be withdrawn after data collection.

- I understand that I can contact the researcher to request a summary of the findings upon completion of the investigation.

- I can confirm that my participation is voluntary and that I am free to withdraw from the study at any time without the need to provide a reason.

**I agree to participate in the study:**

Age:  
Gender:  
Participant Pool Number:
Appendix 9: Debrief Form

Decision Making and Belief

Thank you for participating in the study investigating psychological beliefs and decision making.

The aim of the current study is to investigate two distinct personality factors and how they may interact to influence cognitive decision making.

As a result of participating in the study, you will be fully protected by the British Psychological Society ethical guidelines. Any information or personal details that have been gathered during the course of the study will remain anonymous and the data gathered will be identifiable by participant number only. Questionnaires and consent forms will be stored separately at the University of Wolverhampton Demonstrator office. Please note that anonymous data cannot be withdrawn after data collection.

A summary of the findings will be available from July 2013 from the project researcher upon request. If you would like more information about the study, please ask any questions to the researcher (Stephanie Rhodes: Tel: 0192 325754: Email: stephanierhodes@wlv.ac.uk).

Thank you for your participation.
Hello and welcome to the experiment.

There are two jars of coloured beads. The first jar, Jar A, contains more black beads than white beads. In Jar A, 60% of the beads are black whilst the remaining 40% of beads are white.

However, in the second jar, Jar B, the percentage of coloured beads has reversed respectively; there are less black beads than there are white beads. In Jar B, 40% of the beads are black whilst the remaining 60% of beads are white.

Your task is to request beads, one at a time in order to determine which jar the researcher has selected: Jar A or Jar B by taking into account the prospective percentage of black and white beads that are listed in the sequence.

- Jar A: 60% of the beads are black and 40% of the beads are white
- Jar B: 40% of the beads are black and 60% of the beads are white

You can choose to request as many/ or as few as you wish until you feel you know which jar the sequence of beads is drawn. When you feel you know the answer, please end the experiment.

Please ask any questions to the researcher now if you do not understand the instructions for the experiment.

Thank you.
Appendix 10b: Task Answer Sheet for the Beads Task

Participant Answer Sheet

Please could you tick the box that indicates which jar you believe the beads in the experiment were drawn:

Jar A: Ratio of black beads compared to white beads 60:40.

Jar B: Ratio of black beads compared to white beads 40:60

Thank you for your contribution to the experiment.
Appendix 11: Task Instruction for the Self-Referent Data Gathering Task

Hello and welcome to the experiment.

A University student has recently completed their undergraduate degree and applied for a full time employment position with a reputable organisation.

After completing the job application form, the individual was invited to an interview selection process with the organisation. As a candidate for the position available, the individual was required to complete a skills ability test before attending two formal interviews each in front of a panel of interviewers.

Following the completion of the interview, the two panels of judges were asked to right down their comments regarding the candidate’s performance during the interview selection process.

The first panel of judges from the first interview provided comments of which 60% of the comments were positive and favourable of the candidate’s performance at interview, whilst the remaining 40% of overall comments were negative and unfavourable of the candidate’s performance.

However, the comments from the second panel of interviewers from the second interview revealed altogether different findings. 40% of their comments were positive and favourable of the candidate’s performance, whilst only 60% of their overall comments were negative and unfavourable of the candidate’s performance.

You are about to read a series of comments that came from only one of the two panels of judges. Each comment will express either a positive or negative aspect of the candidate’s performance at interview.

You are asked to read the comments carefully and to determine which panel of interviewers the comments were selected; Panel One or Panel Two in relation to the prospective
percentage of comments that was favourable/ unfavourable towards the candidate’s performance.

➢ Panel One: 60% of comments favoured the candidate’s performance whilst the remaining 40% criticised the candidate’s performance.
➢ Panel Two: 40% of comments favoured the candidate’s performance whilst the remaining 60% criticised the candidate’s performance.

You can choose to read as many/ or as few comments as you wish until you feel you know which one the two panels the comments are selected. When you feel certain of your answer, please end the experiment.

Please ask any questions to the researcher now if you do not understand the instructions for the experiment.

Thank you.
Appendix 12: Information Form

Decision Making and Psychological Experiences

You are invited to participate in a study investigating psychological experiences and decision making.

The study is being conducted by Stephanie Rhodes (Tel: 01902 325754 Email: stephanie.rhodes@wlv.ac.uk) under the supervision of Dr. Niall Galbraith (Tel: 01902 321362: Email: n.galbraith@wlv.ac.uk). The completion of the study is part of a Doctor of Philosophy (PhD) programme.

You will be provided with a psychometric questionnaire and two decision making tasks. You will be kindly asked to read the instructions for each questionnaire/ task carefully. If at any point during the experiment, you feel uncomfortable with any of the questions/ tasks you are being asked to complete do not enter your response.

The questionnaire should take no longer than 10 minutes to complete. It is estimated that the decision making tasks should take no longer than 10 minutes The experiment should take no longer than 30 minutes in total. Following data collection you will be verbally debriefed.

The study will adhere to ethical guidelines outlined by the British Psychological Society. Any information or personal details gathered in the course of the study will remain anonymous and the data gathered will be identifiable by participant number only. Questionnaires and consent forms will be stored separately and securely at the University of Wolverhampton Psychology Demonstrator office MC116. Please note that anonymous data cannot be withdrawn after data collection. After the conclusion of the research project in October 2014, all electronic data will be deleted and questionnaires and consent forms returned to the project supervisor for secure storage in line with the University of Wolverhampton’s data protection legislation.
A summary of the findings will be available from February 2016 from the project researcher upon request.

If you would like more information about the study before providing consent, ask any questions to the researcher named above. If you do decide to participate, you are free to withdraw at any time during the experiment without the need to provide a reason. If you are prepared to participate, please sign the consent form and return it to a researcher.

Thank you.
Appendix 13: Informed Consent

Decision Making and Psychological Experiences

- I confirm that I have read and understand the information sheet inviting me to take part in the study. I understand that I will complete a psychometric tests and two decision making tasks in a random order.

- I understand that data collected will be collated with responses from other participants and will remain confidential and will be anonymous.

- I appreciate that anonymous data cannot be withdrawn after data collection.

- I understand that I can contact the researcher to request a summary of the findings upon completion of the investigation.

- I can confirm that my participation is voluntary and that I am free to withdraw from the study at any time without the need to provide a reason.

I agree to participate in the study:

Age:

Gender:

Participant Pool Number:
Appendix 14: Debrief Form

Decision Making and Psychological Experiences

Thank you for participating in the study investigating psychological experiences and decision making.

The aim of the current study is to investigate personality factors and how they may interact to influence cognitive decision making.

As a result of participating in the study, you will be fully protected by the British Psychological Society ethical guidelines. Any information or personal details that have been gathered during the course of the study will remain anonymous and the data gathered will be identifiable by participant number only. Questionnaires and consent forms will be stored separately at the University of Wolverhampton Demonstrator office. Please note that anonymous data cannot be withdrawn after data collection.

A summary of the findings will be available from February 2016 from the project researcher upon request. If you would like more information about the study, please ask any questions to the researcher (Stephanie Rhodes: Tel: 0192 325754; Email: stephanierhodes@wlv.ac.uk).

Thank you for your participation.
Appendix 15: The Information Form

Psychological Beliefs and Decision Making

You are invited to participate in a study investigating psychological beliefs and decision making.

Who is conducting the study?

The study is being conducted by Stephanie Rhodes (Tel: 01902 325754 Email: stephanierhodes@wlv.ac.uk) under the supervision of Dr. Niall Galbraith (Tel: 01902 321362: Email: n.galbraith@wlv.ac.uk). The completion of the study is part of a Doctor of Philosophy (PhD) programme.

What will I be asked to do?

You will be provided with a psychometric questionnaire and a decision making task. You will be kindly asked to read the instructions for the questionnaire/ task carefully. If at any point during the experiment, you feel uncomfortable with any of the questions/ tasks you are being asked to complete do not enter your response.

The questionnaire should take no longer than 10 minutes to complete. It is estimated that the decision making task should take no longer than 10 minutes. The experiment should take no longer than 20 minutes in total.

If you would like more information about the study before providing consent, please contact Stephanie Rhodes (Tel: 01902 325754 Email: stephanierhodes@wlv.ac.uk).
What will happen after the study?

A summary of the findings will be available from February 2016 from the project researcher upon request. Should you have any concerns regarding your participation in the study, please contact the research supervisor Dr Niall Galbraith (n.galbraith@wlv.ac.uk).

The study will adhere to ethical guidelines outlined by the British Psychological Society. Any information or personal details gathered in the course of the study will remain anonymous and the data gathered will be identifiable by participant number only. Questionnaires and consent forms will be stored separately and securely at the University of Wolverhampton Psychology Demonstrator office MC116. Please note that anonymous data cannot be withdrawn after data collection. After the conclusion of the research project in February 2016, all electronic data will be deleted and questionnaires and consent forms returned to the project supervisor for secure deletion in line with the University of Wolverhampton’s data protection legislation.

If you do decide to participate, you are free to withdraw at any time during the study without the need to provide a reason. However, data cannot be withdrawn once responses have been submitted. If you are prepared to participate, please sign the consent form and return it to a researcher.

Thank you.
Appendix 16: Informed Consent

Psychological Beliefs and Decision Making

- I confirm that I have read and understand the information sheet inviting me to take part in the study. I understand that I will complete a psychometric questionnaire and a decision making task.

- I understand that data collected will be collated with responses from other participants and will remain confidential and will be anonymous.

- I appreciate that anonymous data cannot be withdrawn once your responses have been submitted.

- I understand that I can contact the researcher to request a summary of the findings upon completion of the investigation.

- I can confirm that my participation is voluntary and that I am free to withdraw from the study at any time throughout the data collection process without the need to provide a reason.

I agree to participate in the study:

Age:
Gender:
Participant Pool Number:
Appendix 17: Debrief Form

Psychological Beliefs and Decision Making

Thank you for participating in the study investigating psychological beliefs and decision making.

The aim of the current study is to investigate personality factors and how they may influence cognitive decision making.

As a result of participating in the study, you will be fully protected by the British Psychological Society ethical guidelines. Any information or personal details that have been gathered during the course of the study will remain anonymous and the data gathered will be identifiable by participant number only. Questionnaires and consent forms will be stored separately at the University of Wolverhampton Demonstrator office, MC116. Please note that anonymous data cannot be withdrawn after data collection.

A summary of the findings will be available from February 2016 from the project researcher upon request. If you would like more information about the study, please ask any questions to the researcher (Stephanie Rhodes: Tel: 0192 325754; Email: stephanierhodes@wlv.ac.uk).

Thank you for your participation.
Hello and welcome to the experiment.

A University student has recently completed their undergraduate degree and applied for a full time employment position with a reputable organisation.

After completing the job application form, the individual was invited to an interview selection process with the organisation. As a candidate for the position available, the individual was required to complete a skills ability test before attending a formal interview in front of a panel of interviewers.

Following the completion of the interview, the panel of judges were asked to write down their comments regarding the candidate’s performance during the interview selection process. You will now be given the opportunity to read a selection of the comments the interviewers provided following the candidate’s interview. You are asked to read the comments carefully and to determine whether or not you feel the candidate should be offered the position available with the organisation.

You can choose to read as many/ or as few participants comments as you wish. When you feel you have confidently decided whether or not you feel the candidate should be offered the position, please end the experiment.

Please ask any questions to the researcher now if you do not understand the instructions for the experiment.

Thank you
The candidate was confident throughout the interview process.

The candidate demonstrated a range of skills relevant to the position available.

The candidate was successful in providing examples of relevant skills and abilities they possessed.

The candidate appeared to be enthusiastic to secure the position available.

The candidate asked appropriate questions at the end of the interview.

The candidate answered questions during the interview with a degree of assurance.

The candidate maintained eye contact with the interview panel throughout the interview selection process.

The candidate appeared friendly and approachable.

The candidate provided some good thorough responses to questions asked at the interview.

The candidate possessed a 2.1 classification undergraduate University degree qualification.
The candidate was 10 minutes late for the interview.

The candidate lacked examples of relevant work experience.

The candidate did not dress smartly for the interview.

The candidate’s job application did contain spelling and grammatical errors.

The candidate performed poorer than other candidates in a skills ability test prior to the interview.

The candidate displayed hesitancy before responding to questions at the interview.

The candidate could not answer one of the questions provided in the interview.

The candidate failed to bring appropriate identification.

The candidate had not remained at any previous employment positions longer than six months.

The candidate failed to complete the skills ability test prior to the interview within the allocated time.
Appendix 19

Instructions for the Neutral ‘Realistic’ Decision Making Task

A competitive business has been developing an all new modern vacuum cleaner designed to reduce manual effort.

An independent survey was conducted to assess the popularity of the product for public release. Beforehand, participants had received a detailed written description of the vacuum, along with a 15 minute demonstration.

Participants were then asked to decide if they were in favour of or against the release of the vacuum cleaner for public purchase. Each participant was instructed to state whether they were for or against the vacuum cleaner being made publicly available and to give a genuine reason for their viewpoint.

You will now be given the opportunity to read a selection of the participants’ comments provided in the survey. You are asked to read the comments carefully and to determine the viewpoint you agree with most: for or against the release of the vacuum cleaner.

You can choose to read as many/ or as little participants comments as you wish. When you feel you confidently know which viewpoint you agree with most, terminate the experiment.

Viewpoint Condition Comments: For and Against- 50:50.

Realistically you’ve got to release the cleaner onto the market. It’s not as expensive as you would think and is far better than the one I have at the moment.

I think the fact that the vacuum can be controlled by remote control makes it a winner!
I absolutely loved it! It has moved on in terms of technological advance.

I would definitely buy this vacuum. It needs to be made available for the simple reason I haven’t got to push it around.

So many women would appreciate the marvellous technology of this vacuum– I know my mother would certainly appreciate it.

It’s the dream cleaner isn’t it? A vacuum that goes around on its own – it has been a long time coming!

I liked the vacuum because the man who delivered the demonstration sold it to me completely. Brilliant!

I’m in favour of the vacuum– it was efficient and very modern.

My vote goes in favour of the cleaner – it’s a real advancement as far as vacuum cleaners go.

Apart from the fact it was operated by remote control it also had some extra cool features to it – I would definitely want one!

I’m not sure about the whole remote control thing – it would make people very lazy. I’m not sure something like that should be widely available.
Well it would be fantastic but I think they have made it too complex – look at all the things that could go wrong! I would want something simpler.

Have you seen the price tag? Way too expensive for me.

To be honest, I think that if it was released people would find it disappointing. I don’t think it’s right for the market.

Definitely a No! I’m not that incapable I can’t push a hoover around.

It’s a good idea but I think there are too many features on it – I could see it breaking down quite often.

I’m not that excited about it actually – it’s quite pricey. Not for me.

Another excuse for people not to exercise- I think we’ve got too much of that already. It is a No from me.

I don’t think I quite support the idea. The suction wasn’t brilliant to be honest.

I don’t think it would sell all too well.

It is just a bit too technical for a hoover. I think it would take longer to do the cleaning by remote than if you just got off your bum and pushed it around.
Appendix 20: The Information Form

Decision Making and Belief

You are invited to participate in a study investigating psychological beliefs and decision making.

Who is conducting the study?

The study is being conducted by Stephanie Rhodes (Tel: 01902 325754 Email: stephanierhodes@wlv.ac.uk) under the supervision of Dr. Niall Galbraith (Tel: 01902 321362: Email: n.galbraith@wlv.ac.uk). The completion of the study is part of a Doctor of Philosophy (PhD) programme.

What will I be asked to do?

You will be provided with two psychometric questionnaires and a decision making task. You will be kindly asked to read the instructions for the questionnaire/task carefully. If at any point during the experiment, you feel uncomfortable with any of the questions/tasks you are being asked to complete do not enter your response.

The questionnaire should take no longer than 10 minutes to complete. It is estimated that the decision making task should take no longer than 10 minutes. The experiment should take no longer than 20 minutes in total.

If you would like more information about the study before providing consent, please contact Stephanie Rhodes (Tel: 01902 325754 Email: stephanierhodes@wlv.ac.uk).
What will happen after the study?

A summary of the findings will be available from February 2016 from the project researcher upon request. Should you have any concerns regarding your participation in the study, please contact the research supervisor Dr Niall Galbraith (n.galbraith@wlv.ac.uk).

The study will adhere to ethical guidelines outlined by the British Psychological Society. Any information or personal details gathered in the course of the study will remain anonymous and the data gathered will be identifiable by participant number only. Questionnaires and consent forms will be stored separately and securely at the University of Wolverhampton Psychology Demonstrator office MC116. Please note that anonymous data cannot be withdrawn after data collection. After the conclusion of the research project in February 2016, all electronic data will be deleted and questionnaires and consent forms returned to the project supervisor for secure deletion in line with the University of Wolverhampton’s data protection legislation.

If you do decide to participate, you are free to withdraw at any time during the study without the need to provide a reason. However, data cannot be withdrawn once responses have been submitted. If you are prepared to participate, please sign the consent form and return it to a researcher.

Thank you.
Appendix 21: Informed Consent

Decision Making and Belief

- I confirm that I have read and understand the information sheet inviting me to take part in the study. I understand that I will complete two psychometric questionnaire and a decision making task.

- I understand that data collected will be collated with responses from other participants and will remain confidential and will be anonymous.

- I appreciate that anonymous data cannot be withdrawn once your responses have been submitted.

- I understand that I can contact the researcher to request a summary of the findings upon completion of the investigation.

- I can confirm that my participation is voluntary and that I am free to withdraw from the study at any time throughout the data collection process without the need to provide a reason.

I agree to participate in the study:

Age:

Gender:

Participant Pool Number:
Appendix 22: Debrief Form

Decision Making and Belief

Thank you for participating in the study investigating psychological beliefs and decision making.

The aim of the current study is to investigate personality factors and how they may influence cognitive decision making.

As a result of participating in the study, you will be fully protected by the British Psychological Society ethical guidelines. Any information or personal details that have been gathered during the course of the study will remain anonymous and the data gathered will be identifiable by participant number only. Questionnaires and consent forms will be stored separately at the University of Wolverhampton Demonstrator office, MC116. Please note that anonymous data cannot be withdrawn after data collection.

A summary of the findings will be available from February 2016 from the project researcher upon request. If you would like more information about the study, please ask any questions to the researcher (Stephanie Rhodes: Tel: 0192 325754; Email: stephanierhodes@wlv.ac.uk).

Thank you for your participation.
Appendix 23: The General Perceived Stress Scale (Cohen and Williamson, 1988)

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate by circling how often you felt or thought a certain way.

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

1. In the last month, how often have you been upset because of something that happened unexpectedly? ..................................

2. In the last month, how often have you felt that you were unable to control the important things in your life? ..................................

3. In the last month, how often have you felt nervous and “stressed”? ............

4. In the last month, how often have you felt confident about your ability to handle your personal problems? ............................................................

5. In the last month, how often have you felt that things were going your way?..................................................................................

6. In the last month, how often have you found that you could not cope with all the things that you had to do? .................................................
7. In the last month, how often have you been able
to control irritations in your life?................................. 0 1 2 3 4

8. In the last month, how often have you felt that you were on top of things?.. 0 1 2 3 4

9. In the last month, how often have you been angered
because of things that were outside of your control?............................ 0 1 2 3 4

10. In the last month, how often have you felt difficulties
were piling up so high that you could not overcome them? .................... 0 1 2 3 4
Appendix 24: The Information Form

**Decision Making and Stress**

You are invited to participate in a study investigating psychological beliefs and decision making.

**Who is conducting the study?**

The study is being conducted by Stephanie Rhodes (Tel: 01902 325754 Email: stephanierhodes@wlv.ac.uk) under the supervision of Dr. Niall Galbraith (Tel: 01902 321362: Email: n.galbraith@wlv.ac.uk). The completion of the study is part of a Doctor of Philosophy (PhD) programme.

**What will I be asked to do?**

You will be provided with two psychometric questionnaires and a decision making task. You will be kindly asked to read the instructions for the questionnaire/ task carefully. If at any point during the experiment, you feel uncomfortable with any of the questions/ tasks you are being asked to complete do not enter your response.

The questionnaires should take no longer than 20 minutes to complete. It is estimated that the decision making task should take no longer than 10 minutes. The experiment should take no longer than 30 minutes in total.

If you would like more information about the study before providing consent, please contact Stephanie Rhodes (Tel: 01902 325754 Email: stephanierhodes@wlv.ac.uk).

**What will happen after the study?**
A summary of the findings will be available from February 2016 from the project researcher upon request. Should you have any concerns regarding your participation in the study, please contact the research supervisor Dr Niall Galbraith (n.galbraith@wlv.ac.uk).

The study will adhere to ethical guidelines outlined by the British Psychological Society. Any information or personal details gathered in the course of the study will remain anonymous and the data gathered will be identifiable by participant number only. Questionnaires and consent forms will be stored separately and securely at the University of Wolverhampton Psychology Demonstrator office MC116. Please note that anonymous data cannot be withdrawn after data collection. After the conclusion of the research project in February 2016, all electronic data will be deleted and questionnaires and consent forms returned to the project supervisor for secure deletion in line with the University of Wolverhampton’s data protection legislation.

If you do decide to participate, you are free to withdraw at any time during the study without the need to provide a reason. However, data cannot be withdrawn once responses have been submitted. If you are prepared to participate, please sign the consent form and return it to a researcher.

Thank you.
Appendix 25: Informed Consent

Decision Making and Stress

- I confirm that I have read and understand the information sheet inviting me to take part in the study. I understand that I will complete two psychometric questionnaires and a decision making task.

- I understand that data collected will be collated with responses from other participants and will remain confidential and will be anonymous.

- I appreciate that anonymous data cannot be withdrawn once your responses have been submitted.

- I understand that I can contact the researcher to request a summary of the findings upon completion of the investigation.

- I can confirm that my participation is voluntary and that I am free to withdraw from the study at any time throughout the data collection process without the need to provide a reason.

I agree to participate in the study:

Age: 
Gender: 
Participant Pool Number:
Appendix 26: Debrief Form

Decision Making and Stress

Thank you for participating in the study investigating psychological beliefs and decision making.

The aim of the current study is to investigate personality factors and how they may influence cognitive decision making.

As a result of participating in the study, you will be fully protected by the British Psychological Society ethical guidelines. Any information or personal details that have been gathered during the course of the study will remain anonymous and the data gathered will be identifiable by participant number only. Questionnaires and consent forms will be stored separately at the University of Wolverhampton Demonstrator office, MC116. Please note that anonymous data cannot be withdrawn after data collection.

A summary of the findings will be available from February 2016 from the project researcher upon request. If you would like more information about the study, please ask any questions to the researcher (Stephanie Rhodes: Tel: 0192 325754; Email: stephanierhodes@wlv.ac.uk).

Thank you for your participation.
Appendix 27: The Subjective Task Stress Form

Please take time to reflect upon the task that you have participated in before indicating the degree to which you agree with the following statements.

1  2  3  4  5

Strongly Disagree Not Sure Agree Strongly
Disagree Agree

1. I felt under pressure to complete the task quickly… 1  2  3  4  5

2. I did not feel that I was being judged on my performance on the task… 1  2  3  4  5

3. I was concerned that my decision could be wrong… 1  2  3  4  5

4. I felt that I was being observed throughout the task… 1  2  3  4  5

5. I struggled to remember some of the comments that may have influenced my decision… 1  2  3  4  5
6. I enjoyed taking part in the task…

7. I found the task easy…
Appendix 28: The Information Form

Psychological Beliefs and Stress

You are invited to participate in a study investigating psychological beliefs and decision making.

Who is conducting the study?

The study is being conducted by Stephanie Rhodes (Tel: 01902 325754 Email: stephanierhodes@wlv.ac.uk) under the supervision of Dr. Niall Galbraith (Tel: 01902 321362: Email: n.galbraith@wlv.ac.uk). The completion of the study is part of a Doctor of Philosophy (PhD) programme.

What will I be asked to do?

You will be provided with a psychometric questionnaire and a decision making task. You will be kindly asked to read the instructions for the questionnaire/ task carefully. If at any point during the experiment, you feel uncomfortable with any of the questions/ tasks you are being asked to complete do not enter your response.

The questionnaires should take no longer than 20 minutes to complete. It is estimated that the decision making task should take no longer than 10 minutes. The experiment should take no longer than 30 minutes in total.

If you would like more information about the study before providing consent, please contact Stephanie Rhodes (Tel: 01902 325754 Email: stephanierhodes@wlv.ac.uk).
What will happen after the study?

A summary of the findings will be available from February 2016 from the project researcher upon request. Should you have any concerns regarding your participation in the study, please contact the research supervisor Dr Niall Galbraith (n.galbraith@wlv.ac.uk).

The study will adhere to ethical guidelines outlined by the British Psychological Society. Any information or personal details gathered in the course of the study will remain anonymous and the data gathered will be identifiable by participant number only. Questionnaires and consent forms will be stored separately and securely at the University of Wolverhampton Psychology Demonstrator office MC116. Please note that anonymous data cannot be withdrawn after data collection. After the conclusion of the research project in February 2016, all electronic data will be deleted and questionnaires and consent forms returned to the project supervisor for secure deletion in line with the University of Wolverhampton’s data protection legislation.

If you do decide to participate, you are free to withdraw at any time during the study without the need to provide a reason. However, data cannot be withdrawn once responses have been submitted. If you are prepared to participate, please sign the consent form and return it to a researcher.

Thank you.
Appendix 29: Informed Consent

Psychological Beliefs and Stress

- I confirm that I have read and understand the information sheet inviting me to take part in the study. I understand that I will complete a psychometric questionnaires and a decision making task. I also understand that my pulse rate will measured at three distinct intervals throughout.

- I understand that data collected will be collated with responses from other participants and will remain confidential and will be anonymous.

- I appreciate that anonymous data cannot be withdrawn once your responses have been submitted.

- I understand that I can contact the researcher to request a summary of the findings upon completion of the investigation.

- I can confirm that my participation is voluntary and that I am free to withdraw from the study at any time throughout the data collection process without the need to provide a reason.

I agree to participate in the study:

Age:

Gender:

Participant Pool Number:
Appendix 30: Debrief Form

Decision Making and Stress

Thank you for participating in the study investigating psychological beliefs and decision making.

The aim of the current study is to investigate personality factors and how they may influence cognitive decision making.

As a result of participating in the study, you will be fully protected by the British Psychological Society ethical guidelines. Any information or personal details that have been gathered during the course of the study will remain anonymous and the data gathered will be identifiable by participant number only. Questionnaires and consent forms will be stored separately at the University of Wolverhampton Demonstrator office, MC116. Please note that anonymous data cannot be withdrawn after data collection.

A summary of the findings will be available from February 2016 from the project researcher upon request. If you would like more information about the study, please ask any questions to the researcher (Stephanie Rhodes: Tel: 0192 325754; Email: stephanierhodes@wlv.ac.uk).

Thank you for your participation.
Appendix 31: The Information Form

Psychological Beliefs and Cognitive Reasoning Style

You are invited to participate in a study investigating psychological beliefs and cognitive reasoning style.

Who is conducting the study?

The study is being conducted by Stephanie Rhodes (Tel: 01902 325754 Email: stephanierhodes@wlv.ac.uk) under the supervision of Dr. Niall Galbraith (Tel: 01902 321362: Email: n.galbraith@wlv.ac.uk). The completion of the study is part of a Doctor of Philosophy (PhD) programme.

What will I be asked to do?

You will be provided with three psychometric questionnaires and a decision making task. You will be kindly asked to read the instructions for the questionnaire/ task carefully. If at any point during the experiment, you feel uncomfortable with any of the questions/ tasks you are being asked to complete do not enter your

The questionnaires should take no longer than 30 minutes to complete. It is estimated that the decision making task should take no longer than 10 minutes. The experiment should take no longer than 40 minutes in total.

If you would like more information about the study before providing consent, please contact Stephanie Rhodes (Tel: 01902 325754 Email: stephanierhodes@wlv.ac.uk).
**What will happen after the study?**

A summary of the findings will be available from February 2016 from the project researcher upon request. Should you have any concerns regarding your participation in the study, please contact the research supervisor Dr Niall Galbraith (n.galbraith@wlv.ac.uk).

The study will adhere to ethical guidelines outlined by the British Psychological Society. Any information or personal details gathered in the course of the study will remain anonymous and the data gathered will be identifiable by participant number only. Questionnaires and consent forms will be stored separately and securely at the University of Wolverhampton Psychology Demonstrator office MC116. Please note that anonymous data cannot be withdrawn after data collection. After the conclusion of the research project in February 2016, all electronic data will be deleted and questionnaires and consent forms returned to the project supervisor for secure deletion in line with the University of Wolverhampton’s data protection legislation.

If you do decide to participate, you are free to withdraw at any time during the study without the need to provide a reason. However, data cannot be withdrawn once responses have been submitted. If you are prepared to participate, please sign the consent form and return it to a researcher.

Thank you.
Appendix 32: Informed Consent

Psychological Beliefs and Cognitive Reasoning Style

- I confirm that I have read and understand the information sheet inviting me to take part in the study. I understand that I will complete three psychometric questionnaires and a decision making task.

- I understand that data collected will be collated with responses from other participants and will remain confidential and will be anonymous.

- I appreciate that anonymous data cannot be withdrawn once my responses have been submitted.

- I understand that I can contact the researcher to request a summary of the findings upon completion of the investigation.

- I can confirm that my participation is voluntary and that I am free to withdraw from the study at any time throughout the data collection process without the need to provide a reason.

I agree to participate in the study:

Age:

Gender:

Participant Pool Number:
Thank you for participating in the study investigating psychological beliefs and reasoning style preferences.

The aim of the current study is to investigate personality factors and how they may influence cognitive decision making.

As a result of participating in the study, you will be fully protected by the British Psychological Society ethical guidelines. Any information or personal details that have been gathered during the course of the study will remain anonymous and the data gathered will be identifiable by participant number only. Questionnaires and consent forms will be stored separately at the University of Wolverhampton Demonstrator office, MC116. Please note that anonymous data cannot be withdrawn after data collection.

A summary of the findings will be available from February 2016 from the project researcher upon request. If you would like more information about the study, please ask any questions to the researcher (Stephanie Rhodes: Tel: 0192 325754; Email: stephanierhodes@wlv.ac.uk).

Thank you for your participation.
Appendix 34: The Rational Experiential Inventory (Pacini and Epstein, 1997b)

Please use the following scale to answer these questions.

completely false           completely true
                                      1                                       2                                  3       4                         5

1. ________ I have a logical mind.
2. ________ I prefer complex problems to simple problems.
3. ________ I believe in trusting my hunches.
4. ________ I am not a very analytical thinker.
5. ________ I trust my initial feelings about people.
6. ________ I try to avoid situations that require thinking in depth about something.
7. ________ I like to rely on my intuitive impressions.
8. ________ I don’t reason well under pressure.
9. ________ I don’t like situations in which I have to rely on intuition.
10. ________ Thinking hard and for a long time about something gives me little satisfaction.
11. ________ Intuition can be a very useful way to solve problems.
12. ________ I would not want to depend on anyone who described himself or herself as intuitive.
13. ________ I am much better at figuring things out logically than most people.
14. ________ I usually have clear, explainable reasons for my decisions.
15. _________ I don’t think it is a good idea to rely on one’s intuition for important decisions.

16. _________ Thinking is not my idea of an enjoyable activity.

17. _________ I have no problem thinking things through carefully.

18. _________ When it comes to trusting people, I can usually rely on my gut feelings.

19. _________ I can usually feel when a person is right or wrong, even if I can’t explain how I know.

20. _________ Learning new ways to think would be very appealing to me.

21. _________ I hardly ever go wrong when I listen to my deepest gut feelings to find an answer.

22. _________ I think it is foolish to make important decisions based on feelings.

23. _________ I tend to use my heart as a guide for my actions.

24. _________ I often go by my instincts when deciding on a course of action.

25. _________ I’m not that good at figuring out complicated problems.

26. _________ I enjoy intellectual challenges.

27. _________ Reasoning things out carefully is not one of my strong points.

28. _________ I enjoy thinking in abstract terms.

29. _________ I generally don’t depend on my feelings to help me make decisions.

30. _________ Using logic usually works well for me in figuring out problems in my life.

31. _________ I think there are times when one should rely on one’s intuition.

32. _________ I don’t like to have to do a lot of thinking.

33. _________ Knowing the answer without having to understand the reasoning behind it is good enough for me.

34. _________ Using my gut feelings usually works well for me in figuring out problems in my life.
35. I don’t have a very good sense of intuition.
36. If I were to rely on my gut feelings, I would often make mistakes.
37. I suspect my hunches are inaccurate as often as they are accurate.
38. My snap judgements are probably not as good as most people’s.
39. I am not very good at solving problems that require careful logical analysis.
40. I enjoy solving problems that require hard thinking.