

Attentional Bias to Threat Following Acquired Brain Injury: The Role of Self-  
Discrepancy and Executive Functioning

Liam Gilligan

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Faculty of Medicine and Health Sciences

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## Abstract

**Objective:** Experimental evidence indicates that those with a wide range of mental health conditions show an attentional bias for specific threat relevant information, (e.g., Bar-Haim et al., 2007) with research beginning to explore whether this same threat sensitivity occurs in survivors of acquired brain injury (ABI; Gracey, Evans, & Malley, 2009; Riley, Brennan, & Powell, 2004; Riley, Dennis, & Powell, 2010). This study explored, experimentally, whether those with an ABI demonstrate an attentional bias towards threatening stimuli (negative evaluation/physically threatening), and what factors may influence this bias.

**Method:** 35 participants who had sustained an ABI completed a visual dot-probe task, alongside measures of self-discrepancy, affective distress and executive functioning.

**Results:** Whilst the pattern of results is indicative of this threat detection hypothesis, the difference between threat and neutral trials was found to be non-significant ( $p = .053$ ). Exploratory analyses indicated that executive functioning and affective distress may act as contributing factors to attentional bias. Self-discrepancy between past and current self did not have an impact on attentional bias to negative evaluation stimuli, although discrepancy between current and pre-injury/ideal self was found to correlate with anxiety and depression.

**Conclusions:** The hypotheses were not supported in this study. The clinical and theoretical implications are discussed (e.g., aetiology of threat/affective difficulties and implications for treatment), alongside limitations of the study (e.g., potential sampling considerations) and potential directions for further research are suggested (e.g., exploring potential contributing factors) to help us to further understand the factors that may be involved in attentional bias to threat following brain injury.

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## **1.1 Overview of the Chapter**

This chapter will firstly outline background literature regarding acquired brain injury, including its definition, prevalence and the different areas of a person's functioning that it can impact upon. Following this, relevant literature concerning attentional bias to threat (and its application in both mental health and brain injury populations) and self-identity following brain injury will be presented, including a literature review on the effect upon 'self' following an acquired brain injury. Finally, the rationale for the current thesis is given in light of this, and hypotheses for the study detailed.

## **1.2 Acquired Brain Injury**

Acquired brain injury (ABI) is an inclusive category that embraces acute (rapid onset) brain injury of any cause, including trauma (head injury/post-surgical damage), vascular accident (stroke or subarachnoid haemorrhage), cerebral anoxia, infections (such as meningitis or encephalitis) or other toxic or metabolic insults (e.g., hypoglycaemia) (British Society of Rehabilitation Medicine, 2003). ABI is considered to be one of the leading causes of death and disability in young adults (Walsh, Fortune, Gallagher, & Muldoon, 2012) and, with many of the experienced changes invisible to those around them, it has been termed a silent epidemic (Jones, Haslam, Jetten, Williams, Morris, & Saroyan, 2010).

### **1.2.1 Prevalence of acquired brain injury.**

Due to the wide range of conditions that are encompassed under the umbrella term of ABI, it is difficult to accurately estimate the prevalence of ABI in the population, although there are estimates of around one million people attending A&E services each year with an injury to the head (Kay & Teasdale, 2001; King &

Tyerman, 2008). Of these, approximately 90% are classed as a mild head injury, 5% as a moderate head injury and 5% as a severe head injury (Kay & Teasdale, 2001), with a similar breakdown being found in studies in the United States (Narayan et al., 2002). Using data from head injuries requiring any sort of inpatient care, Tennant (2005) found the incidence rate of admission to hospital following a head injury was high, with 229.4 per 100,000 for all age groups in England. Of those seen with a minor head injury, the majority will not be admitted to hospital, and for those who are, most will be able to go home after 48 hours (National Institute for Health and Clinical Excellence, 2003), with 92% having a normal neurology following this (Klauber, 1993). Stroke and traumatic brain injury (TBI) are reported to make up the largest proportion of ABI in the United Kingdom, with incidence of TBI estimated at approximately 235 cases per 100,000 per year (Tagliaferri, Compagnone, Korsic, Servadei, & Kraus, 2006) and stroke incidence estimated at 7.20 per 1000 (Lee, Shafe, & Cowie, 2011).

Furthermore, the incidence of ABI is influenced by specific demographic and social factors; there tend to be higher rates among young adults and older adults, compared to those of middle age, while a brain injury is more likely to occur in males than females (Greenwald, Burnett & Miller, 2003; Powell, 2004; Tennant, 1995; 2005; Yates, Williams, Harris, Round, & Jenkins, 2006). Taking TBI specifically, the highest prevalence is found in children between the ages of 0 – 4, and in late adolescence, between 15 – 19 years of age (Langlois, Rutland-Brown, & Wald, 2004; Yates et al., 2006). In addition, the incidence of brain injury is influenced by location, with higher rates of head injury found in more urban areas (Yates et al., 2006) and one study in England finding that the variance in inpatient head injuries ranged from 90.7 per 100,000 (in Brent and Harrow) up to 419.4 per 100,000 (in Liverpool) (Tennant,

2005). These studies also examined socio-economic factors, finding that increased unemployment (in the 16 – 24 years age range), permanent sickness (in the working age population), social deprivation (in children under 5 years) and lone parenting increased the incidence rate of head injuries, whereas an increasing percentage of those using public transport to go to work decreased the incidence rate (Tennant, 2005; Yates et al., 2006).

### **1.2.2 Classification of acquired brain injury.**

In this field, the classification of brain injuries has generally been based on injury severity at presentation, predominantly around neurologic injury severity criteria (Saatman et al, 2008). The most commonly used scale is the Glasgow Coma Scale (Teasdale & Jennett, 1974) because of its high inter-observer reliability and reported prognostic capabilities (Narayan et al., 2002). This scale depends upon evaluation of both depth and duration of altered consciousness (Lezak, Howieson, Bigler, & Tranel, 2012) and measures injury severity across the three dimensions of eye opening, verbal responses and motor response, (with lower scores indicating a more significant impairment) summed together to form a Glasgow Coma Score (Teasdale & Jennett, 1974). This is then divided into subtypes, with scores of 13 – 15 classed as mild brain injury, 9 – 12 classified as moderate brain injury and below 8 indicating severe brain injuries (Teasdale & Jennett, 1974).

Aside from the Glasgow Coma Scale, other methods can be used to determine injury severity and functional outcome, including length of coma and the duration of post-traumatic amnesia (PTA) (Bates, 2001; Russell & Smith, 1961; Sherer, Struchen, Yablon, Wang, & Nick, 2008). Length of coma can also be used as a predictor of injury severity and functional outcomes, measured by the number of days an individual is unable to follow commands or spontaneously open their eyes (Bates,

2001). PTA is defined as a transient state of confusion and disorientation, characterised by intellectual and behavioural disturbances (Ahmed, Bierley, Sheikh, & Date, 2000; Levin & Goldstein, 1989). A PTA of less than 1 hour indicates a mild brain injury, 1 – 24 hours indicates moderate brain injury, and longer than this is classed as a severe brain injury (Russell & Smith, 1961).

### **1.2.3 Mechanisms of injury in acquired brain injury.**

As the category of ABI encompasses varying conditions, there are different mechanisms which cause the subsequent brain injury, which can either be primarily focal (in a specific location in the brain) or diffuse (over a widespread area of the brain) (Gennarelli, 1993). Focal injuries often result from direct force applied to the skull or brain, such as a Cerebral Contusion; this is defined as bruising of the brain tissue primarily caused by forceful contact between the surface of the brain and the inside of the skull or by rapid acceleration-deceleration forces, often substantially affecting the frontal and temporal lobes (Chu et al., 1994; Gennarelli, 1993; Granacher, 2003; Werner & Engelhard, 2007). Similar to this is a Cerebral Laceration, which is clinically defined as an injury which the Pia Mater and Arachnoid layers of the Meninges (the protective membrane that surrounds the central nervous system) are torn at the injury site (Granacher, 2003). This requires a greater physical force to generate than a contusion (Granacher, 2003).

Another type of focal injury is that of a specific haemorrhage, in which blood escapes from a ruptured blood vessel, potentially leading to a hematoma (a collection of blood outside the blood vessels due to tearing) (King & Tyerman, 2008; Teale, Liffe, & Young, 2014). Within the context of brain injury, there are different types of haemorrhage named for where the bleeding occurs in the brain or skull, and whilst a full discussion of these specific types is beyond the scope of this thesis (see King &

Tyerman, 2008 for an overview), the type of damage that occurs following these injuries is typically related to the site of the bleed. These can continue to cause further damage following the bleed, causing expanding intracranial lesions and increased intracranial pressure, which compress the surface of the brain inside the skull, forming contusions and limiting blood supply to other areas of the brain (Granacher, 2003). In serious cases, sustained intracranial pressure can cause brain herniation which can shift the structures of the brain, causing damage which is often fatal (Marcoux, 2005).

Diffuse injuries are multifocal injuries, causing damage throughout multiple areas of the brain. One of the most prevalent of these injuries is diffuse axonal injuries where there is widespread tearing or shearing of axons in the white matter of the brain due to violent movement stretching and compressing the axons (King & Tyerman, 2008). This has the consequences of disrupting the connections across the brain. The subsequent swelling and consequences of intracranial pressure (such as ischemic brain injury from insufficient blood supply), as previously described, can also be seen as diffuse injuries, which can cause damage across multiple areas of the brain (Granacher, 2003).

### **1.3 Impairments Following Acquired Brain Injury**

Advances in medical care have meant that there has been a massive improvement in the survival rate of those experiencing an ABI, meaning that those who would have previously succumbed to the metabolic, hemodynamic or other complications as a result of the head injury are now surviving (Diedler et al, 2009; Ghajar, 2000; Jagannathan et al, 2007). Moderate or severe disability and difficulties are found to occur commonly following these injuries (Thomsen, 1984; Thornhill, Teasdale Murray, McEwen, Roy, & Penny, 2000), although even after very serious head injuries, long term outcomes for some patients are reasonably good, with some

improvement in functional abilities, psychosocial adjustment and work capacity (Thomsen, 1984). Age is a significant factor in regards to outcomes from brain injury, with estimates of mortality of 19% in patients aged 20 years old, rising steeply to 71% in those aged 60 and over (Hickey, 1997).

Those that do survive a brain injury often experience a wide range of impairments, which can encompass cognitive, emotional, behavioural, social and physical difficulties (Kersel, Marsh, Havill, & Sleigh, 2001; Lezak, 2012). Many of these domains overlap in regards to the impairments that they can generate, and difficulties in one area will often cause difficulties in another. These will be briefly elaborated on below (please see Tyerman & King, 2008 for a more comprehensive examination).

### **1.3.1 Cognitive difficulties following brain injury.**

Survivors of brain injuries often experience severe and enduring cognitive deficits, such as impairments in memory, attention, executive functioning, language and a slowing of information processing (Khan, Baguley, & Cameron, 2003; Salmond, Menon, Chatfield, Pickard, & Sahakian, 2005). Most survivors experience a period of PTA in the short term following their brain injury, with associated shorter term cognitive difficulties (Wilson, Evans, & Williams, 2008).

When considering memory, the frontal and temporal lobes are crucially involved, particularly in the acquisition of new factual knowledge in the latter case (Tranel & Damasio, 1995), yet these are some of the most common sites for damage in a closed head injury (Kapur, 1988). Memory as a concept is viewed as having many types and mechanisms, including short term, long term, prospective, working, explicit, implicit, recall and recognition; all of which can be affected in differing ways due to an acquired brain injury (Wilson et al., 2008). Rehabilitation of memory problems is

difficult, with recovery being influenced to a certain degree by the type of acquired brain injury, the patient's age and the length of PTA experienced (Wilson et al., 2008).

The frontal lobes are also associated with other areas of cognitive functioning, including attention and executive functioning which, alongside memory, are found to be the most common cognitive disturbances following TBI (Arciniegas, Held, & Wagner, 2002). Executive functions are higher order cognitive abilities that enable a person's planning, problem solving, organisation, self-monitoring, initiation, error correction and behavioural regulation (Evans, 2008). Executive functioning is highly susceptible to damage given the vulnerability of the frontal lobes to the decelerative forces and shearing actions involved in many traumatic brain injuries (McHugh & Wood, 2008), with difficulties in lack of initiative, adaptation and cognitive flexibility being common (Kinsella, Packer, & Oliver, 1991; Tate, 1999). Executive functioning also has an influencing factor in the regulation of emotions (Zelazo & Cunningham, 2007), and better ability to control emotions has been associated with a person's psychological wellbeing (Côté, Gyurak, & Levenson, 2010). Although some patients show improvement in regards to cognitive functioning following ABI, for many, certain impairments do continue and become long term difficulties (Dikmen, Corrigan, Levin, Machamer, Stiers, & Weisskopf, 2009; Draper & Ponsford, 2008).

### **1.3.2 Emotional difficulties following brain injury.**

Emotional disorders are extremely common after an ABI (Broomfield, Quinn, Abdul-Rahim, Walters, & Evans, 2014; Fann, Burington, Leonetti, Jaffe, Katon, & Thompson, 2004; Kim et al, 2007; Silver, Kramer, Greenwalds, & Weissman, 2001), sometimes arising as a direct consequence of specific damage to areas of the brain (Jorge, Robinson, Moser, Tateno, Crespo-Facorro, & Arndt, 2004). As survivors go through various stressors and transition periods adjusting to their new self, emotional

difficulties can also emerge as a reaction to the injury, trauma or its subsequent consequences (Ownsworth et al., 2011; Turner et al., 2011b). There has been a series of papers examining psychiatric disorders such as depression and anxiety (Deb et al., 1999; Jorge, Robinson, Arndt, Forrestor, Geisler, & Starkstein, 1993; Jorge, Robinson, Arndt, Starkstein, Forrestor, & Geisler, 1993; Jorge et al., 2004; Kreutzer, Seel, & Gourley, 2001; Tyerman & Humphrey, 1984), psychosis (Davison & Bagley, 1969) and post-traumatic stress disorder (Bryant & Harvey, 1998; Gil, Caspi, Ben-Ari, Koren, & Klein, 2005; Mayou, Black, & Bryant, 2000) following ABI, with many individuals qualifying for two or more diagnoses (Hibbard, Uysal, Kepler, Bogdany, & Silver, 1998).

Outside of formal psychiatric diagnosis, there are other emotional difficulties associated with the onset of an ABI, with sadness in the early stages of recovery from brain injury focusing on separation from home, family and the loss of their familiar routines (McGrath & Adams, 1999). Whilst engaged in rehabilitation, anxieties can emerge around fear of falling, fear of physical harm and concerns around not making sufficient rehabilitation progress (Collicutt McGrath, 2008). At the end of their journey, discharge from hospital can signal the end point of major recovery, often accompanied by the loss of most professional support networks. This means that patients can feel abandoned at the time that they begin to realise the reality of their long term situation (Turner, Fleming, Ownsworth, & Cornwell, 2011a; Tyerman, 1988). The prevalence of suicidal ideation, suicide attempts and hopelessness have also been investigated in a TBI population. For example, Simpson and Tate (2002) found that levels of hopelessness and suicidal ideation were significantly higher than those reported in non-TBI populations, and 18% of participants reported a post-injury attempt.

### **1.3.3 Behavioural difficulties following brain injury.**

Following a brain injury, behavioural changes are very common, and have been recognised as a major consequence in research for a long time. The classic account of this is the case of Phineas Gage, who after an injury to the head, was described as fitful, irreverent, indulging at times in the grossest profanity and being radically changed, so decidedly that his friends and acquaintances said he was no longer Gage (Harlow, 1868; Macmillan, 2000; Ratie, Talos, Haker, Lieberman, & Everett, 2004). Reported behavioural difficulties may include increased impulsivity, apathy, irritability, aggression, agitation and socially inappropriate behaviours (Alderman, 2003; McAllister, 2008; Ponsford, Oliver, & Curran, 1995; Prigatano, 1992; Wood, 2001). Research has found that these behavioural and personality changes are often the ones which cause the most difficulties for the patient's family to cope with post injury (e.g., Knight, Devereux, & Godfrey, 1998; O'Shanick, & O'Shanick, 1994; Oddy & Herbert, 2003). Behavioural changes and outcomes following ABI are highly dependent on the size and severity of the injury, area of the brain and circuitry disrupted by the injury (Cummings, 1993; Fletcher, Levin, Lachar, Kusnerik, Harward, Mendelsohn, & Lilly, 1996). For example, damage to the orbitofrontal cortex is associated with anti-social conduct, low tolerance of frustration, ego-centricity, poor social judgement and social awareness, whereas medial-frontal difficulties are associated with low arousal, absence of drive and poor motivation (Worthington & Wood, 2008).

#### **1.3.4 Social difficulties following brain injury.**

Many studies of those who have experienced a brain injury show that there are significant losses and breakdowns in various aspects of their social and support networks. The most significant of these are the breakdown in relationships and changes in their role within the family (Morton & Wehman, 1995). Research has found that two years after injury, the number of close friends had diminished and been replaced primarily with casual acquaintances (Weddell, Oddy & Jenkins, 1980), and that as time since injury increases, the size of social networks decreased as people and families become more socially isolated (Kozloff, 1987; Oddy & Humphrey, 1980). This may be due to a series of factors, including the increase in time spent caring for the injured person, difficulties inviting guests as a result of inappropriate/unpredictable behaviour, or the person's inability to converse in a rewarding way for visitors (Oddy & Herbert, 2008).

Furthermore, sexual changes are common following brain injury (Giaquinto, Buzzelli, Di Francesco, & Nolfe, 2003) and often impact upon a person's ability to establish, maintain and enjoy intimate relationships with others (Ownsworth, 2014). The younger age group most often affected by TBI is at a significant point in the development of social skills and identity through friendships and is at a period in life when a person is developing towards social and economic independence (Morton & Wehman, 1995; Rosenbam & Najenson, 1976), amplifying the impact of the injury. These obviously have subsequent implications for emotional difficulties, with many studies reporting that subsequent loneliness is a prominent factor following a brain injury (e.g., Harrick, Krefting, Johnston, Carlson, & Minnes, 1994; Oddy, Couglan, Tyerman, & Jenkins, 1985). Outcome studies following those with a brain injury have found that potential for returning to work is poor, with those with a TBI experiencing

high unemployment levels following their brain injury (Bruckner & Randle, 1972). These psychosocial problems decrease the opportunity to develop social contacts or uptake new leisure activities, creating a major challenge for successful rehabilitation and efforts to integrate back into the community (Gomez-Hernandez, Max, Kosier, Paradiso, & Robinson, 1997; Morton & Wehman, 1995).

### **1.3.5 Physical difficulties following brain injury.**

Physical injury is extremely common following ABI, including motor difficulties (Francis, Wade, Turner-Stokes, Kingswell, Dott, & Coxon, 2004), swallowing difficulties (Cherney & Halper, 1996), seizures (Vespa et al., 1999), fatigue (LaChapelle & Finlayson, 1998) sleep and pain difficulties (Beetar, Guilmette, & Sparadeo, 1996). Brain injury, especially of the traumatic subtype, can result in a range of symptoms which have been grouped together under the term of 'post-concussion syndrome', with difficulties including headaches, fatigue, irritability, dizziness, visual difficulties, sleep difficulties and forgetfulness which persists beyond three months (Carroll, Cassidy, Holm, Kraus, & Coronado, 2004; Mittenberg & Strauman, 2000). Furthermore, survivors will also often experience difficulties around paralysis, motor and balance difficulties, bowel/bladder difficulties, sexual changes and auditory difficulties (Giaquinto, et al., 2003; Howes, Benton, & Edwards, 2005; Stratton & Gregory, 1994), with longer term implications also including a potential risk of psychosis and dementia (Gaultieri & Cox, 1991; Starkstein & Jorge, 2005). Physical difficulties are an extremely pertinent aspect of brain injury which reduces sense of control and normalcy, with some patients describing their body as "an enemy" due to their acquired physical limitations (Jumisko, Lexell, & Soderberg, 2005).

## 1.4 The Role of Attention

Attention is a cognitive function which can be defined as the capacities or processes of how an organism becomes receptive to stimuli and how it may begin processing incoming or attended to excitation (Parasuraman, 1998). There is significant variation on how this is formally conceptualised and it is notoriously difficult to define and measure (Manly & Mattingly, 2004). Posner and Peterson (1990; Peterson & Posner, 2012) posited a neuroanatomical model of attention which describes three hieratically arranged attention systems, comprising alertness (sustained attention, vigilance and arousal, in the right lateralised frontal-parietal-thalamic network), orientation (directed attention/shifting attention, in the posterior attentional system) and an executive which detects targets, supervises and controls attention in an intentional top down process (based in the frontal lobes and anterior cingulate). This model is still broadly supported by neuroscientific evidence which has accumulated since the paper was published, with more elaboration and detail on the original framework (Petersen & Posner, 2012). However, other characteristics of attention which seem to be agreed upon are its finite capacity and the capacities for disengagement in order to shift its focus, and for responsivity to particular sensory stimuli (Lezak, 2012). These characteristics can be influenced, its 'capacity' for example, can be affected by depression, fatigue (Zimmerman & Leclercq, 2002), brain injury (Rousseaux, Fimm, & Cantagallo, 2002) or even as the natural consequence of an ageing brain (Van der Linden & Collette, 2002). Visual attention (a subset of general attention), is a feature of our visual system which allows us to select and ignore visual information in the environment around us (Chun & Wolfe, 2001). This select/ignore mechanism is a necessity given the finite resources that can be allocated to attention, compared to amount of visual information available to attend to.

### **1.4.1 Attentional bias and threat detection.**

Research has consistently shown that our attention is influenced by factors such as emotion (Vuilleumier, Armony, & Dolan, 2003), with cognitive models stating that this attentional bias stems from a lower threshold of appraising threat in stimuli (Mogg & Bradley, 1998). While an attentional bias towards sufficiently threatening stimuli is present for everyone, those with certain difficulties and experiences will exhibit this attentional bias towards specific threatening stimuli, as these are seen as holding a higher threat value to the person. Theorists often take an evolutionary approach to understanding this, as the rapid detection of threat in our surrounding environment is critical for species survival (e.g., Green & Phillips, 2004).

The neurocognitive sensory systems responsible for the fast and efficient detection of emotional or threatening stimuli may have survived as an adaptive advantage in accordance with the Darwinian theory of evolution (Darwin, 1955; Green & Phillips, 2004; Öhman & Mineka, 2001), with some proposing hard wired, dedicated fear modules in the brain which respond rapidly and automatically to such stimuli (e.g., Öhman, 1993; Öhman & Mineka, 2001). This seems to be supported by cognitive science research, finding that a second target in the attentional blink paradigm is less likely to be missed if it is an emotional target (Anderson & Phelps, 2001), reaction times for detecting targets are faster when the target has an emotional value (Eastwood, Smilek, & Merikle, 2001; Fox, 2002; Mogg & Bradley, 1993) or have a threatening evolutionary value (Öhman, Flykt, & Esteves, 2001) and threat superiority effects are still demonstrated where awareness to stimuli is limited (Mogg & Bradley, 1999; Esteves, Dimberg, & Öhman, 1994). Research has even demonstrated a physical, bodily reaction to threatening stimuli in the form of skin conductance responses (Esteves, et al., 1994) and event-related potentials in both

humans (Van Strien et al, 2014; Van Strien, Franken, & Huijding, 2014) and primates (Van Le et al., 2013). Furthermore, research has found positive correlations between activation of the amygdala and other neural structures associated with threat and attentional biases (Anderson & Phelps, 2001; Monk, Nelson, Woldehawariat, Montgomery, Zarahn, McClure, Guyer, Leibenluft, Charner, Ernst, & Pine, 2004). These findings suggest that threatening stimuli have an in-built comparative advantage in gaining access to automatic processing.

LeDoux's affective neuroscience model (1998; 2000) understands threat detection as a process involving multiple areas of the brain, primarily emphasising the role of the amygdala in the control of emotional behaviours. The neural pathways of the amygdala and thalamus are responsible for the primary threat appraisal. This is a rapid and automatic analysis of potentially dangerous stimuli, through thalamic pathways which leads to instantaneous, automatic reactions. After this immediate reaction, the amygdala is then supported by input from additional brain structures (including the hippocampus, frontal lobes and cortical pathways) which provide situational context and relevant characteristics of the threatening stimuli. The amygdala works to integrate the rapid inputs with more detailed information, after which this amygdala activation influences cognitive processes, selective attention, perception and explicit memory, to provide continued survival strategies, or to terminate and down-regulate this threat response (Steimer, 2002; Yiend, Mackintosh & Savulich, 2012).

#### **1.4.2 Measuring attentional bias.**

This threat bias has been measured in the literature using differing methods, either demonstrating how selective attention may benefit performance on tasks, or how performance can be influenced as a result of selective attention to emotional

information within a paradigm (Williams, Mathews, & MacLeod, 1996). A full examination of these methodologies is beyond the scope of this thesis (see Cisler, Bacon, & Williams, 2010 for an overview). This thesis will briefly examine two of these methods.

Firstly, the Emotional Stroop task (MacLeod, 1991; Williams, Mathews, & MacLeod, 1996), which requires participants to name the ink colour of a word stimuli as quickly and accurately as possible, whilst ignoring the meaning of the word. A slower performance on emotional words has been used to indicate an attentional bias (Dresler, Mériau, Heekeren, & van der Meer, 2009; MacLeod, 1991; Williams, Mathews, & MacLeod, 1996). This effect has been hypothesised as a hypervigilance for specific psychopathological words which attracted attention automatically (Mogg, Mathews & Weinman, 1989), or a difficulty disengaging attention from threat-related words (Pineles, Shipherd, Welch & Yovel, 2007). However, this has been critiqued, as this cannot be confirmed as a mechanism of attention, but instead may be related to some aspect of an emotional reaction to the words meaning or wider cognitive processes (Bogels & Mansell, 2004; MacLeod, Mathews, & Tata, 1986).

Secondly, the modified dot probe paradigm (MacLeod et al, 1986) has been used extensively in attentional research to highlight and measure the bias towards threatening stimuli in experimental conditions, and differs from the Emotional Stroop by using multiple stimuli which compete for attentional resources. This task consists of presenting a pair of stimuli simultaneously (one emotional, one neutral), followed by a target at the location of one of those stimuli. Attentional bias to the emotional stimuli is measured as the difference in reaction time to the target when it is presented in place of the emotional stimuli as compared to when presented in place of the neutral stimuli. A faster response time to a target congruent to the location of the

emotional stimuli is interpreted as meaning there is an attentional bias towards emotional stimuli. In addition, a bias score can be calculated by subtracting the reaction times of congruent trials from those of incongruent trials - a positive bias score indicates a vigilance to threat whereas a negative score indicates an avoidance from threat (Mogg, Bradley, & Williams, 1995; Vassilopoulos, 2005).

#### **1.4.3 Attentional bias in mental and physical health.**

The cognitive-affective literature has repeatedly shown that those with specific psychological difficulties or diagnoses demonstrate a more reactive attention to specific threatening stimuli linked to these diagnoses, and bias to these threats underlies some cognitive models of mental health (Beck, 1976; Wells & Matthew, 1996). These results have emerged for those with depression (Peckham, McHugh, & Otto, 2010), anxiety disorders (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg & van IJzendoorn, 2007) such as specific phobia (Watts, McKenna, Sharrock, & Tresize, 1986; Wenzel & Holt, 1999), generalised anxiety disorder (Becker, Rinck, Margraf, & Roth, 2001; Bradley, Mogg, White, Groom, & De Bono, 1999) post-traumatic stress disorder (Ashley, Honzel, Larsen, Justus, & Swick, 2013), panic disorder (Teachman, Smith-Janik, & Saporty, 2007) and social phobia (Asmundson & Stein, 1994; Becker, Rinck, Margraf, & Roth, 2001; Cisler & Koster, 2010; Ononaiye, Turpin, & Reidy, 2007); all demonstrate these emotion-congruent biases. This effect has also been demonstrated in those without formalised diagnoses, for those who have experienced chronic interpersonal violence (DePierro, D'Andrea, & Pole, 2013) and recent trauma (Elessar, Sartory, & Tackenberg, 2004).

This attentional bias has also been demonstrated in research examining other physical conditions such as chronic headaches (Schoth & Liossi, 2010), insomnia (Jansson-FrÖjmark, Bermås & Kjellén, 2012), somatoform disorders (Lim & Kim,

2005), intellectual disability (van Duijvenbode, Didden, Voogd, Korzilius, & Engels, 2012) and William's syndrome (Dodd & Porter, 2011). These biases still exist following recovery from a depressive episode (Joormann & Gotlib, 2007), and there have been attempts to create cognitive-affective models that try to account for many of these processing changes in mental health problems (e.g., Mansell, 2005; Williams, 2006; Wells & Matthews, 1996), with some research finding that inducing negative attentional biases can lead to the development of anxiety symptoms in a non-clinical population (e.g., Matthews & MacLeod, 2002).

### **1.5 Threat Appraisal in Acquired Brain Injury**

The concept of attention and threat appraisal has been tentatively extended to the domain of ABI, with previous research showing that attentional processes can be influenced by brain injury related trauma (Coates, 2008), and this post brain injury threat appraisal is linked to emotional wellbeing and adjustment (Kendall & Terry, 2009; Rochette, Bravo, Desrosiers, St-Cyr-Tribble, & Borget, 2007). Riley, Brennan and Powell (2004) devised a questionnaire to obtain an account of the specific threat appraisals (an anticipation of negative consequences that challenge self-concept) which patients with TBI make in relation to valued roles and activities. This was conceptualised within the context of the stress-appraisal-coping model (Lazarus & Folkman, 1984). They specifically looked at the appraisals which led people to use avoidance as a coping strategy, finding that the whole sample reported at least one of this type of appraisal, and 74% of them reported at least 10. Their data confirmed that there seems to be specific occasions which can give rise to these threat appraisals, including task performance, social situations and situations in which a person's personal safety is a concern, alongside a fourth, less unified category which centres around 'awkward situations/reminder of the injury'. These threat appraisals were often

found to lead to avoidance of activities, and since a core aim of rehabilitation after TBI is to try and facilitate a person's participation in valued roles and activities, consideration of an individual's threat appraisals and how they respond to them requires a more prominent place in rehabilitation research (Riley et al., 2004).

Riley and colleague's (2004) paper draws upon the concept of the 'catastrophic reaction', developed by Goldstein (1952), a reaction of extreme anxiety that is triggered by situations in which the person struggles to complete tasks and activities that were completed with ease prior to the brain injury. Goldstein hypothesised that this anxiety stemmed from the threat posed to the individual's concept of self by the task failure, and that to protect this self-concept and avoid further threat/anxiety, they would start avoiding situations which may trigger these catastrophic reactions (Riley et al., 2004). This catastrophic reaction is, according to Ben-Yishay (2000) a "behavioural manifestation of a threat to the person's very existence" (p. 128) due to the failure of the person to cope with their difficulties.

Riley, Brennan and Powell's (2004) research was then extended and examined further in Riley, Dennis and Powell's (2010) paper, looking at the factors which may explain the individual variation in avoidance of activities. They also examined an alternative context for which to consider this, using cognitive models of anxiety-related avoidance normally found within mental health research (referencing Bandura, 1977 and Beck, Emery, & Greenberg, 1985). This moved towards a conceptualisation which included beliefs around an individual's own perceived ability to cope with a situation, alongside their beliefs about the threat itself. They found that those with a negative evaluation of their ability to cope with a brain injury and those with self-reported low self-esteem were significantly more likely to respond to these

threat appraisals with avoidance, further supporting the idea that threat to self may play a major factor in coping with the consequences of a brain injury.

This idea of threat to self was also raised by Gracey et al. (2009), in which they developed a ‘Y-shaped model’ (see figure 1) to try to account for the consequences, changes and outcomes of ABI. They postulated that for a subset of survivors, the threat of feared and actual catastrophic meanings associated with the person’s post injury situation subsequently leads to the adoption of particular coping strategies, such as avoidance and worry, similar to the previously mentioned research (Riley et al., 2004; Riley et al., 2010). These ultimately fail to resolve this discrepancy, but reduce threat in the short term, leading to poorer psychosocial outcomes and ultimately poorer post-injury adjustment. The authors again drew upon Goldstein’s (1959) description of difficulties being a combination of organic impairment, the catastrophic reaction and loss of skills due to avoidance of this to complement their own model, similar to ideas previously described by others within this research area (Gracey et al., 2009; Riley, et al, 2004).

The ‘Y-shaped model’ also takes into account the role of self-concept and self-discrepancy in threat, noting previous research which has found that those with a TBI experience a comparative self-discrepancy relative to pre-injury and post-injury self, which has been found to be a major factor in post-injury adjustment (Arena & Adams, unpublished) and mental health (Cantor, Ashman, Schwartz, Gordon, Hibbard, Brown, Spielman, Charatz, & Cheng, 2005). This model links the self-discrepancy and coping style literature together with the sense of threat to self, which ultimately underpins adjustment post-injury.

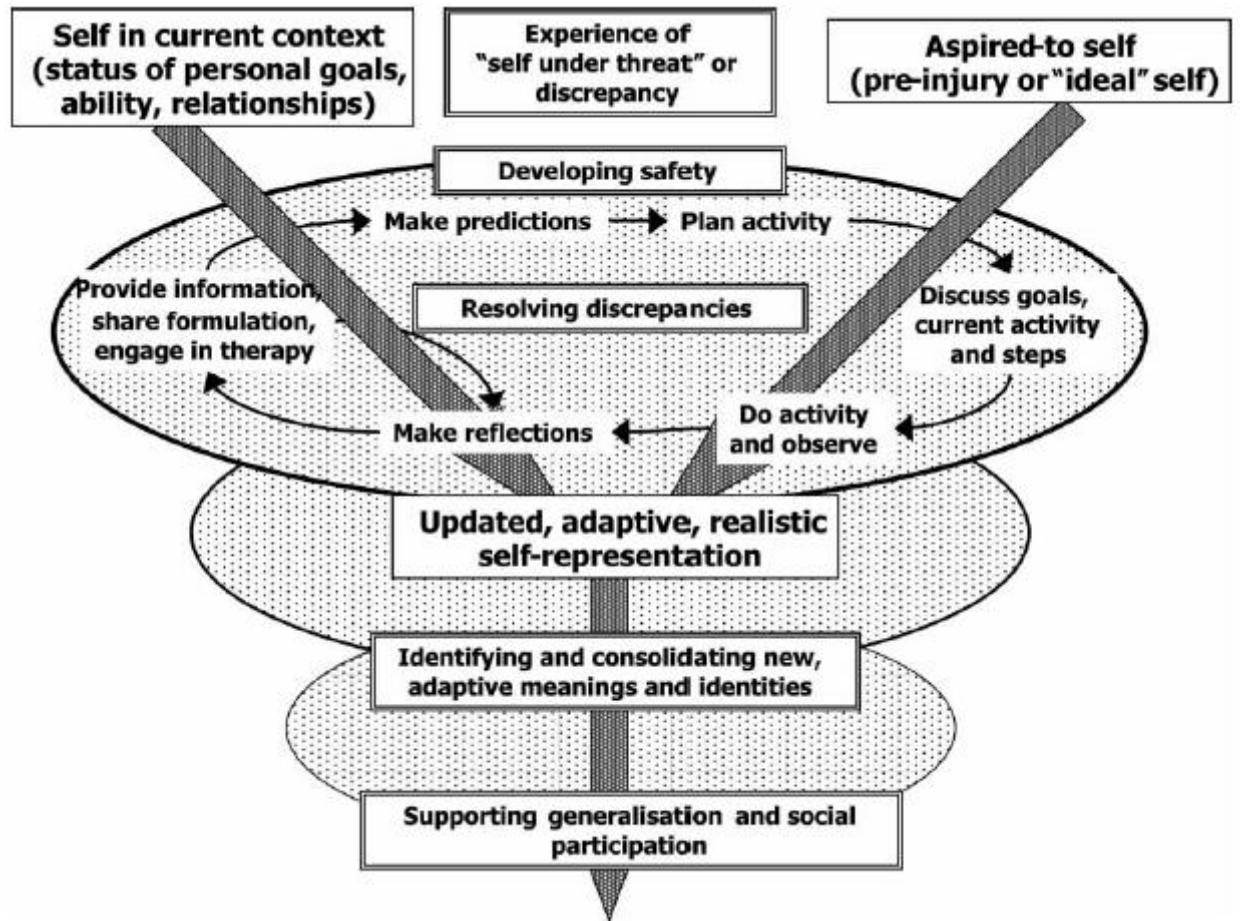


Figure 1. The 'Y-shaped' process model of rehabilitation (Gracey et al., 2009)

## 1.6 Sense of Self in Brain Injury

Ownsworth (2014) stated that the research investigating sense of self in brain injury has only begun to emerge in the literature over the last few decades, originating from the research on self-concept conducted by Tyerman and Humphrey (1984). The self has been referred to as the conscious being responsible for unique thoughts and actions, which encompasses the collective characteristics we think of as our own, including our bodily experiences and internal psychological states (Brinthaupt & Lipka, 1992; Ownsworth, 2014).

It has been said that a brain injury is best characterised as a developmental event representing a fundamental change in the person's sense of self and how they relate to their environment (Moldover, Goldberg, & Prout, 2004). This event is unique

in that the person must cope with both the task of mourning for a lost identity and construction of a new one, whilst accepting a new set of restrictive neurological parameters, acting as 'a sudden break in the continuity of who the person is' (Moldover et al., 2004). Further to this, most individuals face uncertainty regarding their new future, in terms of their survival, recovery level and outcomes (Godfrey, Knight, & Partridge, 1996).

Research looking at the self in ABI has looked at the process of adjustment and coping, since the ongoing stress of ABI for individuals and their families, alongside specific transitions (such as leaving hospital, moving to independent living, trying to return to work) affects individuals differently, influencing sense of well-being (Gracey & Ownsworth, 2012) and research has indicated that this is linked with self-concept. Adjustment to ABI has been investigated and conceptualised within a bio-psycho-social framework, broadly proposing that post-injury adjustment is related to the interaction between the neuropathology of the brain injury, personal factors, psychological factors, and the social and environmental context (Ownsworth, Fleming, Desbois, Strong, & Kuipers, 2006; Williams & Evans, 2003). Some factors that have been found to contribute to a poorer post-injury adjustment are the use of avoidant coping strategies and external locus of control (Dawson, Schwartz, Winocur, & Stuss, 2007; Moore & Stambrook, 1992), reduced levels of social support (Vogenthaler, Smith, & Goldfader, 1989) and personal factors such as personality, coping skills and appraisal of their situation (Rutterford & Wood, 2006). Furthermore, it has been suggested that adjustment following an ABI is not a process of arriving at a set, static point of recovery, but instead a continuous and cyclical process (Muenschberger, Kendall, & Neal, 2008; Newsome & Kendall, 1996).

## 1.7 Self-Discrepancy and its Application to ABI

Our self-concept has an important influence on our behaviours and emotional responses, and struggling with our own self-representation following ABI can be implicated in the subsequent experiences of emotional distress and disorders (Tyerman & Humphrey, 1984; Vickery, Gontkovsky, & Caroselli, 2005). The concept of self-discrepancy has become more apparent in this adjustment/coping literature, with Self-Discrepancy Theory (SDT) opening up as one attempt at explaining this process. It states that people compare themselves to an internalised standard called a 'self-guide', and emotional discomfort emerges when there is a contradictory gap between these two representations (Higgins, 1987). This emotional discomfort then acts as a motivator to reduce the felt disparity between these two comparisons (Higgins, 1987). Working within this understanding, motivation towards rehabilitation goals is dependent on how consistent these goals are with our current 'self' (Vickery et al., 2005). This theory postulates three domains of the self, which includes the 'actual', 'ought' and 'ideal' (Higgins, 1987). The 'ought' and 'ideal' self subsequently motivate people to change or improve, and it has been said that the ideal-self focuses on the presence or absence of positive outcomes, whereas the ought-self focuses on the presence or absence of negative outcomes (Higgins, Roney, Crowe, & Hymes, 1994).

It has been suggested SDT has direct implications for treatment of emotional disorders, (Cantor et al., 2005); it proposes that affective disorders can be partly due to a discrepancy between self-concept (the current, actual self) and these self-guides (the ideal and ought selves). As these discrepancies increase, so will an individual's vulnerability to anxiety or depression, predicting that discrepancies between actual/ideal self-states are associated with depression, and discrepancies between

actual/ought self-states are associated with anxiety (Cantor et al., 2005; Higgins, 1987; Higgins, Klein, & Strauman, 1985). There have been some studies investigating these ideas, some supporting these predictions (Scott & O'Hara, 1993; Strauman, 1992) and some finding negative or mixed results (Bruch, Rivet, & Laurenti, 2000; Ozgul, Heubeck, Ward, & Wilkinson, 2003; Tangney, Nedenthal, Covert, & Barlow, 1998; Weilage & Hope, 1999).

There has been one research study which has specifically expanded SDT into the realm of TBI. Cantor et al. (2005) used this theory as a way of trying to understand and explain elements of depression and anxiety post injury in a TBI population, in that a discrepancy between your actual and ideal self would result in depression, and a discrepancy between actual and ought self would result in anxiety. The authors found a strong correlation between increased affective distress in participants and greater self-discrepancy between past and current self. However, this pilot study did not support the hypothesis specific to SDT, that discrepancies between actual/ideal selves are related to depression, and discrepancies between actual/ought selves are related to anxiety. This may be partly due to the smaller sample size, however, the particular methodology used to examine 'self' in the paper was considered as a potential limiting factor by the authors; as by using an open ended interview, those with brain injury may have struggled to generate meaningful information about 'self' in the more abstract sense of 'ought' and 'ideal' (Cantor et al., 2005). One other possibility is that 'Ought' self is a concept which may also be hard to disentangle from an 'ideal' self in this context. Furthermore, research has found that a patient's sense of self is not a static concept, but influenced by their progress within rehabilitation and recovery. For example, Kristensen (2004) found that prior to the start of rehabilitation, individuals were more concerned with striving to maintain the 'former self', whereas afterwards

there is more of a focus on ‘self-realisation’ and making adjustments to their current self. Therefore, the time since injury/stage of rehabilitation may determine whether affective difficulties related to self have an impact upon a survivor, which wasn’t considered within this study. Cantor et al. (2005) noted that there is a need for further research in the use of this model in brain injury following their pilot study.

## **1.8 Literature Review**

The comorbidity of emotional difficulties following an acquired brain injury has been investigated quite substantially, with consistently elevated levels of distress being found (e.g., Broomfield, Quinn, Abdul-Rahim, Walters, & Evans, 2014; Fann, Burington, Leonetti, Jaffe, Katon, & Thompson, 2004; Kim et al, 2007). However, research is now moving towards examining the after effects of this distress, with recent growth in interest around trying to identify the emotional adjustment, rehabilitation and re-conceptualisation of a person’s identity following a brain injury (Gracey & Ownsworth, 2008). The most obvious conclusion to draw is that there is a negative recognition that the person’s past self has been replaced, with limitations that were not present beforehand (Moldover et al, 2004). However, there are reports that positive sense of self can emerge following a brain injury, with reference to resilience and overcoming adversity (Sabat, Moodley, & Kathard, 2006), acting as a catalyst for personal growth (Ownsworth & Fleming, 2011), so clarification of the literature is justified.

Furthermore, Gracey, Evans and Malley (2009) in their Y-Shaped model, point towards sense of self being a core feature of the development of threat appraisal behaviours and subsequent coping behaviours. In order to gain a better perspective on this element of adjustment and to develop an understanding of how ‘self’ is

conceptualised following a brain injury, this review aims to address the following question: “what is the impact of an ABI on self-identity?”

### **1.8.1 Search strategy.**

A systematic search of the literature was conducted on 25<sup>th</sup> November 2014 using three electronic databases: CINAHL Complete, MEDLINE Complete and PsychINFO. A priori limits were set to papers investigating adult, human populations, published in English and in peer-reviewed journals. The keywords for relevant returned items were examined to ensure that appropriate synonyms of the search terms had been utilised and, where appropriate, mapped to subject terms specific to the database. This was supplemented by identifying further relevant articles from reference lists of articles already included, from review articles, and by hand-searching key journals in the field (*Brain Injury* and *Neuropsychological Rehabilitation*). Literature were searched from the first year that these journals were available and search terms were truncated using ‘\*’ as needed. The following search string was used:

1. Brain Injur\* OR Head Injur\* OR Stroke\*
2. Identit\* OR Self\* OR Selves\* OR Sense of self
3. 1 AND 2

### **1.8.2 Selection process.**

All abstracts were examined to determine suitability for inclusion in the review, and full text articles were obtained if they appeared to meet selection criteria. Figure 2 provides a summary of the search process. Journal articles were considered for

inclusion if they were original research looking at identity or self-concept in individuals with ABI. Articles were excluded if they were not in English, not from peer-reviewed journals (meetings, conference papers or dissertation) or were review/purely theoretical articles which did not report new findings. Case studies were included if they met sufficient methodological strength for a single case experimental design (Tate, McDonald, Perdices, Togher, Schultz & Savage, 2008). Intervention studies focusing on rehabilitation of self-identity/self-concept were also excluded in this search following review, as the literature search revealed that an upcoming systematic review was due to be published on this subject (Ownsworth & Haslam, 2014).

### **1.8.3 Selection of papers.**

The search revealed 264 results, and five additional papers were identified through ancestry search methodology. After duplicates were removed and titles/abstracts were screened in accordance with inclusion/exclusion criteria, 21 studies remained for review (see table 1 and 2 for list of studies).

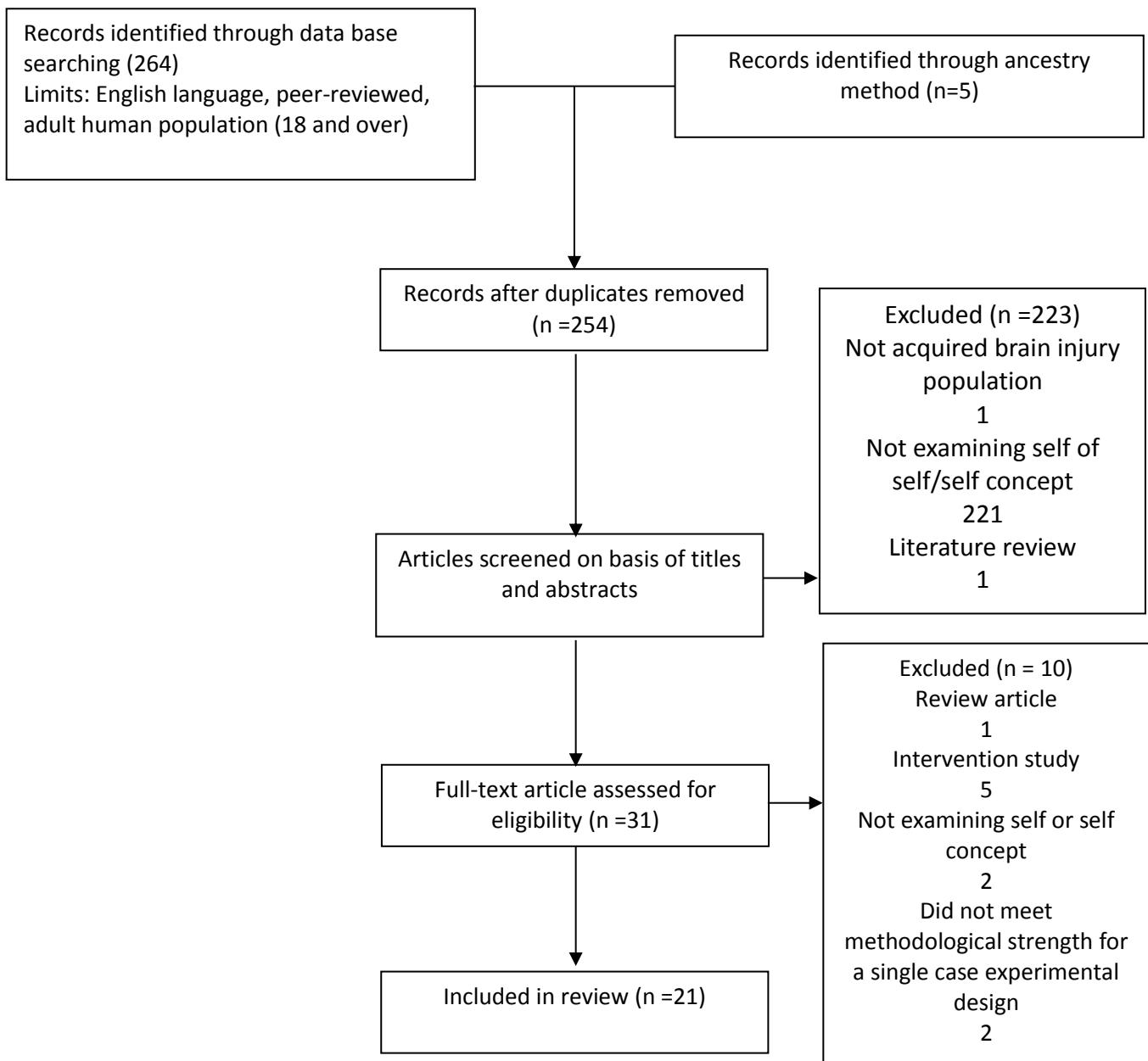


Figure 2. CONSORT flow diagram for the literature review process

Table 1.  
*Summary Of Qualitative Studies Included In the Literature Review*

Authors	Sample size, sex (F/M), diagnosis	Age range	Methodology used	Key themes/narratives identified around self-identity	
Cloute, Mitchell & Yates (2008)	6 (male = 5) TBI	22 – 60	Semi structured interview – discourse analysis	Medical model referencing dependence as intrinsic to TBI TBI as deficit Progression and productivity as key life-defining features	
Douglas (2013)	20 (male = 16) TBI	21 – 54	Qualitative interviews – grounded theory approach	Who I am How I feel about myself Staying connected	
Ellis-Hill, Payne, & Ward (2000)	8 (male = 5) Stroke	56 – 82	Life narrative interviews	All respondents reported a fundamental change in their lives and identity, with a split between themselves and their body.	
Gelech & Deshardins (2011)	4 (gender data not available) ABI	Not available	Semi structured interviews – thematic, syntactic and deep structure analysis	Whilst many of the themes were around the dominant discourse of ‘lost or shattered self’, there were aspects of stability, recovery, transcendence and moral growth in the process of reconstructing self following brain injury.	
Gracey, Palmer, Rous, Psaila, Shaw, O’Dell, Cope & Mohamed (2008)	32 (male = 23) ABI	21 – 59	Structured group discussion – thematic analysis of elicited personal constructs	Experience of self in the world Experience of self in relation to self Emotions Activity	Basic skills Coping/outlook Social relating Motivation Uncertainty
Guise, McKinlay & Widdicombe (2010)	12 patients, 5 carers - Stroke	Under 55	Focus group interviews – discourse analysis	Participants had sensitivities about acquiring a ‘damaged’ sense of self, and attempted to mitigate these experiences.	
Kvigne, Kirkevold & Gjengedal (2010)	20 (all female) Stroke	31 – 80	Interviews – descriptive phenomenological method	There was a lengthy struggle to continue life and preserve the old self following a stroke, with significant loss associated with pre-held female/family roles.	
Lennon, Bramham, Carroll, McElligott, Carton, Waldron, Fortune, Burke, Fizhenry & Benson (2014)	9 (male = 8) TBI	ABI: 28 - 62	Interview – interpretative thematic analysis	There were both positive and negative self-narratives around reconstruction of self following brain injury. Sense of self was described as simultaneously continuous and changing.	

Table 1.  
*Summary Of Qualitative Studies Included In the Literature Review*

Authors	Sample size, sex (F/M), diagnosis	Age range	Methodology used	Key themes/narratives identified around self-identity
Muenchberger, Kendall & Neal (2008)	6 (male = 4) TBI	22 – 49	Interpretive qualitative phenomenological method	Identity transition is characterized by an individualised dynamic process between positive and negative experiences, a struggle for equilibrium and resolution of these tensions.
Nochi (1997)	4 (male = 3) TBI	24 – 40	In-depth interviewing and participant observation	Participants felt that they were carrying a ‘void’ in their understanding of their past and present, which was filled with stories. TBI appears as meanings in self-narratives rather than an objective truth.
Nochi (1998a)	10 (male = 6) TBI	24 – 49	Grounded theory	Participants experience loss of self in various forms, although attempt to avoid or minimize this sense of loss. They find it difficult to develop clear knowledge of becoming their new self, there is a negative comparison to previous self and sense of self is threatened by labels that society places upon them.
Nochi (1998b)	10 (male = 8) TBI	24 - 54	In-depth interviewing and grounded theory	A loss of self is experienced when participants interact with society and are labelled by them, as they contradict the individual’s self-definition. Strategies are devised to maintain a shared meaning of self in society.
Nochi (2000)	10 (male = 8) TBI	27 – 54	In-depth interviewing and participant observation	the self better than others the grown self the recovering self the self living here and now the protesting self
Pallesen (2014)	15 (male = 10) Stroke	42 – 84	phenomenological qualitative method	In managing changes to self-identity, they seemed to be in a continuous process of change that never truly stabilized. Participants coped with this with resignation or personal growth.

Table 2.  
Summary Of Quantitative Studies Included In the Literature Review

Authors	Sample size, sex (F/M), diagnosis	Age range	Type of assessment (self-concept)	Key findings around self-identity
Carroll & Coetzer (2011)	29 (male = 21) TBI	22 – 64	HISDS (version III)	Participants reported significant changes in self-concept, current self viewed negatively in comparison to pre-injury self. Identity change was also associated with depression, grief, low self-esteem and low awareness.
Doering, Conrad, Rief & Exner (2011)	35 (male = 21) ABI	Mean age 44	FSCS	Compared to normative measures, all scales of 'self-concept of achievement' were evaluated more negatively. No difference found between 'feeling respected by others' and 'irritability by others'
Ellis-Hill & Horn (2000)	26 (male = 16) Stroke	50 – 83	HISDS (version II)	Participants described themselves more negatively than prior to their stroke on most constructs measured.
Jones, Haslam, Jetten, Williams, Morris & Saroyan (2011)	630 (male = 384) ABI	9 – 81	TREAT-Q	A relationship was found between worse injury and better reported life satisfaction, with identity strength being a strong mediator, alongside personal and social changes.
Ponsford, Kelly & Couchman (2014)	41 (male = 29) TBI	18 – 73	TSCS	Participants with TBI rated significantly lower levels of self-concept compared to control. Self-concept was also associated with depressive symptoms and anxiety.
Tyerman & Humphrey (1984)	25 (male = 23) TBI	17 – 34	HISDS (version I)	Participants reported having changed substantially due to their head injury, and this was associated with poorer ratings on a wide variety of constructs.
Vickery, Gontkovsky & Caroselli (2005)	19 (male = 13) ABI	19 – 57	HISDS (version I); TSCS	Poorer self-concept ratings were associated with lower subjective quality of life and higher affective distress.

Note: ABI = Acquired Brain Injury; FSCS = Frankfurt self-concept scale; HISDS = Head Injury Semantic Differential Scale; TBI = Traumatic Brain Injury; TREAT-Q = Trauma and Recovery Experiences assessment Tool Questionnaire; TSCS = Tennessee self-concept scale

#### **1.8.4 Results and characteristics of the studies.**

The studies found were a mixture of qualitative studies (14) and quantitative studies (7), with a wide range of methodologies and measures used throughout the literature. Overall the studies covered a large heterogeneous sample of participants ( $N = 972$ ) aged between 9 and 84 (although there may be some crossover of participants between studies), including ABI and TBI populations, (with a predominance of TBI only samples - 12 studies), with a wide mixture of genders, ethnicities and time since injury.

#### **1.8.5 Quantitative studies.**

Tyerman and Humphrey (1984) used the Head Injury Semantic Differential Scale (HISDS) to examine the discrepancy between past and present self in 25 participants with TBI, providing a quantitative measurement of perceived loss and change in identity. They found that 72% of participants declared that they had changed significantly as a person, with the majority of changes being seen as negative. However, there were also instances of positive conceptions as well (feeling more mature, responsible, understanding and appreciative). These authors also discussed the notion that the participants' identity before their injury was particularly important to them, with many believing and hoping that they would return to the level of their pre-morbid functioning. They argued that whilst this was initially a motivating factor for recovery in the short term, when these are found to be unrealistic goals this negative comparison can become a constraint to both rehabilitation and long term adjustment.

Carrol and Coetzer (2011) also examined self-concept using the HISDS (version III) in a TBI sample of 29 participants, finding that present self was regarded negatively in comparison to pre-injury self on many different attributes (e.g., less

happy, satisfied and hopeful), with those individuals who reported the largest change in self-concept more likely to report a much poorer adjustment to difficulties.

Ellis-Hill and Horn (2000) also used this measure in a population of 26 people recovering from a stroke, and, again, rated their present self-concept as similar or more negative than their past self on every aspect assessed (apart from seeing themselves as more caring), rating themselves as less capable, independent, satisfied, interested, active, confident, of less value and less in control as compared to before. The authors also speak about one participant who was severely disabled, who explained that she saw her old life before the stroke as having ended, and that she was beginning a new life.

Two papers which also examined self-concept as a smaller element within their studies. Vickery et al. (2005) used the HISDS in a sample of 19 participants who had sustained an ABI and found that poorer perceived current identity was associated with poorer perceived quality of life. Furthermore, Ponsford, Kelly and Couchman (2014) used the Tennessee Self Concept Scale (Fitts & Warren, 1992) in a sample of 41 participants with TBI, and found that those with a TBI rated significantly lower levels of self-concept.

A German study by Doering, Conrad, Rief and Exner (2011) used the Frankfurt Self-Concept Scale (Deusinger, 1986) to assess the attitudes of their 35 participants who had sustained an ABI and had chronic difficulties as a result, around issues concerning their identity. Compared to the measure's normative data, all scales of 'self-concept of achievement' were evaluated more negatively, again supporting the assumption of a more negative self-concept. However, looking at psychosocial aspects the authors found that there were no differences between 'feeling respected by others'

and ‘irritability by others’, again indicating that not all areas of self-concept may be affected by ABI.

Finally, Jones et al. (2011) used a self-developed questionnaire called the Trauma and Recovery Experiences Assessment Tool and examined responses from 630 individuals with ABI, looking at areas related to personal and social change, and life satisfaction following their accident. They found that counter-intuitively, more severe ABI was associated with a strengthening of personal identity and life satisfaction post-injury, suggesting that those with more severe difficulties are more likely to do significant “identity work” (Jones et al., 2011; p. 12) post injury, such as strengthening social networks post-injury. This may parallel the results identified by Doering et al. (2011) who found that chronic difficulties were associated with a negative sense of self. Jones et al. (2011) suggested that there was capacity for personal and social factors to buffer the negative effects of the severity, with both factors being strengthened through working through their image, which may explain the difference.

Furthermore, the well-being of the participants in the Jones et al. (2011) study was positively related to their personal identity following brain injury; their sense that they were ‘survivors’ and stronger as a result of their injury was associated with greater life satisfaction overall. This study also found that the relationship between injury severity and life satisfaction was mediated by the number of improved relationships post-injury. The authors felt that this may be partly due to the severity of the injury, influencing the support services that patients received. They noted that this was consistent with the idea of personal identity strength being built largely through social relationships, and that access to these groups appears to be integral to the effective management of injury. This may be because these groups provide a source of

important emotional support and practical resources, providing benefits to those individuals. Additionally, the authors hypothesised that cultivating an identity around being a survivor rather than a victim may help individuals to derive strength from their injury, and help them make sense of their experienced changes to self.

### **1.8.6 Evaluation of findings: Quantitative studies**

As the studies reviewed comprised of correlational and quasi-experimental research, literature on critical appraisal of quantitative methodologies was used to guide the evaluation. Two generic frameworks for critical appraisal (Crombie, 1996; Jack, Hayes, Scharalda, Stetson, Jones-Jack, Valliere, Kirchain, Fagen & LeBlanc, 2010) were applied. These criteria are presented in table 3, and the summary table of comparison criterion are presented in table 4.

The majority of studies chose a title and abstract which provided immediate insight and information into the research, with Jones et al. (2011) being excluded due to its lack of immediacy and the vagueness of its terms. All introductions managed to succinctly present the literature leading up to the study, with much of the prior research overlapping as referenced throughout each other's papers. All authors were then able to subsequently justify the rationale or gap in the literature that their study aimed to contribute to, such as through a specific type of injury (e.g. stroke; Ellis-Hill & Horn, 2000) or to examine whether specific concepts are related (e.g. self-concept and quality of life/affective distress; Vickery et al., 2005).

Table 3.

*Criteria for Assessing Quantitative Methodological Quality in Quantitative Studies, Adapted from Crombie (1996) and Jack et al. (2010).*

Criterion	Details
Title and Abstract	1. Does it provide immediate insight into the research 2. Does the abstract provide the reader with key information
Introduction	3. Does the manuscript provide a succinct presentation of previously published literature and offer a rationale for the study
Method: Sample	4. Was the sample size sufficient? 5. Were calculations reported? 6. Were inclusion/exclusion criteria explicitly reported? 7. Were age/gender described? 8. Were severity/chronicity of illness described? 9. Was the control group (if used) appropriate?
Method: Measurement	10. Were suitable measures used? 11. Were psychometric properties reported?
Results/Statistical analysis	12. Were statistical methods appropriate? 13. Were assumptions of the method met? 14. Were descriptive statistics described? 15. Was statistical significance reported?
Discussion	16. Does it adequately summarise main results and findings 17. Have potential biases/confounding been controlled for? 18. Are generalisability of results discussed? 19. Are the limitations discussed? 20. What are the implications or recommendations for education/ clinical practice?

Table 4.

*Summary Of Quantitative Studies Assessed for Methodological Quality, Using Questions Adapted from Crombie (1996) and Jack et al. (2010).*

Authors	Criterion Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Carroll & Coetzer (2011)		✓	✓	✓	✗	✗	✗	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓
Doering, Conrad, Rief & Exner (2011)		✓	✓	✓	✗	✗	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓
Ellis-Hill & Horn (2000)		✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓
Jones, Haslam, Jetten, Williams, Morris & Saroyan (2011)		✗	✓	✓	✓	✗	✗	✓	✓	-	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓
Ponsford, Kelly & Couchman (2014)		✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Tyerman & Humphrey (1984)		✓	✓	✓	✗	✗	✓	✓	✓	-	✓	✗	✓	✓	✓	✓	✓	✗	✗	✗
Vickery, Gontkovsky & Caroselli (2005)		✓	✓	✓	✗	✗	✗	✓	✓	-	✓	✗	✓	✓	✓	✓	✓	✗	✓	✓

The aforementioned research studies seemed to suffer from some similar limitations which have implications for their generalisability to the wider population, such as smaller sample sizes and possible inadequate statistical power (Carrol & Coetzer, 2011; Doering, Conrad and Yates, 2011; Ellis-Hill & Horn, 2000; Ponsford, et al., 2014; Tyerman & Humphrey, 1984). The studies were forthcoming in commenting on this (with none reporting any previous calculations for the appropriate sample size to reach adequate power). Interestingly, small sample size is a critique levelled more generally at research in brain injury (Carroll, Cassidy, Holm, Kraus, & Coronado, 2004). The exception to this was Jones et al. (2011), which had a questionnaire sample of 630 individuals with ABI, although the authors felt there may be issues of self-selection around those who were willing to respond to the questionnaire (and may have had more positive outcomes).

All quantitative papers described their sampling methods appropriately, outlining age ranges and genders of their samples, with inclusion and exclusion criteria made explicitly clear in all but two papers (Carrol & Coetzer, 2011; Jones et al., 2011). Not all of the papers outlined the specifics around severity of injuries, with some descriptives such as “mild, moderate or severe” (e.g. Vickery et al., 2005), whereas some used more standardised tools and measures, such as the Glasgow coma scale (Carrol & Coetzer, 2011). Some papers targeted specific severity populations, with Carrol and Coetzer (2011) indicating that their participants were on the more ‘able’ or ‘well’ end of the injury severity spectrum, again raising issues of generalisability of results to other studies. Similarly, Doering, Conrad and Yates (2011) noted that their sample comprised of participants seeking treatment for chronic difficulties following ABI, and so it may be assumed that they are having ongoing adaptation problems long after their injury, and so may be characterised by especially

negative self-concept, which should be kept in mind when considering these results.

Only two studies used a control group (Ellis-Hill & Horn, 2000; Ponsford, et al.,

2014) and both were appropriate, attempting to match them with the ABI groups.

The measures used were predominantly well suited to the population, with measures such as the HISDS commonly used which was developed for use in brain injury populations (Tyerman & Humphrey, 1984). The HISDS allows the participant to rate themselves compared to a pre-injury self as a way of examining change in self-concept, however these samples only examined the discrepancy between pre-injury self and current self, not examining the current and ideal discrepancy (Carroll & Coetzer, 2011; Ellis-Hill & Horn, 2000; Tyerman & Humphrey, 1984; Vickery, et al., 2005). However, Vickery et al. (2005) and Ponsford et al. (2014) (alongside Doering, Conrad and Yates (2011) using the Frankfurt self-concept scale) did not use any personalised measurement of prior self as their comparison point, instead relying on the generic normative data for the measurement, and Ponsford et al. (2014) and Ellis-Hill and Horn (2000) used matched control groups. Whilst this demonstrates the difference in self-concept in a different way, it limits the conclusions that can be made around a person's self-concept following brain injury, as it is not asking about their own individualised self-identity, although this can address some of the difficulties that may emerge from using a solely subjective self-reported ratings (see Fadnes, Taube & Tylleskär, 2009 for overview of biases).

However different versions of this measure have been used in different studies (Carroll & Coetzer, 2011; Ellis-Hill & Horn, 2000; Tyerman & Humphrey, 1984; Vickery et al., 2005), so this must be considered when directly comparing them. The one exception to this is Doering, Conrad and Yates (2011) who used the Frankfurt Self-Concept Scale, which the authors reported had only been used in ABI research

once before (referencing Gatzweiler, 1996), although Doering, et al. (2011) did present preliminary evidence for good convergent validity with the HISDS in their own study (= .57) .

Jones et al. (2011) was also an exception to this by not using a specialist tool to measure sense of self. Instead the participants were assessed using single items as part of a larger questionnaire (Trauma and Recovery Experiences Assessment Tool), meaning that their conclusions can only be considered within broad contexts, as the nuances of identity and sense of self were not examined. The authors attempted to counter this limitation with research showing that single item measures have been found to correlate well with larger measures (referencing Robins, Hedin, & Trzesniewski, 2001), although general consensus normally points to single-item scales as usually psychometrically inferior to multiple-item scales (Gosling, Rentfrow & Swann, 2003).

All papers used appropriate statistical methodology, and where appropriate, assumptions for methodology such as parametric assessments were indicated where these were used. All studies also reported descriptive statistics and whether or not their analyses were statistically significant. All of the papers were able to adequately summarise the main results and findings, however very few controlled for biases and confounds, with only Jones et al (2011) and Ponsford et al. (2014) addressing these, controlling for other mediating factors and education respectively.

The limitations and generalisability of their research was a topic discussed much more consistently throughout the research, with Doering et al. (2011) failing to discuss the generalisability of their results, and Tyerman and Humphrey (1984) discussing neither of these, using their discussion to talk about the implications of their study for participants and for their measure of self-discrepancy. All of the studies

collected for this literature review discussed implications and recommendations for future practice and research.

### **1.8.7 Findings from quantitative studies: The impact of an ABI on self-identity.**

The results of the quantitative studies seemed to overwhelmingly present the idea of a negative self-concept as compared to the pre-injury self, in regards to their functioning, abilities and often their characteristics and personality. The exception to this was Jones et al. (2011), which, whilst having limitations, found some mediating factors which revealed protective factors in redeveloping identity following brain injury. For example, the severities of the injuries were associated with better sense of self and life satisfaction, mediated by personal and social factors. This may be due to the support they received from others as a result of their injury. The findings of an overall negative sense of self may be a result of the use of quantitative methodology and scales, which focused overwhelmingly on a comparison to past self or specific affective disorders, rather than a focus on a future identity. This may not give the appropriate space to explore the complexities of this area, and this ‘comparison’ may encourage a more negative evaluation that qualitative methodologies do not.

### **1.8.8 Qualitative studies**

Muenchberger, Kendall, and Neal (2008) used an Interpretive Phenomenological Approach (Smith, 1996) to explore the meaning of six TBI survivors’ experiences. They found that identity adjustment following TBI was a dynamic, cyclical journey, comprising a constant interplay between positive and negative experiences, a struggle for equilibrium and for resolution of these tensions. Participants described the post-injury phase as one of partial acceptance and trying to reclaim identity, reflecting on their past selves, focusing on a medicalised illness

narrative and a shrinking of previous identity. The return to pre-injury environments was a trigger point for comparison with their pre-injury self, and as a result these problem situations were avoided. This constriction of activity and the fear of failure they experienced was then found to place them in a position of feeling 'dependant' on others and created a fear of 'not measuring up' to social expectation, leading to an identity shaped by an overwhelming desire to meet societal and normative expectations. However a more positive 'expansion of identity' theme also emerged, in that brain injury represented a 'second chance' at life and heightened their motivation to focus on short-term opportunities and kept them appreciative of life and working towards purposeful goals. The paper stated that it also gave them the opportunity to be perceived as an individual again, rather than a collective (i.e., "people with brain injuries" p. 987).

Clouet, Michelle and Yates (2008) identified a series of themes using Discourse Analysis (Schiffrin, Tannen & Hamilton, 2003), exploring the co-construction of identity for those with six survivors following TBI. They identified four themes; medical model reference; dependence as intrinsic to TBI; TBI as deficit and progression and productivity as key life-defining features. The most prominent of these seemed to be 'TBI as deficit', which included repertoires around an idealised past, the person as a victim/physically impaired, socially and functionally deficient, and an idealised lost potential future. Alongside this was a 'medical model' theme that also emerged in the aforementioned Muenchberger, et al. (2008) paper which reported a feeling of abandonment and a requirement for reliance on health services. The theme around 'dependence as intrinsic to TBI', outlined how there was a reliance on significant others and lack of independence being a key life defining feature, although there was less elaboration on this in the study itself.

Douglas (2013) aimed to explore the ways in which 20 adults who had sustained severe to very severe TBI viewed themselves several years after their injuries, using a Grounded Theory methodology (Glaser & Strauss, 1967). This paper establishes themes around “who I am”, “how I feel about myself” and “staying connected”. Part of “Who I am” included striving statements, capturing the goals that survivors wanted, where injury consequences were more apparent and were reflected on, alongside difficulties in social relations and activities. There was also the emergence of the ‘self as a burden’, especially in relation to family members and the associated guilt that came from this perception. However many reflected on being more content post-injury, feeling that they were getting better/stronger and feeling more positive about the future. In addition to this, it became evident that many of the participants saw themselves as much more altruistic, with a greater focus on living in the present and feeling fortunate by comparison. Furthermore, a sense that framing the injury in this way gave validation to the process of identifying new, fulfilling goals for the survivors, similar to the themes emerging in Muenchberger, et al’s (2008) study.

Similarly to themes found in Clouet et al. (2008), Gelech and Deshardins (2011) found in their sample of four ABI survivors, that the patient’s accident altered the relative value associated with some of the roles which had been lost post injury (e.g., employed/married), and so were no longer seen as necessary for their happiness or selfness; transforming what initially appears as a loss to the self into a gain. The authors reported that personhood was deemed to have remained largely intact through the injury experience, whilst simultaneously increasing compassion, patience and respect of life, rather than being dominated by grief and loss. They also reported that many discussions were in accordance with a dominant discourse of ‘lost or shattered self’, focusing on negative alterations and losses. They found that this was related to

both the changes in the practical consequences of the injury (decrease in practical competencies, cognitive abilities and autonomy) and the responses from others around them. The authors elaborated on the power of others, explaining that ‘self’ depends heavily on relationships with others and the social world.

Ellis-Hill, Payne and Ward (2000) examined the self in relation to eight participant’s experiences of their own body following a stroke. All of the respondents described that their lives had undergone a change that could be likened to entering a new foreign world which, when realised as a more permanent change, is challenging to the survivors’ identity. Individuals spoke about tasks which made them realise how they had taken their body for granted, and that suddenly this had become something that was completely out of control for them, as bodies became perplexing to them. The authors drew on ideas that body and self are normally seen to be inseparable, and that a sense of self is created through the relationship of the body with the external world (Leder, 1990; Merleau-Ponty, 1963). Furthermore, the authors described the self-body relationship as not being static or gradually improving, but dynamic and situation dependant, which draws a parallel with Muenchberger et al’s (2008) thoughts of TBI as a dynamic process between positive and negative experiences.

Pallesen (2014) used phenomenological qualitative interviews to examine self-identity following a stroke in 15 people, and found similar themes to Ellis-Hill, Payne and Ward (2000) emerged around an unreliable and “forcibly present” body (p. 235), leading to an unpleasantness in how their body was experienced. There were also discussions around anxiety about coping with their level of functioning, and that their body was now experienced as far more vulnerable, “aged in functioning” (p. 5) and a reduced trust in their body. These participants also spoke of the effect of injury on relationships, bringing up themes which had already been explored in previous papers

(Gelech & Deshardins, 2011; Jones et al., 2011), talking about how relationships were disrupted and social contacts diminished over, although some spoke of the supportive role that friends and family had played in the rehabilitation process. Furthermore, a theme of growth or change emerged from some of the survivors, generating a range of ways of dealing with difficulties: becoming more flexible in problem solving, enduring, will power and active ways of confronting their newly acquired difficulties, despite the constant struggle. The authors reflected on how symptoms of participant amnesia/cognitive difficulties may have influenced the answers, and that in some cases, a family member was occasionally present, which may have led to a 'negotiated narrative' when they couldn't agree on events.

One paper which also explored the struggle following stroke was Kvigne, Kirkevold and Gjengedal (2004), who investigated how 20 female stroke survivors experienced their life following a first-time stroke. They found that the participants struggled to continue life in familiar ways, and were unable to preserve their former lives and previous self. They felt that the suddenness of a stroke thrust them into a role of being acutely ill, characterised by vulnerability and exhausting and overwhelming feelings of shock, confusion, shame, guilt and grief. However, this was also accompanied by contradictory feelings of hope and a strong will to live, leading to conflict around feelings, whilst attempting to strengthen positives. This loss of self was felt strongly within their 'role' as housewives, many encountering substantial difficulties in completing standard tasks, although demonstrating a strong will to develop new routines and strategies to accept new ways of doing things. This exploration of the self within the family, and the loss of important central positions underlined the importance of the reactions of others in the self following ABI, with

many survivors willing to go to considerable lengths to maintain a ‘normal’ life for their husbands.

Lennon et al. (2014) examined the reconstruction of self in nine ABI survivors as compared to spinal cord injury and also found negative themes emerging from their participants. Considering only those with ABI, individuals described a negative view of self, feeling defined by their injury or their functional impairments. There were also descriptions of self narratives related to their inability to continue with identity-related roles, loss of autonomy and a poor comparison to their pre-injured selves. Again, positive aspects of self following brain injury also emerged, finding that these seemed to fall into two types, the first being positive self-attributes that developed from the experience. Those with ABI found that the experience contributed something positive to their sense of self, describing new skills as a consequence of their experience, such as finding ways around difficulties. There were also quotes from survivors, feeling that their injury helped them to become a stronger person, making them calmer, open-minded and more at ease with themselves as a person. As also identified in other papers in this review, the authors found that those with ABI had facilitated a re-evaluation of their life priorities, and were more appreciative of their lives. The second sub-theme identified strategies that promoted a positive self-reconstruction, such as now engaging in meaningful activity and trying to engage more with other people through activities such as returning to work.

Guise, McKinlay and Widdicombe (2010) used Discourse Analysis (Schiffrin, Tannen & Hamilton, 2003) to examine the language used by 12 young stroke survivors and their carers in focus groups. They found that participants seemed to be sensitive about having acquired a potentially ‘damaged’ sense of self, and despite clearly identifying it as a serious life event, many minimised these experiences. They

seemed to take into account the carers who were present, minimising the negative inferences that others might make of them as stroke sufferers. The authors drew a comparison to Ellis-Hill, Payne, and Ward (2000), contrasting that their participants did not talk about a disrupted view of self, but the minimisation of negative experiences was seen as implying a sense of stigma around being a stroke survivor.

The study by Gracey et al. (2008) incorporated Personal Construct methodology (Kelly, 1955) and qualitative research methods as a way of understanding and conceptualising the experiences of self after ABI in 32 individuals. This methodology allowed the development of dichotomous constructs to help interpret people's experience and sense making, encouraging the comparison of pre-injury, current and ideal selves to identify these constructs. They identified nine themes which suggested that following an ABI, individuals make sense of themselves in terms of both subjective experience and activity together. A high proportion of the developed constructs fell under a broad "experience of self in the world" theme, which looked at activities, skills, confidence and a sense of belonging. Second to this, many of the constructs were placed under the heading of "basic skills", suggesting that in line with many of the other papers examined in this review, changes in ability compared to pre-injury self were also important to this participant group in coming to terms with their post injury self. The other themes of 'experience of self in relation to self', 'coping/outlook', 'emotions', 'social relating', 'activity' and 'motivation' all generate poles which demonstrate the complexity inherent in construction of self following brain injury.

The final papers identified in this review examining self-identity within ABI populations were all completed by Nochi (1997; 1998a; 1998b; 2000). Nochi (1997) conducted interviews to evaluate understanding of self following injuries in four

individuals, with themes in this paper focusing around ‘the void’, which one of the participants used to refer to a blank period in the past memory, but more generally, the ‘unknown’ that people with TBI encounter when they try to understand themselves and their loss of self. The author hypothesised that whilst this loss of self can be attributable to the consequences of physical and cognitive functioning after sustaining ABI, it is not limited to this. This void can also impact on their past, making it difficult to build a narrative around themselves, creating a missing link in the narrative of their sense of self and feeling lost in their present self, affecting their self-esteem based on their current abilities and ‘failures’.

In Nochi’s (1998a) paper, Grounded Theory (Glaser & Strauss, 1967) was used to expand on these previous themes, identifying a similar sense of uncertainty and loss, around self and interpretations of the past and future in ten individuals. These were often due to the ‘memory blanks’ from the brain injury which impacted on how they understood their current situation and generated a comparison to a past sense of self (a sense of ‘not who I was’). The paper noted that whilst people experience loss of self in many different ways, they also subsequently develop strategies to avoid or minimise their sense of loss, by using metaphors, neurological terms, or by keeping a narrative/story around hope of recovery, believing that this negative self-image is a temporary one which will be replaced by the pre-injury self. This minimisation strategy was also seen in Guise et al. (2010), although this was in relation to protecting others. Nochi also found a loss of self in the eyes of others, that the message they received from others was something that they themselves did not believe themselves to be. This led to a sense of ‘classifying’ the individuals, pressing pathological or negative labels upon them, affecting their sense of individual self.

This labelling as a threat to loss of self was further explored by Nuchi (1998b), examining ten participants with TBI. It emerged that those with TBI are sensitive to societal messages about who they are, and that these messages often contradict their self-definitions, making them feel misunderstood by others and further underlining a loss of their own self. These messages are often grouped and labelled around an image of abnormality, powerlessness or sickness, furthering the idea that they are different and removed from their old identity prior to their injury, and have lost their selves in society. Similarly to his 1998a paper, Nuchi also identified that those with a TBI develop strategies to manage these negative images, hiding their functional changes and attempting to control information about themselves, or even to deny and try to change the labels attributed to them.

Nuchi (2000) examined sense of self in ten individuals with a TBI who were coping with their changed lives; a relatively unexamined group within this literature review. Several themes emerged from this study, firstly “the self better than others” in which the present self is contrasted with worse possibilities, adopting a “things could be worse” mentality. This mirrored the studies of Tyerman and Humphrey (1984) and Lennon et al. (2014), who also found their participants compared themselves to others favourably. “The grown self” emerged as a second category in this paper, reflecting on how the experience of TBI had contributed to positive characteristics, acquiring insight into themselves or growing from a moralistic point of view (e.g., stopping drug taking behaviours). This paper’s themes mirrored other studies in this review which have found elements of post-accident growth and a sense of developing or growing stronger following ABI (Douglas, 2013; Gelech & Deshardins, 2011; Jones et al., 2011; Lennon et al., 2014; Muenchberger et al., 2008). Further themes emerged around a “recovering self”, looking at returning towards their pre-injury self, and “the

self living here and now”, (trying to restore self-worth without contrasting against pre-injury selves/others). Finally, some of these narratives were classified under “the protesting self”: obtaining a certain image of the world and locating difficulties there, instead of within themselves and their injury.

### **1.8.9 Evaluation of findings: Qualitative studies.**

These qualitative studies were considered individually in line with the Critical Appraisal Skills Programme (CASP: 2014) framework for qualitative research (see table 5), with this framework applied to these papers in table 6. It was found that all papers assessed clearly stated the aims of the research, and use appropriate methodology to try and reach these aims, with a wide variation in techniques used across the studies. These studies used different qualitative techniques to investigate these questions around self following brain injury, and it was found that many of the papers produced very similar and comparable themes. This helps to strengthen against the limitations of the individual papers, in regards to how generalisable they are when trying to answer the literature review question.

Almost all of the papers made a clear statement about the aims of the research, the only exception being the papers belonging to Nochi (1997; 1998a; 2000) which were often presented as very vague and open in their aim (e.g. ‘...aims to describe the experiences of people with TBI from their viewpoints by analysing their self narratives’). The use of qualitative methodology was appropriate to answer the authors questions, although there were some papers in which multiple methodology was used (e.g., Gelech & Desjardins, 2011) and it wasn’t made explicitly clear why multiple methods of analysis were chosen, although each one was elaborated on.

Table 5.

*Critical Appraisal Skills Programme - Qualitative Appraisal Tool Questions (CASP: 2014)*

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1. Was there a clear statement of the aims of the research?
2. Is a qualitative methodology appropriate?
3. Was the research design appropriate to address the aims of the research?
4. Was the recruitment strategy appropriate to the aims of the research
5. Was the data collected in a way that addressed the research issue?
6. Has the relationship between researcher and participants been adequately considered?
7. Have ethical issues been taken into consideration?
8. Was the data analysis sufficiently rigorous?
9. Is there a clear statement of findings?
10. How valuable is the research?

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Most papers used an appropriate recruitment strategy, with some selecting specialist populations to answer their specific questions (Douglas 2013 Kvigne, Kirkevold and Gjengedal, 2004; Nochi, 2000). However Muenchberger et al. (2008) reported the use of sampling through informal connections in the community. Furthermore Nochi (1997) identified and Gelech and Deshardins (2011) asked clinicians to identify participants based on whether they would be suited to the demands of the interview process and Nochi (1997; 1998a; 1998b) seemed to use some of the same participants across studies, some of whom were known to him outside a purely professional relationship. These are all acknowledged by the authors, and may all introduce the possibility of bias dependant on the researchers view, with Nochi (1998a) specifically recruiting those with loss-of-self experiences.

Table 6.

*Summary Of Qualitative Studies assessed for methodological quality- Critical Appraisal Skills Programme - Qualitative Appraisal Tool Questions*

Authors	Criterion Number	1	2	3	4	5	6	7	8	9
Cloute, Mitchelle & Yates (2008)		✓	✓	✓	✓	✓	✗	✗	✓	✓
Douglas (2013)		✓	✓	✓	✓	✓	✗	✗	✓	✓
Ellis-Hill, Payne, & Ward (2008)		✓	✓	✓	✓	✓	✓	✗	✓	✓
Gelech & Deshardins (2011)		✓	✓	✓	✗	✓	✗	✗	✓	✗
Gracey, et al. (2008)		✓	✓	✓	✓	✓	✓	✓	✓	✓
Guise et al. (2010)		✓	✓	✓	✓	✓	✗	✓	✓	✗
Kvigne, Kirkevold & Gjengedal (2010)		✓	✓	✓	✓	✓	✗	✗	✓	✓
Lennon et al. (2014)		✓	✓	✓	✓	✓	✗	✗	✓	✓
Muenchberger, Kendall & Neal (2008)		✓	✓	✓	✗	✓	✗	✗	✓	✓
Nochi (1997)		✗	✓	✓	✗	✗	✓	✗	✓	✓
Nochi (1998a)		✗	✓	✓	✓	✓	✗	✗	✓	✗
Nochi (1998b)		✓	✓	✓	✓	✓	✗	✗	✓	✓
Nochi (2000)		✗	✓	✓	✓	✓	✗	✗	✓	✓
Pallesen (2014)		✓	✓	✓	✓	✓	✗	✓	✓	✓

Data analysis methods were described in detail for many of the papers, however none of these papers spoke about any sort of saturation limits for their data (although Douglas, (2013) did discuss a methodology of increasingly clearer themes developing as data was analysed), which means that although similar themes were drawn from the participants, the extent to which we can judge whether these sample sizes were appropriate is limited. This ties into the wider critique of the brain injury research literature that sample sizes are generally small and underpowered (Carroll et al., 2004). Nuchi (1997) was identified as a possible exception to appropriate data collection, speaking vaguely about how themes were identified, coded or discarded, and although he makes reference to previous literature, his strategy seemed to be very personal to him.

The findings from each of the papers were generally presented clearly, although in some papers where there were multiple qualitative methods used to generate themes and ideas, these were sometimes confusingly presented, impairing the ability to recognise the specific techniques used to generate themes (e.g., Gelech & Desjardins, 2011). Furthermore, there was generally less discussion around evidence against the researchers' arguments, predominantly focusing on their own data and whether this was found to be supported by other research. There was also little discussion around credibility of their findings outside of comparison to other research, with issues such as triangulation limited because samples predominantly used brain injury patients, except for Cloute, et al. (2008), Ellis-Hill, Payne and Ward, (2008), Guise et al. (2010), and Palleson (2014) who also used some carers, but they often gave conflicting stories to those with a brain injury.

In line with this recognition of the influence of impacting factors, few papers spoke about the influence of the researcher, or the impact that this may have on the participant. Nuchi (1997) was transparent about this relationship and considered the potential that this may have had in influencing his results, and Ellis-Hill et al. (2008) spoke about the background of the researcher and the assumptions that participants may make of her, and how this may have influenced the results. Gracey et al. (2008) spoke about social constructionist research, recognising that the researchers theoretical and socio-cultural perspective will influence the analysis (although did not explicitly relate this back to the impact on the relationship), and Lennon et al (2014) also briefly spoke about the influence of researchers views. This consideration was not found in any other papers in this review. Very few papers took reported their thoughts or considerations around ethical issues, with Gracey et al. (2008) and Guise et al (2010) speaking to it briefly, and Palleson (2014) devoting part of their paper to ethical consideration within the project.

All papers described their data analysis techniques in detail and it all seemed to be sufficiently rigorous, with some papers , such as Gracey et al. (2008), Muenchberger et al. (2008) and Lennon et al. (2014) using methods of inter- rated reliability to minimise the influence of potential bias and maximise bias-free coding, alongside Nuchi (1998a; 1998b) speaking about senior qualitative researchers overlooking his themes. When considering or reflecting on other sources of potential bias/impacting factors, many of the other papers fell short, with Cloute, Mitchelle and Yates (2008) seeming to focus on evaluating a theme around the medical model, to the apparent detriment of the other emerging themes in the text. This may reflect a source of bias in the researchers, or the narrative that they wanted to put across, however they did not reflect on this, which is important since reflexivity is often seen to be integral

to qualitative research (Shaw, 2010), and no research is able to fully eliminate error and bias (Norris, 1997). Not all papers were able to generate a clear statement of findings in their discussion, with those papers (Gelech & Deshardins, 2011; Guise et al., 2010; Nuchi, 1998a) instead choosing to push directly into implications, theorising and concluding thoughts.

The final question on which these studies were considered was on how valuable this research was, and it seems that this body of literature adds considerably to the wider knowledge base. Whilst there is a much larger debate about the nature of the knowledge produced by qualitative research and whether it can be legitimately judged (Mays & Pope, 2000) such as distrust for not being able to provide a generalisable foundation for clinical decisions (Berkwits & Inui, 1998; Jones, 1995), qualitative methodologies are some of the most effective methods used to capture expressive information that is not conveyed in quantitative data, about the beliefs, values, feelings and motivations that underlie our behaviour (Berkwits & Inui, 1998). It takes a stance that begins by accepting that there are a range of different ways of making sense of the world, concerned with the meaning of those who are researched and understanding their view of the world, rather than those of the clinician undertaking the research (Jones, 1995). From this, there is a view that qualitative methodologies can encourage participatory or emancipatory research for those in oppressed or less powerful positions (such as those with disabilities), allowing narratives or experiences which are normally distorted by academic discourse, models or ignored entirely to emerge and be heard (Nind, 2008; Oliver, 1997).

Whilst qualitative data approaches the problem from a different perspective to quantitative data, attempting to understand something in its context and becoming immersed in it, compared to the enumeration and measurement of quantitative

approaches (which are often seen as more limited) (Abusabha & Woeflel, 2003) they can be complementary to each other. Qualitative research can be the best approach for investigating newer phenomenon, providing depth and detail which may then lead on to more established research methodologies (Rusinová, Pochard, Kentish-Barnes, Chaize & Azoulay, 2009).

All the studies in this review have contributed to this process, with quantitative research starting to emerge and be explored in this area (see quantitative research section), however these papers also provide rich narratives and description of thoughts, feelings, perspectives and perceptions that would have been lost or were unable to be expressed through the quantitative methodology, with most of these papers exploring potential applications of their results to practice. Furthermore, whilst the research in this area has generally found similar themes, of a sense of loss or an element of post-traumatic growth and positivity, these studies have all come to these conclusions through different methodologies and sample types, underlining how important and prevalent these feelings seem to be in this population.

#### **1.8.10 Findings from qualitative studies: The impact of an ABI on self-identity.**

The qualitative studies discussed in this literature review have generated themes which describe a more balanced view of self following brain injury. If we are to synthesise the qualitative research throughout this literature review, using a thematic methodology (Thomas & Harden, 2008), three distinct overarching themes emerge, often found across multiple studies, alongside a forth, more general theme. The first theme to emerge from this literature was primarily around the sadness and loss of the participants 'past self' and the distress that emerges from a negative comparison to their post-injury self. This change occurred in regards not only to lost skills and abilities, but from a change in their bodies, their role, their support networks

and ultimately, a loss of their place in society. This leads to a sense of dependence on others, sensitivity about their difficulties, the increase feeling of ‘deficit’ or ‘difference’ and a potential assimilation into the medical model, identifying predominantly as a ‘patient’. This theme is the one which seemed to most conclusively mirror the results found in the quantitative studies.

Despite this, however, themes of sadness and loss were also accompanied and contrasted by stories of survival, of moving onwards and growing stronger, and the positive impact that this event had on their sense of self, often through a re-evaluation of life priorities. This often took the form of a greater appreciation of life, of now living in the present, and identifying as a survivor, allowing them to understand how strong they had been to survive and work through their injuries. Whilst this narrative was not as evident in the literature as the first, more negative theme, this sense of recovery and moving upwards was a very hopeful one, and was felt very strongly by the participants where it was described.

Placed between these two themes, which may be broadly seen as negative and positive outcomes following brain injury, was a theme which seems to acknowledge the confusion in identity that can often emerge following a brain injury. This theme acknowledges the somewhat ongoing nature that recovery from a brain injury entails, speaking of post-injury identity as a dynamic process between positive and negative experiences, a continuous, changing process that never truly stabilises (and this may be managed by pushing towards resignation or personal growth, inherent in the other two identified themes). Outside of these three main themes, there was also a more general theme which may be entitled ‘Who I am’, with considerations to their skills, activities, social support and more philosophical thoughts as to who they are now,

without being attached to the strong positive, hopeful or negative and despondent feelings of the first two themes.

### **1.8.11 Conclusion: What is the impact of an ABI on self-identity?**

This literature review aimed to address the question of “what is the impact of an ABI on self-identity?” Both quantitative and qualitative research was examined to try and answer this, with themes and findings emerging around a sense of loss and a negative comparison to the past self were a common impact of ABI (e.g., Ellis-Hill & Horn, 2000; Nuchi, 1997; Tyerman & Humphrey, 1984). Conversely, positive themes also seemed to emerge, predominantly from the qualitative research (e.g., Lennon et al., 2014; Nuchi, 2000; Pallesen, 2014) but also in one quantitative study (Jones et al., 2011), finding that brain injury can lead to a positive, stronger self, often leading to a re-evaluation of their life priorities and being more at ease with themselves. This literature emphasised the individual, dynamic nature of identity change following brain injury, and emphasised the impact that ABI has on self-identity.

### **1.9 Rationale for the current study**

The literature review identified a range of positive and negative narratives and results associated with adjustment to and development of self-identity following brain injury. It became evident that there were dynamic and complex tensions between grappling with the pre-injury identity and development of a new post-injury identity, and how this led to feelings of inadequacy and negative comparison, impacting on relationships and activities. This is a growing area of research, with poor self-identity or comparison to a past, pre-injury self being hypothesised as an underlying factor for models and hypotheses around threat appraisal in brain injury (Goldstein, 1952; Gracey et al., 2009; Riley et al., 2004; Riley et al., 2010) and linked with higher

instances of affective distress (Cantor et al., 2005, Carroll & Coetzer, 2011; Ponsford et al., 2014; Vickery et al., 2005).

It can be hypothesised therefore that if a survivor perceives a negative discrepancy between their past, pre-injury identity and their current, post-injury self, this may make them more susceptible to the impacts of perceived negative evaluation, fear of task failure or a general threat to sense of self (due to their existing beliefs of perceived ability to manage in situations which increase this anxiety). This may lead to more attention being paid to these stimuli which are deemed threatening, which may lead to avoidance of these threat inducing situations (Gracey et al., 2009; Muenchberger et al., 2008; Riley et al., 2004; Riley et al., 2010).

However this area has yet to be examined using an experimental methodology, with a gap in the research to examine attentional bias to threat in an ABI population. Previous research has identified that the most pertinent threat appraisals for those who have experienced a TBI were around social situations, personal safety being a concern and task performance (Riley et al., 2004), so this study will aim to use such stimuli to examine attentional bias in this population using a dot-probe task. The literature review outlined the importance of self-identity following a brain injury, and as a potential underlying mechanism of threat appraisal, as hypothesised by some (Gracey, et al., 2009), then this also needs to be examined within this current study.

This research will therefore aim to examine attentional bias to threat in an ABI population, in order to see if survivors of a brain injury are more sensitive to threat stimuli, in line with the identified threat appraisals of Riley et al. (2004), negative evaluation and physical threat, and how this may be influenced by the discrepancy between past and present self. It was hypothesised that survivors would be more sensitive to negative evaluation stimuli as compared to physical threat stimuli, give

how themes around social judgement, interaction with the social world and the impact on support structures seemed to appear throughout the literature review, in comparison to themes relevant to ‘physical’ threat.

Further to this, given that executive functioning comprises a major factor in both attention and response to emotional stimuli (Jurado & Rosselli, 2006; Peterson & Posner, 2012 Zelazo & Cunningham, 2007), the frequency in which these cognitive disturbances are found following brain injury (Arciniegas, Held, & Wagner, 2002; McHugh & Wood, 2008), and that impairment in executive function may mean a person less able to self-regulate and potentially inhibit their response to emotional stimuli (Hofmann, Schmeichel & Baddeley, 2012), this will also be factor which will be explored in this study.

This research will also aim to investigate whether or not greater self-discrepancy between current and past/ideal self, and increased emotional distress, are indicated in a brain injury population, which have found to be linked (Cantor et al., 2005). Furthermore, research has hypothesised that that poorer comparison to past self is a potential underlying factor for threat appraisal in brain injury (Goldstein, 1952; Gracey et al., 2009; Riley et al., 2004; Riley et al., 2010). It will therefore be examined whether this pre-injury/current discrepancy relates to a greater negative evaluation of the self, as demonstrated with greater attention paid to negative evaluation stimuli.

### **1.9.1 Hypotheses.**

It is hypothesised that:

1. Those with an ABI will show greater attentional bias to threatening words compared to neutral words (measured by reaction time to stimuli). This will also be found when controlling for executive functioning.
2. There will be a greater attentional bias towards negative evaluation words, followed by physical threat words, with neutral words detected slowest (measured by reaction time to stimuli).
3. Participants with a greater self-discrepancy between past and current self will be associated with a greater attentional bias towards negative evaluation threatening stimuli. This will also be found when controlling for executive functioninig.
4. Those with a greater self-discrepancy between past and current self, and current and ideal self will show more affective distress as measured by the Hospital Anxiety and Depression Scale.

## Chapter Two: Methodology of the Study

### **2.1 Overview of the Chapter**

This chapter will describe the design of the thesis study and recruitment of and characteristics of participants, alongside a description of ethical issues and calculation of power for the sample size. Following this, the procedure and measures used in this study will be presented.

### **2.2 Design**

A single sample within-participants quasi-experimental design was used to investigate the relationship between attentional bias to threatening word stimuli, and how this is influenced by self-discrepancy and executive functioning. Data was obtained at a single time point only, gathered via computerised dot-probe task, EF task and self-report questionnaire measures.

### **2.3 Ethics**

Guidelines from the British Psychological Society (2004) and Medical Research Council (2012) were consulted and considered during the development of this project. Ethical approval (Appendix G) was obtained from the Nottingham 2 proportionate review sub-committee of the National Research Ethics Service (NRES) committee East Midlands (reference number: 14/EM/0194). Research governance approval and site specific permission was sought for each recruitment site; South Warwickshire NHS Foundation Trust (Appendix H/I), Norfolk Community Health and Care Trust (Appendix J) and Cambridgeshire Community Services NHS trust (Appendix K/L).

### **2.4 Power and Sample Size**

A previous study using similar correlational methodologies (Cantor et al., 2005) found medium to large effect sizes (.54 – .83), and a meta-analysis of dot-probe

studies in anxiety (Bar-Haim et al., 2007) and depression (Peckham, McHugh & Otto, 2010) found a small - medium effect size ( $d = .45$  and  $.52$  respectively), and these were used as a guide for calculating sample size. A power analysis completed using G\*Power (Faul, Erdfelder, Buchner & Lang, 2009) for a repeated measures ANOVA for hypothesis 1, with a proposed medium effect size of  $0.25$  would require 40 participants to achieve a power of  $0.80$  to detect at a significance level set at  $0.05$ . For the second part of the hypothesis, involving the covariate of executive functioning, there is no pre-existing data in this population to assess whether this factor may increase or reduce power (by either explaining some of the variability or adding statistical noise) (Mefford & Witte, 2012), and so this data will have to be assessed as exploratory and interpreted with caution as regards to power.

For hypothesis three, the current study contained one potential predictor variables - self-discrepancy, with 'attentional bias to threat' as the outcome variable with executive functioning as a controlled variable. Sample size was assessed using power tables (Clark-Carter, 2010, pg. 651), for a correlation of  $.5$  and power of  $0.83$ , a sample size of 40 was found to be suitable. An additional power calculation with G\*Power (Faul, Erdfelder, Buchner & Lang, 2009) was conducted. To achieve a power of  $0.80$ , significance level of  $0.05$  with a correlation of  $.5$  in a bivariate correlational model, a sample of 37 was found to be suitably powerful.

## **2.5 Consent**

In order for people with ABI to be considered for inclusion in the study, the referring clinicians in the recruitment centres were asked to consider if potential participants were capable of informed consent, and to refer only those who met this criterion. All participants were informed both verbally and on the consent sheet that

they could withdraw from the study at any time, without any repercussions on the treatment that they were also receiving.

## 2.6 Participants

Participants were individuals who had sustained an ABI at least 6 months previously, recruited from 4 brain injury sites across East Anglia and the Midlands; The Oliver Zangwill Centre (n = 6), The Colman Centre for Specialist Rehabilitation Services (n = 3), The Evelyn Community Head Injury Service (n = 10) and the Royal Leamington Spa Rehabilitation Hospital (n = 16). Participants were a combination of those living in the community, those under outpatient services, those who were currently undertaking inpatient neurorehabilitation or were awaiting discharge from inpatient neurorehabilitation services. In total 35 participants (6 female) participated in the study, all were aged between 24 and 69 years ( $M=45.6$ ,  $SD=13.98$ ), and 31 were right handed. The time since injury ranged from 182 days to 5500 days ( $M=1127$ ;  $SD = 1230$ ). Information related to further participant demographics are summarised below in table 4.

In order to be eligible to participate in the study, the following inclusion and exclusion criteria had to be met. Individuals had to be aged between 18 and 70, sustained an acquired brain injury, and at least 6 months post injury. Individuals were excluded if there were significant, severe co-morbid mental health difficulties (such as psychosis or bipolar affective disorder), substance misuse problems, or had significant cognitive or visual difficulties which would preclude them from taking part, as assessed by the referring clinician. Individuals were also excluded if their English abilities or literacy level would be insufficient to complete the questionnaires, excluding those without English as their first language.

Table 7.

*Descriptive Statistics For Participant Demographic Information*

	Sample Frequency	Sample Percentage
<b>Ethnicity</b>		
White	32	91.43%
Mixed	1	2.86%
Indian	1	2.86%
Black African	1	2.86%
<b>Marital Status</b>		
Single	7	20%
Married	23	65.71%
Co-Habiting	3	8.57%
Widowed	1	2.86%
Divorced	1	2.86%
<b>Education</b>		
Some Secondary School	1	2.86%
GCSEs	7	20%
A-Levels	4	11.43%
Diploma	8	22.86%
Undergraduate Degree	12	34.29%
Postgraduate Degree	3	8.57%
<b>Post-injury Employment</b>		
None	16	45.71%
Voluntary	5	14.29%
Paid	14	40%
<b>Cause of injury</b>		
TBI – Road Traffic Accident	14	40%
TBI - Assault	2	5.71%
TBI – Fall	6	17.14%
TBI – Sports injury	2	5.71%
ABI – Stroke/Bleed	10	28.57%
ABI – Encephalitis	1	2.86%

N = 35

## 2.7 Confidentiality

Once consent had been acquired, participants were given an identification number to be used in place of all names on all response sheets to ensure that data was managed in accordance with the Data Protection Act (1998). Names, identification numbers and electronic data were stored in separate, password-protected databases for

which access was limited to the researcher. Paper copies of questionnaires were stored securely on University of East Anglia premises. Participants were informed that confidentiality may have to be broken if the researcher became concerned about their safety or the safety of others, raising any concerns with the referring clinicians or their GP. They were also informed that their identity would not be revealed in any research output.

## **2.8 Measures**

### **2.8.1 Demographic information.**

Individuals were asked their age, gender, ethnicity, educational attainment, marital status, the date and nature of injury and post-injury employment status. If the exact date of the accident is unknown, this was rounded to the start of the known month.

### **2.8.2 Modified dot probe task: Stimuli and apparatus.**

A Toshiba Satellite Pro C850 laptop running Windows 7 was used to present all displays and to record participant's responses in this experiment. Stimuli were displayed on a 15.6 inch screen with a 1366 x 768 pixel resolution and 60p Hz refresh rate, positioned below eye level and at a viewing distance of approximately 60cm. The dot probe programme was built and run with OpenSesame (Mathôt, Schreij, & Theeuwes, 2012). Initial versions of the programme were revised with the assistance of professional and service user feedback.

The visual dot probe task comprised a total of 92 randomised trials. Each trial began with the presentation of a white fixation dot in the centre of a black screen for 500ms. Following this, a pair of words simultaneously appeared to the left and right of the fixation cross, presented in upper case lettering for 500ms and were 15cm apart on the screen, font size 30. Each trial consisted of a “negative evaluation-neutral”,

“physical threat-neutral” or “neutral-neutral” word-pair combinations, and trials were counterbalanced in regards to word location. All participants completed 10 practice dot-probe trials before the experimental trials began, in order to orient them to and prepare them for the task. If required participants would have been entitled to more practice trials, however none chose to undertake this.

On all trials the offset of the word pairs was followed by the presentation of a probe “X” in uppercase writing, appearing in the place of one of the words. Participants were instructed to indicate the location of this probe on the screen (pressing Z for left and M for right) as quickly and as accurately as possible. Participants had to indicate their response before the next trial would start.

### **2.8.3 Word list generation.**

The visual dot probe task included 2 different categories of threat-related words, Negative evaluation (e.g., stupid, pathetic) and Physical threat (e.g., injury, violence), which were chosen in line with previous research which examined threat appraisals in a brain injury population and found these threat types important to consider (Riley et al., 2004). For each category, 16 words were used, using previously published research in social phobia which had been previously identified as having a high overall threat rating (Ononaiye, Turpin & Reidy, 2007). Each word was paired with a neutral word, with all word pairs matched for length and frequency in the English language (Ononaiye et al., 2007). In addition to this, a series of paired neutral words were also chosen from lists identified to be of low threat value to act as baseline trials during the dot probe (Ononaiye et al., 2007). These word pairs are presented in appendix A.

#### **2.8.4 Hospital anxiety and depression scale.**

The Hospital Anxiety and Depression scale (HADS: Zigmond & Snaith, 1983) is a self-report scale consisting of seven items related to depression and seven items relating to anxiety symptoms, experienced over the past week and scored from 0 – 3, giving a range of 0 – 21, where normal is 0–7, mild is 8–10, moderate is 11–14, and severe is 15–21. A systematic review of studies found that a cut-off point of 8/21 for each scale gave a specificity of 0.78 and sensitivity of 0.90 for the anxiety scale, and a specificity of 0.79 and sensitivity of 0.83 for caseness (Bjelland, Dahl, Haug & Neckelmann, 2002).

Initially developed for use with outpatient populations experiencing somatic symptoms related to physical injury, it is a quick, brief measure with good internal consistency (Cronbach's alpha = 0.89), with a test-retest reliability between 0.70 – 0.85 depending on time since last administration (Herrmann, 1996). It has been widely validated across many populations (Bjelland, Dahl, Haug & Neckelmann, 2002) and has been used successfully in, and demonstrates a high internal consistency for ABI populations (anxiety = 0.92, depression = 0.88, total HADS = 0.94) (Dawkins, Cloherty, Gracey & Evans, 2006; Senathi-Raja, Ponsford & Schönberger, 2010; Whelan-Goodinson, Ponsford & Schönberger, 2009). This measure takes between 2 and 5 minutes to complete.

#### **2.8.5 Head injury semantic differential scale - III.**

In order to assess self-discrepancy between present and past self, the Head Injury Semantic Differential Scale-III (HISDS-III, Tyerman & Humphrey, 1984) was selected due to its ease of administration, ease of completion and established use in previous brain injury populations (Carroll & Coetzer, 2011; Ellis-Hill & Horn, 2000; Tyerman & Humphrey, 1984; Vickery et al., 2005).

The HISDS-III was developed to provide information on the changes in self-concept of those people who have sustained a brain injury. The scale comprises 18 adjective pairs for which individuals are asked to rate themselves on a 7 point scale, from negative to positive, with ratings summed for a total score ranging from 20 – 140, higher scores indicating a more positive view of self. Strong internal reliability of the HISDS-III has been demonstrated, with a Cronbach's coefficient alpha of 0.93 and a split half Guttman's coefficient of 0.93 (Ellis-Hill & Horn, 2000), and takes around 10 minutes to complete.

### **2.8.6 European brain injury questionnaire.**

The European Brain Injury Questionnaire (EBIQ: Teasdale et al., 1997) was selected as a way of categorising and defining the characteristics and difficulties of the participants in the current study. The EBIQ comes in 2 parallel versions, a 'self' for the individual with brain injury to complete, and a 'significant other' to be completed by someone who knows them well (Teasdale et al, 1997). The EBIQ contains 63 questions relating to problems or difficulties that people sometimes experience in their lives following a brain injury, divided into 8 specific subscales assessing different areas of functioning: Cognitive (13 items); Somatic (8 items); Physical (6 items); Impulsivity (13 items); Motivation (5 items); Depression (9 items); Isolation (4 items) and Communication (4 items), with a Core scale comprising of 34 of these items. These items are rated on a scale of 1 (Not at all), 2 (A little) or 3 (A lot). Test-retest reliability has been investigated in research, with correlation coefficients ranging from 0.55 – 0.90 with a median of 0.76 (Sopena, Dewar, Nannery, Teasdale & Wilson, 2007), with alternative models also proposed to improve construct validity of the measure (Bateman, Teasdale & Willmes, 2009).

### **2.8.7 Executive functioning: Modified six elements task.**

The Behavioural Assessment of Dysexecutive Syndrome (Wilson et al., 1996) is a battery developed in response to the awareness that conventional neuropsychological tests often failed to capture real difficulties faced by those with EF problems. One part of this battery is the Modified Six Elements Test; first described by Shallice and Burgess (1991), a 10 minute task consisting of 6 sub-tasks, including story dictation, picture naming and arithmetic problems. They are told to complete at least some of the 6 individual subtasks, whilst following rules that govern performance. It measures planning, attention, task scheduling and performance monitoring, demonstrating inter-rater reliability of .88 to 1, with a high test-retest reliability (Wilson, Evans, Emslie, Alderman & Burgess, 1998). It is reliably correlated with reported everyday difficulties in EF (Hawkins 2006; Norris & Tate, 2000).

### **2.9 Procedure**

Potential participants were identified by local clinicians at each of the research sites in line with inclusion and exclusion criteria, and were approached by these staff for permission for their contact details to be given to the main researchers. In order to be considered for the study, staff members were asked if participants were capable of informed consent, and those who were unable to provide this were not referred. Participants were first approached by the referring clinician to ask permission to be contacted by the researcher. Once permission was agreed to, participants were contacted by phone and the study was explained to them, and any immediate questions were answered. If they agreed to meet, an appointment time and venue was arranged and a letter confirming this, information sheet and researcher contact details were

posted to them. Prior to data collection, individuals were given another copy of the study information sheet to read and were given another opportunity to ask questions.

Testing took place at a location convenient to the participant, either a healthcare setting or at their home, in a private space. Prior to testing, participants were given a brief overview of the experiment, the information sheet was reviewed to ensure that it was understood, and participants were provided with a consent form to sign. Participants were informed that their involvement was voluntary and they could stop the experiment at any time without repercussion on their care.

After signing the consent form, participants completed the demographic questionnaire (see Appendix B), followed by the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983), Head Injury Semantic Differential Scale-III (Tyerman & Humphrey, 1984) and European Brain Injury Questionnaire (Teasdale et al., 1997). Following this, the dot probe paradigm was completed, followed lastly by the 6 elements test (Wilson et al., 1996). The questionnaires were administered with assistance as required (e.g., reading questions aloud or recording participant responses on their behalf). The assessment was carried out in a single session that lasted between 45 and 75 minutes depending on the speed of the participants.

## Chapter Three: Results of the Study

### 3.1 Overview of the Chapter

This chapter will present the findings of the study, summarising the preliminary analysis of results, including descriptive statistics and initial checks for parametric assumptions. Following this, it will present the findings for each of the hypotheses in turn, before concluding with a summary of the overall findings from the study.

### 3.2 Data Preparation and Missing Data

The data was entered on a database on SPSS statistics 19, and explored for missing values. Every participant completed a HADS, HISDS-III, EBIQ, 6ET and dot probe experiment, and data was collected for all of these measures. An EBIQ questionnaire was also given to an independent rater for completion as chosen by the participant (a relative or staff member). 30 (86%) of these were returned, and the missing data was attributed a ‘missing value’ and recorded as ‘missing’ in the SPSS database. All data was included in the analysis, with descriptive statistics on the EBIQ derived from the 35 participants with brain injury, and the 30 from the independent raters.

### 3.3 Testing Assumptions of Parametric Data

In order to carry out the analyses required for each of the hypotheses, data was examined for normality and other assumptions for parametric assessment. These were explored with visual inspection of histogram and stem-and-leaf diagrams, alongside a non-significant Kolmogorov-Smirnov, with most key hypothesis variables meeting the assumptions for planned analyses. Some measures did not meet normality assumptions and whilst reflect and square root data transformations were attempted (see appendix M/N), these did not make any difference to the results, so the original

data is presented and parametric assessments were used on the original data, given their robustness against violated assumptions, although results were interpreted with caution. Tests of heterogeneity of variance were also completed, which showed that for the repeated measures ANOVA and ANOVA with covariate required of hypothesis one, Mauchly's test of Sphericity was found to be significant, so Greenhouse-Geisser corrections were used to minimise the possibility of type I errors.

### 3.4 Descriptive Statistics for the Sample Measures

#### 3.4.1 Measures of affective distress: HADS.

Descriptive statistics of the scores obtained from the HADS are displayed in table 5. The severity of emotional distress was also classified according to the pre-described guidelines for the HADS (Zigmond & Snaith, 1983) and are displayed in table 6. These results indicate that the majority of participants fall into the 'normal' range for anxiety and depression.

Table 8.

*Descriptive statistics for the HADS*

HADS Scale	Minimum Score	Maximum Score	M	Standard Deviation
HADS – Anxiety	0	17	7.2	4.13
HADS Depression	0	14	6.14	4.09

N=35

Table 9.

*Classification/sample percentages for the HADS*

HADS Scale	Normal (0 – 7)	Mild (8 – 10)	Moderate (11 – 14)	Severe (15 – 21)
HADS – Anxiety	21 (60%)	6 (17.1%)	6 (17.1%)	2 (5.7%)
HADS Depression	22 (62.9%)	7 (20.0%)	6 (17.1%)	0 (0%)

N=35

### **3.4.2 Measures of executive functioning: BADS 6ET.**

Descriptive statistics of the scores obtained from the BADS 6ET are displayed in table 7, indicating that executive functioning abilities were varied throughout the sample, with a majority indicating some difficulties.

Table 10.

*BADS 6 Elements test scores and sample frequency*

	M	BADS performance Score (sample frequency)					
BADS – 6ET	2.46	1	(9)	2	(8)	3	(11)
N = 35							4 (7)

### **3.4.3 Measures of self-discrepancy: HISDS-III.**

Descriptive statistics of the sub-scales of the HISDS-III and overall score are displayed in table 8. These indicate that participants predominantly rated themselves less favourably on all scales of the ‘current self’ scale, and higher on all scales of the ‘ideal self’ as compared to themselves prior to their injury.

A repeated measures analysis of variance (ANOVA) was conducted on the total self-discrepancy scores for pre-injury self, current self and ideal self of the HISDS-III. Mauchly’s test of sphericity indicated that the assumption of sphericity had been violated,  $\chi^2 (2) = 21.19$ ,  $p = .0005$ , therefore degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ( $\epsilon = .679$ ). The results showed that there was a significant effect of HISDS-III type,  $F (1.36, 46.14) = 103.47$ ,  $p = .0005$ . Post-hoc comparisons using the LSD test indicated that all scales were significantly different from each other ( $p = .0005$ ).

Table 11.  
*Descriptive statistics for the HISDS-III*

	Pre-injury self	Current self	Ideal self
	M (SD)	M (SD)	M (SD)
Bored/Interested	6.4 (0.78)	4.4 (1.57)	6.7 (0.67)
Unhappy/Happy	5.4 (1.39)	3.9 (1.69)	6.8 (0.41)
In Control/Helpless	6.4 (0.69)	3.3 (1.14)	6.4 (0.88)
Worried/Relax	5.3 (1.67)	3.6 (1.90)	6.5 (0.79)
Satisfied/Dissatisfied	5.5 (1.29)	3.4 (1.63)	6.8 (0.43)
Despondent/Hopeful	6.1 (1.35)	4.0 (1.74)	6.7 (0.58)
Self-confident/Lacks confidence	6.1 (1.26)	3.7 (1.69)	6.6 (0.64)
Stable/Unstable (emotionally)	5.9 (1.23)	3.5 (1.63)	6.4 (0.88)
Attractive/Unattractive (as a person)	4.9 (1.23)	3.6 (1.66)	6.3 (0.85)
Of Value/Worthless	6.1 (0.93)	3.6 (1.88)	6.5 (0.82)
Aggressive/Unaggressive	5.4 (1.67)	4.3 (1.63)	6.1 (1.24)
Calm/Irritable	5.4 (1.48)	3.6 (1.85)	6.5 (0.70)
Capable/Incapable	6.5 (0.58)	3.7 (1.38)	6.7 (0.51)
Dependent/Independent	6.5 (0.75)	3.7 (1.81)	6.6 (0.77)
Inactive/Active	6.1 (1.15)	4.0 (1.67)	6.6 (0.62)
Withdrawn/Talkative	5.4 (1.52)	4.3 (1.94)	6.0 (1.03)
Friendly/Unfriendly	6.0 (1.30)	5.5 (1.30)	6.6 (0.65)
Patient/Impatient	4.9 (1.73)	4.0 (1.69)	6.1 (1.14)
Total Score	104.3 (12.08)	70.3 (20.69)	116.7 (7.82)

N=35

#### **3.4.4 Measures of sample characteristics/difficulties: EBIQ.**

Descriptive statistics of the scores obtained from the sub-scales of the EBIQ and its overall score are displayed in table 9 (35 self-rated forms, 30 other rated forms). This measure was used to provide a quantitative measure to characterise the sample, indicating that there was a range of difficulties across both scales, indicating a

heterogeneous sample. These items are rated on a scale of 1 (Not at all), 2 (A little) or 3 (A lot), with each subscale being the mean score of the scale items.

Table 12.  
*Descriptive statistics for the EBIQ*

	Self scale - M	Range	Other scale M	Range
Somatic	1.82	1 – 2.63	1.79	1 – 3
Cognitive	1.91	1 – 2.77	1.97	1.23 – 3
Motivation	1.78	1 – 2.80	1.75	1 – 2.80
Impulsivity	1.79	1 – 3	1.90	1.15 – 2.92
Depression	1.90	1 – 2.89	1.80	1.11 – 2.89
Isolation	1.89	1 – 3	1.98	1 – 3
Physical	1.57	1 – 2.50	1.66	1 – 2.5
Communication	1.89	1 – 3	1.91	1 – 2.75
Core Symptoms	1.85	1 – 3	1.87	1.21 – 2.79
Total Symptoms	115.23	65 – 168	116.60	78 - 179

N=35 (self); N = 30 (other)

A paired samples t-test was conducted to evaluate whether the total symptom score between the self-rated and other-rated EBIQ forms showed significant differences. There were no statistically significant differences found between the self-rated form ( $M=114.77$ ,  $SD = 26.90$ ) and other-rated form ( $M=116.60$ ,  $SD = 25.45$ ),  $t(29) = -.535$ ,  $p = .597$ .

### **3.4.5 Measures of attentional bias: Dot probe paradigm.**

All dot probe trial data was screened and trials in which an incorrect response was made were removed from the analysis, leading to the removal of 96 trials (2.98% of total trials). In addition, reaction times which were recorded as very fast (<200ms) were assumed to be anticipatory errors were excluded, alongside very slow trials

(>3000ms) which were assumed to be concentration lapses, leading to the removal of 37 trials (1.15% of total trials). Further to this, three participants were completely excluded from the dot probe, two for producing a high level of errors throughout the paradigm (20.83% and 29.17% trial errors) and one who had substantive difficulties with motor coordination during the task.

Median reaction time data was used to calculate the averages for each trial type for each participant for each participant. This was done to provide a more stable measure and minimise the effect of individual cognitive difficulties and variation within the trials, which may skew the reaction time data, given the heterogeneous nature of cognitive difficulties in ABI. This method has been used previously in attentional bias studies to control for outliers in data (Horry & Wright, 2009; MacLeod, Rutherford, Campbell, Ebsworthy, & Holder, 2002). The means and standard deviations of the final sample are presented below in table 10, with these represented graphically in figure 3, indicating that trials with a threatening stimuli had faster reaction times than neutral only trials. In this figure, ‘congruent’ trials means that the probe ‘X’ appeared in place of a ‘threat’ word, ‘incongruent’ means that the probe appeared in place of the paired neutral word.

Attentional bias scores were also calculated by subtracting the reaction times of congruent trials (dot probe in place of threatening stimuli) from those of incongruent trials (dot probe in place of non-threatening stimuli), in which a positive bias score indicates vigilance to threat whereas a negative score indicates avoidance of threat. The average attentional bias scores for ‘negative evaluation’ stimuli was 15.41, and 11.56 for ‘physical threat’ stimuli, indicating a small attentional bias towards threatening stimuli. This bias score will be used to test hypothesis 3.

Table 13.

*Average median reaction time data/standard deviation across dot probe trials*

Dot Probe Trial Type	M	SD
Neutral – Neutral Trial	609.97	147.47
Negative Evaluation – Incongruent Trial	587.75	140.16
Negative Evaluation – Congruent Trial	572.34	127.38
Physical Threat – Incongruent Trial	586.84	144.44
Physical Threat – Congruent Trial	575.28	131.18

N = 32

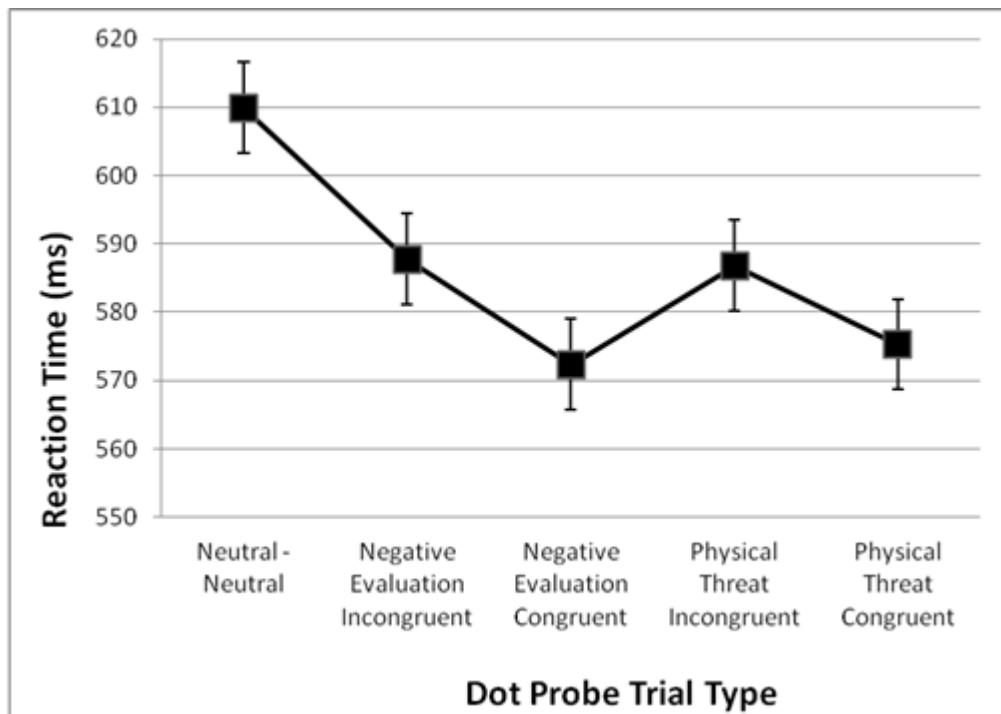


Figure 3. Average median reaction times and standard error scores across dot probe trials

### 3.5 Hypothesis Testing

1. Those with an ABI will show greater attentional bias to threatening words compared to neutral words (measured by reaction time to stimuli). This will also be found when controlling for executive functioning.

To assess whether those with a brain injury demonstrated a statistically significantly greater attentional bias to threatening words compared to neutral words, reaction time data between the five dot probe trial types were compared.

A repeated measures ANOVA was conducted on the reaction time data for the dot probe trial type, controlling for the covariate of executive functioning (as measured by the BADS). Mauchly's test of sphericity indicated that the assumption of sphericity had been violated,  $\chi^2(9) = 42.03, p = .0005$ , therefore degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ( $\epsilon = .675$ ). The results show that there was no significant effect of dot probe trial type on reaction time, when controlling for executive functioning,  $F(2.70, 81.00) = 1.46, p = .234, \eta^2 = .046$ . These results suggest that after controlling for executive functioning abilities, there were no significant differences in reaction times on each of the trial types. Without controlling for executive functioning and with Greenhouse-Geisser correction, reaction time differences were found to be only marginally above significance,  $F(2.70, 81.00) = 2.75, p = .053, \eta^2 = .084$ . However this may reflect a power issue (please see chapter 4 for a full discussion).

Given the mixed nature of the participant group, a mix of those with clinical levels of affective difficulties and those not, preliminary exploratory analyses were also undertaken to examine the effect sizes for those with clinical levels of affective difficulties (as measured by the HADS) as compared to those without reported difficulties. Examining all participants who scored above the clinical cut off on either anxiety (HADS-A) or depression (HADS-D) scale ( $n = 17$ ), effect sizes were found to be  $\eta^2 = .187$  (without controlling for executive functioning) and  $\eta^2 = .121$  (controlling for executive functioning), compared to those who scored in the 'normal' range ( $n = 16$ );  $\eta^2 = .012$  (without controlling for executive functioning) and  $\eta^2 = .032$  (controlling for executive functioning). This was also examined in the specific HADS-A ( $\eta^2 = .184$  non-controlled,  $\eta^2 = .105$  controlled) and HADS-D groups ( $\eta^2 = .200$  non-controlled,  $\eta^2 = .125$  controlled).

2. There will be a greater attentional bias towards negative evaluation words, followed by physical threat words, with neutral words detected slowest (measured by reaction time to stimuli).

As the main effect was found to be non-significant, post-hoc tests examining reaction time speed and attentional biases between trial types were not undertaken.

3. Participants with a greater self-discrepancy between past and current self will be associated with a greater attentional bias towards negative evaluation threatening stimuli. This will also be found when controlling for executive functioning.

Partial correlation was used to examine the relationship between self-discrepancy of past/current self and attentional bias towards negative evaluation, whilst controlling for executive functioning. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity, which were all met. There was a weak negative correlation found between the two variables, controlling for executive functioning,  $r = -.253$ ,  $n = 32$ ,  $p = .170$  (Dancey & Reidy, 2004) indicating a non-significant relationship. Without controlling for executive functioning, there was still a negative correlation, which was again found to be non-significant  $r = -.252$ ,  $n = 32$ ,  $p = .165$ . This result indicates that a greater self-discrepancy between past and current self was not associated with a greater attentional bias towards negative evaluative stimuli, although this may be an issue of power (please see chapter 4 for a further discussion).

4. Those with a greater self-discrepancy between past and current self, and current and ideal self will show more affective distress as measured by the Hospital Anxiety and Depression Scale.

The relationship between self-discrepancy between past/current and current/ideal self and affective distress (anxiety and depression) was investigated using Pearson product-moment correlation coefficient. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity, with these assumptions all being met. One extreme outlier was removed from the analysis (Osborne & Overbay, 2004). Effect sizes (using Pearson's correlation coefficient  $r$ ) were measured using Cohen's (1988) criteria, where an effect size of .10 indicates a small effect, .30 as a medium effect, and .50 represents a large effect.

There was a moderate negative correlation found between self-discrepancy between past/current self and anxiety,  $r = -.49$ ,  $n = 34$ ,  $p = .008$ , indicating a medium effect size, and a moderate/strong negative correlation found between past/current self-discrepancy and depression,  $r = -.67$ ,  $n = 34$ ,  $p = .0005$  (Dancey & Reidy, 2004), indicating a large effect size. The difference between these correlations was not found to be statistically significant,  $Z = 1.099$ ,  $p > 0.05$ .

There was a moderate negative correlation found between self-discrepancy between current/ideal self and anxiety,  $r = -.62$ ,  $n = 34$ ,  $p = .000$ , and a strong negative correlation found between current/ideal self discrepancy and depression,  $r = -.71$ ,  $n = 34$ ,  $p = .0005$  (Dancey & Reidy, 2004), both indicating a large effect size. The difference between these correlations was not found to be statistically significant,  $z = 0.649$ ,  $p > 0.05$ . The difference between both depression ( $Z = -0.306$ ) and anxiety ( $Z=0.756$ ) correlations were also not found to be statistically significant. All these

results support the hypothesis that greater self-discrepancy between current and past/ideal self meant higher levels of reported affective distress.

## Chapter Four: Discussion

### 4.1 Overview of the Chapter

This chapter will consider and discuss the main findings of the research in relation to each of the hypotheses, and how these may be explained in relation to previous research. It will then discuss the theoretical and clinical implications of this research, before highlighting potential areas for future research to develop this further.

### 4.2 Results

#### 4.2.1 Hypothesis 1:

Those with an ABI will show greater attentional bias to threatening words compared to neutral words (measured by reaction time to stimuli). This will also be found when controlling for executive functioning.

This hypothesis was not supported by the research findings. Whilst median reaction time data showed that trials which included threatening stimuli (both negative evaluation and physically threatening) demonstrated a faster reaction time to the dot probe compared to neutral trials, and that on threat-congruent trials (where the dot probe appeared in the location of the ‘threat’ word) they were found faster (indicating an attentional bias to these words), analyses revealed that this pattern of results were not statistically significant, with the same results appearing when executive functioning was controlled for.

#### 4.2.2 Hypothesis 2:

There will be a greater attentional bias towards negative evaluation words, followed by physical threat words, with neutral words detected slowest (measured by reaction time to stimuli).

Whilst examination of the raw data indicated that there were some differences in reaction times between these trial types, these differences were not investigated statistically due to the original main effect not being found.

#### **4.2.3 Hypothesis 3:**

Participants with a greater self-discrepancy between past and current self will be associated with a greater attentional bias towards negative evaluation threatening stimuli. This will also be found when controlling for executive functioning.

This hypothesis was also not supported, as there was no statistically significant association found between these two variables with discrepancy and attentional bias only weakly correlated, both when the influence of executive functioning was and was not controlled for.

#### **4.2.4 Hypothesis 4:**

Those with a greater self-discrepancy between past and current self, and current and ideal self will show more affective distress as measured by the Hospital Anxiety and Depression Scale.

Correlations conducted between these two measures showed that there were moderate and strong negative correlations for both anxiety and depression scales with both current/ideal and current/pre-injury discrepancies, indicating that a higher level of self-discrepancy was associated with higher affective distress. It was found that there was a stronger correlation found between anxiety and depression and self-discrepancy in the current/ideal discrepancy as compared to the pre-injury discrepancy. None of these correlations were found to be statistically different from each other.

## **4.3 Theoretical and Empirical Implications**

### **4.3.1 Attentional bias, executive functioning and self-discrepancy.**

This study was the first to use a visual dot probe task to measure attentional bias to threat in an acquired brain injury population, building on research which has explored this previously (Riley et al., 2004; Riley et al., 2010) by using an experimental paradigm. The pattern of results seems to suggest that there is a possible attentional bias to threat-related stimuli following brain injury, but this was not established statistically, and that there are other potential factors which may be influencing these mechanisms. Whilst this first hypothesis was not supported statistically, its results provide interesting avenues which require further thought and consideration, such as the role of executive functioning or affective difficulties in these mechanisms, alongside other methodological limitations which may influence these results. These will be considered and discussed throughout this discussion, mindful of the conclusions that can be drawn with such preliminary and somewhat explorative data.

The findings from this study have a number of theoretical implications, the first of which provides some indication for possible mechanisms which may underlie attentional bias to threat in brain injury populations. Some authors have drawn upon theories and put forward ideas that describe anxiety and threat appraisal as the result of a ‘threat to sense of self’ or as a result of the discrepancy between past and present self, ultimately leading to the adoption of anxiety avoiding strategies (e.g., Gracey et al., 2009; Riley et al., 2004; Riley et al., 2010). This has led to cognitive models of anxiety-related avoidance being considered as appropriate for helping to understand this phenomenon in brain injury, with some beginning to look at a person’s existing beliefs and ability to cope with situations as related to this. For example, Riley et al.

(2010) found that those with a negative evaluation of their ability to cope with a brain injury and self-reported low self-esteem were more likely to respond to threat appraisals with avoidance; supporting the concept that threat to self may play a major factor in coping with the consequences of a brain injury. This may also have direct implications for understanding the results of the current study, as research has identified that self-esteem is a predictor of psychological distress after ABI (Cooper-Evans, Alderman, Knight & Oddy, 2008), and that in this study, exploratory results showed that those with increased affective difficulties demonstrated stronger effect sizes in the dot probe paradigm, although it was not established whether these were statistically significant differences.

Whilst these ideas are still in their infancy as related to attentional bias to threat in brain injury, models in the cognitive-emotion literature around similar threat/anxiety related diagnoses (such as social anxiety) can be drawn upon to explore this further (e.g., Beck, 1976; Wells & Matthew, 1996). One example of this is the Self-Regulatory Executive Function (S-REF) model of emotional disorder, conceptualised by Wells and Matthews (1996) which draws inspiration from cognitive theory. This model integrates information processing research with Beck's (1967b) schema theory, putting forward that there is an interaction between automatic processing, voluntary processing and self-beliefs, which underlie self-regulatory processes. These processes are then managed by plans specified to cope with self-relevant negative information, such as monitoring for external threat or active rumination about specific personal deficiencies. Some of these strategies are worse when used as an ongoing long-term strategy, and may ultimately exacerbate difficulties. Therefore, if following a brain injury someone begins to have thoughts around feeling inferior to others; these self beliefs may be integrated into their threat

monitoring processes and responded to negatively. This model also suggests that executive functioning is temporarily disrupted by emotional processes, and so in the context of existing executive difficulties, this may have an even greater effect. Whilst this is only one model which incorporates these ideas, drawing on this cognitive-affective literature provides an interesting basis to further develop these ideas in a brain injury population.

What some exploratory analyses in the current research found was that once executive functioning was controlled for, the level of non-significance rose substantially and effect sizes decreased (although these were not investigated statistically). This may indicate that executive functioning is an integral part of understanding the underlying mechanisms of this attentional bias, in line with its role in both attention and response to emotional stimuli (Jurado & Rosselli, 2006; Peterson & Posner, 2012; Zelazo & Cunningham, 2007).

Furthermore, hypothesis three found that the level of self-discrepancy was not found to be associated with attentional bias to threat in negative evaluative stimuli. This may indicate that rather than being related to 'threat to sense of self', this attentional bias may be the result primarily of an inability to effectively regulate emotional or threatening stimuli. Emotion regulation is a process by which individuals modulate and express their emotional experiences or intake of emotionally arousing information to respond to environmental demands (Campbell-Sills & Barlow, 2007; Garnefski & Kraaij, 2007; Melka, Lancaster, Bryant & Rodriguez, 2011). This regulation can be a conscious, intentional process, or an unconscious process occurring without awareness (Gross & Thompson, 2007), and successful emotion regulation draws heavily on realms of executive functioning, such as anticipating outcomes, planning and executing responses (Banfield, Wyland, Macrae, Münte, &

Heatherton, 2004; Gyurak, Goodkind, Madan, Kramer, Miller & Levenson, 2009).

Gyurak et al. (2009) proposed that down-regulation of fear in response to a threatening stimulus requires the integration of perceptual cues, anticipating a response to these cues, and the division of an action plan (such as breathing steadily and keeping facial muscles immobile) alongside continuously monitoring and adjusting ongoing behaviour.

Extrapolating this understanding to the current study, the executive functioning difficulties that have emerged as a consequence of the brain injury may mean that participants were less able to effectively manage and respond to the emotional stimuli that were being automatically processed during the dot probe task. Similarly, research examining attentional biases in those with alcohol dependence problems found that attentional difficulties in their population were associated with specific executive control deficits; specifically an inability to detect and resolve the conflict between task relevant stimulus and the interference provoked by task-irrelevant stimuli (Maurage, de Timary, Billieux, Collignon & Heeren, 2014). Further evidence from the literature indicates that executive functioning deficits can compromise a person's ability to integrate emotional cues into the decision making process (Eslinger & Damasio, 1985; Gyurak et al., 2009) and that executive functioning can modulate emotionally laden responses, such as delaying gratification (Eigsti et al., 2006; Garon, Bryson & Smith, 2008) and refraining from expressing a sense of disgust in a socially unacceptable setting (von Hippel & Gonsalkorale, 2005). Miyake et al. (2000) put forward the conceptualisation that there were three distinct categories which organised executive functioning: shifting (being able to switch back and forth between competing tasks), updating (mentally manipulating information held in the working memory) and inhibition (the ability to constrain inappropriate responses or cognitions); it may

therefore be argued that difficulties in inhibition are a major factor to investigate further as explaining attentional bias to threat in brain injury. These hypotheses have to be considered very carefully within the context of the current study, as the results found were only indicative of these results, and found not to be statistically significant.

However, it is unlikely that deficits in executive functioning are solely responsible for these results, and it is potentially more appropriate to consider that executive functioning difficulties may exacerbate a poorer sense of self, or that the emotional stimuli impair the abilities of these cognitive functions, as suggested by some cognitive models (Wells & Matthews, 1996). Research has found that threat-relevant stimuli impair processes associated with executive functioning, and seemed to be consistent with the idea that threat-relevant stimuli depletes a shared ‘resource pool’ of executive functioning and emotional processing, which was linked to differences on inhibitory control and accuracy, depending on threat type (Lindström & Bohlin, 2012). Understanding this in the context of the current study, brain injury may ‘shrink’ the resource pool available to executive functioning and emotional processing and, if previous experience have made you more sensitive to threatening stimuli in a similar vein to difficulties such as social anxiety (such as being viewed negatively by others or previous mental health conditions), these together may result in an increased attentional bias towards threat stimuli due to being unable to effectively regulate responses. It may require both these elements (impaired executive functioning and poor self-concept/affective difficulties) to generate this threat bias following brain injury.

Other theories are also relevant to consider within these ideas, such as anxiety leading to an attentional bias by amplifying the responsiveness of the amygdala to

threat-relevant cues, and impairing the recruitment of top-down attentional control from prefrontal control mechanisms (Bishop, 2007). Similarly, attentional control theory (Eysenck, Derakshan, Santos & Calvo, 2007) suggests that anxiety disrupts the ‘inhibition’ and ‘shifting’ elements of executive functioning. These impairments are then associated with an increased influence of the stimulus-driven attentional system to threat, as mechanisms which regulate automatic responses are weakened. These would be important models to consider adapting to an ABI population.

Research examining coping strategies may be useful to draw upon as well, as these results have potential implications for how we understand how people with a brain injury may react when confronted with a difficult situation. Krpan, Levine, Stuss and Dawson (2007) found that impaired executive functioning was associated with a greater use of emotion-focused coping strategies (e.g., denial and avoidance) and the use of fewer problem-focused coping strategies. This is likely due to the disruption of ‘top-down’ processes which underpin and support cognitive reappraisal and regulation of emotions (Etkin, Egner & Kalisch, 2011), and so whilst individuals with a brain injury may plan to use particular coping strategies in stressful situations, their ability to implement these strategies may be compromised by damage to areas pivotal in the control and management of emotional and behavioural self-regulation (Stuss, 2007).

Research has found that the ability to flexibly draw upon and utilise a range of strategies in different scenarios is much more effective and adaptive than an overreliance on one particular coping approach (Carver, Schier & Weintraub, 1989), but neuropsychological and executive functioning deficits, such as impaired planning, inhibition and cognitive flexibility may compromise people’s ability to draw upon effective coping strategies as required in different situations (Ownsworth, 2014, p.67). These papers, drawn together, lend greater credence to the possibility that these threat

appraisals/attentional biases are likely due to a combination of pre-existing psychological difficulties, ideas about the self and what constitutes a ‘threat to self’, compounded by additional difficulties in cognitive processes and executive functioning, leading to an inability to effectively manage and respond appropriately to emotionally threatening stimuli.

#### **4.3.2 Self-discrepancy and affective distress in a brain injury population**

Replicating the results of many previous studies (Cantor et al., 2005; Carroll and Coetzer, 2011; Ponsford, et al., 2014; Vickery et al., 2005), our results found that a greater self-discrepancy between pre-injury and current self was associated with increased levels of anxiety and depression. This same result was also found for the discrepancy between the current self and the ideal self being correlated with anxiety and depression, with ideal self being rated similarly to the pre-injury self in many respects. This current/ideal discrepancy has not been as routinely investigated in previous research, with only Cantor et al., (2005) reporting similar results using the Beck Depression Inventory (Beck, Steer & Brown 1996), Beck Anxiety Inventory (Beck, 1993) and The Selves Adjective Checklist and Selves Interviews (Strauman, 1990) (finding significant correlations only on the selves adjective checklist.).

Taken together, it is evident that self-identity plays a key part in understanding mental health following a brain injury, and that the perceived discrepancy between current and ideal self is at least as important as the current/pre-injury discrepancy. These results have theoretical implications for understanding the aetiology of emotional difficulties following a brain injury. These difficulties are determined by multiple factors due to the heterogeneity of these survivors (Cantor et al., 2005; Moldover et al., 2004), it may be that understanding how these self-discrepancies are related to, or are mediated by other factors involved in emotional difficulties

following brain injury, such as social support (Douglas & Spellacy, 2000; Morton & Wehman, 1995), past psychiatric history (Ashman et al., 2004; Rapoport, 2012), unemployment/poverty (Seel et al., 2003) time post-injury and injury severity (Osborn, Mathias & Fairweather-Schmidt, 2014) is an important next step to consider. An alternative explanation to these results offered by Cantor et al. (2005) is that those with depression generally describe their current selves more negatively, due to cognitive biases caused by the depression (Beck, 1967a; 1976), which may be a hypothesis that needs exploration in future research. Furthermore, pre-injury/current discrepancy has been found to be linked with low self-esteem (Carroll & Coetzer, 2011), which if linked back to the previous work undertaken by Riley et al. (2010) identifying this as a significant factor in threat appraisal, highlights how interlinked these concepts are.

#### **4.4 Strengths and Weaknesses of the Study**

All of the measures used in the study were selected on the basis of good reliability and validity, and have been previously used and validated in a brain injury population. Furthermore, there was only a small amount of missing data (for the ‘other’ form of the EBIQ) across the sample, meaning that the constructs involved in this study were appropriately measured. The only measure, for which this previous application does not apply, is for the visual dot probe task. As this is the first study to the author’s knowledge to use this paradigm in a brain injury population, it relied upon previous research to aid design, especially drawing upon research which has examined individuals with cognitive difficulties (Dodd & Porter, 2011; van Duijvenbode, Didden, Voogd, Korzilius & Engels, 2012) to try and minimise confounding factors. This paradigm was also shown to service users and professionals working in brain injury for their feedback on the paradigm, who made suggestions

about increasing the size of font used in the dot probe and considerations around those who have photo-sensitive epilepsy.

Additionally, one aspect of this study which needs to also be considered due to the novel nature of this research is exposure duration of the word stimuli. Previous research has found that whilst attentional bias is not affected by exposure duration of word stimuli in a non-clinical population (Mogg, Bradley, de Bono, & Painter, 1997), in anxious populations there is an initial threat reaction at 500ms, but at longer durations this becomes either a threat avoidance reaction or no reaction at all to emotional stimuli (Mogg, Bradley, Miles & Dixon, 2004; Schofield, Inhoff & Coles, 2013). Whilst a 500ms stimulus duration was used in this study to try and elicit this effect, this participant group has not been explored before, and although it has been used in samples with probably developmental delay (Dodd & Porter, 2011), given other potential cognitive difficulties, it may be hypothesised that an appropriate threat-inducing response at this duration cannot be assumed.

The negative evaluation and physically threatening words chosen to include in the dot probe were validated from previous research (Ononaiye, Turpin & Reidy, 2007) and were specifically designed for a socially anxious population. These words were chosen to be approximately comparable to the threat-appraisal groups identified in Riley et al. (2004) – ‘social situations’(negative evaluation) and ‘situations in which a person’s personal safety is a concern’ (physically threatening), and as such the results need to be considered in light of this, perhaps using more specific, targeted brain injury words in future research.

Whilst attempts were made to reach a sample size that would satisfy the power requirements for all of the hypotheses, this could not be achieved within the time constraints for hypothesis one, two and three, which were all underpowered as a

result, and it is likely that hypothesis one with a covariate would also significantly underpowered. This has to be considered as a potential influence in whether the study had the power to adequately detect any effects for this, and so future studies may wish to see whether or not this result is replicated in a larger sample. Despite this being underpowered, results for hypothesis one without examining executive functioning as a covariate were only just above the level of significance, which may indicate that in a sufficiently powered study, this result may reach significance. The effect sizes reported in this study may therefore act as a basis for sample size estimates of future studies.

It is also worth considering that the analysis used in this study may have significantly influenced the results that were found. The inclusion of executive functioning as a covariate is likely to have increased the chance of a Type I error, as it aims to eliminate its influence as a factor in attentional bias. As previous research seems to point towards executive functioning as being a core factor involved in these attentional processes, controlling for it as a factor may have meant the odds of discovering a true effect may have been hindered. This line of reasoning can also be taken with the exploratory statistics around affective distress as an influencing factor on dot probe timings. Despite this, the research has tentatively shown that these factors are contributory to the process and are in need of further examination, however future research may wish to use these variables as independent variables rather than covariates, to assess more accurately whether they make a significant contribution to the variance in reaction times on the dot probe task.

This sample was recruited from different centres across the region of East Anglia, and from a specialist rehabilitation hospital in Leamington Spa; whilst this improved the pool of potential participants, both of these areas have little cultural

diversity, alongside other demographic variables (such as higher proportions of university educated individuals) which limits the generalisability of the present sample. Furthermore, the recruitment criteria for this project meant that the people recruited were predominantly more ‘high functioning’ and with less obvious impairments comparative to others with a brain injury. Whilst this will have strengthened the internal validity of the study by potentially limiting confounding factors, these may again impact on the generalisability of findings (although results on the individual and informant EBIQ indicated a heterogeneous sample in regards to difficulties (see table 9).

As this sample comprise those with mainly ‘invisible’ symptoms of brain injury, this may have had an impact on how sensitive they were to the threatening stimuli in the dot probe. Research has found that substantial changes in physical appearance following ABI, such as weight changes or visible scarring, have been found to contribute to poor self-concept after brain injury, due to perceived or actual negative reactions from the public (Morris, Prior, Shoumitro, Lewis, Mayle, Burrow & Bryant, 2005). This was not considered as part of this study, and may have implications for the data from this project, given that the physical appearance of most participants was not substantially changed, recruiting participants with a mixed aetiology. However it is likely that if this was explored further, such as examining those with visible physical difficulties following stroke, it would likely only strengthen the results found in this study.

Further to this, a limitation that needs to be considered within the wider concept of this project is that the original research on which this project is predominantly based (Riley et al., 2004; Riley et al., 2010) used samples containing only those who had sustained a TBI, whereas this study took participants with any sort

of ABI (although 69% of the sample had sustained a TBI). This may have implications for how comparable the results are in relation to the research that it is based upon, as it is currently not known whether those with other types of ABI have different threat appraisals than those who have just sustained a TBI.

Finally, and very importantly, participants were predominantly without clinical levels of affective distress, with only 40% of the participants reporting a clinical degree of anxiety or depressive difficulties. Exploratory analysis identified that effect sizes were much stronger in those participants with a clinical level of anxiety and depression (mild – severe), compared to non-clinical and the whole sample. This has implications for both the dot probe and threat-detection aspects of this study. Previous meta-analyses have found that attentional bias in the dot probe for mental health conditions is generally not found in non-clinical participants (Bar-Haim et al., 2007) and that personal and psychological factors as important in understanding threat appraisal in brain injury (Riley et al., 2010), this may mean that having a predominantly ‘well’ participant group may have therefore diluted this threat bias effect. In reference to the previous consideration around analysis, it may be that controlling for executive functioning in an already ‘dilute’ sample may have impacted on how easily results could be found, and so future research may wish to follow the example of previous research which has looked at factors involved in the dot probe paradigm (Ononaiye, Turpin, & Reidy, 2007), and examine these factors in a divided, high/low structure, in order to better examine their influence.

#### **4.5 Clinical Implications**

The clinical implications from this study relate predominantly to the understanding and treatment of anxiety and depression following brain injury, within the discussed limitations of the study. The aetiology of emotional difficulties

following brain injury is multi-determined, given the heterogeneity of patients (Cantor et al., 2005; Moldover et al., 2004) but, historically, rehabilitation programmes primarily focused on cognitive deficits alongside externalising behavioural problems, often overlooking emotional and psychosocial adjustment (Kangas & McDonald, 2011). This has meant that treatment approaches for this population are limited and have not adapted to fit the varied needs of those with a brain injury, leaving us with a poor understanding of the factors which trigger and maintain these difficulties following brain injury (Cantor et al., 2005).

Despite this, adaptations to psychological therapies have begun to develop for those who have sustained an anxiety disorder following ABI, predominantly using CBT. Case reports (Ashworth, Gracey & Gilbert, 2011; Williams, Evans & Fleminger, 2003a; Williams, Evans & Fleminger, 2003b) and group studies (Ashworth, Clarke, Jones, Jennings & Longworth, 2014; Bradbury, Christensen, Lau, Ruttan, Arudine & Green, 2008; Kangas & McDonald, 2011; Tiersky, Anselmi, Johnston, Kurtyka, Roosen, Schwartz & DeLuca, 2005) have found good results for CBT and third wave approaches (such as Acceptance and Commitment Therapy and Compassion focused therapy), although there is also evidence of mixed results in this population as well (Anson & Ponsford, 2006; Hodgson, McDonald, Tate & Gertler, 2005) (for a review on CBT and ABI, see Waldron, Casserly & O'Sullivan, 2013).

This thesis found that greater self-discrepancy between current and pre-injury self was associated with greater anxiety and depression, replicating results found previously in the literature (Carrol and Coetzer, 2011; Ellis-Hill & Horn, 2000; Ponsford, et al., 2014; Tyerman & Humphrey, 1984; Vickery et al., 2005). Interestingly, it also found that the discrepancy between the current and the persons

‘ideal’ self was also associated with greater affective difficulties, an area which has not been widely considered within these previous studies (Cantor et al., 2005).

It seems, therefore, that it would be beneficial for professionals to measure and consider these changes in self-discrepancies as part of general rehabilitation when working with those who, following a brain injury, show affective difficulties. The evidence for these interventions, at present is moderate and in their infancy, but they highlight the need for a greater focus on the impact of assessment and intervention within rehabilitation (Ownsworth & Haslam, 2014). It may be that interventions which specifically target biases may be an area that needs further attention in this population, such as cognitive bias modification (CBM; Beard, 2011). CBM for attention most commonly uses a modified version of the dot probe, altering the contingency between probes and threat stimuli, guiding attention away from threat stimuli by replacing only neutral stimuli with probes (Beard, 2011). Now that feasibility for the use of a dot probe in brain injury has been established, this may be a viable area to explore further.

The Y-shaped Model of Rehabilitation (Gracey et al., 2009) also draws together these ideas around self-discrepancies into a clinical model, putting forward that the process of reintegration and adaptation following brain injury initially involves understanding and coming to terms with these discrepancies. This then leads to a consolidation of this developing post-injury self, and continued psychological growth. This process may be inhibited when there the person still experiences their ‘self under threat’, and that this threat may lead to the adoption of coping strategies which reduce threat in the short term, but fail to resolve these underlying discrepancies (Gracey et al., 2009), which is supported by evidence linking threat appraisals to the use of avoidance as a coping mechanism (Riley et al., 2010). This

thesis supports the underlying assumptions of this model, and it may be able to act as a way of formulating difficulties, and both pre-injury/current and current/ideal discrepancies may act as a target for intervention, potentially targeting social discrepancies, interpersonal discrepancies and personal discrepancies (Gracey et al., 2009). Furthermore, research has found that discrepancy in sense of identity has been associated with shame following a stroke (Dowswell, Lawler, Dowswell, Young, Forster & Hearn, 2000), which may have implications for treatments developed to focus on shame, such as compassion focused therapy (Gilbert, 2009; 2010). Mental health research has found that the use of self-discrepancies as a focus for treatment can be used to help understand and treat difficulties (e.g., Crane, Barnhofer, Duggan, Hepburn, Fennell & Williams, 2008; Veale, Kinderman, Riley & Lambrou, 2003).

Further to understanding possible mechanisms of the development and maintenance of post-ABI emotional difficulties, this study's results in relation to executive functioning and threat appraisal may have important implications for intervention and treatment, although caution needs to be taken in considering the results of the current study for future interventions, given statistical insignificance. Studies examining the role of executive dysfunction in mental health treatment have found that those with poorer executive functioning skills typically have poorer treatment outcomes (Johnco, Wuthrich & Rapee, 2013; Mohlman, 2005; Mohlman, 2013; Mohlman & Gorman, 2005), that implementing executive functioning training into treatment produces better outcomes (Mohlman, 2008) and that specific frontal activity of the brain can predict responsiveness to CBT (Kumari et al., 2009).

This literature, however, has not been applied to a brain injury population, instead focusing predominantly on older adults with cognitive difficulties. Taking CBT (Beck, 1995) as an example, the ongoing use of thought restructuring exercises

(challenging negative thoughts and generating adaptive thoughts), formulation and implementation of behavioural plans and engaging in daily self-monitoring of cognitions, behaviours and physiological symptoms all involve the use of executive functioning (Mohlman & Gorman, 2005). Therefore if the role of executive functioning is not properly accounted for when trying to formulate and treat someone for post-TBI affective difficulties using a CBT perspective, this can have serious implications for the success of treatment and its subsequent outcomes. Clinicians should take this into account when undertaking therapeutic work with patients, either augmenting executive functioning training into treatment (Mohlman, 2008) or using research which has aimed to rehabilitate executive functioning first (Levine, Robertson, Clare, Carter & Hong, 2000; Manly, Hawkins, Evans, Woldt & Robertson, 2002). This is especially important given the susceptibility to damage to executive functioning following TBI, given the vulnerability of the frontal lobes (McHugh & Wood, 2008).

#### **4.6 Suggestions for Future Research**

Further research in this area should firstly aim to replicate the study with sufficient statistical power, to see whether or not these potential attentional biases towards threat are a real consequence of sustaining a brain injury. It may also be clinically relevant to examine whether or not threat appraisal words specific to brain injury can be generated and used, to see whether or not a threat appraisal bias is detected (indicating whether it's a specific, or more generalised threat appraisal).

Additionally, future studies should aim to attend to some of the methodological weaknesses raised from this study and areas which were not examined, such as focusing on more specific clinical groups (e.g., TBI only) or on those with higher levels of affective distress and self-discrepancy, to see whether this

strengthens the results found, and to examine whether or not this negative threat bias relies on impaired levels of executive functioning and poor self-concept/distress coming together. Additionally, future research may wish to examine self-discrepancy and attentional bias using specific populations for which this poorer self-concept may be a more apparent issue – such as those with visible difficulties, weight changes or visible scaring, as mentioned previously (Morris et al., 2005). This would examine the finding in this research that self-discrepancy did not seem to influence attention to negative stimuli, to see whether this is a consequence of the current studies sample of participants.

The nature of the cognitive and executive functioning difficulties underlying this should also be investigated, using questionnaires such as the Dysexecutive Questionnaire (DEX; Wilson et al., 1996) or the Behaviour Rating Inventory of Executive Function – Adult version (BRIEF-A; Gioia, Isquith, Guy & Kenworthy, 2000) or neuropsychological assessments which measure different aspects of executive functioning or attention, to explore which specific elements of these cognitive abilities may contribute to these possible attentional biases. If established, this may then lead to novel assessments and interventions aimed at rehabilitating the mechanisms maintaining this threat bias.

If these attentional biases are found to be replicable, and these hypothesised variables (executive functioning/psychological or adjustment factors) are found to be key in underlying these, future studies should aim to develop assessments to identify these biases, and subsequent interventions to help those with these difficulties, perhaps through targeting these underlying factors, or through applying treatments such as cognitive bias modification (Beard, 2011) to a brain injury population.

Furthermore, the links between self-discrepancy and affective distress were confirmed in this study, both between the current and pre-injury self, but also between the current and ideal self, which needs further investigation in future studies. These results and the previous literature it supports, indicate that this link is something that needs more attention from clinicians, with models emerging which specifically structure rehabilitation around understanding and addressing self-discrepancy in both ideal and pre-injury discrepancies (the Y-shaped model; Gracey, et al., 2009) and research beginning to examine intervention in brain injury targeting self-concept (Ownsworth & Haslam, 2014), which needs further attention in the future.

#### **4.7 Conclusion**

This study was the first to use a visual dot probe task to measure attentional bias to threat in an ABI population, adding an experimental paradigm to the wider literature around threat following ABI. A pattern of results emerged which whilst consistent with the hypothesis and previous research that those who have sustained an ABI will show a stronger attentional bias towards threatening stimuli, as compared to neutral stimuli, was found to be non-significant when investigated statistically. Analyses indicated that executive function may play an important contributing factor in this process.

Furthermore, it seems that current mental health or psychological difficulties are also a contributing factor, which may partly explain the results of this current study as it used a predominantly ‘well’ sample of participants. Further to this, a larger self-discrepancy between current self compared to both pre-injury and ideal self was associated with increased levels of anxiety and depression, with the current/ideal discrepancy being an area that has had less attention prior to this study. However the significance of these results must be considered and reflected on carefully,

acknowledging that results were non-significant and so conclusions can only be seen as tentative at present.

Despite the methodological limitations, these results have theoretical implications for understanding the underlying mechanisms of this threat appraisal, that perhaps both executive functioning difficulties and emotional difficulties are required to activate this attentional bias. This research may also have implications for understanding coping strategies that survivors use to manage these threatening, stressful situations. The findings in relation to self-discrepancy and affective distress underline the importance of this in understanding emotional distress following brain injury.

The clinical implications of these results relate to the understanding and treatment of affective difficulties following brain injury, their potential aetiology and the impact that executive functioning and self-discrepancy may have on potential interventions. These results also provide potential support to models of rehabilitation (such as Y-shaped model; Gracey, et al., 2009) which place these ideas around self-discrepancy as underpinning factors in understanding adjustment following brain injury. It is hoped that the results of the current study, and the new research directions that it subsequently opens, will help us to further understand the factors involved in attentional bias to threat following brain injury.

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## Appendices

Appendix A : Table Showing Dot-Probe Word Pairs By Category

Appendix B: Participant Demographic Questionnaire

Appendix C: Head Injury Semantic Differential Scale – III

Appendix D: European Brain Injury Questionnaire

Appendix E: Participant Information Sheet (with Oliver Zangwill heading)

Appendix F: Participant Consent Form (with Oliver Zangwill heading)

Appendix G: Proportionate Review Confirmation Letter

Appendix H: Confirmation Letter from South Warwickshire NHS Foundation Trust

Appendix I: Confirmation E-Mail from South Warwickshire NHS Foundation Trust

Appendix J: Confirmation Letter from Norfolk Community Health and Care NHS Trust

Appendix K: Confirmation Letter from Cambridgeshire Community Services NHS Trust

Appendix L: Letter for access from Cambridgeshire Community Services NHS Trust

Appendix M: Attempted data transformations (Median reaction time data: Physical stimuli trials)

Appendix N: Attempted data transformations (HISDS-III ideal scale)

Appendix A: Table Showing Dot-Probe Word Pairs by Category

Negative Evaluation		Physical Threat		Neutral Words	
(paired neutral words)		(paired neutral words)		(paired neutral words)	
STUPID	BARREL	INJURY	SILVER	OCTOPUS	POTTING
MOCKED	BANNER	DISEASE	VERSION	AGENT	BROAD
FOOLISH	GRADUAL	LETHAL	MARROW	FLOORING	POSTCARD
EMBARRASSED	TRANSFORMED	CANCER	SADDLE	LEAFLET	OATMEAL
FAILURE	BALANCE	PAIN	BANK	GUITAR	MILLER
DISGRACED	WAREHOUSE	AMBULANCE	FLOWERING	GINGER	RUBBER
PATHETIC	EXTERIOR	DEADLY	LADDER	HOUR	MIND
INFERIOR	INVENTOR	ILLNESS	MUSTARD	INCH	TOOL
WORTHLESS	CULTIVATE	EMERGENCY	FURNITURE	SAUSAGE	PADDOCK
RIDICULED	PICTORAL	VIOLENCE	CREATION	SHAMPOO	GALLERY
INEPT	PURGE	DOCTOR	CATTLE	JUICE	VENUE
CRITICISED	INGREDIENT	COFFIN	ROCKET	CREEK	SALAD
INADEQUATE	LOCOMOTION	STROKE	STRING	FRESH	INDEX
ASHAMED	ORCHARD	FATAL	PERCH	SHEEP	SLOPE
HUMILIATED	MINIATURES	HOSPITAL	NUTSHELL	PIANO	CREST
INCOMPETENT	MANUFACTURE	CORONARY	SNAPSHOT	CARROT	DONKEY

Appendix B: Participant Demographic Questionnaire

***Participant Demographics Questionnaire***

Participant Number		Age	
Date of Assessment		Sex	

Ethnicity	White / Mixed / Indian / Pakistani / Bangladeshi / Other Asian / Black Caribbean / Black African / Other Black / Chinese / Other Ethnic
Marital Status	Single / Married / Co-habiting / Widowed / Divorced
Education	Some Secondary School / GCSEs / A-Levels Diploma / Undergraduate / Postgraduate
Post-injury employment	None / Voluntary / Paid
Cause of injury	
Date of injury	

Appendix C: Head Injury Semantic Differential Scale – III

<b>HEAD INJURY SEMANTIC DIFFERENTIAL SCALE – III</b>								
Participant number:								
Date:								
Pre-Injury / Current / Ideal								
Bored	O	O	O	O	O	O	O	Interested
Unhappy	O	O	O	O	O	O	O	Happy
In Control	O	O	O	O	O	O	O	Helpless
Worried	O	O	O	O	O	O	O	Relaxed
Satisfied	O	O	O	O	O	O	O	Dissatisfied
Despondent	O	O	O	O	O	O	O	Hopeful
Self-Confident	O	O	O	O	O	O	O	Lacks Confidence
Unstable (Emotionally)	O	O	O	O	O	O	O	Stable
Attractive (as a person)	O	O	O	O	O	O	O	Unattractive
Of Value	O	O	O	O	O	O	O	Worthless
Aggressive	O	O	O	O	O	O	O	Unaggressive
Calm	O	O	O	O	O	O	O	Irritable
Capable	O	O	O	O	O	O	O	Incapable
Dependent	O	O	O	O	O	O	O	Independent
Inactive	O	O	O	O	O	O	O	Active
Withdrawn	O	O	O	O	O	O	O	Talkative
Friendly	O	O	O	O	O	O	O	Unfriendly
Patient	O	O	O	O	O	O	O	Impatient

## Appendix D: European Brain Injury Questionnaire

### EBIQ (European Brain Injury Questionnaire) - Self-Rating

Patient identification: \_\_\_\_\_

Date: \_\_\_\_\_

This questionnaire is concerned with a number of problems or difficulties that people sometimes experience in their lives. We would like to know how much you have experienced any of these **within the last month**. Please read each item in the questionnaire and respond by marking your answer in the circle under 'Not at all' or 'A little' or 'A lot'. Do not spend too much time on any item. Just give your most immediate response.

How much have you experienced the following?

		Not at all	A Little	A lot
01	Headaches .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
02	Failing to get things done on time .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
03	Reacting too quickly to what others say or do .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
04	Trouble remembering things .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
05	Difficulty participating in conversations .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06	Others do not understand your problems .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
07	Everything is an effort .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
08	Being unable to plan activities .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
09	Feeling hopeless about your future .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10	Having temper outbursts .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11	Being confused .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12	Feeling lonely, even when together with other people .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13	Mood swings without reason .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14	Feeling critical of others .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15	Having to do things slowly in order to be correct .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16	Faintness or dizziness .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17	Hiding your feelings from others .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18	Feeling sad .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19	Being 'bossy' or dominating .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

		Not at all	A Little	A lot
20	Needing to be reminded about personal hygiene . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21	Difficulty managing your finances . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22	Trouble concentrating . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23	Failing to notice other people's moods . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24	Feeling anger against other people . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25	Having your feelings easily hurt . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26	Feeling unable to get things done . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
27	Annoyance or irritation . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
28	Problems with household chores . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
29	Lack of interest in hobbies at home . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
30	Feeling lonely . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
31	Feeling inferior to other people . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
32	Sleep problems . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
33	Feeling uncomfortable in crowds . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34	Shouting at people in anger . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35	Difficulty in communicating what you want to say . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
36	Being unsure what to do in dangerous situations . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37	Being obstinate . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
38	Lack of interest in your surroundings . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
39	Thinking only of yourself . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
40	Mistrusting other people . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
41	Crying easily . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
42	Difficulty finding your way in new surroundings . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
43	Being inclined to eat too much . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
44	Getting into quarrels easily . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
45	Lack of energy or being slowed down . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
46	Forgetting the day of the week . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
47	Feeling of worthlessness . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
48	Lack of interest in hobbies outside the home . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

		Not at all	A Little	A lot
49	Needing help with personal hygiene .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
50	Restlessness .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
51	Feeling tense .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
52	Acting inappropriately in dangerous situations .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
53	Feeling life is not worth living .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
54	Forgetting appointments .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
55	Leaving others to take the initiative in conversations .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
56	Loss of sexual interest or pleasure .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
57	Throwing things in anger .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
58	Preferring to be alone .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
59	Difficulty in making decisions .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
60	Losing contact with your friends .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
61	Lack of interest in current affairs .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
62	Behaving tactlessly .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
63	Having problems in general .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

If you have a close relative who is also completing this questionnaire, then please answer the following questions about that person.

64	Do you think that his/her life has changed after you had the injury? .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
65	Do you think that he/she is having problems due to your present situation? .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
66	Do you think that his/her mood has changed due to your present situation? .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Any other comments?

Thank-you for your cooperation

## EBIQ (European Brain Injury Questionnaire) - Relative-Rating

Patient identification: .....

Relative identification: .....

Date: .....

This questionnaire is concerned with a number of problems or difficulties that people sometimes experience in their lives. We would like to know how much your brain-injured relative has experienced any of these **within the last month**. Please read each item in the questionnaire and respond by marking your answer in the circle under 'Not at all' or 'A little' or 'A lot'. Do not spend too much time on any item. Just give your most immediate response.

In your view, how much has he/she experienced the following?

		Not at all	A Little	A lot
01	Headaches .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
02	Failing to get things done on time .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
03	Reacting too quickly to what others say or do .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
04	Trouble remembering things .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
05	Difficulty participating in conversations .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06	Others do not understand his/her problems .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
07	Everything is an effort .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
08	Being unable to plan activities .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
09	Feeling hopeless about his/her future .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10	Having temper outbursts .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11	Being confused .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12	Feeling lonely, even when together with other people .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13	Mood swings without reason .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14	Feeling critical of others .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15	Having to do things slowly in order to be correct .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16	Faintness or dizziness .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17	Hiding his/her feelings from others .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18	Feeling sad .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19	Being 'bossy' or dominating .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

		Not at all	A Little	A lot
20	Needing to be reminded about personal hygiene . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21	Difficulty managing his/her finances . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22	Trouble concentrating . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23	Failing to notice other people's moods . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24	Feeling anger against other people . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25	Having his/her feelings easily hurt . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26	Feeling unable to get things done . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
27	Annoyance or irritation . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
28	Problems with household chores . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
29	Lack of interest in hobbies at home . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
30	Feeling lonely . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
31	Feeling inferior to other people . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
32	Sleep problems . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
33	Feeling uncomfortable in crowds . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34	Shouting at people in anger . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35	Difficulty in communicating what he/she want to say . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
36	Being unsure what to do in dangerous situations . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37	Being obstinate . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
38	Lack of interest in his/her surroundings . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
39	Thinking only of himself/herself . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
40	Mistrusting other people . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
41	Crying easily . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
42	Difficulty finding his/her way in new surroundings . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
43	Being inclined to eat too much . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
44	Getting into quarrels easily . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
45	Lack of energy or being slowed down . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
46	Forgetting the day of the week . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
47	Feeling of worthlessness . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
48	Lack of interest in hobbies outside the home . . . . .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

		Not at all	A Little	A lot
49	Needing help with personal hygiene .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
50	Restlessness .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
51	Feeling tense .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
52	Acting inappropriately in dangerous situations .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
53	Feeling life is not worth living .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
54	Forgetting appointments .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
55	Leaving others to take the initiative in conversations .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
56	Loss of sexual interest or pleasure .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
57	Throwing things in anger .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
58	Preferring to be alone .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
59	Difficulty in making decisions .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
60	Losing contact with his/her friends .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
61	Lack of interest in current affairs .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
62	Behaving tactlessly .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
63	Having problems in general .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please answer the following questions about **yourself**.

64	Has your life changed after your relative had the injury? .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
65	Are you having problems due to his/her present situation? .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
66	Has your mood has changed due to his/her present situation? .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Any other comments?

Thank-you for your cooperation

## Appendix E: Participant Information Sheet (with Oliver Zangwill heading)



Information Sheet for Participants – 4<sup>th</sup> February 2014

### **Threat appraisal following acquired brain injury: The role of self-discrepancy**

Researcher: Liam Gilligan (Trainee Clinical Psychologist)

Supervised by: Dr Margo Ononaiye, Dr Fergus Gracey and Dr Dave Peck

Doctoral Programme in Clinical Psychology, School of Medicine and Health Sciences,

University of East Anglia

My name is Liam Gilligan; I am a trainee Clinical Psychologist doing a research study as part of my training at the University of East Anglia. You are being invited to take part in this research. Before you take part in this research, it is important that you understand why this is being done and what it will involve.

Please take some time to read it carefully, and feel free to ask if anything is not clear or you wish to discuss it further.

- Purpose of the study:**

People who have had a brain injury can experience a range of difficulties which can change how they choose to do things on a day-to-day basis. Some of these might be related to the amount of attention that they pay to things which they think are threatening to them, such as people judging them negatively. This research wants to find out more about attention in people who have had a brain injury, and how this is affected by certain things, such as what that person thinks of themselves.

- Why have I been chosen?**

You have been invited to take part in this research because you have experienced a brain injury in the past.

- Do I have to take part?**

No, it is up to you whether you wish to take part in the study. If you decide not to take part, it will not affect any of your care or activities, and you can choose to stop during the study at any time.

- **What will happen if I choose to take part?**

If you agree to take part, a time will be arranged a time for me to visit, when I can answer any questions that you have. You will have to complete a consent form and fill in some details about yourself (such as your age). Then you will have to complete some questionnaires that look at your mood and some questions about how you see yourself now and before your brain injury. You will also have to complete a task on a laptop that should take about 20 minutes, and a sorting task that should take about 15 minutes. In total it should take between 60 and 90 minutes.

- **Will my results be confidential?**

Yes – everything that is collected from these measures will be kept strictly confidential, so no-one else will see them, and all your questionnaires will have a number to use instead of your name to ensure this.

If at any time the researcher becomes concerned that you might be at risk of harming yourself or other people, then they will need to break this confidentiality and talk to someone involved in your care (either a health worker at your service or your GP) to inform them of this. I will try to discuss this with you first if it happens.

- **What will happen to the results of the study?**

Once I have completed all the assessments, I will write a report about the research for the University which will be published in an academic journal. Your name and personal details will not be in the report.

- **Who is funding and organising this research?**

This research is being funded and organised by the University of East Anglia as part of my doctoral research project.

- **Further information and contact details**

If you wish to discuss the project further, please feel free to contact the researcher (Liam Gilligan) at [insert email address]. If you have any problems or have any complaints about the study then please contact Dr Margo Ononaiye, at [insert email address].

If you wish to discuss this project with someone independent from the project or have any concerns or complaints, than please contact [local contact], at [insert email address]

Thank you for reading this information sheet and considering taking part in the research. Please feel free to discuss this with anyone else that you wish to (your family, friends and health staff).

Appendix F: Participant Consent Form (with Oliver Zangwill heading)



Participant Consent Form

**Threat appraisal following acquired brain injury: The role of self-discrepancy**

Researcher: Liam Gilligan (Trainee Clinical Psychologist)

Supervised by: Dr Margo Ononaiye, Dr Fergus Gracey and Dr Dave Peck

Doctoral Programme in Clinical Psychology, School of Medicine and Health Sciences,

University of East Anglia

Please **initial** the box if you agree

1. I can confirm that I have read and understood the information sheet dated 4<sup>th</sup> February 2014 about the above study and have had the opportunity to ask questions
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my health care or legal rights being affected
3. I agree to take part in the above study.

Signing this form does not commit you to completing the study. You are free to leave the study at any time without having to give a reason for doing so.

---

**Name of Participant**

---

**Date**

---

**Signature**

Liam Gilligan

---

---

**Name of Researcher**

**Date**

**Signature**



**NRES Committee East Midlands - Nottingham 2**

The Old Chapel  
Royal Standard Place  
Nottingham  
NG1 6FS

Telephone: 0115 8839311  
Facsimile: 0115 8839294

29 April 2014

Mr Liam Gilligan  
Trainee Clinical Psychologist  
Cambridgeshire and Peterborough NHS Foundation Trust  
Doctoral programme in Clinical Psychology  
2.30, Elizabeth Fry building, School of Medicine, Health Policy and Pr  
University of East Anglia, Norwich, Norfolk  
NR4 7TJ

Dear Mr Gilligan

<b>Study title:</b>	<b>Threat appraisal following acquired brain injury: The role of self-discrepancy</b>
<b>REC reference:</b>	<b>14/EM/0194</b>
<b>IRAS project ID:</b>	<b>147394</b>

The Proportionate Review Sub-committee of the NRES Committee East Midlands - Nottingham 2 reviewed the above application on 28 April 2014.

We plan to publish your research summary wording for the above study on the NRES website, together with your contact details, unless you expressly withhold permission to do so. Publication will be no earlier than three months from the date of this favourable opinion letter. Should you wish to provide a substitute contact point, require further information, or wish to withhold permission to publish, please contact the Rec Manager Miss Andrea Graham, [nrescommittee.eastmidlands-nottingham2@nhs.net](mailto:nrescommittee.eastmidlands-nottingham2@nhs.net).

**Ethical opinion**

- The Committee agreed the title is not particularly user friendly.
- The Committee agreed the Study did not have any material ethical issues

On behalf of the Committee, the sub-committee gave a favourable ethical opinion of the above research on the basis described in the application form, protocol and supporting documentation, subject to the conditions specified below.

**Ethical review of research sites**

The favourable opinion applies to all NHS sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see

"Conditions of the favourable opinion" below).

### **Conditions of the favourable opinion**

The favourable opinion is subject to the following conditions being met prior to the start of the study.

Management permission or approval must be obtained from each host organisation prior to the start of the study at the site concerned.

*Management permission ("R&D approval") should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements.*

*Guidance on applying for NHS permission for research is available in the Integrated Research Application System or at <http://www.rforum.nhs.uk>.*

*Where a NHS organisation's role in the study is limited to identifying and referring potential participants to research sites ("participant identification centre"), guidance should be sought from the R&D office on the information it requires to give permission for this activity.*

*For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.*

*Sponsors are not required to notify the Committee of approvals from host organisations.*

### **Registration of Clinical Trials**

All clinical trials (defined as the first four categories on the IRAS filter page) must be registered on a publically accessible database within 6 weeks of recruitment of the first participant (for medical device studies, within the timeline determined by the current registration and publication trees).

There is no requirement to separately notify the REC but you should do so at the earliest opportunity e.g when submitting an amendment. We will audit the registration details as part of the annual progress reporting process.

To ensure transparency in research, we strongly recommend that all research is registered but for non clinical trials this is not currently mandatory.

If a sponsor wishes to contest the need for registration they should contact Catherine Blewett ([catherineblewett@nhs.net](mailto:catherineblewett@nhs.net)), the HRA does not, however, expect exceptions to be made. Guidance on where to register is provided within IRAS.

**You should notify the REC in writing once all conditions have been met (except for site approvals from host organisations) and provide copies of any revised documentation with updated version numbers. The REC will acknowledge receipt and provide a final list of the approved documentation for the study, which can be made available to host organisations to facilitate their permission for the study. Failure to provide the final versions to the REC may cause delay in obtaining permissions.**

**It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).**

## Approved documents

The documents reviewed and approved were:

Document	Version	Date
Evidence of insurance or indemnity	Zurich Municipal	22 May 2013
Investigator CV	Liam Gilligan	
Investigator CV	Dr Margarita Ononaiye	
Participant Consent Form	2	04 February 2014
Participant Information Sheet	2	04 February 2014
Protocol	1	04 February 2014
Questionnaire: EBIQ (European Brain Injury Questionnaire)		
REC application	147394/596645/1/780	17 March 2014

## Membership of the Proportionate Review Sub-Committee

The members of the Sub-Committee who took part in the review are listed on the attached sheet.

## Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

## After ethical review

### Reporting requirements

The attached document "After ethical review – guidance for researchers" gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Notification of serious breaches of the protocol
- Progress and safety reports
- Notifying the end of the study

The NRES website also provides guidance on these topics, which is updated in the light of changes in reporting requirements or procedures.

### Feedback

You are invited to give your view of the service that you have received from the National Research Ethics Service and the application procedure. If you wish to make your views known please use the feedback form available on the website. Information is available at National Research Ethics Service website > After Review

14/EM/0194

Please quote this number on all correspondence

We are pleased to welcome researchers and R & D staff at our NRES committee members' training days – see details at <http://www.hra.nhs.uk/hra-training/>

With the Committee's best wishes for the success of this project.

Yours sincerely



**Dr Martin Hewitt**  
Chair

Email: nrescommittee.london-westlondon@nhs.net

*Enclosures:* *List of names and professions of members who took part in the review*

*"After ethical review – guidance for researchers"*

*Copy to:* *Mrs Sue Steel*  
*Dr Paula Waddingham, Cambridgeshire Community Services NHS Trust*



Research Office  
Room 3  
Medical School Building  
Warwick Hospital  
Lakin Road  
Warwick  
CV34 5BW

9<sup>th</sup> May 2014

Liam Gilligan  
Cambridge and Peterborough NHS Foundation Trust  
Elizabeth House  
Fulbourn Hospital  
Fulbourn  
Cambridge  
CB21 5EF

01926 495321 EXT. 4411  
[jo.williams@swft.nhs.uk](mailto:jo.williams@swft.nhs.uk)

Dear Liam

**Existing Honorary Contract issued by Cambridge and Peterborough NHS Foundation Trust**

Thank you for submitting a copy of your honorary contract with Cambridge and Peterborough NHS Foundation Trust. I am pleased to offer you an honorary research contract in South Warwickshire NHS Foundation Trust on the same terms as the above contract except as detailed below. Please accept this letter as confirmation of such an arrangement.

The contract if accepted by you will commence on 9<sup>th</sup> May 2014 and ends on 31<sup>st</sup> March 2015 unless terminated earlier in accordance with the clauses in the contract or the research study is completed whichever is the sooner

Amendments to the existing honorary research contract issued by Oxford University NHS Trust are as follows

- o Whilst undertaking research through South Warwickshire NHS Foundation Trust, you will remain accountable to your employer but will follow the reasonable instructions of Dr Chris Marguerie – Lead for Research and Development in this NHS organisation or those given on his behalf in relation to the terms of this right of access
- o We will not reimburse any expenses you incur in the course of your research unless by prior arrangement we have agreed to do so. Similarly, we accept no responsibility for damage to or loss of personal property
- o If your circumstances change in relation to your health, criminal record, professional registration or any other aspect that may impact on your suitability to conduct research, or your role in research changes, you must inform your employer through its normal procedures. You must also inform your nominated manager in this organisation

Yours sincerely

A handwritten signature in black ink that reads "Jo Williams".

Jo Williams  
Research Governance Senior Manager

Appendix I: Confirmation E-Mail from South Warwickshire NHS Foundation Trust

**From:** Jo.Williams@swft.nhs.uk [Jo.Williams@swft.nhs.uk]  
**Sent:** 09 May 2014 08:19  
**To:** Liam Gilligan (MED)  
**Cc:** Rob.Poppleton@swft.nhs.uk; Susan.Bleasdale@swft.nhs.uk  
**Subject:** R&D Approval SWFT080514-01

Dear Liam

**Re:** Treat Appraisal following acquired brain injury

**REC:** 14/EM/0194

**R&D No.** SWFT080514\_01

**Protocol:** Version 1 04 February 2014

Thank you for your application to undertake the above named study at South Warwickshire NHS Foundation Trust. Following review of your submitted paperwork I am pleased to inform you that I am in a position to grant R&D approval on behalf of the Trust

Should there be a requirement for you to change the protocol you will need to inform me and we can look at whether we are still able to support the research. Please ensure your site file is kept up to date at all times as it is open to auditing at short notice

Please find attached your letter of access, should you wish to accept the conditions please email to confirm

I hope you enjoy working on the study and will look forward to reading the outcome

Kind Regards

Jo

**Jo Williams**

Undergraduate Education & Research Manager

South Warwickshire NHS Foundation Trust

Room 3 Medical School Building

Lakin Road

Warwick

CV34 5BW

**Tel:** 01926 495321 **Ext:** 4411

**Mobile:** 07785573430

**Fax:** 01926 600849

**Website:** [www.swft.nhs.uk](http://www.swft.nhs.uk)

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Ref: 2014SS01

**Norfolk & Suffolk Primary & Community Care Research Office**

Hosted by: South Norfolk CCG

Lakeside 400

Old Chapel Way

Broadland Business Park

Thorpe St Andrew

Norwich

NR7 0WG

**Mr Liam Gilligan**

University of East Anglia

Doctoral Programme in Clinical Psychology

2.30 Elizabeth Fry Building

School of Medicine, Health Policy and Practice

Norwich

NR4 7TJ

Tel: 01603 257283

Fax: 01603 257292

25 June 2014

E-mail: [paul.mills1@nhs.net](mailto:paul.mills1@nhs.net)

<http://www.southnorfolkccg.nhs.uk/research/about-us>

Dear Mr Liam Gilligan

**Re: 2014SS01. Threat appraisal following acquired brain injury. The role of self-discrepancy**

**REC Number:** 14/EM/0194

**Chief Investigator:** Mr Liam Gilligan

**Sponsor:** University of East Anglia

Further to your submission of the above project to the Norfolk & Suffolk Primary & Community Care Research Office your project has now been reviewed and all the mandatory research governance checks have been satisfied. I am therefore pleased to inform you on behalf of **Norfolk Community Health & Care NHS Trust** that NHS permission (R&D approval) was granted on 25<sup>th</sup> June 2014 for your study to take place at the following sites:

- Norfolk Community Health & Care NHS Trust

Please note the following points:

- Transfer of patient identifiable or confidential data must be in accordance with Norfolk Community Health & Care NHS Trust policies.
- Participants are informed, prior to consent that medical records will be checked by staff at NCH&C and shared with the researcher and that this is noted on the medical notes.
- Contact details of relevant support should be provided to participants should they become distressed.

You may now begin your study at the above sites. **Please note also, if you wish to extend approval to any sites other than those listed above you must apply for this through the Norfolk & Suffolk Primary & Community Care Research Office.**

NHS Permission is granted on the basis of the information supplied in the application form, protocol and supporting documentation, if anything subsequently comes to light that would cast doubts upon, or alter in any material way, any information contained in the original application, or a later amendment application there may be implications for continued NHS Permission.

Permission is granted on the understanding that the study is conducted in accordance with the Research Governance Framework and the terms of REC favourable opinion.

If you have any queries regarding this or any other project please contact Paul Mills, R&D Officer, at the above address. Please note, the reference number for this study is **2014SS01** and this should be quoted on all correspondence.

Yours sincerely



Clare Symms

**Research Governance Manager, Norfolk & Suffolk Primary & Community Care Research Office**  
*Signed on behalf of Norfolk Community Health & Care NHS Trust*

cc: Sue Steel, Research Sponsor, University of East Anglia  
Margo Ononaiye, Academic Supervisor, University of East Anglia

#### **Conditions of NHS Permission**

Please note the following conditions of NHS Permission - it is your responsibility to ensure that these conditions are disseminated to all parties involved in this project at the above sites.

#### **You must notify the Norfolk & Suffolk Primary & Community Care Research Office of:**

- All proposed changes to this study, whether minor or substantial
- All Serious Adverse Events relevant to the above sites
- Any deviations from the protocol or protocol breaches including any urgent safety measures that are required to be taken in order to protect research participants against any immediate hazard to their health or safety
- All incidents<sup>1</sup> or complaints in relation to the research project at the above sites
- Any Sponsor or funder initiated audits, or any regulatory inspections to be conducted in relation to this study at the above sites
- The study conclusion and/or termination of the study; where smartcards have been issued, this notification must be made on a site by site basis to allow deactivation of smartcards at that site.
- All publications relating to the study

#### **Documentation:**

You are required to maintain a site file for the study at your site. This should be maintained in accordance with ICH-GCP and will include as a minimum:

- (a) Final approved protocol
- (b) Copies of REC favourable opinion, NHS Permission letter relevant to your site, any other approvals necessary (e.g. MHRA)
- (c) Participant information sheets, consent forms, invitation letters, posters/adverts and any other documentation given to the participant

It is your responsibility to update the information held at each site with any amendments made to this documentation and all approval letters applicable to those amendments and to ensure that all essential documents held at site are maintained, stored and archived as appropriate.

#### **Scope of permission**

- Please note that the above permission applies only to research activity on NHS staff or premises or involving NHS Patients and/or their tissues, data or samples. Separate agreements and permissions will be required for research involving private patients or those under the care of social services.

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<sup>1</sup> An incident is defined as any event or circumstance that could have, or did, lead to harm, loss or damage and includes loss of data, confidentiality breaches, harm to researchers or staff or damage to property.

**Cambridgeshire Community Services**   
**NHS Trust**

9<sup>th</sup> September 2014

Mr Liam Gilligan  
2.30, Elizabeth Fry building, School of Medicine,  
Health Policy and Practice  
University of East Anglia, Norwich, Norfolk  
NR4 7TJ

RMG Office  
Lockton House  
Clarendon Road  
Cambridgeshire  
CB2 8FH  
camstrad@cambridgeshire.nhs.uk

Direct dial: 01223 725466

Dear Mr Gilligan

**Re: L01402 Threat appraisal following acquired brain injury: The role of self-discrepancy**

**REC Number: 14/EM/0194**

Your proposal has been reviewed by the Medical Director of Cambridgeshire Community Services NHS Trust.

I am pleased to inform you that Cambridgeshire Community Services NHS Trust has given permission for the following research to take place.

**This permission is subject to the enclosed standard terms and conditions and conditional upon you notifying the research governance team of any changes to the study-related paperwork.**

**Members of the research team who are not employed by the Trust must have appropriate substantive or honorary research contracts or letters of access with the Trust prior to commencing work on the study, additional researchers who join the study post approval must also hold a suitable contract or letter of access before they start.**

Unless we hear from you within a month of this letter, we will assume that you are abiding by these conditions.

The project must follow the agreed protocol and be conducted in accordance with Trust policy and procedures in particular in regard to data protection, health & safety and information governance standards. The research team are required to follow the reasonable instructions of the research site manager and can contact the RMG office for RMG advice or the Trust RMG lead in relation to queries on local policy.

On completion of clinical trials of interventional medicinal products/devices participants need to be aware that local Trust prescribing policy and formulary applies therefore participants cannot expect to continue on the research trial product/device on completion of the trial.

Approval is subject to adherence to the Data Protection Act 1998, NHS Confidentiality Code of Practice, the Human Tissue Act 2004, the NHS Research Governance Framework for Health and Social Care, (2nd edition) April 2005, the Mental Capacity Act and any further legislation released during the time of this study. Approval for Clinical Trials is on the basis that they are conducted in accordance with European Union Directive and the Medicines for Human Use (Clinical Trials) Regulations 2004 principles, guidelines and later revisions, and in accordance ICH Good Clinical Practice.

You will be required to complete monitoring information during the course of the research, as requested by the RMG office. Cambridgeshire Community Services NHS Trust reserves the right to withdraw research management approval for a project if researchers fail to respond to audit and monitoring requests.

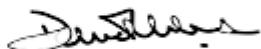
Should any adverse incidents occur during the research, Cambridgeshire Community Services NHS Trust Incident and Near Miss Reporting Policy should be used, the RMG Office informed and incident procedures adhered to at the research site.

If you make any amendments to your project, please ensure that these are submitted to the research ethics committee and the RMG office and that any changes are not implemented until approval has been received.

We welcome feedback about your experience of this review process to help us improve our systems. May I take this opportunity to wish you well with your research and we look forward to hearing the progress and outcomes for the study.

Please contact the RMG team should you have any queries.

Yours sincerely,



Dr David Vickers  
Medical Director  
Cambridgeshire Community Services NHS Trust

cc: Mrs Sue Steel  
cc: Dr Andrew Bateman

# Cambridgeshire Community Services

NHS Trust

11<sup>th</sup> September 2014

Mr Liam Gilligan  
Trainee Clinical Psychologist  
Doctoral programme in Clinical Psychology  
2.30, Elizabeth Fry building, School of  
Medicine, Health Policy and Practice  
University of East Anglia, Norwich,  
Norfolk Post Code NR4 7TJ

C/o RMG Office  
NHS Cambridgeshire  
Lockton House  
Clarendon Road  
Cambridge  
Cambs  
CB2 8FH

Dear Mr Gilligan

**Letter of access for research: L01402 Threat appraisal following acquired brain injury: The role of self-discrepancy**

As an existing NHS employee you do not require an additional honorary research contract with this NHS organisation. We are satisfied that the research activities that you will undertake in this NHS organisation are commensurate with the activities you undertake for your employer. Your employer is fully responsible for ensuring such checks as are necessary have been carried out. Your employer has confirmed in writing to this NHS organisation that the necessary pre-engagement checks are in place in accordance with the role you plan to carry out in this organisation. This letter confirms your right of access to conduct research through **Cambridgeshire Community Services** NHS Trust for the purpose and on the terms and conditions set out below. This right of access commences on **11/09/2014** and ends on **31/09/2015** unless terminated earlier in accordance with the clauses below.

You have a right of access to conduct such research as confirmed in writing in the letter of permission for research from this NHS organisation. Please note that you cannot start the research until the Principal Investigator for the research project has received a letter from us giving permission to conduct the project.

You are considered to be a legal visitor to Cambridgeshire Community Services NHS Trust premises. You are not entitled to any form of payment or access to other benefits provided by this organisation to employees and this letter does not give rise to any other relationship between you and this NHS organisation, in particular that of an employee.

While undertaking research through Cambridgeshire Community Services NHS Trust you will remain accountable to your employer, **University of East Anglia**, but you are required to follow the reasonable instructions of your nominated manager, Dr David Vickers Medical Director, in this NHS organisation or those given on his behalf in relation to the terms of this right of access.

Where any third party claim is made, whether or not legal proceedings are issued, arising out of or in connection with your right of access, you are required to co-operate fully with any investigation by this NHS organisation in connection with any such claim and to give all such assistance as may reasonably be required regarding the conduct of any legal proceedings.

You must act in accordance with Cambridgeshire Community Services NHS Trust policies and procedures, which are available to you upon request, and the Research Governance Framework.

You are required to co-operate with Cambridgeshire Community Services NHS Trust in discharging its duties under the Health and Safety at Work etc Act 1974 and other health and safety legislation and to take reasonable care for the health and safety of yourself and others while on Cambridgeshire Community Services NHS Trust premises. Although you are not a contract holder, you must observe the same standards of care and propriety in dealing with patients, staff, visitors, equipment and premises as is expected of a contract holder and you must act appropriately, responsibly and professionally at all times.

If you have a physical or mental health condition or disability which may affect your research role and which might require special adjustments to your role, if you have not already done so you must notify your employer and the Trust manager prior to commencing your research role at the Trust.

You are required to ensure that all information regarding patients or staff remains **secure and strictly confidential at all times**. You must ensure that you understand and comply with the requirements of the NHS Confidentiality Code of Practice ( <http://www.dh.gov.uk/assetRoot/04/06/92/54/04069254.pdf> ) and the Data Protection Act 1998. Furthermore you should be aware that under the Act, unauthorised disclosure of information is an offence and such disclosures may lead to prosecution.

Cambridgeshire Community Services NHS Trust will not indemnify you against any liability incurred as a result of any breach of confidentiality or breach of the Data Protection Act 1998. Any breach of the Data Protection Act 1998 may result in legal action against you and/or your substantive employer.

You should ensure that, where you are issued with an identity or security card, a bleep number, email or library account, keys or protective clothing, these are returned upon termination of this arrangement. Please also ensure that while on the premises you wear your ID badge at all times, or are able to prove your identity if challenged. Please note that this NHS organisation accepts no responsibility for damage to or loss of personal property.

We may terminate your right to attend at any time either by giving seven days' written notice to you or immediately without any notice if you are in breach of any of the terms or conditions described in this letter or if you commit any act that we reasonably consider to amount to serious misconduct or to be disruptive and/or prejudicial to the interests and/or business of this NHS organisation or if you are convicted of any criminal offence. Where applicable, your substantive employer will initiate your Independent Safeguarding Authority (ISA) registration in-line with the phasing strategy adopted within the NHS and the applicable legislation. Once you are ISA-registered, your employer will continue to monitor your ISA registration status via the on-line ISA service. Should you cease to be ISA-registered, this letter of access is immediately terminated. Your substantive employer will immediately withdraw you from undertaking this or any other regulated activity and you **MUST** stop undertaking any regulated activity.

You must not undertake regulated activity if you are barred from such work. If you are barred from working with adults or children this letter of access is immediately terminated. Your employer will immediately withdraw you from undertaking this or any other regulated activity and you **MUST** stop undertaking any regulated activity immediately.

Your substantive employer is responsible for your conduct during this research project and may in the circumstances described above instigate disciplinary action against you.

If your circumstances change in relation to your health, criminal record, professional registration or ISA registration, or any other aspect that may impact on your suitability to conduct research, or your role in research changes, you must inform the NHS organisation that employs you through its normal procedures. You must also inform your nominated manager in this NHS organisation.

Yours sincerely

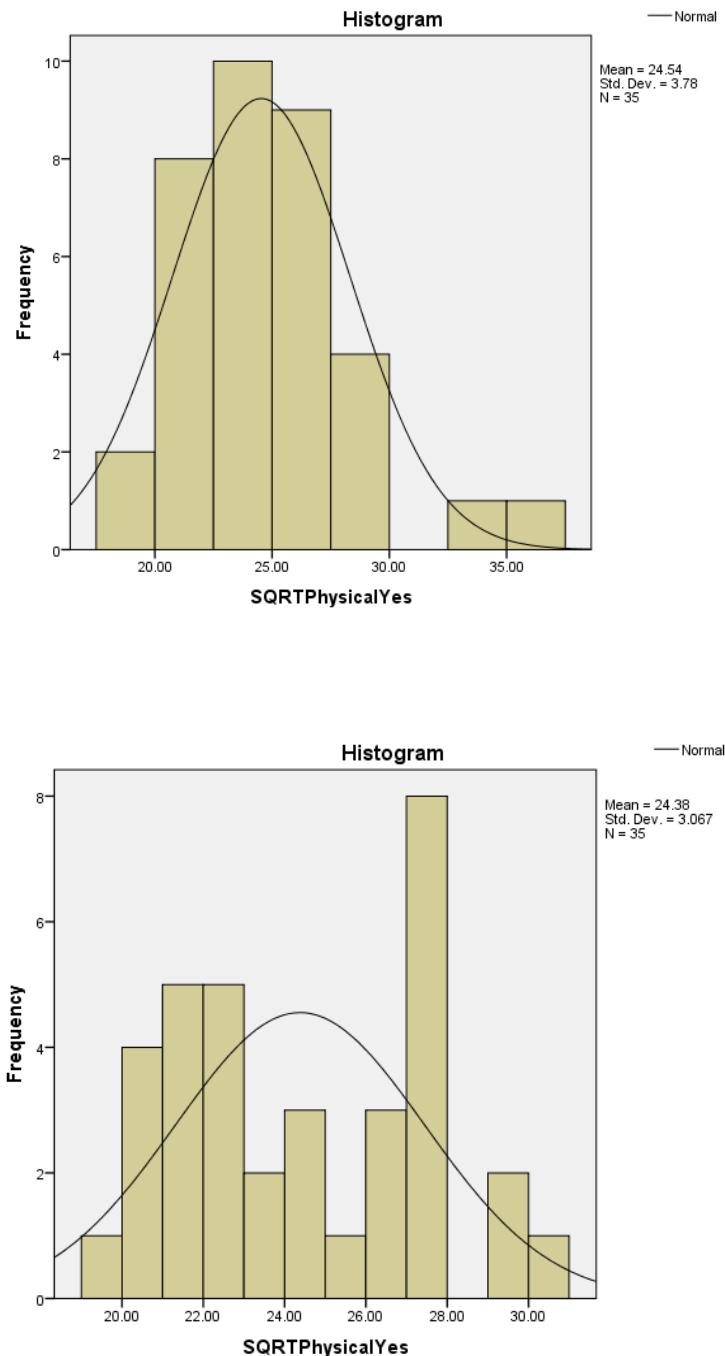


**Dr David Vickers**  
Medical Director  
Cambridgeshire Community Services NHS Trust

cc: Vivienne Shaw CLRN RMG Manager, RMG office, Lockton House, Clarendon Road Cambridge CB2 8FH

cc: Dr Margo Ononaiye, Deputy Programme Director (Clinical), Doctorate of Clinical Psychology Course, Faculty of Medicine and Health Sciences, University of East Anglia, Norwich Research Park, Norwich, NR4 7TJ

Appendix M: Attempted data transformations (Median reaction time data:  
Physical stimuli trials)



## Appendix N: Attempted data transformations (HISDS-III ideal scale)

