DAVID M. S. ELEY BSc Hons MSc

INVESTIGATING THE RELATIONSHIP BETWEEN SOCIAL COGNITION, NEUROPSYCHOLOGICAL FUNCTION AND POST-TRAUMATIC STRESS DISORDER IN ACQUIRED BRAIN INJURY.

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SUMMARY OF PORTFOLIO

Section A gives an overview of Brain Injury, followed by a review of two aspects of social cognition; emotion recognition and Mentalization, in the context of Traumatic Brain Injury. There is a suggestion of a prevalence of deficits, although the roles these might play in the development of psychosocial difficulties are not established. Implications of the literature and future research directions are considered.

Section B describes an empirical study investigating the direct relationships between aspects of social cognition and neuropsychological function, and symptoms related to Post-Traumatic Stress Disorder. Relationships were tested using correlations and multiple regression analysis. It was found that measures of Mentalization, visual attention and delayed memory had direct relationship with symptoms relating to depression and PTSD.

Section C provides a critical appraisal of the study described in Section B. It addresses four questions designed by the course regarding: research abilities and skills; what could of been done differently and why; clinical implications, and ideas for future research. Personal reflections from the author are included, focusing on the process of carrying out the project and particular points of learning.

Contents

Abstract 3

Introduction 4

- **Traumatic Brain Injury** 4
- **Psychosocial Difficulties** 5
- **Executive Functioning** 6
- **Social Cognition** 8

Critical Review 10

- **Recognition of Emotion in Traumatic Brain Injury** 10
  - **Recognition of Facial Affect** 11
  - **Impact of Presentation Medium** 13
  - **Rehabilitation of Emotional Recognition Difficulties** 17
  - **Summary** 19
- **Mentalization** 19
  - **Mentalization and Traumatic Brain Injury** 20
  - **Mentalization, Emotion Recognition and Executive Functions** 22
  - **Summary** 23
- **Overall Summary** 24

Conclusions and Future Research Directions 25

References 27

Contents

Abstract 4

Introduction 5

- **Acquired and Traumatic Brain Injury** 6
- **Post-Traumatic Stress Disorder and Brain Injury** 6
- **Etiological Mechanisms of PTSD Following TBI** 8
- **Neuropsychological Function and the Maintenance of PTSD** 10
- **Social Cognition and Brain Injury** 11
- **Social Cognition, Brain Injury and PTSD** 12
- **Summary and Research Hypotheses** 13

Method 16

- **Participants** 16
  - **Sample** 16
  - **Inclusion Criteria** 17
- **Design** 17
- **Measures** 18
- **Social Cognition** 18
  - **Mentalization** 18
  - **Emotion Recognition** 19
  - **Social Judgement Making** 20
  - **Emotion-based Decision-making** 21
- **Neuropsychological tests** 21
  - **Executive Function** 21
  - **Attention** 22
  - **Working and Delayed Memory** 23

Psychological Outcome Questionnaires 24

PTSD Symptoms 24

Depression and Anxiety 25

Anger 25

Procedures and Ethical Considerations 25

Settings and Service User Involvement 27

Data Analysis 27

Power Calculation 27

Planned Analysis 28

Results 28

Examination of Data 28

Analysis of Demographic Variables 29

Hypothesis One -Two 31

Hypothesis Three 32

Hypothesis Four 35

Hypothesis Five 37

Discussion 38

Neuropsychological Constructs and Psychological Outcomes 39

Social Cognition and Psychological Outcomes 39

Negative Representations and Psychological Outcomes 42

Methodological Considerations 42

Clinical Implications 44

Conclusions 44

References 46

Section C

Contents

Question 1: Research abilities and Skills **3**

Question 2: What could have been done differently and why **6**

Question 3: Clinical implications **7**

Question 4: Future research directions **8**

References **10**

List of figures and tables

Sections B: **Page**

Table 1: *Frequency of injury sustained by survivors.* 15

Table 2: *Bonferroni comparisons for significant ANOVA's for social cognition measures.* 29

Table 3: *Significant correlations identified between: Social cognition; neuropsychological measures, and psychological outcomes.* 31

Table 4: *Regression analysis for visual selective attention and Mentalization predicting depressive symptoms.* 32

Table 5: *Regression analysis for Mentalization and delayed memory recall predicting PTSD symptoms.* 33

Figure 1: *Correlations for Mentalization and visual selective attention with depression symptoms.* 34

Figure 2: *Correlations for Mentalization and delayed memory recall, with PTSD symptom.* *35*

Tables 6: *Correlations between negative second-order Mentalizations, and psychological outcomes.* *36*

Section D

Contents

Appendix A: Literature Search **3**

Appendix B: Recognition of Faux Pas Test **4**

Appendix C: Additional criterion developed for Faux Pas Test responses **29**

Appendix D: Reading the Mind in the Eye Test **30**

Appendix E: The Social Situations Task **77**

Appendix F: Impact of Events Scale- Revised **81**

Appendix G: Hospital Anxiety and Depression Scale **83**

Appendix H: State-Trait Anger Expression Inventory-2 **84**

Appendix I: NHS Research Ethics Committee Letter **85**

Appendix J: Research and Development Department letter(s) **89**

Appendix K: Participant information sheet(s) **91**

Appendix L: informed consent sheet **100**

Appendix M: Examination of Parametric Assumptions **102**

Appendix N: Summary Table Data **105**

Appendix O: Regression Table for Anxiety to Age **106**

Appendix P: Regression Table for Anger to Age **107**

Appendix Q: Submission guidelines for *Neuropsychoanalysis* **108**

DAVID M. S. ELEY BSc Hons MSc

Major Research Project

SECTION A

Literature Review

Mentalization, Emotional Recognition and Executive Function Difficulties Associated with Traumatic Brain Injury.

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Contents

Abstract 3

Introduction 4

- **Traumatic Brain Injury** 4
- **Psychosocial Difficulties** 5
- **Executive Functioning** 6
- **Social Cognition** 8

Critical Review 10

- **Recognition of Emotion in Traumatic Brain Injury** 10
  - **Recognition of Facial Affect** 11
  - **Impact of Presentation Medium** 13
  - **Rehabilitation of Emotional Recognition Difficulties** 17
  - **Summary** 19
- **Mentalization** 19
  - **Mentalization and Traumatic Brain Injury** 20
  - **Mentalization, Emotion Recognition and Executive Functions** 22
  - **Summary** 23
- **Overall Summary** 24

Conclusions and Future Research Directions 25

References 27

Abstract

Historically, research into psychosocial difficulties related to Traumatic Brain Injury (TBI) has focused upon neuropsychological constructs, such as executive function, and has not always been consistent in finding associations. This current review focuses upon evidence relating to aspects of social cognition, specifically Mentalization and emotion recognition, and the potential role impairments might play in psychosocial difficulties. Context is provided by giving an overview of TBI and associated psychosocial difficulties, as well as an introduction to executive function, Mentalization and emotion recognition. Research evidence that has focussed on emotion recognition, Mentalization and executive function in TBI survivors is reviewed. Particular consideration is given to the prevalence of deficits, the pattern of difficulties across modalities, and discrepancies in the types of emotions affected. Overall, the role of emotion recognition and Mentalization in psychosocial difficulties has not been established in the literature reviewed. In addition, the relationship between impairments in Mentalization and executive function is not clear. The review draws conclusions regarding suggestions for potential research directions, and theoretical and clinical implications this may have.

Introduction

Those investigating brain injuries have long been interested in the relationship between impairments in neuropsychological constructs, such as Executive Functioning (EF), and psychosocial difficulties. Recent research has begun to focus upon impairments in social cognition in order to better understand its role in psychosocial difficulties after brain injury. Two key areas of social cognition are Emotion Recognition (ER) and Mentalization*. The primary focus of this review will be to examine the literature relating to these aspects of social cognition in survivors of Traumatic Brain Injury (TBI).

To begin, context is provided by giving an overview of TBI and associated psychosocial difficulties, as well as an introduction to EF, Mentalization and ER, and why these are thought to be implicated in these difficulties. This is followed by a review of literature relating to ER in TBI survivors, followed by that relating to Mentalization. Finally those studies which have examined ER, Mentalization, and EF together are discussed. Suggestions for future research directions are given.

Traumatic Brain Injury

Estimates for TBI in developed countries, such as the United Kingdom (UK), are between 225 to 335 per 100,000 people (McMillan & Greenwood 1991; World Health Organisation [WHO], 2006). "TBI generally refers to injury involving the brain

*The terms Mentalization and Theory Of Mind are used interchangeably in the literature, seemingly to be used to describe the same 'thing'. The term Mentalization is preferred during this review as it has a well-developed conceptual basis (Fonagy, Bateman & Luyten, 2012).

from some type of impact and/or acceleration/deceleration of the brain" (Lezak, Howieson, Bigler & Tranel, 2012, p.180); is typically non-progressive, and the three main causes being road traffic accidents, falls and assaults (WHO, 2006). Although the term TBI can include other common types of Acquired Brain Injury (ABI), such as stroke or anoxia, only papers relating specifically to TBI are discussed.

Psychosocial Difficulties

For the survivors of TBI and their partners, there is a sequelae of negative psychosocial outcomes, including: emotional difficulties (Douglas & Spellacy, 2000; Williams & Evans, 2003; McMillan, Williams & Bryant, 2003); marital and relationship breakdown (Wood & Yurdakul, 1997); poor family functioning (Schönberger & Ponsford, 2010); adjustment difficulties in child relatives (Daisley & Webster, 2008); sexual relationship difficulties (Ponsford, 2003); impaired empathy (Wood & Williams, 2008); interpersonal tensions and unemployment in the workplace (Kersel, Marsh, Havill, & Sleigh, 2001; Ownsworth & McKenna, 2004) and increasing social isolation (Morton & Wehman, 1995; Elsass & Kinsella, 1987; Tate et al., 1989).

In addition, core difficulties in socially skilled behaviour are described as a common and disabling consequence of TBI (McDonald, 2003; McDonald, Flanagan, & Rollins, 2002). This behaviour is characterised by self-focused conversation, failing to attend to conversational partners, difficulties in topic shifting and slowness of comprehension (McDonald et al., 2006; McDonald et al., 2002) and it is likely to be related to psychosocial outcomes.

Executive Functioning

Links between psychosocial outcomes and traditional neuropsychological constructs have been the focus of much research, in particularly EF. This is partially due to frontal lobe damage being associated with difficulties of EF, which is often a result of TBI (Lezak et al., 2012). In addition, compromised capacity in this area is linked with poor socially competent behaviour, social dependency, and reduced psychosocial outcomes (Lezak et al., 2012). In addition, difficulties in EF are considered to have a greater significant impact on adjustment and recovery than other types of neuropsychological difficulties (Crawford & Henry, 2005).

Associations between EF and psychosocial difficulties have been demonstrated. The Behavioural Assessment of Dysexecutive Syndrome [BADS] (Wilson et al., 1996) demonstrated moderate to large correlations between its subtests scores, and the ratings made by relatives of 'neurological' patients using the Dysexecutive Questionnaire (DEX) (Crawford & Henry, 2005). In a similar group of patients and relatives, comparable results were found for other commonly used (in UK) tests of EF, including Verbal Fluency and the Wisconsin Card Sorting Test [WCST], with moderate correlations being found with the ratings made using the DEX (Burgess et al., 1998). However, the relationship between measures of EF and psychosocial difficulties has not been consistently found in other types of brain injuries, especially TBI.

For survivors of TBI, the associations appear less clear, and have not always predicted outcomes (Milders, Ietwaart, Crawford & Currie, 2008). For example, following TBI, associations have been found between measures of EF and psychosocial outcomes using the Trail Making Test (Nybo, Sanio & Müller, 2004), Fluency tests (Tate, 1999; Ownsworth & Flemming, 2005) and the WCST (Vilkki et al., 1994). However, at other times the WCST (Tate, 1999; Mathias & Coats, 1999) and Fluency tests (Vilkki et al., 1994 ; Milders, Fuchs & Crawford, 2003; Milders et al., 2008) showed no association, as did the *Brixton test* (Wood & Liossi, 2006) and the *Key Search* test (Wood & Liossi, 2006; Ownsworth & Flemming, 2005). This highlights the complexity in measuring EF (Crawford & Henry, 2005), especially, "those aspects relevant to psychosocial outcomes" (Milders et al., 2008, p.324) and leaves the links between altered EF (as a result of TBI), the underlying social dysfunction and psychosocial outcomes uncertain.

This uncertainty is further highlighted by case studies of TBI survivors whom have demonstrated 'intact' EF, however, seem unable to make sound decisions in their social worlds (Damasio, 1994). In these cases it is thought that aspects of social cognition, such as emotion-based decision-making, are altered as a result of brain injury and are responsible for reduced psychosocial outcomes. However, social cognition has many different aspects, which may contribute a role in increased psychosocial difficulties for TBI survivors generally, including those with EF difficulties.

Social Cognition

Social cognition can be defined broadly as, “the ability to construct representations of the relation between oneself and others and to use those representations flexibly to guide social behaviour” (Adolphs, 2001, p.231). Mentalization is a part of social cognition and is described as, “the imaginative mental activity that enables us to perceive and interpret human behaviour in terms of intentional mental states [e.g. needs, desires, feelings, beliefs, goals, purpose, and reasons]” (Fonagy, et al., 2012 p.4). Although treated separately, ER can be conceived as an aspect of Mentalization which is relying on external physical/visible features or actions of others. This contrasts to Mentalization per se, which is focused on internal or interior mental processes, such as thoughts, feelings and experiences (Fonagy et al., 2012). For the purposes of this review I will continue to refer to them separately.

The interest in social cognition from those in clinical practice and social cognitive neuroscience has grown (Fonagy et al., 2012), and has led to a useful conceptualisation of Mentalization abilities, with the distinctive neural systems underpinning these being identified through neuroimaging studies (Uddin et al., 2007; Satpute & Lieberman, 2006). Specifically, frontotemporoparietal and medialfrontoparietal networks (Satpute & Lieberman 2006; Lieberman, 2007) are implicated as underlying mentalisation abilities, which includes both phylogenetically ‘older’ (amygdala, ventromedial prefrontal cortex [PFC], and lateral temporal cortex) and ‘newer’ (lateral/medial PFC, lateral/medial parietal cortex and medial temporal lobe) parts of the brain.

Difficulties in social competence in TBI survivors is likely to be susceptible to social cognition deficits, as noted previously with EF, the frontal/prefrontal lobes, particularly orbital and ventromedial regions, as well as the limbic system (amygdala and temporal lobes) are areas of the brain which can be commonly damaged as a result of TBI (McDonald, 2003; Radice-Neumann et al., 2007; Lezak et al., 2012). In addition, damage of the white matter tracts around these areas as a result of Traumatic Axonal Injury (TAI) is also a feature of TBI (Lezak et al., 2012), and leads to the 'severing' of connections between these parts of the brain (Adolphs et al., 2000; Green, 2004). Furthermore, the growing recognition of social cognition difficulties for TBI survivors has been acknowledged within the proposed revisions to criteria for TBI in the DSM-V, something which is not present in the current DSM-IV (American Psychological Association [APA], 2012; 2000).

The relationship between EF and Mentalization remains unclear. Some neuroanatomical evidence suggests that Mentalization could be distinct and separate from general EF (Apperly et al., 007; Geraci, Surian, Ferraro & Cantagallo, 2010; Rowe, Bullock, Polkey, & Morris, 2001; Zald & Andreotti, 2010). However, it has been argued that Mentalization difficulties can be secondary to primary executive dysfunction (Channon & Crawford, 2000; Snowden et al., 2003; Henry et al., 2006). This implies a higher susceptibility for TBI survivors to social cognition difficulties, with there being essentially being two 'routes' for this to manifest (Channon & Crawford, 2000). Although it is also acknowledged that due to the close proximity of the neuroanatomical structures associated with both EF and of Mentalization, independent damage to both sets of structures could be a result of

TBI (Henry et al., 2006). Overall this area has been described as controversial with more research needed (Bibby & McDonald, 2005). The roles of impairments in these areas are likely to be complex and multifaceted. A review of literature pertaining to these areas would be useful in establishing an initial understanding and help guide future investigations.

Critical Review

This review will examine the literature concerning ER, Mentalization and EF in TBI survivors. Details of the systematic literature searches used can be found in Appendix A. Studies relating to ER will be presented, followed by those relating to Mentalization. Finally those papers which have examined EF, together with ER and Mentalization are discussed.

Recognition of Emotion in Traumatic Brain Injury

A number of studies have sought to demonstrate emotional recognition difficulties, for both verbal and nonverbal cues, for TBI survivors (Radice-Neumann et al., 2007; Zupan, Neumann, Babbage, & Willer, 2009). Literature has been organised into three sections: Recognition of Facial Affect; Impact of Presentation Medium and Rehabilitation of ER Difficulties.

Recognition of Facial Affect

Babbage et al., (2011), conducted a meta-analysis which combined the results of 13 studies which had examined the emotional recognition difficulties, using static stimuli, in TBI survivors. The studies collectively represented 296 TBI adults compared to 296 Matched Healthy Controls (MHC). The TBI survivors, on average, performed 1.1 standard deviations below the healthy controls. From this it was calculated that 13% to 39% of brain injury patients will have difficulties in facial affect recognition. The authors do caution that these results are restricted to facial affect recognition and cannot be assumed to transfer to other modalities (such as vocal or other forms of nonverbal affect). It is also restricted to static images, such as photographs, and cannot be generalised to dynamic stimuli, such as videos (Babbage et al., 2011). It is also worth noting that seven of the 13 studies included in the meta-analysis used photographs taken from the same series (Ekman & Friesen, 1976; 1978), which have been criticised for being black-and-white and appearing visually dated. Thus they may represent a higher-level of abstraction, and therefore of increased difficulty for people with TBI, than might be found using contemporary colour photographs (McDonald & Saunders, 2005). Despite these criticisms, this appears to be strong supporting evidence for the prevalence of difficulties in facial affect recognition in TBI survivors.

These difficulties appear to be more pronounced for some emotions than for others. Several studies have shown that TBI survivors appear to be significantly worse in general at recognising negative affect facial expressions (e.g. anger, disgust, sadness, and fear) as compared to positive emotions (e.g. happiness, joy and

surprise) which remain relatively preserved (Green, 2004; Hopkins, Dywan & Segalowitz, 2002; Jackson & Moffat, 1987; McDonald et al., 2003; Spell & Frank, 2000; Ietswaart et al., 2008; McDonald, Flanagan, Rollins & Kinch., 2003; McDonald et al., 2011; Callahan et al., 2011). However, difficulties for specific negative emotions have not been consistently found. So although difficulties in recognising 'fear' and 'disgust' have been found across some studies (Croker & McDonald 2005; McDonald et al., 2003; Woods & Williams, 2010; Callahan et al., 2011), difficulties with 'anger' and 'anxiety' have been reported less (Wood & Williams, 2010).

The primary hypothesis for this pattern of difficulties in ER for TBI survivors is that either TAI, or damage to the prefrontal cortex, disrupts the network involved in processing negative emotions (Adolphs et al., 2000, Hornak et al, 1996). However, others have suggested that these differences could represent task difficulty between identifying positive and negative emotions. This is due to the pattern of relative difficulty found in a control group being similar to that in a group of TBI survivors (Ietswaart, et al., 2008). Methodological issues to be considered include the likely presence of ceiling and floor effects, as the number of different emotions to be identified is relatively small, as well as there being a broader range of negative emotions to distinguish (i.e. fear, anger, disgust, sadness) as compared to positive ones (i.e. happy and surprise), thus reducing discrimination and increasing task difficulty (Ietswaart et al., 2008).

An often reported weakness of neuropsychological research is the small sample sizes for individual studies, which can limit the detection of effects, as well as reduce the generalisability to the TBI population. This is particularly relevant for research

into TBI due to the heterogeneity of the clinical population, in both terms of types and causes of trauma (McDonald, Bornhofen, & Hunt, 2009; McDonald & Saunders, 2005). The combining of results into a meta-analysis helps to address these criticisms, and provides robust estimate of facial affect difficulties for TBI survivors. However, the use of photographs questions the ecological validity of the findings, as a participant would be a more 'active' observer in everyday interactions, as well as the presence of facial movement. These criticisms become more salient when simulation processes, such as 'mimicry', are starting to be investigated (McDonald et al., 2011). Differential impairment for recognition of negative emotions, as compared to positive emotions, is also supported, although the underlying mechanisms remain unclear. The reliance on photographs limits the generalisability of these findings to other modalities or mediums.

Impact of Presentation Medium

The description of the literature thus far has focused on emotional recognition relating to static images, such as photographs. These images differ dramatically from real-life emotional displays, as they provide an indefinite exposure to the fixed expression, as well as, depriving the viewer of important information regarding facial movement, which may assist in ER (McDonald, 2005). Furthermore, these findings cannot be generalised to affect recognition from verbal cues, which has begun to receive more attention in research, and has led to the development of theories of bimodal processing of emotion (Zupan et al., 2009). The importance of research in these two areas is underlined by neuroanatomical studies suggesting moving displays of emotion are processed via the parietal lobes (typically undamaged in

TBI), whereas static image processing systems are mediated via the temporal lobes, which are more typically damaged in TBI (Adolphs, Tranel & Damasio, 2003; McDonald, 2005). In addition, there is the suggestion that the two systems (verbal and nonverbal) depend upon distinct, if overlapping systems (Adolphs, Damasio & Tranel 2002).

Two studies to date have examined ER using dynamic video displays, comparing TBI survivors to healthy control participants. McDonald and Saunders (2005) assessed the ability of 34 adults with severe chronic TBI to recognise six basic emotions (happiness, surprise, anger, fear, sadness and disgust), under four different conditions. (1) When provided with videos of expressions of emotion including facial expression, body movement and voice; (2) when provided with static images; (3) when provided with videos, but without audio, and (4) when provided with audio track alone. The TBI survivors were found to be significantly impaired (relative to healthy controls) on video and audio only conditions. In addition, eight of the TBI group were considered 'abnormally' impaired for the static images condition, as compared to just one member, for the videos without audio condition. Overall, it was concluded that judgement of dynamic emotional expression, in the absence of auditory information appears to be relatively normal for the vast majority of TBI participants. A more recent study (Williams & Wood, 2010) partially replicated these results when comparing the performance of 64 TBI survivors, on recognising emotions from video and still photographs, to healthy controls. Whilst impaired in overall accuracy of affect recognition for both types of displays, the TBI group were more accurate in recognising emotion displayed in audiovisual media compared to still media. Furthermore, as with research using static images, negative emotional

expressions were significantly harder to recognise than positive ones for TBI survivors using the videos. Lastly, measures of information processing speed were not associated with performance on either of the emotional recognition tasks. This not being necessarily intuitive, as dynamic facial expressions potentially place additional demands on information processing which is typically slowed in people with TBI (McDonald & Saunders, 2005).

Difficulties for vocal affect recognition in TBI survivors has been identified in many studies (Ietswaart et al 2008; McDonald & Saunders, 2005; Milders et al., 2003; Milders et al., 2008; Spell & Frank, 2000). Dimoska and colleagues (2010) investigated whether these difficulties were related to an inability to concurrently process semantic information (the *what*) and emotional prosody (the *how*) of spoken speech. This was done using three conditions which varied the amount of semantic information available ([1] Well formed English sentences; [2] Nonsense language and [3] Low-pass filter speech producing muffled voices). They found that for a group of 18 TBI survivors, reducing semantic processing demands did not improve perception of emotional prosody, and that they were significantly less accurate than a group of demographically matched control participants. This suggests that difficulties arise due to an impairment processing of emotional prosodic itself rather than semantic processing demands, leading to an overreliance on the *what,* rather than the *how* of conversational remarks.

The impact of emotional valency appears to be less clear, with less consistency across studies. For instance, Dimoska et al., (2010) reports TBI individuals were selectively impaired when labelling some emotions (happy and afraid), but not others

(pleasantly surprised and angry). 'Pleasantly surprised' was difficult for both groups, while 'anger' was easier for the TBI group. Similarly, Spell and Frank (2000) also found TBI adults were impaired when judging 'fear', and accurate when judging an 'angry' voice, but in contrast found 'happy' to be well recognised. Other studies reported no differences between the accuracy for different emotions (Ietswaart et al., 2008; McDonald & Saunders, 2005). In comparison to the literature using static images, there are fewer studies, using small sample sizes, and so there has been less replication of specific effects being highlighted here.

As demonstrated by McDonald & Saunders (2005), those with TBI appear to be particularly poor using audio information to gauge affect. In fact the use of video displays in the absence of audio allowed TBI survivors to perform equivalently to the control participants. This is consistent with research which suggests TBI survivors can demonstrate significantly slower processing speed for auditory stimuli as compared to visual (Zupan et al., 2009), implying that visual information may receive preference due to being processed more swiftly. The results of these studies also suggests that executive or attentional deficiencies relating to semantic processing of auditory information are not implicated, and that it appears to be an impairment in recognising emotional prosody in itself. There appears to be some replication of difficulties in judging negative affect, as found in static images, for videos, but less so for audio recognition tasks. Limited amounts of literature and small samples sizes reduce the reliable generalisation of the results to the TBI population as a whole with further research required.

Rehabilitation of Emotional Recognition Difficulties

A sign of the progress made in emotional recognition research for those with TBI, is that three studies examining the efficacy of rehabilitation of these difficulties have been published. Bornhoften & McDonald (2007), aimed to tackle these difficulties using a programme based around two core techniques; Errorless Learning (EL) and Self Instruction Training (SIT). These programmes were conducted over 25 hours across eight weeks, using groups of two to three TBI outpatient volunteers (n=12), who were randomly allocated to either a treatment group or a waiting list/delayed treatment group. The treatment group showed significant improvement in accuracy when judging video displays of basic emotions, and improved ability to draw social inferences relating to sarcasm, sincerity and deception, which were maintained at one month follow-up. These results were partially replicated by Bornhoften & McDonald (2008), using 18 TBI outpatient volunteers, who were randomly allocated to treatment programmes (which had the same content as the previous study but each only used either EL or SIT) or a waiting list control group. Similar improvements were found for the ability of participants to draw social inferences, however, improvements for judging basic emotions was found for static images, rather than videos. A longer follow-up period showed that these improvements were not maintained at 6-months. For both studies no improvement was found on psychosocial outcome measures (Bornhoften & McDonald, 2008).

The final study, (Radice-Neuman, Zupan, Tomita & Willer, 2009) compared two different rehabilitation interventions; Facial Affect Recognition (FAR), and Stories of Emotional Inference (SEI). FAR is a computer based treatment which aimed to

improve use of emotionally relevant facial features and self-emotional processing. Whereas SEI was a story based intervention, which aimed to improve the use of contextual cues of emotional features and relate the stories to events in the survivors own lives. These were conducted in individual one hour sessions, over three days for two to three weeks. In total 19 TBI outpatient volunteers took part, being randomly assigned to each programme. Those who received the FAR intervention significantly improved in their ability to recognise emotion from static images of faces and in their ability to provide more emotionally descriptive inferences about how they and others would feel in hypothetical situations. In comparison, those undertaking the SEI intervention only showed improvement in being able to provide more emotional inferences about how they would feel in a given context. Neither group showed significant improvement in recognising emotion from voices or video displays. Unlike the previous studies (Bornhoften & McDonald, 2007; 2008), those participants receiving the FAR intervention did show a small but significant effect improvement for psychosocial outcomes, specifically ratings by relatives of socio-emotional behaviour. However, the short two week follow-up period gives little indication as to whether these improvements are maintained. In addition, it is questionable that the a priori power calculations were based upon unpublished data from a different patient population (those with Autism Spectrum Disorders), rather than published data using TBI survivors (i.e. Bornhoften & McDonald, 2007; 2008)

Although promising, the sample sizes are small, limiting both statistical power and the generalisability of the results. The short follow-up period leaves questions over the maintenance of the gains. Longer follow-up periods would also allow the readministration of cognitive measures, and enable the determination as to whether

gains might be attributable to more general improvements in cognitive function, rather than social cognition per se.

Summary

Overall there is supporting evidence for the prevalence of emotional recognition difficulties in TBI survivors. Deferential impairment for recognition of negative emotions has been seen in studies using both static and video images, although this is less apparent for verbal affect. Executive or attentional processing abilities appear to play less of a role than would be intuitively thought regarding these difficulties for TBI survivors. The core of the literature is based around the use of static images, and so provides a good estimate of the difficulties using these. However, fewer studies have examined affect recognition from videos or audio only and so small sample sizes limit the statistical power and generalisability of the research. Mixed results have been found in developing interventions for the rehabilitation of ER difficulties in TBI survivors, with limited success regarding psychosocial outcomes.

Mentalization

Researchers have sort to demonstrate Mentalization difficulties for TBI survivors, often administering measures of EF, and other neuropsychological constructs in order to identify relationships between these different psychological functions. Tasks used to investigate Mentalization typically focus on first-order representations (what is another person thinking or feeling) and second-order representations (what does one person think, somebody else thinks or feels), as well as using Non-Mentalizing

Inference (NMI) tasks, to distinguish general inference ability from Mentalization. Literature found through the systematic searches has been organised into two sections: Mentalization and TBI and Mentalization, ER and EF.

Mentalization and Traumatic Brain Injury

Bibby & McDonald, (2005) compared performance of 15 TBI survivors on both Mentalization tasks and NMI tasks, to MHC participants. The Mentalization tasks used a series of false-belief stories to assess first- and second-order representations, as well as visual cartoon drawings. It was found that TBI patients were poorer on both NMI and Mentalization tasks. Further analysis suggested that TBI survivors had a weakness for general inference making, which was associated with their performance on both nonverbal and second-order verbal Mentalization tasks. However, this was not the case for the first-order verbal Mentalization task, the performance on which could not be accounted for via working memory ability or language demands of the task, indicating a specific Mentalization difficulty. Similar results were found by Martin & McDonald (2005), whom in addition to the Mentalization tasks described above, also examined the comprehension of non-literal ironic jokes. TBI survivors have been characterised by a literal comprehension of language in social interactions (McDonald & Flanagan, 2004, McDonald et al., 2003), with those who have been able to understand non-literal humour displaying more socially appropriate behaviour (Braun, Lissier, Baribeau & Ethier, 1989). Sixteen TBI survivors were significantly impaired on the tasks measuring Mentalization, irony comprehension and EF, as compared to matched controls. However, neither Mentalization nor EF measures were associated with poor irony

comprehension, only general inferential reasoning. So although difficulties in Mentalization and EF have been found, they were not associated with each other, supporting the idea of a distinction between the two.

Havet-Thomassin and colleagues (2006) used the Reading the Mind in the Eyes [RME] (Baron-Cohen et al., 2001) and the Character Intention Task [CIT] (Sarfati et al., 1997), as well as a number of EF measures to compare 17 TBI survivors to 17 MHC. The TBI participants performance was found to be impaired on most EF tests and both Mentalization tasks, although no relationship was found between the measures. These results were replicated by Muller et al., (2010), comparing 15 TBI survivors to 15 MHC. In addition to the CIT and RME, two other Mentalization tasks were used: the Recognition of Faux Pas Test [Faux Pas Test] (Stone, Baron-Cohen, & Knight, 1998), and first-order and second-order false belief tasks, as well as an increased number of measures of EF. The Faux Pas Test required participants to identify whether a faux pas (i.e. somebody saying something they should not have without realising) had taken place within a series of stories. While the first- and second-order false beliefs were also examined using a series of stories, in which participants had to accurately identify the beliefs of the characters. The TBI subjects performed worse than controls and all Mentalization tasks, except for first-order false beliefs, with no association being found with the EF measures. Although these results are suggested to indicate a distinction between Mentalization and EF difficulties in TBI survivors, it was acknowledged by the authors (Havet-Thomassin et al., 2006) that the lack of a control task (in the form of NMI type task) is a weakness, with further replication required to confirm the conclusions.

One study contradicts the findings of the previous four presented, having found an association between measures of Mentalization and EF. Milders and colleagues (2006) compared 36 TBI survivors with 34 orthopaedic controls using two measures of Mentalization (Faux Pas Test and the Cartoon test [Happe et al., 1999]) and two EF measures of 'fluency'. TBI participants showed significant impairment relative to controls post injury and at one year follow-up, as well as associations between measures of Mentalization and EF. This represents a strong challenge to previous research findings, due to the much larger sample size. Accumulatively, these studies lend support to the prevalence of Mentalization and EF difficulties in survivors of TBI. However, the relationship between the two, as well as that of general inferential ability is less certain.

Mentalization, Emotional Recognition and Executive Functions

Four studies to date have examined the areas of Mentalization, ER, and EF together in TBI survivors. Henry, and colleagues (2006) compared 16 TBI participants to 17 MHC using: RME (Mentalization), photographs (emotional recognition) and verbal fluency (EF); with all three measures being found to be significantly impaired for those with TBI. ER and Mentalization were found to be correlated in the control participants, but not for the TBI survivors. In contrast EF and Mentalization were associated for the TBI group but not the controls. It was concluded that some deficits in some aspects of EF may partially underlie difficulties in Mentalization. However, only one measure for each of the areas being investigated was used, which has been advised against (Milders et al., 2006) especially when more recent research by Spikman et al., (2012) has found no associations between similar measures using a

larger sample of TBI survivors (n=28), and a greater range of measures (two for Mentalization and three for EF).

Milders et al., (2003) compared a group of 17 TBI survivors to an equal number of matched orthopaedic control participants on measures of ER (both for photographs and voices), Mentalization (Faux Pas Test and RME) and cognitive flexibility (two EF measures of 'fluency'). In addition, ratings were taken by relatives of the participant's behaviour difficulties. The TBI participants showed significant impairment relative to the control group on recognising emotion, detecting faux pas and nonverbal fluency. However, none of the impairments was significantly associated with relative's ratings of behaviour following TBI, although Mentalization (using the Faux Pas test) correlated relatively high (r = -.61). These results were replicated by (Milders et al., 2008) using a similar paradigm (33 TBI survivors compared to 34 orthopaedic matched controls) but with slightly different measures (ER [using photographs and voices], Mentalization [Faux Pas Test and false belief task] and EF [Brixton test and verbal fluency]). Emotional Recognition, Mentalization and cognitive flexibility were all found to be impaired in the TBI survivors, shortly after injury (mean=2.1 months) and 1 year later. Behavioural problems increased (as rated by a relative) over the year but were not significantly associated with any of the measures of ER, Mentalization or EF.

Summary

Research examining ER, Mentalization and EF, together, in TBI survivors, has replicated the findings found in previously presented research, of a prevalence of

difficulties relating to these areas. The relationship between these abilities, as well as psychosocial outcomes has not been established. Some have found associations between EF and Mentalization (Henry et al., 2006; Milders et al., 2006), whilst others have not (Havet-Thomassin et al., 2006; Muller et al., 2010; Spikman et al., 2012). Direct links between Mentalization (as well as EF and emotional recognition) and psychosocial outcomes have not been found (Milders et al., 2003; Milders et al., 2008), leading some to raise doubts regarding the role of social cognition in psychosocial outcomes for TBI survivors (Milders et al., 2008). However, this is perhaps not surprising when considering the difficulties outlined at the beginning of this review in establishing links using EF measures. A far more developed neuropsychological construct as compared to Mentalization, with a far wider range of measures. This is especially relevant when considering the small sample sizes and heterogenic nature of the TBI, which may account for the difficulties found in drawing specific relationships between the areas under investigation.

Overall Summary

TBI is a significant public health problem, which is associated with a vast amount of negative psychosocial outcomes, particularly those related to social interactions. There have been difficulties in drawing consistent direct links between EF and these outcomes. This review has examined two areas of social cognition, ER and Mentalization within TBI Survivors. There is strong evidence to suggest a prevalence of emotional recognition difficulties in TBI survivors, for both visual and vocal stimuli. Impairment for recognition of negative emotions has been demonstrated for visual displays of affect, but has been found less consistently for verbal affect. These

difficulties appear unrelated to information processing difficulties as a result of TBI. A prevalence of Mentalization and EF difficulties has been shown in survivors of TBI. However, a relationship between the two has not been clearly demonstrated. In addition, ER, mentalisation or EF, has not been directly associated with psychosocial measures, which perhaps explains the limited success demonstrated by rehabilitation programmes for ER. Methodological issues in assessing Mentalization and EF, within the context of TBI, demonstrated a challenge to establishing direct links to psychosocial outcomes, as did the heterogenic natures of impairments found in TBI samples, and the population as a whole.

Conclusions and Future Research Directions

Overall, the role of social cognition, specifically ER and Mentalization, within psychosocial difficulties remains unclear. Research literature has demonstrated a prevalence of difficulties in these areas following TBI, but has failed to link these directly to ratings of psychosocial difficulties. This is despite there being a good argument based upon both neuroanatomical and theoretical considerations for this to be the case. The primary role of future research involving social cognition variables would be to directly establish relationships between these and psychosocial outcomes. The identification of such a relationship would enable greater understanding of the development of poor outcomes, relating to specific aspects of social cognition. This would ultimately help in the continued development of rehabilitation or therapy programmes by tailoring them to specific aspects, and so improving outcomes.

In those studies which included measures of EF in addition to those of Mentalization, no relationship between these and measures of psychosocial difficulties were found. This is supportive of the highlighted inconsistency in the role of executive dysfunction in psychosocial difficulties for those with TBI, with some previous studies finding associations, whilst others have not. Furthermore, the relationship between Mentalization and EF continues to remain unclear, as some studies showed a relationship between measures of these constructs, whilst others did not. The high prevalence of difficulties in these areas for those with TBI might be indicative of a susceptibility (due to the 'two' routes hypothesis) however, this is far from conclusive, and requires more research.

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DAVID M. S. ELEY BSc Hons MSc

Major Research Project

SECTION B

Journal Paper

Neuropsychological and Social Cognition Predictors of Post-Traumatic Stress Disorder Symptoms in Acquired Brain Injury: An Exploratory Study.

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For Submission to:

Neuropsychoanalysis

Contents

Abstract 4

Introduction 5

- **Acquired and Traumatic Brain Injury** 6
- **Post-Traumatic Stress Disorder and Brain Injury** 6
- **Etiological Mechanisms of PTSD Following TBI** 8
- **Neuropsychological Function and the Maintenance of PTSD** 10
- **Social Cognition and Brain Injury** 11
- **Social Cognition, Brain Injury and PTSD** 12
- **Summary and Research Hypotheses** 13

Method 16

- **Participants** 16
  - **Sample** 16
  - **Inclusion Criteria** 17
- **Design** 17
- **Measures** 18
- **Social Cognition** 18
  - **Mentalization** 18
  - **Emotion Recognition** 19
  - **Social Judgement Making** 20
  - **Emotion-based Decision-making** 21
- **Neuropsychological tests** 21
  - **Executive Function** 21
  - **Attention** 22
  - **Working and Delayed Memory** 23

Psychological Outcome Questionnaires 24

PTSD Symptoms 24

Depression and Anxiety 25

Anger 25

Procedures and Ethical Considerations 25

Settings and Service User Involvement 27

Data Analysis 27

Power Calculation 27

Planned Analysis 28

Results 28

Examination of Data 28

Analysis of Demographic Variables 29

Hypothesis One -Two 31

Hypothesis Three 32

Hypothesis Four 35

Hypothesis Five 37

Discussion 38

Neuropsychological Constructs and Psychological Outcomes 39

Social Cognition and Psychological Outcomes 39

Negative Representations and Psychological Outcomes 42

Methodological Considerations 42

Clinical Implications 44

Conclusions 44

References 46

Abstract

Objectives. Literature suggests that aspects of social cognition, as well as neuropsychological difficulties play a key role in the development and maintenance of PTSD symptoms in brain injury survivors. The present study aimed to explore the direct relationship between measures of neuropsychological function and social cognition, and psychological outcomes related to Post-Traumatic Stress Disorder [PTSD].

Design. A quantitative, cross-sectional, correlational design was employed, using correlational and multivariate regression methods of analysis.

Methods. Forty-nine adult brain injury survivors were administered a range of measures of neuropsychological function (memory, executive function and attention); social cognition (Mentalization, emotion recognition, social judgment making and emotion-based decision-making) and Psychological outcomes related to PTSD (depression, anxiety, anger and PTSD symptoms).

Results. Significant relationships were found between measures of Mentalization, attention and memory, and symptoms relating to depression and PTSD. Selective visual attention and Mentalization were found to account for 37% of the relevant variance for depressive symptoms, while Mentalization and delayed memory recall accounted for 24% of the relevant variance for PTSD symptoms. Different measures of Mentalization showed unexpected correlation directions, which had significant implications for the role Mentalization might play in maintaining PTSD symptoms.

Conclusions. These findings suggest an association between aspects of social cognition and neuropsychological functioning, and psychological outcomes related to PTSD. It is thought that impairments in these areas could play a role in maintaining these in ABI survivors.

Introduction

Brain injury survivors are at risk of a wide range of poor psychosocial outcomes including, but not limited to, emotional difficulties (Williams & Evans, 2003), relationship difficulties (Wood & Yurdakul, 1997; Ponsford, 2003) and interpersonal tensions and unemployment in the workplace (Ownsworth & McKenna, 2004). The role of neuropsychological factors, related to brain injury, has been extensively researched, in particularly for executive functioning. However, clear links between difficulties in executive functioning and psychosocial outcomes have not always been consistently found in research studies (Milders, Ietswaart, Crawford & Currie, 2008). The role of social cognition constructs, such as Mentalization* has yet to be determined, and although thought by many to play an important role (McDonald, 2003) significant relationships have yet to be established (Milders et al., 2008).

Neuropsychological and social cognition difficulties in brain injury survivors have been specifically argued to play a role in the development and maintenance of psychosocial difficulties related to Post-Traumatic Stress Disorder [PTSD] (Yeates, 2009; Verfaellie, Amick & Vasterling, 2012). The present study planned to explore the relationships between these constructs and PTSD related symptoms. What follows is an overview of brain injury and PTSD literature, followed by a description of the role social cognition is thought to play in these difficulties. Finally, hypotheses drawn from the literature are given.

*The terms Mentalization and Theory of Mind are used interchangeably in the literature, seemingly to be used to describe the same 'thing'. The term Mentalization is preferred during this review as it has a well-developed conceptual basis (Fonagy, Bateman & Luyten, 2012).

Acquired and Traumatic Brain Injury

Traumatic Brain Injury (TBI) is a significant public health problem, with estimates for developed countries, such as the United Kingdom (UK), being between 225 to 335 per 100,000 people (McMillan & Greenwood, 1991; World Health Organisation [WHO], 2006). "TBI generally refers to injury involving the brain from some type of impact and/or acceleration/deceleration of the brain" (Lezak, Howieson, Bigler & Tranel, 2012, p.180) which is typically non-progressive, and the three main causes being road traffic accidents, falls and assaults (WHO, 2006). However, the term TBI can include other common types of Acquired Brain Injury (ABI), such as stroke or hypoxia, and often fulfil admission criteria for many UK TBI services.

Post-traumatic Stress Disorder and Brain Injury

Early conceptions of the etiological mechanisms for the development of PTSD led for some to argue that it was incompatible with TBI (Bontke, Rattok, & Boake, 1996; Sbordone, 1992). Loss of Consciousness (LoC) and/or amnesia (often associated with TBI) for a traumatic event would prevent the formation of memory and therefore 're-experiencing' of trauma memories in the present could not happen. Although early research supported this position, finding incidence rates of PTSD in TBI samples close to 0% (Mayou, Bryant & Duthie, 1993; Sbordone & Liter, 1995). More recent research has challenged this position strongly, with studies pointing to different incidence rates for mild TBI (mTBI), as compared to moderate-severe types.

In mTBI samples, incidence rates for PTSD have been found between 11 to 24% (McMillan, 1996; Gil, Caspi, Ben-Ari,Koren & Klein, 2005; Harvey & Bryant 1998; 2008), with aspects of PTSD Symptomatology occurring for between 33 to 48% of sample members (Mayou, Black & Bryant, 2000; Bryant & Harvey, 1999; Hickling, Gillen, Blanchard, Buckley & Taylor, 1998). Furthermore, mTBI samples have been seen to have increased incidence rates of PTSD Symptoms, as compared to groups whom have experienced trauma through similar events but did not suffer TBI (Schneiderman, Braver & Kang, 2008; Hoge et al., 2008). For example, Bryant and colleagues (2010) followed up patients who had attended hospital, finding those who suffered mTBI were twice as likely to develop PTSD, as well as other anxiety related disorders (i.e. panic disorder, agoraphobia or social phobia) than patients without TBI. However, some research has found mTBI to be 'protective' against select re-experiencing symptoms found in PTSD (Bryant et al., 2009), highlighting the complicated interrelationship between brain injury and trauma experience.

Evidence for survivors with moderate-severe TBI is less clear, with limited controlled studies, and a reliance on single case reports (McMillan, Williams & Bryant, 2003). From uncontrolled group studies, incidence rates have been reported of between 19 to 33% (Bryant, Marosszeky, Crooks & Gurka, 2000; Hibbard, Uyssal, Kepler, Bogdany & Silver, 1998; Ohry, Rattock & Solomon, 1996), although a figure of 18% has been found in a representative post-acute community sample (Williams, Evans, Wilson, & Needham, 2002). However, the likelihood of PTSD has been found to decrease as the severity of TBI increases (Glaesser, Neuner, Lutgehetmann, Schmidt & Elbert, 2004).

The variability of incidence rates across studies highlights methodological criticisms of this literature. For instance, the use of self-report measures serves to over diagnose PTSD in severe TBI groups, with incidence rates of 44-59%, compared to only 3% when structured interviews were used (Sumpter & McMillan 2005; McMillan 2001). In addition, the severity of the brain injury is not always clearly defined within these studies (McMillan, Williams, & Bryant, 2003). Despite these criticisms, these recent findings amount to an increasing challenge to earlier conceptualisations of PTSD within TBI.

Recent studies examining other types of brain injury have begun to show increasing evidence of the presence of PTSD Symptoms in other non-progressive brain injury groups, such as stroke survivors (Sembi, Tarrier, O'Neill, Burns & Faragher, 1998) or hypoxia (Layton, Krikorian, Dori, Martin & Wardi, 2006). Early research indicating incidence rates for stroke survivors to be typically between 31 to 36% (Bruggiman et al., 2006; Meriman, Norman & Barton, 2007; Noble et al., 2011). These are likely to share some of the etiological mechanisms for the development and maintenance of PTSD as identified in TBI.

Etiological Mechanisms of PTSD Following TBI

Four etiological pathways for the development of PTSD symptoms following TBI have been constructed through the integration of cognitive neuropsychological and cognitive-behavioural frameworks (King 2008a; 2008b; Yeates, 2009; Verfaellie et al., 2012).

1. Less severe TBI does not always lead to retrograde or post-traumatic amnesia (Verfaellie et al., 2012), allowing full recall of the traumatic event.

2. Despite alterations to consciousness, a significant amount of survivors are left with partial recall (Creamer, O'Donnell & Pattison, 2005; Williams, Evans, Needham & Wilson, 2002) or with, "islands of memory" (King, 1997, p82) of the events before, after or during the incident rather than a complete absence (King, 1997; McMillan, 1996).

3. Affective and sensory perceptual experiences of the traumatic incident being processed at an implicit, unconscious level (Layton & Wardi-Zonna, 1995; Brewin, Dalgleish & Joseph, 1996). Although recent cognitive-behavioural models acknowledge this pathway (Ehlers & Clark, 2000; King 2001), it is also consistent with psychoanalytic perspectives, which place less primacy on the role of consciously accessible memories within a trauma etiology, with or without TBI (Yeates, 2009; Yovell, 2000; Brewin, et al. 1996; Layton & Krikorian, 2002).

4. The later reconstruction of memory from secondary sources, such as family, observers or media accounts, can be formed into a cohesive narrative of the event and integrated into first person recall, which leads to the development of PTSD symptoms (Bryant, 2001; Yeates, 2009).

Neuropsychological Function and the Maintenance of PTSD

Intellectual resources can be broadly thought to impact on coping and problem-solving for post-trauma adjustment (Verfaellie et al., 2012). However, there are two areas which are affected through TBI, independently of intellectual functioning, and are thought to influence the maintenance of PTSD.

1. For TBI, there can be significant difficulties in retrieving specific memories, with a tendency towards an 'over-general' recall of memory, which has been linked to depression (Bessel, Watkins & Williams, 2008). 'Over-generalised' memory for the trauma event is seen to play a key role in maintaining PTSD symptoms (Brewin, 2007; Ehlers and Clark, 2000). In addition, impaired verbal memory for TBI is well established. This is seen as important as although contextual representations are not inherently verbal, they do provide a basis for narrative memories, allowing the deliberate retrieval and manipulation into a person's knowledge base (Verfaellie et al, 2012).

2. Executive and attention problems have been linked with difficulties in relationships, social and emotional behaviour (Yeates, 2008; Tate, 1999; Vilkki et al., 1994) and influence subsequent return to work post-injury (Nybo, Sainio & Muller, 2004; Ownsworth & McKenna, 2004). Difficulties in these areas can limit access to sources of social support, which is seen as one of the most powerful post-trauma predictors of PTSD symptoms (Brewin, 2003).

Social Cognition and Brain Injury

Social cognition can be defined broadly as, “the ability to construct representations of the relation between oneself and others, and to use those representations flexibly to guide social behaviour” (Adolphs, 2001, p.231,). The role of social cognition in psychological difficulties for brain injury survivors has been the focus of recent research (Babbage et al., 2011; Martin-Rodriguez & Leon-Carrion, 2010).

For TBI survivors, core difficulties in socially skilled behaviour are described as a common and disabling consequence of TBI (McDonald, 2003), and are likely to be related to psychosocial outcomes. There is now empirical support for the prevalence of deficits in key social cognition areas of: emotional recognition (Babbage et al., 2011; McDonald & Saunders, 2005; Williams & Wood, 2010); Mentalization (Muller et al., 2010; Stone, Baron-Cohen & Knight, 1998); social judgement making (Blair & Cipolotti, 2000), and emotion-based decision-making (Adlam et al., 2009; Levine et al., 2005). However, there has been limited success in attempts to directly link these and psychosocial outcomes. For example, Levine et al., (2005) found a relationship between emotion-based decision-making and depression, whereas no significant relationship has been found between emotional recognition and Mentalization, and relatives ratings of behaviour difficulties for survivors (Milders, Fuchs, Crawford, 2003; Milders, Ietswaart, Crawford & Currie, 2008).

Comparable evidence for impairment in similar areas of social cognition has been found in other types of ABI, including: emotion recognition (Braun, Traue, Frisch, Deighton & Kessler, 2005); Mentalization (Happe, Brownell, & Winner, 1999;

Channon & Crawford, 2000); social judgement making (Harskamp, Rudge & Cipoletti, 2005) and emotion-based decision-making (Scheffer, Monterio & Almeida, 2011).

Social Cognition, Brain Injury and PTSD

To date there has been no empirical study which has examined the role of social cognition deficits within the maintenance of PTSD symptoms in TBI or other ABI survivors. Despite the lack of attention in this area, some themes have been articulated.

Yeates (2009) reviewed the PTSD literature relating to TBI, using a neuropsychoanalytic framework to explore the prevailing themes of 'hostility' and 'threat' within social and interpersonal spheres of TBI survivors. These themes have been commented upon in the previous PTSD literature (King 1997; Williams, Evans & Wilson 2003; Williams et al., 2002) but were not principally examined in relation to the development of PTSD. Yeates' examination revealed that for some survivors, their representations of others, and the social world, took on a 'persecutory' flavour, with others actions being experienced as 'attacking' as well as, "neglecting, uncaring and unsympathetic" (p207, Yeates, 2009). He also noted from the literature that survivor's fears were often socially orientated, such as the avoidance of crowds, of social roles/ relationships being altered or fears for family members being assaulted. Drawing on psychoanalytic theory of PTSD, Yeates suggested that TBI survivors with deficits in social cognition might be particularly susceptible to these malevolent relationship experiences through the undermining of their ability to use *Symbolisation*

(Segal, 1957), and a resultant reliance on *Projective Identification* processes in order to cope (Garland, 1998).

These themes are congruent with research findings found in non-brain injury samples. For example, those who put external blame for the incident on other people were more likely to develop PTSD symptoms (Kushner, Riggs, Foa & Miller, 1992), with the distress being more likely to be maintained a year following the incident (Delahanty et al,. 1997). In addition, Mentalization and emotion recognition difficulties have been demonstrated in traumatized adults (Fonagy, et al., 2003; Gapen, 2009) suggesting these difficulties, in some cases, could be related to the process of trauma rather than being unique to brain injury. The implication for TBI survivors is that they are more susceptible to social experiences (post-trauma) which help maintain PTSD symptoms, and due to neurological and social cognition deficits are less able to access the means to alleviate symptoms.

Summary and Research Hypotheses

Overall, it seems trauma experiences and neuropsychological vulnerabilities related to brain injury, in particularly for TBI, can result in PTSD symptoms. Social cognition impairments as a result of TBI appear to be associated with themes of malevolent relationship experiences, and could have a role in maintaining poor psychosocial outcomes, in particular PTSD symptoms. From the research presented, it could be argued that the combination of trauma experience, neuropsychological and social cognition difficulties in TBI survivors suggest a susceptibility to the maintenance of PTSD symptoms. In addition, evidence of a prevalence of PTSD symptoms and

impairments in social cognition in other types of ABI, might be suggestive of shared etiological mechanisms for these other types of brain injury.

This study aimed to explore the relationships between the aforementioned areas of neuropsychology and social cognition, and a broad range of psychological outcomes relating to PTSD symptomatology. This was done using a representative community sample of mixed etiology, including both TBI, and other forms of ABI. On the basis of existing literature and research, the following hypothesis were formulated in order to guide the study.

1. There are significant relationships between social cognition measures of emotional recognition, Mentalization, social judgement and emotion-based decision-making and psychological outcomes for PTSD.

2. There are significant relationships between neuropsychological measures of delayed memory, executive function and attention, and psychological outcomes for PTSD.

3. Social cognition and neuropsychological measures will have a direct effect in predicting psychological measures of PTSD.

4. Performance on social cognition and neuropsychological measures will demonstrate a negative correlation coefficient with psychological measures of PTSD.

5. The amount of ‘negative’ representations of mental states will demonstrate a positive correlation coefficient with psychological measures of PTSD.

Method

Participants

Sample

Participants were 49 adult brain injury survivors, who were recruited from community brain injury services across three different sites around the United Kingdom. They were aged between 30 and 68 years old (M = 38, SD = 8.9). Thirty-six (73%) were male; 13 (27%) female. Time since injury varied between 1.67 years to 31.33 years (M = 6.73, SD = 6.5). Specific information regarding severity of injury and length of post trauma amnesia was not available, nor was there specific information relating to cause of the injury (i.e. sustained through accident or by fault of someone else). However, the injuries sustain by the group were overall to be considered moderate to severe in terms of severity. Table 1 displays the type and frequency of brain injuries sustained.

Table 1

Frequency of type of injury sustained by survivors

Type of Injury	Frequency	Percent (%)
Traumatic Brain Injury	20	40.8
CVA* Haemorrhagic	12	24.5
CVA Ischaemic	9	18.4
Hypoxia	3	6.1
Infection	2	4.1
Other	3	6.1
Total	49	100

*CVA = Cardio-Vascular Accident

Inclusion criteria

To participate in the study, survivors had to be at least 18-months post-injury, mobile, be able to communicate (with or without assistance), and display few gross behavioural difficulties. In addition, they had to demonstrate capacity to consent to participate in the research. It was aimed for this sample to be heterogeneous in terms of severity and neuropathology, to help it be representative of typical outpatient service populations. Prior research has demonstrated psychological and emotional impairments in a mixed brain injury sample (Hornak, Rolls & Wade, 1996).

Design

A quantitative, cross-sectional, correlational design was employed in the current study. This was chosen due to previous use in similar areas of research (Henry et

al., 2006), and its ability to analyse measures of many factors using multivariate statistics.

Measures

Social Cognition Tests

Mentalization

Mentalization ability was measured using two tests, the first being the Recognition of Faux Pas Test [FPT] (Stone et al., 1998, Appendix B). A faux pas (FP) occurs when someone says something they should not have said, not knowing or realising that they should not have said it. To understand a FP has occurred, someone has to represent two mental states; that of the person making the FP (i.e. not knowing that they should not say it) and that of the person hearing it (who would feel insulted or hurt). The FPT consists of 20 stories (10 containing a FP; 10 Controls in which no FP takes place). Participants are asked four questions regarding each story, giving a maximum score out of 40. In addition, the total for question four on the FP, gives a specific score relating to second-order representations (maximum 10). Each story also has a control question to ascertain whether the participant has understood the story. This test has been shown to discriminate participants with orbito-frontal, medial frontal and amygdala lesions from controls (Stone et al., 1998; Stone et al, 2003; Lee et al., 2010) and has been used to identify deficits in TBI samples (Milders et al., 2003; Milders et al., 2008).

In order to test hypothesis five, participant's responses were further scored using a scoring criterion developed for this study (Appendix C). The types of errors made by

the participants were categorised as either being of *Omission* (no representation) or *Commission* (incorrect representation) for both first- and second-order representations. In addition, the commission errors for the second-order representations were scored as either being positively or negatively intended i.e. whether the character in the story is thought to have committed the faux pas on purpose, with either a 'good' or 'bad' intention. The total number of negative second-order representations will be used to test hypothesis five.

The second test is the Reading the Mind in the Eyes Test [RME] (Baron-Cohen et al., 2001, Appendix D). This task involves participants identifying mental states from black and white images of the eye region. There are 36 images for which the participants has to pick one of four words (word definition handout is provided) which best describes the persons thoughts or feelings, with correct answers being given one point (maximum 36). It has been shown to discriminate those with amygdala lesions from controls (Stone et al., 2003), as well as demonstrate reduced performance by those with unilateral frontal lobe lesions (Rowe, Bullock, Polkey & Morris, 2001), and with TBI survivors (Muller et al., 2010).

Emotional Recognition

Emotional recognition was measured using the Emotion Evaluation Task [EET](part one) of The Awareness of Social Inference Test [TASIT] (McDonald, Flanagan & Rollins, 2002). Participants are asked to identify emotions enacted during short (15 to 60 seconds) videotaped vignettes. The EET comprises of 28 scenes of actors interacting in everyday situations and portraying different emotions (fear, anger, sadness, disgust, surprise, happiness and 'neutral'). Some scenes include only one

actor (e.g. on the telephone) while others include two or more (having a conversation). The participant is given one point for each correctly identified emotion (maximum 28). It has demonstrated good reliability and validity with TBI samples (McDonald et al., 2006) as well as discriminating between those with TBI and controls (McDonald et al, 2003; McDonald & Saunders, 2005).

The short-form of The Benton Facial Recognition Test (Benton et al., 1994) was used to screen out participants with prosopagnosia and potentially exclude them from the TASIT and RME analyses.

Social Judgement Making

Social judgement making was measured using The Social Situations Task [SST] (Dewey, 1991, Appendix E). This aims to assess participants ability to judge the appropriateness of behaviours (for which there are no formal social prohibition), but are likely to produce irritation or anger in others. It consists of eight short stories, each incorporating behaviours which are considered appropriate and inappropriate. At various points in each story the participant is asked to comment on how appropriate the behaviour was. Scores relating to identification (maximum 12) and perceived severity of violation are generated (maximum 36). Lower scores indicate lower identification and perceived severity of violations. It has been shown to be sensitive to those with difficulties in social judgement [related to Aspergers] (Ellis, Ellis, Fraser & Deb, 1994), as well as in those with frontal temporal dementia and TBI (Lough et al., 2006; Blair & Cipolotti, 2000).

Emotion-based Decision-making

Emotion-based decision-making is to be measured by the Bangor Gambling Task [BGT] (Bowman & Turnball, 2004). It aims to assess participant's ability to use emotion-based learning to deal with decision-making processes. The BGT consists of a single deck of 100 regular playing cards which are sequenced to create a pattern of winning and losing streaks. Cards are turned over in turn, with each card assigned a monetary value which the participant will either win or lose. The participant chooses whether to gamble or not before each card is turned over, with them keeping any of the money which they win. Performance on the BGT has been shown to be highly correlated with other gambling tasks (Bowman & Turnball, 2004), which have been widely used in the assessment of Emotion-based decision-making (Toplak et al., 2010) and been shown to discriminate between TBI survivors and controls (Adlam et al., 2009; Levine et al., 2005).

Neuropsychological Tests

Executive Function

Aspects of executive functioning were measured in several ways. This included Zoo map and Modified Six Elements subtests from the Behavioural Assessment of Dysexecutive Syndrome [BADS] (Wilson et al., 1998). Zoo Map looks at participant's ability to formulate and implement a plan, and to follow a pre-formulated plan, while Modified Six Elements examines a participant's ability to time manage, and involves dividing available time between doing six simple tasks. Both tasks have a number of rules which are not to be broken during completion and result in scoring penalties. Raw scores were used during data analysis.

In addition The Hayling Sentence Completion Test [Hayling] and The Brixton Spatial Anticipation Task [Brixton] (Burgess & Shallice, 1997) were also used to measure executive functioning, examining inhibition and rule detection. The Hayling consists of two sets of 15 sentences which have the final word missing. During the first set the administrator reads the sentence aloud and asks the participant to complete the sentence with an appropriate word. During the second set, participants are asked to complete the sentence with a nonsense ending word. The Brixton is visually based consists of 56 depictions of two rows of five circles. One of the circles is filled, with the position changing across different depictions. Participants' task is to detect the rule(s) governing the position of the filled circle and use it to predict its future position. Performance on both tests is expressed as scaled scores.

Attention

Visual selective attention, attentional switching and sustained attention were respectively measured using the Map Search, Visual Elevator and Lottery subtests from the Test of Everyday Attention [TEA] (Robertson, Ridgeway & Nimmo-Smith, 1994). Map search requires participants to search for symbols on a map, within a time limit of two minutes. Visual elevator task asks participants to count up and down as they follow a series of visually presented 'doors' in the elevator. Lottery subtest requires participants to listen to a series of letter-number combinations (two letter and three numbers) and are instructed to write down the two letters preceding any set of numbers that ends in '55'. There are 10 'winning' numbers presented within a series of numbers across 10 minutes. Performance on all subtests is expressed as scaled scores.

Working and Delayed Memory

Working memory was measured using the Spatial Span and Letter-Number Sequencing subtests of the Wechsler Memory Scale, 3rd Edition [WMS-III], (Wechsler, 1997). Spatial span consists of a 3D array of 10 blocks, and requires the participant to repeat a number of tapping sequences (using the blocks), following demonstration by the administrator, with these increasing in length. In Letter-Number sequencing, participants are presented with a mixed list of numbers and letters and are required to repeat the list, but saying the numbers first (in ascending order) and then the letter (in alphabetical order). These raw scores are combined to produce the WMS-III Working Memory Index [WMS-III WMI)score.

Delayed memory was measured using the Logical Memory (I & II) and Visual Reproduction (I & II) subtest of the WMS-III (Wechsler, 1997). Logical memory involves the oral presentation of a story to the participant who is then tested for immediate recall and delayed recall. During the visual reproduction subtest, participants are presented with a series of line drawings, and are then tested on their immediate and delayed recall. Performance is expressed as scale scores, which were combined and divided by two to produce a modified WMS-III Delayed Memory Recall [WMS-III DMR] score; which has been used in previous research (Weddell & Leggett, 2006).

All the neuropsychological tests used have been shown to be reliable and valid measures of the specific functions, which have been shown to be commonly

impaired following both TBI and ABI (Lezak et al, 2012) and are regularly used in the clinical assessment of neuropsychological functioning in ABI services.

Psychological Outcome Questionnaires

A broad range of psychological outcomes relating to PTSD symptoms was used. This was due to recent criticisms that DSM-IV conceptualisation of PTSD as being too narrowly focused on fear to the exclusion of other emotions (Allen, Lemma & Fonagy, 2012), and that many PTSD symptoms are relatively non-specific, overlapping extensively with other disorders such as anxiety and depression (Spitizer, First & Wakefield, 2007; McHugh & Treisman, 2007).

PTSD Symptoms

PTSD symptoms was measured using the Impact of Event Scale- Revised [IES-R] (Weiss & Marmar, 1997; Weiss, 2004, Appendix F). It consists of 22 questions which correspond to the criteria for PTSD in the DSM-IV-TR (APA, 2000), including symptoms relating to: Hyper-arousal, Intrusion and Avoidance. Each question is scored 0 to 5 (maximum 110). Although the use of self-report measures for diagnosing PTSD in those with serious TBI has been criticised (Sumpter & McMillan, 2005), it was also described as being, “useful to screen for PTSD symptoms after [TBI]” (Sumpter & McMillan, 2005, p425) and has been used in previous studies using both TBI samples (Williams et al., 2002) and ABI samples (Sembi et al., 1998).

Depression and Anxiety

Depression and anxiety symptoms were measured using the Hospital Anxiety & Depression Scale [HADS] (Zigmond & Snaith, 1983, Appendix G). It consists of 14 items, seven relating to anxiety and seven relating to depression. Each item is scored on 0 to 3, giving a maximum score of 21 for each subscale. These scores have been shown to be a valid and reliable measure for survivors of both TBI (Schönberger & Ponsford, 2010; Whelan-Goodinson, Ponsford & Schönberger, 2008) and other types of ABI (Dawkins, Cloherty, Gracey & Evans, 2006).

Anger

Anger was measured using the State and Trait subscales from State-Trait Anger Expression Inventory -2 [STAXI-2] (Spielberger, 1999, Appendix H). The state subscale consists 15 items rated on a one to four, and trait subscale consists 10 items, also rated on a one to four. This gives maximum scores of 60 and 40 respectively. It has been recommended for the use of assessment of anger in those with TBI (Granacher, 2008) and has been used previously with both TBI and ABI samples (Walker et al., 2010; Weddell, 2010; Medd & Tate, 2000).

Procedure and Ethical Considerations

Ethical approval was gained from the NHS research Ethics Committee (Appendix I). Further Approval was granted by the Research and Development Department within the trust from which participants were recruited (Appendix J).

Potential participants were identified through clinical team discussion at each of the respective data collection sites. From those selected by the team as eligible, the clinical key worker for each potential participant passed on an information sheet (Appendix K), describing the purpose and procedures of the research. Including, the data management information, and contact details for requesting additional information, or making a complaint. After a week, they were approached by the key worker to identify initial expressions of interest. If so, contact details were passed on to the researcher(s), who made telephone contact to clarify their decision. Where possible, the data collection occurred as part of routine clinical assessment and rehabilitation in an attempt to minimise 'test' burden for the participants.

Typically the first meeting would take place at the local brain injury service and involved the completion of the neuropsychological tests, as well as the psychological questionnaires. Depending on the amount of time available this could be split over two to three sessions. In addition, participants could request that these take place at their home (in accordance with Trust guidelines for lone working). When meeting, opportunity was given to ask further questions about the study, after which informed consent was given in writing (Appendix L).

All data were anonymised, through the use of participant numbers, and kept in a secure location, held on a password protected database. Participants were reminded of right to withdraw throughout the study, with it emphasised that it would not affect their healthcare. Confidentially was discussed at the start of all meetings.

Settings and Service User Involvement

The research was conducted from one NHS service and two centres of vocational ABI rehabilitation. The planned research was approved by a brain injury service user panel. In addition, one of the research sites had a steering group containing a survivor, relative and Headway representative, who have also approved this study.

Data Analysis

Power Calculation

Using Cohen's (1988) tables indicates that sample size of 56 would be required to achieve desirable statistic power (.8 level) in detecting a significant ($p < .05$) relationship between neuropsychological and social cognition measures, and psychological outcomes; based on average correlation coefficients found in similar research samples (Weddell & Leggett, 2006; Weddell, 2010). In other brain injury studies, psychological outcomes have shown relationships of a medium effect size for samples of 60 index ABI participants (Ergh et al., 2002; Ergh et al., 2003).

In terms of the number of variables entered into the regression equations, it is suggested that a minimum of 10-15 participants per predictor would be needed (Field 2009), and that a minimum of 60 for medium sized effects (Miles & Shevlin, 2001). Using these as a guideline, conservatively, four predictors could be usefully included in each discrete analysis.

Planned Analysis

The results are presented in the following order. First, examination of the data is given, followed by analysis of the relationships between the demographical variables and the psychological outcome variables. Hypothesis testing is then presented; with the planned examination for each hypothesis stated prior to the results.

Results

Examination of Data

Analysis was completed using IBM SPSS (Version 20.0). Data screening and checking of assumptions for parametric statistics was conducted prior to analysis. Significant outliers that were identified were removed (Field, 2009). Remaining outliers were retained, as the mean values and the 5% trimmed mean values were alike, signifying that the outlier values were not impacting upon the distribution (Pallent, 2010). Missing values were present in the data; analyses were to be conducted pairwise were appropriate to maximise the use of available data.

Not all measures included in the study met assumptions for parametric statistics (see Appendix M). Data can be transformed in a variety of ways in order to meet these assumptions. However, it is considered by some to interfere with validity of results (Games, 1984) and seldom works (Field, 2009). An alternative is to use bootstrapping, which is a robust method of inferential statistical analysis (Field, Miles & Field, 2012) which can be used when parametric assumptions are not met, and is considered advantageous when using a small sample size (Preacher & Hayes, 2008). Having parametric data allows certain assumptions to be made about the sampling distribution, and the probability of particular test statistics occurring.

Bootstrapping involves empirically estimating the sampling distribution by generating samples from collected data, as well as other statistics of interest (e.g. mean, standard error, etc). All bootstrapping analyses were done using 1000 samples, and Bias corrected and Accelerated Confidence Intervals [BCa CI] (Field, 2012; Hayes 2009). Unless otherwise stated, all statistic reported were bootstrapped.

None of the correlations between variables exceeded 0.9; tolerance values above 0.1, and variance inflation factor(s) were all substantially below 10; indicating no multicollinearity between potential predictors (Field, 2009). Post-regression analysis diagnostic statistics included Cook and Mahalanobis distances, DFbeta statistics and covariance ratios; which were judged to be within acceptable boundaries (Field, 2009).

Analysis of Demographic Variables

A correlational analysis revealed age to have a significant negative correlation with Anxiety scores (r=-.45, p< .01; 95%BCa CI [-.63, -.25]) and Trait Anger (r=-.36, p< .01; 95%BCa CI [-.54, -.17]).

Categorical variables were tested using a combination of t-tests and Analysis of Variance [ANOVA], using the Bonferroni test for post-hoc comparisons. Female brain injury survivors were found to report significantly higher rates of PTSD symptoms (M=44.9; 95%BCa CI [33.10, 56.55]) as compared to male survivors (M=27.85; 95%BCa CI [18.63, 34.08]), t (44) = -2.50, p< .02; r = .46.

Type of injury was grouped into three categories ('TBI', 'Cardio Vascular Accident' [CVA] and 'Other' [e.g. Hypoxia, tumour, infection]). For the social cognition measures, significant differences were found between the groups on FPT, specifically the total FPT score ($F(2,39)=4.13$, $p<.024$) and the total for second-order Mentalizations ($F(2,39)=7.09$, $p<.002$). In addition, significant differences were found on the total score for the SST ($F(2,43)=4.28$, $p<.020$) and the BGT ($F(2,39)=7.05$, $p<.002$). Results of the Bonferroni comparisons are presented in Table 2.

Table 2

Bonferroni comparisons for significant ANOVA's for social cognition measures.

			95% BCa CI[†‡]	
Comparisons	**Mean Score Difference**	**Standard Error[†]**	**Lower**	**Upper**
Total Faux Pas Score				
TBI Vs. CVA	-4.57*	1.73	-8.29	-1.16
Other Vs. CVA	-4.80	2.56	-10.38	.76
Other Vs. TBI	-.23	2.24	-5.56	4.60
Second-order Mentalizations **				
TBI Vs. CVA	-2.40*	.63	-3.65	-1.15
Other Vs. CVA	.89	.87	-.83	2.76
Other Vs. TBI	-1.52	1.00	-3.67	.54
Social Situations Task Total Score				
TBI Vs. CVA	-4.19*	1.75	-7.82	-.57
Other Vs. CVA	-6.13*	2.43	-10.12	-.95
Other Vs. TBI	-1.94	2.62	-6.55	3.14
Bangor Gambling Task				
TBI Vs. CVA	9.52	6.38	-2.54	22.77
Other Vs. CVA	-25.92*	8.74	-40.94	-9.46
Other Vs. TBI	-35.44*	9.47	-52.67	-17.39

*$p<.05$
** Total score for Question 4 for faux pas stories only
[†] Based on 1000 bootstrap samples
[‡] if zero is not included in the CI, it is conceptually the same as rejecting the null hypothesis at $p < .05$ (Hayes, 2009).

The TBI survivors showed significantly lower total FPT scores (M=24.89; SD=6.23), and second-order Mentalizations scores (M=1.95; SD=1.31) as compared to the CVA survivors (M=28.84; SD=6.18) and (M=4.35; SD=2.40). While the CVA survivors scored significantly higher on the SST (M=19.84; SD=4.56), than both TBI survivors (M=15.65; SD=6.23) and the 'Other' group (M=13.71; SD=6.04). Lastly, the 'Other' group scored significantly lower on the BGT (M=-31.33; SD=20.95), than both TBI (M=4.10; SD=20.34) and CVA survivors (M=-5.41; SD=17.11).

Further significant differences were found between the injury groups for the two neuropsychological measures, the TEA Lottery subtest ($F(2,39)=6.59, p<.003$) and WMS-III DMR ($F(2,39)=5.16, p<.010$). Post-hoc comparisons revealed that the TBI survivors (M=9.84; SD=3.25) scored significantly higher for sustained attention (Lottery) than the CVA survivors (M=6.29; SD=3.29). While the 'Other' group (M=6.83 ;SD=1.99) scored significantly lower for delayed memory (WMS-III DMR) than both the TBI (M=10.76; SD=3.23) and CVA survivors (M=11.32 ;SD=3.00). No significant differences were found between groups on the psychological outcome measures. A summary table of all the data can be found in Appendix N.

Hypothesis One - Two

It was hypothesised that there would be significant relationships between measures of social cognition, and psychological outcomes for PTSD (hypothesis 1). As well as, significant relationships between neuropsychological measures and psychological outcomes for PTSD (hypothesis 2)

Table 3 presents those measures which were found to be significantly correlated ($p < .05$). Significant associations were found between measures of Mentalization, attention and memory, and psychological outcomes.

Tables 3

Significant correlations identified between: social cognition; neuropsychological measures, and psychological outcomes.

	Anxiety (HADS)	**Depression (HADS)**	**PTSD Symptoms (IES-R)**	**Anger – Trait (STAXI)**
Demographics				
Age	-.450**	-	-	-.359*
Social Cognition				
Reading Mind in the Eyes	-	-	.348*	-
Faux Pas Total score	-	- .314*	-	-
Faux Pas Omission score	-.332*			
Neuropsychological Functioning				
TEA Map Search II		-.471**	-	
TEA Visual Elevator	-	-	-.338*	-
WMS III Working Memory Index	-	-	-.334*	-
WMS III Delayed Memory Index (Modified)	-	-	-.294*	-

** Significant at the $p < .01$ level.
*Significant at the $p < .05$ level.

Hypothesis Three

It was hypothesised that social cognition and neuropsychological measures will have a direct effect in predicting psychological measures of PTSD. Separate multiple regression models were constructed for each outcome (i.e. depression, PTSD symptoms) using the measures that were found to be significantly correlated with it. These were entered blockwise, in order of correlation coefficient strength. Due to

age being the only predictor for Anxiety and Anger (trait), the regression models for these have been placed in Appendix O and P, while no regression was conducted with state anger due to a lack of correlating measures.

The results indicate that a direct effects model containing two predictor variables of selective visual attention (*β*=.53, *p*<.001) and Mentalization (*β*=.39, *p*<.013) was statistically significant in predicting depressive symptoms, accounting for 37% of the relevant variance ($F(2,41)=11.45$, *p*<.001) [Table 4]. No significant relationship was found between selective visual attention and Mentalization (*r*=-.14, *p*<.37, 95% BCa CI [-.36, .07]) therefore neither would be considered to be a mediator for the other (Baron & Kenny, 1986).

Table 4

Regression analysis for visual selective attention and Mentalization predicting depressive symptoms

					95% BCa CI	
Predictor	**B**	**SE**[†]	***p***	***β***	**Lower**	**Upper**
Step 1						
Constant	8.28	.78	.001	-	-	-
TEA Map Search II	-.422	.11	.001	-.47**	-.63	-.25
Step 2						
Constant	15.35	2.80	.001	-	-	-
TEA Map Search II	-.47	.10	.001	-.53**	-.69	-.32
Faux Pas Total	-.25	.10	.013	-.39*	-.44	-.08

r^2 = .22 for step 1, Δr^2 = .37 (*p* < .000)). *p< .05. **p< .01.
[†]Based on 1000 bootstrap samples

It was also indicated that a direct effects model containing two predictor variables of Mentalization (*β*=.53, *p*<.001) and delayed memory recall (*β*=.39, *p*<.013) was statistically significant in predicting PTSD symptoms, accounting for 24% of the

relevant variance ($F(2,40)=6.36$, $p<.004$) [Table 5]. This was preferred to including attention switching and working memory in a three or four predictor model. The inclusion of working memory did not significantly change the amount of variance accounted for by the model ($\Delta r^2=.01$, $F(1,38)=.443$, $p<.51$), similarly for attention switching ($\Delta r^2=.08$, $F(1,39)=3.963$, $p<.054$), although these were approaching significance.

Table 5

Regression analysis for Mentalization and delayed memory recall predicting PTSD symptoms.

					95% BCa CI	
Predictor	**B**	**SE**[†]	***p***	**β**	**Lower**	**Upper**
Step 1						
Constant	-2.73	17.43	.879	-	-	-
RME	1.44	.738	.067	.29	.12	2.72
Step 2						
Constant	14.19	18.35	.473	-	-	-
RME	2.05	.744	.001	.42	.78	3.55
WMS III Delayed memory score	-3.09	.929	.013	-.41	-4.94	-1.22

r^2 = .09 for step 1, Δr^2 = .24 (p < .007). *p< .05. **p< .01.
[†]Based on 1000 bootstrap samples

A significant relationship was found between Mentalization and delay memory recall ($r=.304$, $p<.05$, 95% BCa CI [-.38, .593]). However, the β for Mentalization was larger in step 2 ($\beta=.42$), than in step 1 ($\beta=.29$), when delayed memory recall was accounted for, and so mediation would not be considered to have taken place (Baron & Kenny, 1986).

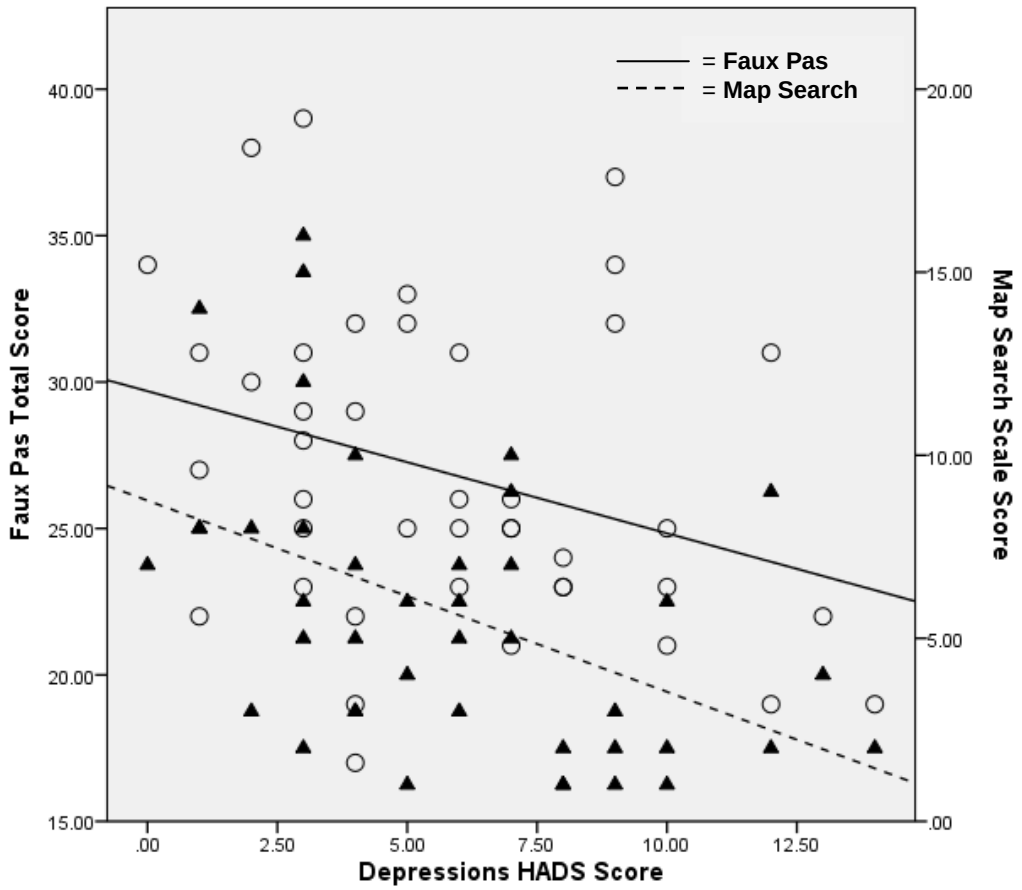
Hypothesis Four

It was hypothesised that performance on social cognition and neuropsychological measures will demonstrate a negative correlation coefficient with psychological measures of PTSD. So as performance decreases, there is a corresponding increase in symptoms reported.

The direction of regression coefficients for both selective visual attention and Mentalization is as predicted. A lower performance on both of these measures was accompanied by a corresponding increase in depression symptoms (see Figure 1).

Figure 1

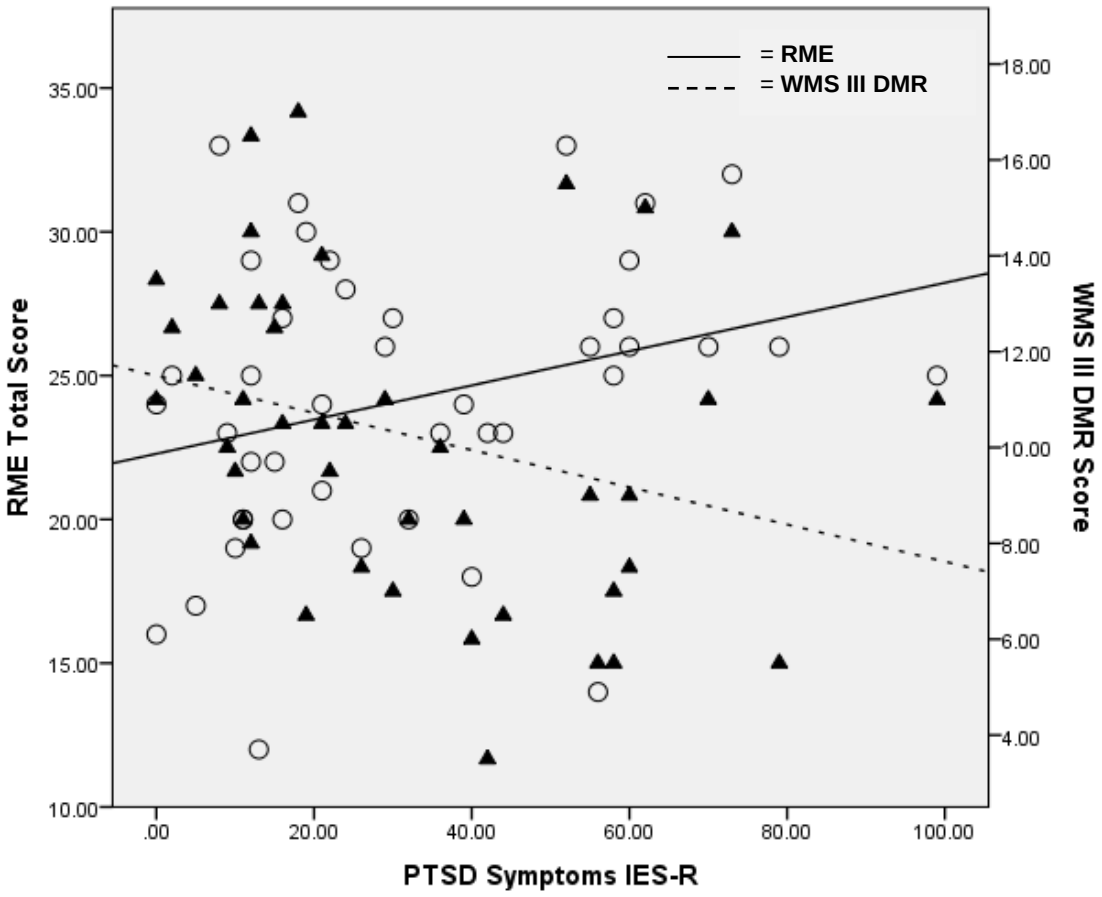
Correlations for Mentalization and visual selective attention with depression symptoms.



The direction of the regression coefficient for delayed memory recall was as predicted; as delayed memory recall scores got lower there is a increase in PTSD symptoms (see Figure 2). However, the Mentalization scores (for the RME) do not show a predicted relationship; as Mentalization scores increase, so do PTSD symptoms (see Figure 2). This goes against the prediction made in hypothesis four, and will be addressed in the discussion.

Figure 2

Correlations for Mentalization and delayed memory recall, with PTSD symptoms



Hypothesis Five

It was hypothesised that the amount of negative second-order representations of mental states will demonstrate a positive correlation coefficient with psychological measures of PTSD. Total negative second-order representations did not significantly correlate with any of the psychological outcome variables (Table 6), not supporting the hypothesis. However, almost half the sample made at least one negative second-order Mentalization error (n =22, 44%).

Table 6

Correlations between negative second-order Mentalizations and psychological outcomes.

	Anxiety (HADS)	**Depression (HADS)**	**PTSD Symptoms (IES-R)**	**Anger-Trait (STAXI)**	**Anger-State (STAXI)**
Faux Pas test					
Negative second-order representations (total)	.07	.04	.16	.131	.08

** Significant at the 0.01 level.
*Significant at the 0.05 level.

Discussion

The purpose of this study was to explore the relationship between psychological outcomes related to PTSD, neuropsychological constructs and social cognition, in survivors of TBI and ABI. It was hypothesised that there would be significant relationships between neuropsychological and social cognition measures, and psychological outcomes for PTSD. The results of this study partially support this prediction. Significant relationships were found between symptoms relating to depression and PTSD, and measures of Mentalization, selective visual attention, delayed memory, attentional switching, and working memory.

It was also hypothesised that neuropsychological and social cognition measures would have a direct effect in predicting psychological outcomes related to PTSD. This was also partially supported, with Mentalization and selective visual attention predicting depression symptoms, as well as, Mentalization and delayed memory predicting PTSD symptoms.

The first of the final two hypothesises predicted that there would be a negative correlation between performance on social cognition and neuropsychological measures and psychological outcomes. This was partially supported with three demonstrating this relationship (Mentalization, selective visual attention and delayed memory), while one showed a positive correlation (a different measure of mentalisation). The second hypothesis predicted a positive correlation between the amounts of ‘negative’ representations of mental states and psychological outcomes, was not supported. Results will be reviewed below.

Neuropsychological Constructs and Psychological Outcomes

The significant relationships between delayed memory and selective visual attention, and psychological outcomes were consistent with previous research (Verfaellie et al., 2012; Ownsworth & Mckenna, 2004), with increasing difficulties in these areas being associated with greater symptoms reported.

The lack of significant relationships between measures of executive function and psychological outcomes is unexpected considering the variety of measures used and its repeated association in previous literature (Nybo et al., 2004; Vilkki et al., 1994). However, the sample size did not meet the minimum required for appropriate statistical power, and so these effects may not have been detected. In addition, associations between executive functioning and psychosocial outcomes have not always been consistently found in previous research (Milders et al., 2008).

Social Cognition and Psychological Outcomes

The lack of a significant relationship between emotion recognition and psychological outcomes is unexpected considering the prevalence of these difficulties (Babbage 2011). However, TBI survivors have been shown to demonstrate fewer difficulties with recognising emotion from dynamic displays (McDonald & Saunders, 2005; Williams & Wood, 2010) as were used in this study. This seems a likely explanation, as the mean score for the sample (20.85), was above the 5 percentile cut-off of 20, with 45% of individuals scoring below this.

The significant relationships between the two measures of Mentalization and psychological outcomes is an interesting finding given the previous lack of significant correlations with behaviour difficulties (Milders et al., 2003; Milders et al., 2008) and that it was found in a representative community sample of heterogeneous etiology. Although FPT total scores were of the predicted correlation direction; with decreasing performance being associated with increasing depressive symptoms. The RME test scores showed the opposite; increasing performance being associated with increasing PTSD symptoms. However, these two tests measure slightly different aspects of Mentalization. The RME examines externally-focused Mentalization, that is, mental processes that rely of physical or visible features (Fonagy et al., 2012; Baron-Cohen et al., 2001). This compares to the FPT test which examines internally-focused Mentalization (Stone et al., 1998), that is, mental processes focusing upon the mental interior e.g. intentions, wishes (Fonagy et al., 2012). Increased emotional arousal is associated with a predilection for externally-focused Mentalization, which is seen as a more 'automatic' process, and a move away from internally-focused Mentalization, considered to be more controlled and reflective (Fonagy et al., 2012).

Discrepancies between these two aspects of Mentalization have been seen in other patient populations. For instance, those diagnosed with Borderline Personality Disorder [BPD] have difficulty understanding the intentions of others (internally-focused task), while being hypersensitive to emotions which they observe (externally-focused task) (Fonagy et al, 2012). In addition, Fertuck and colleagues (2009) found that BPD participants demonstrated 'enhanced' Mentalization, using

the RME, and suggested the increased accuracy was due to, “constant vigilance to potential rejection” (p1986), but due to strong expectations of abandonment, misrepresent the content or intention behind the representations. The RME being particularly ‘well-suited’ for such individuals as the majority of representations within it are of neutral or negative Mentalizations (77% [Harkness, 2005]).

It is tentatively suggested that the sample showed a hypervigilance for externally-focused negative/neutral Mentalizations, related to their trauma experience (Yeates, 2009), and that this demonstrated a positive relationship with the RME due to content. However, they were less able to access internally-based Mentalization resources. This could be due to brain injury per se; maintained as part of heightened emotional arousal (sustained via hypervigilance) or a combination of the two. These were unexpected findings, and perhaps indicate experiences following brain injury can be similar to PTSD, but are perhaps fundamentally different and there is a requirement for more specific measures tailored for TBI survivors.

Social judgement making and emotion-based decision-making did not demonstrate significant relationships with the psychological outcomes. Although these constructs were established for TBI (Blair & Cipolotti, 2000; Adlam et al., 2010), this was less so for ABI. A more homogeneous sample of one etiology would have helped in identifying specific effects for certain injury types, although this would have reduced the representativeness of the sample.

Negative Representations and Psychological Outcomes

Negative representations of mental states showed no significant correlation with any psychological outcomes. The TBI survivors performed significantly worse regarding Mentalization (using the FPT) and social judgement, than those with CVA injuries. However, the two groups did not significantly differ on psychological outcomes, so it is cautiously suggested that these results may indicate the presence of different mechanisms for maintenance of PTSD related symptoms, for those with TBI as compared to CVA-type ABI.

Methodological Considerations

The cross-sectional nature of this study needs to be acknowledged, and that causality cannot be assumed from the analyses presented. However, the exploratory nature of the research and timescale meant this cross-sectional design was most appropriate. The use of bootstrap procedures in order to meet parametric assumptions increases the reliability and validity of the statistical analysis. However, the current study did not meet the minimum number of participants indicated by a priori power analysis, nor that needed for a regression analysis and is therefore, limited by this. However, despite an underpowered sample; significance was achieved, perhaps indicating the strength of the relationships between Mentalization, attention and memory, and the psychological outcomes.

Characteristics of the sample which impact on the generalisability of the results include the variability in the time since injury for the participants, which was between

18 months to 30 years, with the average being six and a half years. Experience of maintained symptoms, as well as the adjustment process in general, would be thought to perhaps be very different depending upon the time span. There was also a lack of specific information on severity of the injuries sustained (i.e. Glasgow coma scale scores or length of post trauma amnesia) as well as a lack of detailed information about the incidents themselves. This makes it hard to draw firm comparisons with other research samples, as well as specific ABI populations.

The use of self-report measures in this study can be criticised, as survivors of TBI are considered to be unreliable witnesses to their own experiences, due to difficulties in self-awareness and insight (Lezak et al., 2012). The main measure of PTSD symptoms, IES-R, has its own limitations in its use with the TBI survivors. Although described as a useful 'screen' (Sumpter & McMillan, 2005), and demonstrated the ability to measures post trauma symptoms for TBI survivors. It is less clears as to whether it captures TBI survivors' full experiences around trauma related symptoms. Unfortunately, there are currently no measures of PTSD symptoms for TBI survivors that do account fully for their experiences following trauma, or for the length of time since the brain injury was acquired. In addition, the broad range of outcome measures and the lack of formal diagnoses of PTSD for participants might question whether these findings are specific to PTSD processes. However, some argue that PTSD is less distinctive than previously conceived, and suggest the PTSD and depression represent an integrated reaction to a traumatic stressor (Freidman, Resick & Keane, 2007). The last point being highly relevant as it was symptoms depression and PTSD symptoms that were found to be significantly predicted in the present study.

Clinical Implications

Due to the exploratory nature of this study, clinical implications are hard to draw. I certainly hope these findings highlight how ABI impairments play a significant role in maintaining post-trauma symptoms and how survivors may require significant support with these impairments in order to prevent the maintenance of the symptoms. This understanding can be usefully shared with family, friends and professionals working with the ABI survivor, and help maintain these relationships which are crucial to recovery and adjustment. During interactions (during therapy or otherwise) it would be worth noting when 'malevolent' themes become apparent and perhaps try and identify any precursors which may makes these stronger or more apparent.

Conclusions

In conclusion, findings from the current study suggest that there is a relationship between mentalisation ability, attention and memory, and symptoms of depression and PTSD. These findings are consistent with previous research literature relating to social cognition and neuropsychological difficulties in brain injury. The findings do not suggest a relationship between emotional recognition, social judgment, emotion-based decision-making, executive functioning, or negative representations of mental states, and psychological outcomes. Finally these findings highlight the important contribution of social cognition and neuropsychological factors in relation to psychosocial difficulties for brain injury survivors and that the assessment of these in clinical practice could be beneficial. Due to methodological limitations of the study,

and the early stage of research in the area, replication of the current findings would be necessary.

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DAVID ELEY BSc Hons MSc

Major Research Project

SECTION C

Critical Appraisal

Word Count: 1999

Contents

Question 1: Research abilities and Skills **3**

Question 2: What could have been done differently and why **6**

Question 3: Clinical implications **7**

Question 4: Future research directions **8**

References **10**

Critical Appraisal

The research presented, aimed to examine the relationship between neuropsychological and social cognition constructs, and symptoms relating to PTSD. The current section presents a critical appraisal of this research, and is done by addressing four questions designed by the programme for this purpose.

Question 1: What research skills have you learned and what research abilities have you developed from undertaking this project and what do you think you need to learn further?

The experience of completing this project has sharpened key practical time-management and organisational abilities. By being involved in a multisite research project, I have learned a great deal about how to conduct a project of this size within the NHS, as well as in collaboration with private sector services and colleagues. This includes becoming aware of the need to be realistic in terms of both the time scales and resources required, as well as, the need to anticipate difficulties when preparing research projects, and possible solutions. For instance, in this study two of the five data collection sites became unavailable (one closing and the other withdrawing). This obviously impacted on the rate at which data could be collected, as well as being a source of worry as to whether the remaining sites would stay involved with the project.

Joining a study which was at the early stages of data collection had a number of advantages, including: the ethic's and research committee approval having already been gained; the 'working up' of core research ideas having been done for these

processes, and the relative security, and resources, of being a part of a research ‘collaboration’. However, there were a number of disadvantages, which proved to be valuable learning opportunities for my future participation in research. The most salient being my initial feelings of a lack of ‘ownership’ for my project and the length of time it took for me to develop this. This was longer than I had previously experienced, to which I partially attribute to the amount of new areas of literature I had to become familiar with (I.e. Neuropsychology, social cognition, PTSD for TBI/ABI, CBT for PTSD, the neuropsychoanalytic approach and psychoanalytic/ psychodynamic theories of PTSD and Mentalization). I also needed to spend a long time understanding my supervisors thoughts which meant I spent less time developing my own ideas and thinking, which I felt left me disconnected and less self-invested than I imagined prior to the project. A key external factor in this was my experience with my Quality Improvement Project, which was also a project which I joined after its initial conception and I experienced difficulties in writing up the results and understanding the implications for the wider research. This did motivate me to be more consciously engaged with my MRP project and to have an open and honest conversation regarding my concerns with my supervisor, to avoid similar difficulties in this project. I think this helped me significantly in finding my own ‘voice’ in the writing up of the results and confidence in the theoretical links I had begun to form.

I used the term research ‘collaboration’, rather than team, due to the nature of our relationships with each other and the project. Apart from my external supervisor, people who were involved were volunteers, usually as part of a requirement for their own education or training courses (such as other DClinPsych courses or MSc’s), or for research experience for applications for clinical psychology training. So although

there was a lot of motivation, people's involvement could sometimes reduce suddenly either in relation to increases in workloads, or the completion of their requirements. This would impact on recruitment and sometimes did not feel as 'secure' as I initially thought it would be. I also felt I had little ability to influence this as the nature of people's involvement was voluntary and so requests had to be negotiated. I will hold these things in mind for future working, as despite these difficulties I would consider working in this way in the future. I found it enjoyable working with so many different people and think it could be a resource efficient way in developing a line of research over a period of time within the NHS. This taught me the value of clear and explicit communication of expectations and being honest about what time and personal resource I can commit.

On a practical note, I did not have the actual experience of carrying out an ethics or research approval application form. As well as being active in getting advice and experience in the future, I will need to also learn more about securing research funding through grant applications. However, I did gain experience in conference presenting (Eley, 2012), which I prepared for by presenting to a neuropsychoanalysis study group based in London. I learned a great deal about academic presentation, 'networking' skills, and was exposed to lots of different ideas and ways of thinking through this. I feel this has given me a lot of confidence in developing my research and/or academic profile in the future.

Prior to this project most of my research experience had been with quantitative methods, however, I had not encountered multiple regressions outside of a review context (i.e. for critical reviews). I feel my understanding of regression approaches

has been greatly improved because of my experience with this project. I also learned about 'bootstrapping' techniques, and is something I feel will be of value in any future quantitative research I undertake. I am keen to learn more about these techniques, and although I feel confident in my analysis for this research, I feel there is a lot to still learn regards this area.

Question 2: If you were able to do this project again, what would you do differently and why?

Although this would have been impossible, I would have liked to have been involved from the beginning, gaining more direct experience of the application processes as well as being involved with the initial thinking and measures selection. Apart from my feelings of 'owning' the project being improved, I would have liked to have made some suggestions in terms of the recording of information. I learned that these processes are extremely important, in particularly for a project involving different data collection sites. This is not just from an organisational point of view but a research-analysis view also. For instance, I would of recorded the separate subscales of the IES-R (Hyperarousal, Intrusion, Avoidance), rather than just the total score, as well as the separate scores for verbal and non-verbal delayed memory recall. This could have allowed some specific analyses on these variables, especially as the IES-R was the most specific outcome measure of PTSD symptoms, and the role of verbal memory being implicated specifically in prior research. In addition, I would have liked to have recorded separate scores of accuracy of recognition for the different emotion 'types' (Positive, negative, neutral) on the RME and examine these in relation to the other variables. Unfortunately due to the 'raw'

score sheets being held at different sites, going back to retrospectively get this information proved problematic, and would have been easier if the materials were based at one site. However, I acknowledge that there was already a significant burden on the people involved, and that limits have to be put in place in order to get the research conducted.

The prospect of joining a study examining a newly developing area was both exciting and daunting. At the beginning, I don't think I realised the difficulty involved in familiarising myself with all these different areas, and it took a lot longer than I implicitly thought it would. Consequently during the course of conducting the research, I was unrealistic in evaluating my level of understanding in relation to where it 'should' have been in terms of time scales, which impacted on my perceived levels of competency. The anxiety this raised in me and the amount of procrastination I conducted highlighted how important my confidence in completing a task is to me. I think being realistic at the beginning would have been helpful. I think mapping out these areas in a more formal manner would have helped me keep track of where I was in the literature, and be more realistic about my appraisal of progress and improved my confidence in task completion.

Question 3: <u>Clinically</u>, as a consequence of doing this study, would you do anything differently and why?

At a service level, ABI is most often discussed within a medical model framework, with the presenting difficulties being primarily related to the injuries sustained. This is not to say that neuropsychological difficulties, such as memory or executive

functioning don't have a role in these, but this can lead to explanations being sort strictly using these concepts, to the exclusion of others. This is especially relevant to social and emotional difficulties, where concepts such as 'attachment' can be helpful. The former view is certainly something I internalised from my experience as an assistant psychologist. Being exposed to psychoanalytic thinking within the context of brain injuries has made me feel a lot more confident about approaching these difficulties. It has widened the choice of frameworks that I can draw on for ideas for use in therapy, team discussions, and the avocation of the benefits, and better provision, of psychological services for ABI patients. The latter being something I previously thought of as being adequately provided, but now realise is sadly lacking across brain injury services.

Question 4: If you were to undertake further research in this area what would that research project seek to answer and how would you go about doing it?

I would like to review the literature presented in Section A in a more detailed accordance of Bateman and Fonagy's (2012) conception of Mentalization, as well as to perhaps expand it to include those with ABI. This was something I was unable to do due to this work only being published two months prior to the hand in date of the MRP. I think this would aid the comparison of Mentalization difficulties in ABI to other clinical populations, enable cross-pollination of ideas for interventions and highlight further gaps for future research to address.

In terms of the current project there are plans to expand the number of participants and to gain a healthy control group (for the Mentalization tasks) over the summer of

2012, something I am likely to be involved in. The overall project is longitudinal in design with the planned re-administration of the outcome questionnaires every three months for a year after initial data collection, and so there will be further opportunity to examine these and perhaps draw some conclusions relating to causality. A possible expansion could include a focus on a particular injury group. The sample that was recruited here was fairly heterogeneous. In the search for clear delineation of what difficulties present for whom, the recruitment of further participants would be helpful to see if any differences have been 'missed', due to the lower numbers for each of the injury types.

In a slightly different direction from this, I would be interested in research focusing on the development of Mentalization-based therapy techniques to be used in psychotherapy and rehabilitation with ABI patients. Bateman and Fonagy (2012) discuss how Mentalization therapy is the balance of activating the attachment system via the therapeutic relationship, and developing a curiosity for mental states of both yourself and others. Early research has begun to examine the effects of oxytocin (hormone related to attachment) on implicit attachment styles (Krahe, Harrison, Paloyyelis & Fotopoulou, 2012). Examining the impact of brain injury on the attachment network or style, perhaps in relation to oxytocin, might give some indication as to how available the attachment network is in ABI patients for use in therapeutic relationships. The use of video during psychotherapy sessions would also be a useful avenue and has shown promising results in helping awareness of impairment for hemiplegia (Besharati, Jenkinson, & Fotopoulou, 2012) and could be helpful for psychosocial difficulties.

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DAVID M. S. ELEY BSc Hons MSc

Major Research Project

SECTION D

Appendix of Supporting Material

Contents

Appendix A: Literature Search **3**

Appendix B: Recognition of Faux Pas Test **4**

Appendix C: Additional criterion developed for Faux Pas Test responses **29**

Appendix D: Reading the Mind in the Eye Test **30**

Appendix E: The Social Situations Task **77**

Appendix F: Impact of Events Scale- Revised **81**

Appendix G: Hospital Anxiety and Depression Scale **83**

Appendix H: State-Trait Anger Expression Inventory-2 **84**

Appendix I: NHS Research Ethics Committee Letter **85**

Appendix J: Research and Development Department letter(s) **89**

Appendix K: Participant information sheet(s) **91**

Appendix L: informed consent sheet

100

Appendix M: Examination of Parametric Assumptions

102

Appendix N: Summary Table Data

105

Appendix O: Regression Table for Anxiety to Age

106

Appendix P: Regression Table for Anger to Age

107

Appendix Q: Submission guidelines for Neuropsychoanlysis
108

Appendix A:
The systematic review was informed by PRISMA (Moher, Liberati, Tetzlaff & Altman, 2009) which was developed to improve the quality of systematic reviews.

An electronic literature search was conducted, using the databases listed below:

- Applied Social Sciences Index and Abstracts (ASSIA) (From earliest to current)
- Cumulative Index to Nursing and Allied Health Literature (CINAHL) (From earliest to current)
- Ovid MEDLINE (From earliest to current)
- EBSCOHost (From earliest to current)
- PsycINFO (From earliest to current)
- PubMed Central (PMC) (From earliest to current)

Key search terms were combined and included:

Traumatic Injury	Brain	Emotion/Affect Recognition	Theory of Mind	Mentalizing
Acquired Injury	Brain	Emotion/Affect Identification	Mentalization	Social Cognition
Closed Head Injury			Mentalisation	

The search was limited to English-language papers that were published in peer-reviewed journals and included adults (between the ages of 18-65 yrs). These identified papers were screened in accordance with the following exclusion criteria.

- Those with samples which were included other form of ABI (e.g. stroke) TBI.
- Those which involved progressive neurological conditions such as dementia.

The bibliographies of these articles identified as meeting the criteria were also searched for relevant material. This yielded 27 studies which examine the emotion recognition or Mentalization in TBI survivors.

*Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *Me*ta-*A*nalyses: The PRISMA Statement. British Medical Journal, 339, 332-336.

Appendix B: Recognition of Faux Pas Test

REMOVED FROM ELECTRONIC RECORD

Appendix C: Additional criterion developed for Faux Pas Test responses

Faux Pas Test Error Analysis (viii):

1. Score question 4 (why did they say it?) out of ten
2. For info:
   - Look for errors in all the stories (FP & control) - First Order Questions are Q1. & Q3.
   - When Q.1 is answered incorrectly on the FP stories, then we infer 2 omission errors of 1st order representations (Q's, 1 & 3,) plus 1 omission error of 2nd order representation for Q4 for that story
   -The coding grid is below:

Participant No:			
Total Correct score /10 for Q4s across all Faux Pas Stories:			
	Errors of Omission	**Errors of Commission**	
1st Order Representations (Q's 1 & 3)	2nd Order Representations (Q4)	+ve valency (Q4)	-ve valency (Q4)
Example (Story 11): "No" to Q1. or incorrect answer to Q3, e.g., *"You shouldn't talk if you're late for meetings"*	Example: Answer that only includes a self-reference for the offending character, no mention of that character's attitude to the recipient of FP or other character, e.g., *"He thought the joke was funny"*	Example: A reference to offending character's attitude to others, but of a benign or positive nature, e.g., *"He thought the joke would cheer everyone up"*	Example: A reference to offending character's attitude to others, but of a malign or negative nature *e.g., "He was being nasty; he wanted them to squirm"*
Frequency:	Frequency:	Frequency:	Frequency:
Interesting examples?			
Total:	Total:	Total:	Total:
Grand Omission Error Total:		Grand Commission Error Total:	

Appendix D: Reading the Mind in the Eyes Test

REMOVED FROM ELECTRONIC RECORD

Appendix E

REMOVED FROM ELECTRONIC RECORD

Appendix F:

REMOVED FROM ELECTRONIC RECORD

Appendix G:

REMOVED FROM ELECTRONIC RECORD

Appendix H:

REMOVED FROM ELECTRONIC RECORD

Appendix I: NHS Research Ethics Committee Letter.

Study Title: **Social Cognition and Psychosocial Predictors of Couple, Family & Work Interpersonal Outcomes following Acquired Brain Injury (ABI)**
REC reference number: **09/H0604/81**

Thank you for your letter of 11 August 2009, responding to the Committee's request for further information on the above research and submitting revised documentation.

The further information has been considered on behalf of the Committee by the Chair.

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised, 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.

For NHS research sites only, management permission for research ("R&D approval") should be obtained from the relevant care organisation(s) 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.rdforum.nhs.uk.

Where the only involvement of the NHS organisation is as a Participant Identification Centre, management permission for research is not required but the R&D office should be notified of the study. Guidance should be sought from the R&D office where necessary.

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

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 final list of documents reviewed and approved by the Committee is as follows:

Document	*Version*	*Date*
Response to Request for Further Information		11 August 2009

Weschler Memory Scale		
REC application	Parts A-D	11 June 2009
E-mail from Funder	Neuropsychoanalysis Foundation	29 April 2009
Unfavourable Opinion Letter from Xxxxxx REC		
Student's/Academic Supervisor's CV	Dr Xxxx xxxxxx	
Flow Chart		
Protocol		
Investigator CV	Ms xxxxx xxxxxxx	10 June 2009
Letter from Funder	Neuropsychoanalysis Foundation	01 July 2008
GP/Consultant Information Sheets	2	15 September 2008
Letter of invitation to participant	1	20 August 2008
Covering Letter		05 June 2009
xxxxx Doctoral Course Letter		04 June 2009
xxxxx Doctoral Course Letter		01 June 2009
Letter from University of xxxxxx		05 June 2009
E-mails from University of xxxxxxx		
Interview Schedules/Topic Guides	1	
Research Project Supervisory Structure		
Dewey Stories		
Benton Facial Recognition Test		
The Awareness of Social Inference Test		
Reading the Mind in the Eyes Test		
Recognition of Faux Pas Test		
TEA - Map Search		
Hayling & Brixton Tests		
BADS - Modified 6 Elements		
BADS - Zoo Map		
Bangor Gambling Task		
BDI-II		
IES-R		
STAXI-2		
HaDs Questionnaire		
TEA - Lottery		
Communications Patterns Questionnaire		
Economic Issues Questionnaire		
Who does what Questionnaire?		
Career Strain Index		
BAI		
Work Personality Profile		
CBCL-R		
Closeness & Independence Scale		
Dyadic Adjustment Scale		
Social Provisions Scale		

Participant Information Sheet: ABI Survivor	5	02 August 2009
Participant Information Sheet: Partner	5	02 August 2009
Participant Consent Form: ABI	4	
Participant Consent Form: Partners	4	
Other CV		

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees (July 2001) and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

After ethical review

Now that you have completed the application process please visit the National Research Ethics Service website > After Review

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.

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
- 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.

We would also like to inform you that we consult regularly with stakeholders to improve our service. If you would like to join our Reference Group please email referencegroup@nres.npsa.nhs.uk.

09/H0604/81	**Please quote this number on all correspondence**

Yours sincerely

Appendix J: Research and Development Department letter(s).

OBMH indemnity letter

Ref:

Ms xxxxx xxxxxx
Trainee Clinical Psychologist

Dear Ms xxxxxr

Project Title: Social Cognition & Psychosocial Predictors of Couple, Family & Work Interpersonal Outcomes following Acquired Brain Injury
Rec Ref: 09/HP0606/73

This letter confirms that indemnity will be provided for you by the Trust for the above study, according to the information you have provided within the application form. This confirmation is also subject to the formal approval of the National Research Ethics Service and on the understanding that you have a contract of employment with this Trust.

I wish you every success with the study
Yours sincerely

OBMH sponsor letter

To Whom It May Concern:

Project Title: Social Cognition & Psychosocial Predictors of Couple, Family & Work Interpersonal Outcomes following Acquired Brain Injury
Rec Ref: 09/HP0606/73

I can confirm that xxxxxx and xxxxxxx Mental Health NHS Foundation Trust will act as research sponsor for the above study and will comply with the Department of Health Research Governance Framework for Health and Social Care 2005. As sponsor, the Trust will also provide indemnity for the above study.

Sponsorship is confirmed subject to formal approval from a Research Ethics Committee and the understanding that should any substantial amendments be submitted to the Ethics Committee, these would also be copied to the Trust R&D office.
Yours sincerely

Appendix K: Participant information sheet(s).

Participant Information Sheet (ABI Survivor)

Difficulties in social interactions after Acquired Brain Injury (ABI) and the impact for the family and the workplace

We would like to invite you to take part in a research study. Before you decide you need to understand why the research is being done and what it would involve for you. Please take time to read the following information carefully. Talk to others about the study if you wish.

- Part 1 tells you why we are doing this study and what will happen to you if you take part.

- Part 2 gives you more detailed information about the conduct of the study.

Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Part 1:

What is the Purpose of this Study?

Current research has highlighted more negative outcomes in couples, family and work relationships following acquired brain injury, compared with other conditions. The reasons for this are likely to be complex.

Some research has shown that personal and social issues such as age, gender, work status and wider social support have a large influence on relationships following different types of injury. Emotional distress in survivors of injury and relatives has also been shown to be very influential.

Studies are now beginning to explore what is unique to neurological injuries that contribute to negative relationship outcomes. Difficulties in memory, planning and organisation have been shown to influence relationships.

However other mental abilities may have more relevance: recognising the emotions and perspectives of others, using knowledge of what is socially appropriate, or 'gut feeling' to make the right decisions.

This study aims to explore the role of difficulties in these areas, plus the other personal and social factors, in influencing outcomes for a) couples, b) child relatives and c) relationships in the workplace. 150 survivors of ABI and their partners will be recruited from 5 community brain injury services across England.

Why Have I been Invited?

You have been invited because:

- you have sustained an acquired brain injury over 18 months ago
- you are currently in a long-term relationship.

Who else has been invited?

- your partner will also be asked to participate, and
- a professional who can provide information on your social interactions in the workplace (either a member of the brain injury service, a work placement provider or employer).

We are hoping to involve up to 150 survivors of ABI, their partners, and vocational informants.

Do I have to take Part?
It is up to you to decide. We will describe the study and go through this information sheet. We will then ask you to sign a consent form to show you have agreed to take part.

You are free to withdraw from any section of the research, at any time, without giving a reason. This would not affect the standard of care you receive.

What will happen to me if I take part?
If you are happy in principal to participate, you should let your key worker know within seven days.

They will then pass on your contact details to the lead researcher, who will then contact you to explain any issues, answer any questions and clarify your decision on participating.

You will then agree a time to meet with them and start the study. You will have contact with the researcher four or five times over the next year.

1. The first occasion will typically be at your local brain injury service, and will involve the completion of neuropsychological tests (pen and paper tests of memory and thinking) and questionnaires on feelings and relationships.

   This will be conducted in addition to your standard assessments within your local brain injury service, and may be fitted into to the assessment phase of your rehabilitation. This session will be the longest in the study and will last up to three hours, including breaks.

   If you prefer, this session can be undertaken at your home. If you have already completed any of the tests or questionnaires within the preceding six months, we will use this information and not do the tests on this occasion. We would also like to access your clinical notes to obtain details about your injury and rehabilitation to date.

2. After this, we would then like to repeat some of the questionnaires only every three months, for a further three times. These should take 30-40 minutes to complete and can be done with the researcher present or in your own time, handing these back to your key worker at the brain injury service.

3. Your partner will also be asked to complete questionnaires only at the same time as yourself. These questionnaires will be on their emotions, experience of relationships and if you have a child in the family one questionnaire will ask your partner about how your child is coping.

4. A small group of survivors and partners will be asked to participate in an additional way, if certain difficulties are found during the initial neuropsychological assessment. These people (20-30 survivors plus partners) will be invited to participate in one or two detailed interviews about their experiences of their relationship before and after the injury.

   This interviews will each last up to one hour and can be done jointly as a couple or individually, depending on both partners' preference. The interviews will be recorded using audio tapes. The interviews will only be conducted by the lead investigator, Dr xxxx xxxx, who is a clinical psychologist and has experience in discussing personal

issues with couples and families. These interviews can be undertaken at either the local brain injury service or at your home.

Expenses and Payments
Unfortunately there will be no expenses reimbursed or payments provided, other than any standard arrangement you may have for the payment of travel expenses with your local brain injury service.

Any part of this research can be undertaken at your home to avoid the need to travel if you prefer.

What are the possible disadvantages of taking part?

- The first session will involve test of memory and other aspects of thinking, which may make you tired, uncomfortable, feel mentally strained or even give you a headache.

- The questionnaires and interviews (for those who are asked to participate in these) may ask you to think and disclose difficult feelings and experiences from your personal life, and may cause you some distress.

Full emotional support for you or your partner will be made clearly available through your local brain injury service or other relevant organizations offering useful support will be identified if distress is caused, or if you would like to explore any issues raised further.

What are the possible advantages of taking part?

- We cannot promise the study will help you but the information we get from this study may help improve the treatment of people with acquired brain injury, and their experiences of relationships at home and in the workplace.

- As a result of the research process we may be able to identify your needs in a high level of detail, which can be used by your local brain injury service to support you and your family.

What will happen when this study stops?
When the study is complete you will receive an information letter outlining the main findings.

What if there is a problem?
Any complaint about the way you have been dealt with during the study or any possible harm you might suffer will be addressed. The detailed information on this is given in Part 2.

Will my taking part in this study be kept confidential?
Yes. We will follow ethical and legal practice and all information about you will be handled in confidence. The details are included in Part 2.

If the information in Part 1 has interested you and you are considering participation, please read the additional information in Part 2 before making any decision.

Part 2:

What will happen if I don't want to carry on with the study?
You can withdraw from the study but keep in contact with us to let us know your progress. Information collected may still be used, unless you explicitly state otherwise. All information collected will be handed over to your local brain injury service

What if there is a problem?

Complaints:
If you have a concern about any aspect of this study, you should ask to speak to the researchers who will do their best to answer your questions (Dr xxxxx xxxxx tel:xxxxxxxxxx). If you remain unhappy and wish to complain formally, you can do this through the NHS Complaints Procedure. Details can be obtained from the Patient Advice and Liaison Service, PALS: www.pals.nhs.uk.

Harm:
In the event that something does go wrong and you are harmed during the research and this is due to someone's negligence then you may have grounds for a legal action for compensation against xxxxxxxx Mental Health Foundation NHS Trust but you may have to pay your legal costs. The normal National Health Service complaints mechanisms will still be available to you.

Will my taking part in this study be kept confidential?

- Your responses to neuropsychological tests and questionnaires will be anonymised through the allocation of a participant number. One file linking participant numbers to actual names will be stored at the Community Head Injury Service, Xxxxxxx.

- All hard copies of forms and questionnaires will be temporarily stored securely in this location, and will be accessible only to the research team and NHS R&D departments who monitor the quality of all research undertaken.

- These records will then be returned to your clinical file at your local brain injury centre once the information has been transferred to a secure electronic database. The results from your neuropsychological testing will be fed back to your rehabilitation team as soon as possible so your care can benefit from this research.

- All transcripts from the detailed interviews will be anonymised, which means that any identifiable details (name, places, occupation, other unique detail) will be changed on the transcripts. All interview transcripts and audio recordings will be kept by Dr Xxxx xxxxxx at the Community Head Injury Service, Xxxxxxx and stored securely. These will then be destroyed after one year.

Involvement of your family doctor (GP)
Your GP will be informed of your decision to participate in this study, and the details of the study itself. No specific information from your responses within the study will be communicated directly to the GP unless concern for your wellbeing or the wellbeing of others has been raised during data collection. In this case we would ask for your consent to involve the GP.

What will happen to the results of the study?
The results of this research will be communicated to other clinicians via conference presentations, published articles and books. The results will either reflect overall patterns in the whole group or where specific individual data is used (e.g., interview data), this will be in anonymised form. When the study is complete you will receive an information letter outlining the main findings.

Who is funding this study?

Research time, equipment and expenses are currently being funded by xxxxxxx NHS PCT and Universities of xxxxx and xxxxxx, in addition to a grant awarded by the International Neuro-psychoanalysis Fund.

Who has reviewed the study?
All research in the NHS is looked at by independent group of people, called a Research Ethics Committee to protect your safety, rights, wellbeing and dignity. This study has been reviewed and approved by xxxxxx Research Ethics Committee A.

Further Information and contact details

For each category please contact the following:

1. General information about research: http://www.nrr.nhs.uk

2. Specific information about this research project: Dr Xxxx xxxxxx, tel: xxxxxxxxxxx

3. Advice as to whether they should participate: either Dr Xxxxx xxxxxx, or if you prefer, your keyworker at your local brain injury service.

4. Who they should approach if unhappy with the study: either Dr Xxxxx xxxxxx, or if you prefer, your keyworker at your local brain injury service.

This is your copy to keep, along with a copy of the consent form overleaf.

Participant Information Sheet (Partner)

Difficulties in social interactions after Acquired Brain Injury (ABI) and the impact for the family and the workplace

We would like to invite you to take part in a research study. Before you decide you need to understand why the research is being done and what it would involve for you. Please take time to read the following information carefully. Talk to others about the study if you wish.

Part 1 tells you the purpose of this study and what will happen to you if you take part.
Part 2 gives you more detailed information about the conduct of the study.

Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Part 1:

What is the Purpose of this Study?
Compared to other long-term conditions, existing research has highlighted that there are much more negative outcomes in couples, family and work relationships following acquired brain injury. The reasons for this are likely to be complex. Some research has shown that regardless of the nature of brain injury, personal and social issues such as age, gender, work status and wider social support have a large influence on relationships. Emotional distress in survivors of injury and relatives has also been shown to be key.

Studies are now beginning to explore what is unique to neurological injuries that contribute to these negative outcomes. Difficulties in memory, planning and organisation have been shown

to influence relationships. However other mental abilities may be more important: recognising the emotions and perspectives of others, using knowledge of what is socially appropriate, or 'gut feeling' to make the right decisions.

This study aims to explore the role of difficulties in these areas, plus the other personal and social factors, in influencing outcomes for a) couples, b) child relatives and c) relationships in the workplace. 150 survivors of ABI and their partners will be recruited from 5 community brain injury services across England.

Why Have I been Invited?
You have been invited because your partner sustained an acquired brain injury over 18 months ago. Your partner will also be asked to participate, and a professional who can provide information on their social interactions in the workplace (either a member of the brain injury service, a work placement provider or employer). We are hoping to involve up to 150 survivors of ABI, their partners, and vocational informants.

Do I have to take Part?
It is up to you to decide. We will describe the study and go through this information sheet, which we will then give to you. We will then ask you to sign a consent form to show you have agreed to take part. You are free to withdraw from any section of the research, at any time, without giving a reason. This would not affect the standard of care you or your partner will receive.

What will happen to me if I take part?
If you are happy in principal to participate, you should let your key worker know within seven days. They will then pass on your contact details to the lead researcher, who will then contact you to explain any issues, answer any questions and clarify your decision on participating. You will then agree a time to meet with them and start the study. You will have contact with the researcher four or five times over the next year

Each occasion can be at your local brain injury service, or if you prefer, this session can be undertaken at your home. It will involve the completion of questionnaires on your feelings and experiences of personal relationships. If you have a child in the family one questionnaire will ask questions about your child's coping and behaviour. This will all take 20-40 minutes. At any time this can be done with the researcher present or in your own time, handing these back to your partner's keyworker at the brain injury service or sending back to the researcher by post.

Your partner will also be asked to complete similar questionnaires and on the first occasion a range of neuropsychological tests.

A small group of injury survivors and partners will be asked to participate in an additional way, if certain difficulties are found during the initial neuropsychological assessment. These people (20-30 survivors plus partners) will be invited to participate in one or two detailed interviews about their experiences of their relationship before and after the injury. This interviews will last up to one hour each and can be done jointly as a couple or individually, depending on both partners' preferences. The interviews will be recorded using audio tapes. The interviews will only be conducted by the lead investigator, Dr Xxxxx xxxxxx, who is a clinical psychologist and has experience in discussing personal issues with couples and families. These interviews can be undertaken at either the local brain injury service or at your home.

Expenses and Payments
Unfortunately there will be no expenses reimbursed or payments provided, other than any standard arrangement you may have for the payment of travel expenses with your local brain

injury service. Any part of this research can be undertaken at your home to avoid the need to travel if you prefer.

What will I have to do?
If you decide to take part you will be asked to complete a variety of questionnaires, and for some a detailed interview, only if you are comfortable doing so.. You can refuse consent for any of this at any time, without giving a reason.

What are the possible disadvantages of taking part?
The questionnaires and interviews (for those who are asked to participate) may ask you to think and disclose difficult feelings and intimate experiences from your personal life, and may cause you some distress. Full emotional support for you or your partner will be made clearly available through your local brain injury service or other relevant organizations offering useful support will be identified if distress is caused, or if you would like to explore any issues raised further.

What are the possible advantages of taking part?
We cannot promise the study will help you but the information we get from this study may help improve the treatment of people with acquired brain injury, and their experiences of relationships at home and in the workplace. From assessment, thinking and taking about these issues yourself, particular needs may be identified in a high level of detail that can be used by your local brain injury service to support you and your family.

What will happen when this study stops?
When the study is complete you will receive an information letter outlining the main findings.

What if there is a problem?
Any complaint about the way you have been dealt with during the study or any possible harm you might suffer will be addressed. The detailed information on this is given in Part 2.

Will my taking part in this study be kept confidential?
Yes. We will follow ethical and legal practice and all information about you will be handled in confidence. The details are included in Part 2.

If the information in Part 1 has interested you and you are considering participation, please read the additional information in Part 2 before making any decision.

Part 2:

What will happen if I don't want to carry on with the study?
You can withdraw from the study but keep in contact with us to let us know your progress. Information collected may still be used, unless you explicitly state otherwise. All information collected will be handed over to your local brain injury service

What if there is a problem?

Complaints:
If you have a concern about any aspect of this study, you should ask to speak to the researchers who will do their best to answer your questions (Dr Xxxx xxxxxx: tel: xxxxxxxxx). If you remain unhappy and wish to complain formally, you can do this through the NHS Complaints Procedure. Details can be obtained from the Patient Advice and Liaison Service, PALS: www.pals.nhs.uk.

Harm:
In the event that something does go wrong and you are harmed during the research and this is due to someone's negligence then you may have grounds for a legal action for compensation against xxxxxxxx Mental Health Foundation NHS Trust but you may have to pay your legal costs. The normal National Health Service complaints mechanisms will still be available to you.

Will my taking part in this study be kept confidential?
Your responses to neuropsychological tests and questionnaires will be anonymised through the allocation of a participant number. One file linking participant numbers to actual names will be stored at the Community Head Injury Service, Xxxxxxx. All hard copies of forms and questionnaires will be temporarily stored securely in this location, and will be accessible only to the research team and NHS R&D departments who monitor the quality of all research undertaken. These records will then be returned to your clinical file at your local brain injury centre once the information has been transferred to a secure electronic database. The results from your neuropsychological testing will be fed back to your rehabilitation team as soon as possible so your care can benefit from this research.

All transcripts from the detailed interviews will be anonymised by any identifiable details (name, places, occupation, other unique detail) being changed on the transcripts. All interview transcripts and audio cassette recordings will be kept by Dr Xxxx xxxxxx at the Community Head Injury Service, Xxxxxxx and stored securely. These will then be destroyed after one year.

Involvement of your family doctor (GP)
Your GP will be informed of your decision to participate in this study, and the details of the study itself. No specific information from your responses within the study will be communicated directly to the GP unless concern for your wellbeing or the wellbeing of others has been raised during data collection and you have consented to the GP's subsequent involvement.

What will happen to the results of the study?
The results of this research will be communicated to other clinicians via conference presentations, published articles and books. The results will either reflect overall patterns in the whole group or where specific individual data is used (e.g., interview data), this will be in anonymised form. When the study is complete you will receive an information letter outlining the main findings.

Who is funding this study?
Research time, equipment and expenses are currently being funded by xxxxxxxxxx NHS PCT and Universities of xxxxxx and xxxxxx, in addition to a grant awarded by the International Neuro-psychoanalysis Fund.

Who has reviewed the study?
All research in the NHS is looked at by independent group of people, called a Research Ethics Committee to protect your safety, rights, wellbeing and dignity. This study has been reviewed and given favourable opinion by xxxxxx Research Ethics Committee A.

Further Information and contact details

For each category please contact the following:

1. General information about research: http://www.nrr.nhs.uk
2. Specific information about this research project: Dr Xxxx xxxxxx, tel: xxxxxxxxx

3. Advice as to whether they should participate: either Dr Xxxx xxxxxx, or if you prefer, your keyworker at your local brain injury service.
4. Who they should approach if unhappy with the study: either Dr Xxxx xxxxxx, or if you prefer, your keyworker at your local brain injury service.

This is your copy to keep, along with a copy of the consent form overleaf.

Appendix L: Informed Consent Sheet.

CONSENT FORM

Title of Project: **Difficulties in social interactions after Acquired Brain Injury (ABI) and the impact for the family and the workplace**

Name of Researcher: Dr xxxxxx xxxxxx

Please initial box

1. I confirm that I have read and understand the information sheet dated..... (version.....) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected. ☐

3. I understand that relevant sections of my clinical notes and data collected during the study, may be looked at by individuals from xxxxxxxxxx NHS Primary Care Trusts, from regulatory authorities or from the NHS Trust, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my records. ☐

4. If I am asked to be interviewed, I am happy for the interviews to be audio-taped. No: ☐ Yes: ☐

(If yes) I would prefer to be interviewed:

Individually ☐
Jointly with my partner ☐
No preference ☐

(you will asked to reconfirm your choice if asked to be interviewed)

5. I agree to my GP being informed of my participation in the study ☐

6. I agree to take part in the above study. ☐

_____	_____	_____
Name of Participant	Date	Signature
_____	_____	_____
Name of Person taking consent	Date	Signature

When completed, 1 for patient; 1 for researcher site file; 1 (original) to be kept in medical notes

CONSENT FORM (Partners)

Title of Project: **Difficulties in social interactions after Acquired Brain Injury (ABI) and the impact for the family and the workplace**

Name of Researcher: Dr xxxxx xxxxx

Please initial box

1. I confirm that I have read and understand the information sheet dated..... (version.....) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected. ☐

4. If I am asked to be interviewed, I am happy for the interviews to be audio-taped. No: ☐ Yes: ☐

(If yes) I would prefer to be interviewed:

Individually ☐
Jointly with my partner ☐
No preference ☐

(you will asked to reconfirm your choice if asked to be interviewed)

5. I agree to my GP being informed of my participation in the study ☐

6. I agree to take part in the above study. ☐

_____	_____	_____
Name of Participant	Date	Signature
_____	_____	_____
Name of Person taking consent	Date	Signature

When completed, 1 for patient; 1 for researcher site file; 1 (original) to be kept in medical notes

Appendix M: Examination of Assumptions for the Data

Parametric assumptions were examined for the whole sample using IBM SPSS 20.0. These were done for all the measures. What are presented here are graphs relating to the core regression analysis for scores relating to depression (HADS) and PTSD symptoms (IES-R). Figures 1 and 2 relate to the first regression model (depression), while figures 3 and 4 relate to the second (PTSD symptoms).

Figure 1, presents a scatter plot of the standardized predicted values (*ZPRED, X-Axis) and the standardized residuals (*ZRESID) for depressions scores for the sample. If the assumption of homoscedasticity (that at each level of the predictor variables, the variance in the residual terms should be constant) is met then this plot should, “look like a random array of dots evenly dispersed” (Field, 2009, p247*). However, the data in the graph appears to ‘funnel out’ to the left (lines added for emphasis), so indicates the presence of heteroscedasticity in the data.

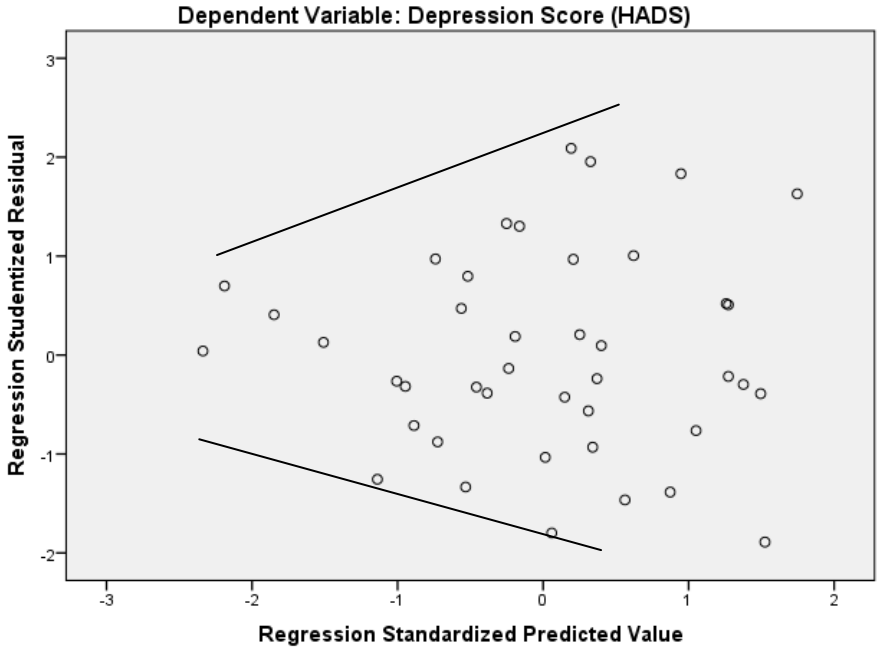

Figure 1

Figure 2, is a normality probability plot, and is used to examine the distribution of the data. The straight line represents a normal distribution, which the data is plotted against; therefore the more data points which are plotted against the data the closer to a normal distribution the data is. Although some deviation, a Kolmogorov-Smirnov test indicates that the distribution is not significantly different from a normal distribution (*K-S*=1.26, 46, p< .064)

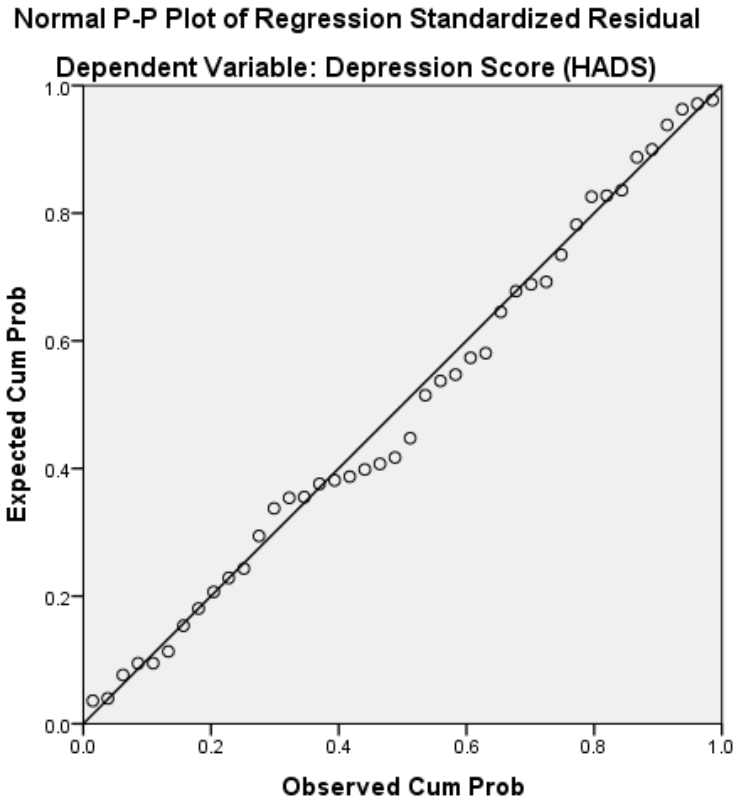

Figure 2

Figure 3, shows a scatter plot of the standardized predicted values (*ZPRED, X-Axis) and the standardized residuals (*ZRESID) for PTSD symptom scores. There is no particular shape to pattern of dots and appear randomly distributed. Figure 4, is normality probability plot. The plotted data points appear to deviate from the 'normality line' quite a bit; which is confirmed by a significant Kolmogorov-Smirnov test (K-S, 46, p< .034).

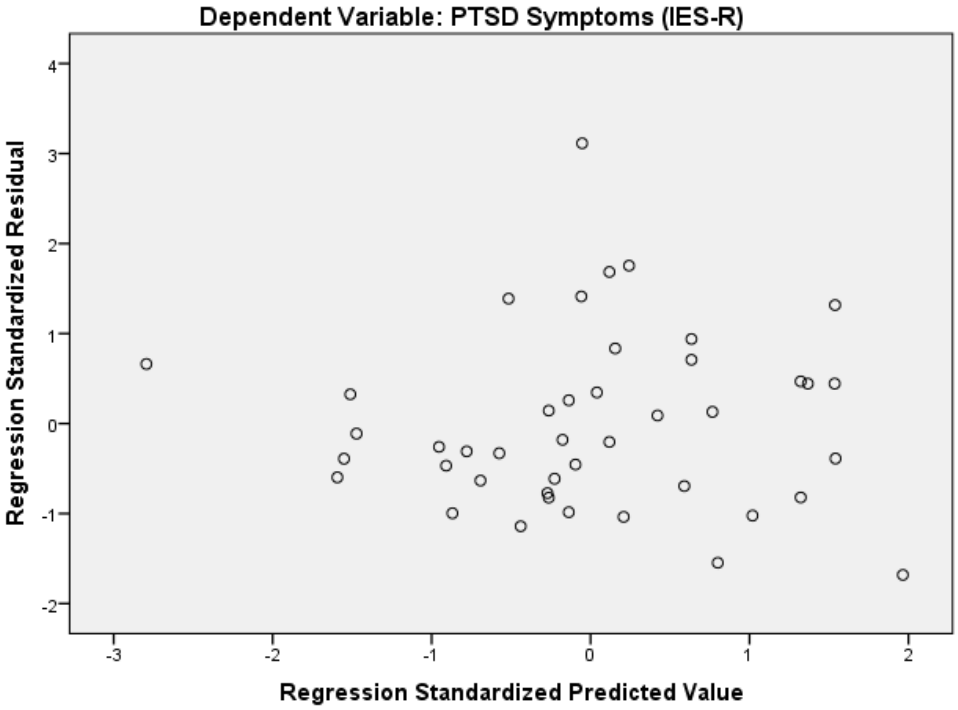

Figure 3

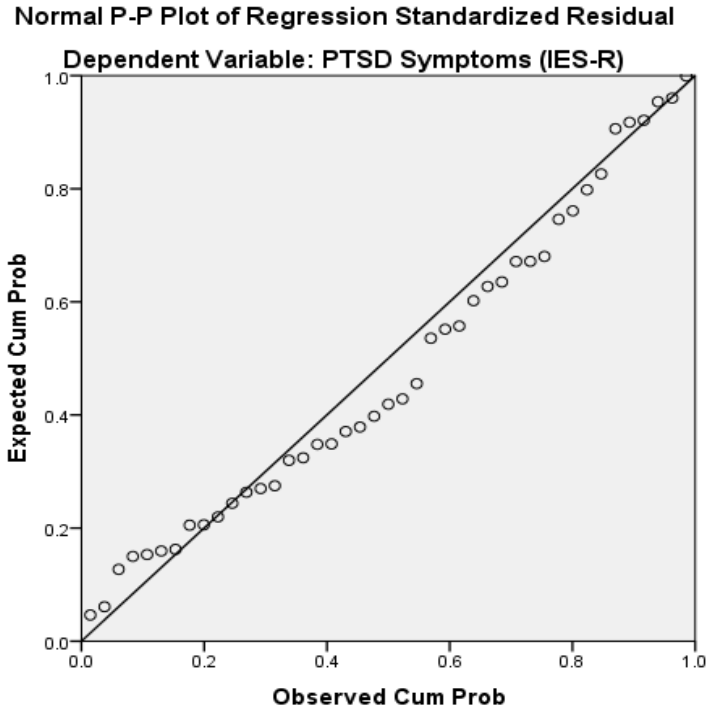

Figure 4

*Field, A. (2009). *Discovering Statistics using SPSS* (3rd Edn.). London: Sage Publications.

Appendix N:

			Bias-corrected accelerated Confidence intervals†				
	Mean	**SD†**	**lower**	**Upper**	**Min.**	**Max.**	**Range**
Psychological Outcomes Measures							
HADs- Depression	6.91	3.40	4.98	6.85	0	14	0-21
HADs- Anxiety	7.98	4.03	6.92	9.10	0	18	0-21
IES-R	31.52	24.12	20.08	27.47	0	99	0-110
STAXI-State	17.33	4.51	16.13	18.70	8	30	0-60
STAXI-Trait	17.44	7.19	15.55	19.34	10	37	0-40
Social Cognition Measures							
TASIT Part 1 Total Score	20.86	3.86	19.83	21.88	12	28	0-28
Faux Pas Test	26.57	5.44	25.09	28.06	17	39	0-40
Faux Pas Q4	2.98	2.18	2.36	3.59	0	8	0-10
Faux Pas Negative Representations	.70	.795	.4773	.95	0	2	0-10
Mind in the Eyes Test	23.94	5.22	22.45	25.25	11	33	0-36
Social Situations Test Violation Severity Score	17.09	5.96	15.13	19.04	6	30	0-36
Social Situations Test Violation Score	9.56	2.00	9.02	10.11	5	12	0-12
Social Situations Test Normative Score	9.72	1.70	9.25	10.19	6	12	-100 to +100
Bangor Gambling Task	-5.83	23.15	-12.39	.6287	-51	43	
Neuropsychological Measures							
Executive Functioning							
BADS Zoo Map (RS)	10.31	5.58	8.78	11.83	-6.00	16.0	-16 to +16
BADS 6-Elements (RS	4.89	1.43	4.40	5.34	1.0	6.0	-6 to +6
Hayling (SS)	5.10	1.43	4.71	5.54	1.0	8.0	0-10
Brixton (SS)	5.60	2.50	4.73	6.44	1.0	10.0	0-10
Attention							
TEA Map Search (SS)	5.48	3.87	4.44	6.63	1.0	16.0	1-19
TEA Visual Elevator (SS)	5.44	4.87	4.12	7.08	0.0	19.0	1-19
TEA Lottery (SS)	7.81	3.57	6.65	9.00	1.0	13.0	1-19
Memory							
WMS III Working Memory (Index Score)	99.44	17.84	94.04	104.64	49.0	136.0	40-160
WMS III Delayed Memory (Composite)	10.42	3.28	9.51	11.30	3.5	17.0	0-40

†based on 1000 bootstrap samples

SD = Standard Deviation; SS = Scaled Score; RS = Raw Score

Appendix O:

The results indicate that a direct effects model containing one predictor variable of Age (*β*= -.45, *p*<.002) was statistically significant in predicting anxiety symptoms, accounting for 20% of the relevant variance (*F*(1,44)=11.20, *p*<.002) [Table 1].

Table 1

Regression analysis for age predicting anxiety symptoms

					95% BCa Confidence Interval	
Predictor	**B**	**SE**[†]	***p***	**β**	**Lower**	**Upper**
Step 1						
Constant	17.55	2.70	.001	-	-	-
Age	-.20	.06	.002	-.45**	-.31	-.11

r^2 = .20 for step 1 (*p* < .002). *p< .05. **p< .01.
[†]Based on 1000 bootstrap samples

Appendix P:

The results indicate that a direct effects model containing one predictor variable of Age (*β*= -.36, *p*<.012) was statistically significant in predicting anxiety symptoms, accounting for 13% of the relevant variance (*F*(1,44)=6.52, *p*<.014) [Table 2].

Table 2

Regression analysis for age predicting trait anger

					95% BCa Confidence Interval	
Predictor	**B**	**SE**[†]	***p***	**β**	**Lower**	**Upper**
Step 1						
Constant	31.05	5.00	.001	-	-	-
Age	-.29	.10	.012	-.36*	-.489	-.086

r^2 = .13 for step 1 (*p* < .014). **p*< .05. ***p*< .01.
[†]Based on 1000 bootstrap samples

Appendix Q: Submission guidelines for Neuropsychoanalysis

Guidelines for Authors

Authors are reminded that it is their responsibility to ensure they comply with the terms of the authors' release statement on the topics of **CONFLICT OF INTEREST, HUMAN AND ANIMAL RIGHTS, INFORMED CONSENT** , and **TRANSFER OF COPYRIGHT** (see below). Authors whose work is accepted for publication in Neuropsychoanalysis will be required to submit a signed copy of the statement by post to the Journal Administrator, *Neuropsychoanalysis,* 13 Prowse Place, London, NW1 9PN, U.K., or by fax to +44 (0)20 7284 4030, or as an attachment to an email to

Neuropsychoanalysis uses a peer-review system based around electronic submission. Authors are requested to send their manuscripts (and revisions after acceptance) to the Journal Administrator or to Prof. Oliver Turnbull, Editor The physical address for contacting the journal is: c/o The International Neuropsychoanalysis Centre, 13 Prowse Place, London, NW1 9PN, U.K.

Submitted manuscripts should include on the title page the author's full name, affiliation, address,telephone number, facsimile number, and email address, as well as a 200-word summary of the or paper.

PREPARATION OF MANUSCRIPTS

All manuscripts submitted to *Neuropsychoanalysis* should conform to the style of the journal as outlined here. Manuscripts must be typewritten and double-spaced, including text, footnotes, extracts, and references, using 8.5 x 11 or A4-size paper with at least 1.5-inch (4-cm margins all around. An electronic version of the manuscript must be supplied.

The **title of the paper**, which should be as concise as possible, and the **author(s)name(s)** should appear on the title page.

Author(s) affiliation(s) should be given in an unnumbered footnote on the first page of the paper, together with the **correspondence author's** full postal address and email address.

An **abstract** of no more than 200 words summarizing the essential contributions must be included.

Keywords. 6 keywords must be provided, in alphabetical order and separated by semicolons. No acronyms or abbreviations should be used

Text headings. There should be three text headings at most, typed as follows: A (centered); B (underlined flush left); C (underlined and run into paragraph).

Footnotes should be used only if absolutely essential. They should be numbered consecutively and should appear at the bottom of the page on which the reference is made.

Quotation marks , which must be double rather than single, should appear outside low punctuation (e.g., “No,” said the doctor). Single quotation marks are reserved for quotations within quotations.

Artwork —figures, charts, drawings, photographs, etc.—must be supplied as individual *black-and-white high-resolution* digital image files, separate from the text file, and named by first author and figure number (e.g., Brown1.tif). Powerpoint files cannot be accepted. Line art should be professionally drawn (freehand lettering is not acceptable). Any cost for preparation or alteration of artwork will be borne by the author(s). Figure captions should be set within the text, on a separate line after the appropriate paragraph. Tables should be double-spaced, with rules top and bottom and under the column heads; there should be no other rules, either horizontal or vertical. The table title goes above the top table rule.

Quotations. Whenever material from another work is quoted directly, the quotation must be exact and must be followed by the source and the page number in parentheses. Quotations of six or more lines should be set off from the text as a block quote, with the date and page number in brackets at the end: [Freud, 1900, p. 593]

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Citations and References

Text citations

Citations in the text should provide the author’s name and, in parentheses, the year of publication of the original paper or book.

Example: According to Freud (1900, 1915), . . .

Or, if the author’s name does not naturally appear in the sentence, the parentheses contain the author’s name, followed by a comma, and the year of original publication.

If citations to more than one author are given, they should be separated by semicolons and listed in alphabetical order. Citations to works with four or five authors should use all names on first occurrence, then first author et al. thereafter. Citations to works with six or more authors should use only first author plus et al. in the text; in the references, list the first six authors then use et al. for other authors.

Example : It has been suggested (e.g., Bowlby, 1960a, 1960b; Freud, 1926; Kaufman & Rosenblum, 1967a; Maquet et al., 1997) that . .

Reference Section

The reference section should include only works cited in the text.

References should be listed alphabetically by authors. They should not be numbered. The author's name is followed by the year of original publication of the article or book.

Journal articles: give title of the article, full unabbreviated title of the journal, volume number, and inclusive page numbers.

Books : give title (in italics), place of publication, name of publisher, and, if the year of original publication does not coincide with the edition cited, the date of the edition referred to.

Chapters from edited books: give chapter title, title of the book (in italics), name(s) of the editor(s), place of publication, publisher, and inclusive page numbers of the chapter.

When several works by one author are referred to, place them in chronological sequence. When an author has published more than one work in the same year, list them alphabetically by title, and the date is followed by a, b, c, etc. Single-authored works precede multiple-authored works with the same first author, regardless of date.

If an English version of a work is available or the work was originally published in English, then this version must be used.

(Note: all quotations from Freud's works that are in *The Standard Edition of the Complete Psychological Works of Sigmund Freud*, published by Hogarth Press, London, must be cited from there.

Sample references:
Brown, J. (1997). Title of paper. *Full Journal Title*, 00 (0): 000–000.
Brown, J. (1998). *Title of Book* . Place: Publisher.
Brown, J. (1999). Title of chapter. In: *Title of Book* , ed. J. Smith & M. Smith. Place: Publisher, pp. 000–000.
Freud, S. (1900). *The Interpretation of Dreams*. Standard Edition, 4/5.
Freud, S. (1928). A religious experience. Standard Edition , 21: 167–172.