Traumatic Brain Injury, Post-traumatic Stress Disorder Symptom Reporting and Attentional Bias: Unravelling the Misidentification of Post-traumatic Stress Disorder in People with a Traumatic Brain Injury.

& Clinical Research Portfolio

VOLUME I

(Volume II bound separately**)**

LOUISE MARIE REID (BSc Hons)

University of Glasgow
Division of Community Based Sciences
Section of Psychological Medicine

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Faculty of Medicine Graduate School

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TABLE OF CONTENTS

Volume I (this bound copy)

APPENDICES

LIST OF TABLES & FIGURES

CHAPTER 1

MAJOR RESEARCH SYSTEMATIC REVIEW

To what extent are the findings of attentional bias in Post-traumatic Stress Disorder dependent on methodology?

Written according to guidelines for submission to the Journal of Traumatic Stress

(Notes for contributors Appendix 1.1)

Address for correspondence:

Division of Community Based Sciences
Section of Psychological Medicine
University of Glasgow
Gartnavel Royal Hospital
1055 Great Western Road
Glasgow
G12 0XH

Abstract

This systematic review summarises the evidence for an attentional bias in Post-traumatic Stress Disorder (PTSD) and specifically explores the extent to which the findings are dependent on methodology. A systematic search strategy was used to identify published literature, which was then subjected to analysis of quality using a rating scale that was created by modifying a published scale for rating methodological quality. This allowed for critical discussion of the papers included. Research indicates that the most commonly used paradigm for measuring attentional bias in PTSD is the modified Stroop task, although other paradigms such as the dot-probe paradigm have also been utilised. Overall there is good evidence to support the view that PTSD is associated with an attentional bias for trauma-related words on a Stroop task. Methodological issues are discussed and recommendations for future research are made.

1. Introduction

Symptoms of Post-traumatic Stress Disorder (PTSD), like hypervigilence, have been attributed to an attentional bias to threat stimuli. If this is the case, then attentional bias could be a further target for treatment of PTSD. However, more needs to be understood about the phenomenon of attentional bias in PTSD. This paper systematically reviews evidence from studies that have recruited individuals with PTSD from adult populations to determine to what extent the findings of attentional bias in PTSD are dependent on methodology.

1.1 Clinical Characteristics and Prevalence of PTSD

Post-traumatic stress disorder (PTSD) is an anxiety disorder (DSM-IV: American Psychiatric Association, 1994); its symptoms are clustered within intrusion, hyperarousal and avoidance following exposure to a traumatic event. The traumatic event is perceived as frightening and threatening to the life or physical integrity of the self or others. PTSD can be diagnosed when criteria A-F are satisfied within DSM-IV (Appendix 1.2). Symptoms must have been present for at least one month in duration and have had an adverse impact on daily functioning.

Epidemiological studies on PTSD in the United States show a lifetime prevalence rate of 5–10% and a current prevalence of 1–5% in adult populations (Breslau et al., 1998; Kessler, Chiu, Demler, Merikangas, & Walters, 2005; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995; Resnick, Kilpatrick, Dansky, Saunders, & Best, 1993). Until recently, large national surveys on PTSD in Europe have been relatively scarce. However, a large study on the general adult population in the Netherlands suggested that 52.2% of the population reported at least one stressful event throughout their life and an estimated 3.8% of the population had PTSD (Bronner et al., 2009).

1.2 Conceptual Models of PTSD

The symptoms of PTSD are most usefully conceptualised in terms of Lang's (1977, 1979) Bio-informational Processing Theory (Foa, Steketee, & Rothbaum, 1989). This is an early, single

representation, information processing model based on the notion that memory can be thought of as a network involving thousands of nodes with a dense set of interconnections between them. In single representation theories, memory consists of a pattern of interconnections between nodes (Brewin, 2005). The Bio-informational Processing theory maintains that fear-relevant stimuli are stored in semantic *fear networks.* According to Lang (1979), fear networks contain three related types of information: (1) information about the traumatic event, such as sights and sounds; (2) information about the person's emotional and physiological response to the event; and (3) information concerning the individual's interpretation of the degree of threat. Therefore, Lang (1979) proposed that fear information is stored in memory in a particular integrative way which can facilitate cognitive, motor and psychophysiological responding. Lang, Levin, Millar & Kozak (1983) proposed that patients with anxiety disorders have a stable fear network which can be readily activated when matched to elements in the environment. Lang et al., (1983) further posited that less prominent fear-relevant stimuli, like trauma words, can activate the fear network in people with anxiety disorders because other elements of the network are likely to be active e.g. psychophysiological responses. For patients with PTSD, Blanchard, Pallmeyer & Gerardi (1982) suggested that symptoms, like intrusive memories, are triggered by a fear response to degraded peripheral threat cues which is facilitated by an attentional bias.

The Bio-informational Processing Theory (Lang, 1977) has been developed to account for how a significant traumatic event can violate a person's previously held basic concept of safety. This Emotional Processing Theory (Foa & Rothbaum, 1998) suggests ways in which a traumatic memory can lead to a structure in memory that is different from one that is created for an everyday frightening experience (Brewin, 2005). One such mechanism involved large numbers of potent stimulus-danger interconnections being formed between nodes, so that their connections to each other became much stronger than their connections to non-trauma-related nodes (Brewin, 2005). Although network theories are helpful in conceptualising PTSD, Brewin (2005) highlights that these networks cannot account for the special features of PTSD, such as

the distortion in the sense of time and why some traumatic memories take the form of flashbacks whilst others appear like normal memories.

In contrast to fear network theories (that a traumatic memory is an ordinary memory that has a particular structure; i.e. stronger interconnections), it has been suggested that traumatic memories are represented in a fundamentally distinct way (Brewin & Holmes, 2003). Here, symptoms of PSTD such as flashbacks and re-experiencing occur when trauma memories become dissociated from the memory system for everyday memory.

Dual Representation Theory (Brewin, Dalgleish, & Joseph, 1996) is one such theory that suggests that traumatic memories are stored in a fundamentally different way to ordinary memories. Here, two memory systems are thought to work in parallel, but one may take precedence over the other in different circumstances. The Verbally Accessible Memory (VAM) system involves the conscious storage of narrative memories of the trauma. The information stored in the VAM system can be consciously accessed when required. The Situationally Accessible Memory (SAM) system involves implicit (unconscious) processing. The SAM system processes information from lower level perceptions of the traumatic scene, such as sights and sounds which were too briefly attended to in order for them to be contained in the VAM system. Flashbacks are thought to represent the operation of SAM system in that they are triggered involuntarily by situational reminders of the trauma (Brewin, & Holmes, 2003).

1.3 Attentional Bias

Attentional bias is a phenomenon where an individual redirects attentional resources to the most salient task with resultant disruption of other ongoing cognitive activities (Mogg & Bradley, 1998). Attentional bias is believed to be important in the development and maintenance of PTSD because chronic over-arousal to mild threat stimuli can occur when attention is constantly biased to such stimuli (Brewin, 2005). Attentional bias is frequently measured using the modified Stroop task in which participants are instructed to colour-name words which are

emotionally laden. This task is based on the hypothesis that longer response latencies indicate attentional resources being preferentially allocated to the meaning of the word and thus, interfering with the task of colour-naming (Johnson & Hasher, 1987). Although attentional bias is thought to be an important characteristic of PTSD (Brewin, 2005), different methods have been used to measure this construct leaving the key question of, to what extent do findings depend on methods used.

1.4 Aim

To conduct a systematic literature search to identify the experimental paradigms used to measure attentional bias in PTSD and to determine to what extent the findings are dependent on methods.

1.5 Research Questions

1. Does the evidence suggest there is an attentional bias in PTSD?
2. Is the evidence for attentional bias dependent on methods?

2.0 Methods

Insert Figure 1.1

A systematic literature review was conducted (see Figure 1.1). The search covered the period, between 1980 and 2008 because PTSD was first included in DSM third edition in 1980. The following computerised databases were searched: MEDLINE (1950 to October 2008 week 4), EMBASE (1980 to 2008 week 43), PSYCHINFO (1967 to October 2008 week 4); CINAHL (1982 to October 2008 week 4); PUBMED, COCHRANE LIBRARY and BRITISH NURSING INDEX & ARCHIVE (1985 to October 2008).

The search used the following key words [POST TRAUMATIC STRESS DISORDER] or [PTSD] and [ATTENTIONAL BIAS] or [COGNITIVE BIAS] or [INFORMATION

PROCESS*]. Article titles were initially reviewed and articles with no reference to the systematic review topic were excluded. A second reviewer (EW) independently screened the article titles. If no consensus was found between the second reviewer and the author, online abstracts were obtained and reviewed. Online abstracts were obtained for all articles that seemed relevant based on the title. Abstracts were reviewed by the author and independently by the second reviewer to establish if the article met the inclusion criteria described below. Reprints of potentially eligible articles were obtained. A hand search of all references of included journal articles were searched to identify further relevant articles. Additionally, the Journal of Traumatic Stress, Biological Psychiatry, Journal of Anxiety Disorders and Journal of Abnormal Psychology were manually searched.

2.1 Inclusion and Exclusion Criteria

Studies were included if they investigated attentional bias in adult populations with PTSD. Only studies which investigated PTSD caused by trauma in adulthood were eligible. Studies which included lifelong trauma, other psychiatric disorders or physical problems (like chronic pain) were not eligible. Exclusion criteria therefore included: (1) child/adolescent population studied; (2) attentional bias not measured; (3) studies that investigated the neuropsychology of PTSD in general; (4) case reports and (5) dissertation abstracts.

2.2 Data Extraction

Data extracted from each paper included: clinical, demographic and methodological information. Two reviewers independently rated the methodological quality of each article according to strict quality criteria (Appendix 1.3). The quality criteria were based on Cook & Campbell's (1979) (taken from Ellis, Landany, Krengal, & Schult, 1996) article in which threats to the validity of designs were identified. These criteria were modified to be appropriate for studies on attentional bias and PTSD. The proportion of agreement between the independent raters for rating the quality of each paper was 100%.

3.0 Results

From the electronic database search a total of 71 papers were identified and from the hand search, a further 9 papers were identified. On examination of the full-text, 13 papers from the electronic database search, and one paper from the hand search met full inclusion and exclusion criteria (Table 1.1). A total of 66 papers (Appendix 1.4 and 1.5) were excluded. The studies are reported here according to the research questions of the current systematic review and the results are discussed with regard to methodologies employed.

Insert Table 1.1

3.1 Does the evidence suggest there is an attentional bias in PTSD?

The modified Stroop task has been used to investigate attentional bias in trauma victims of crime (Paunovic, Lundh, & Ost, 2002), combat (Constans, McCloskey, Vasterling, & Brailey, 2004; Vrana, Roodman, & Beckham, 1995; McNally, English, & Lipke, 1993; McNally, Kaspi, Riemann, & Zeitlin, 1990), motor vehicle accidents (Bryant, & Harvey, 1995), rape (Cassiday, McNally, & Zeitlin, 1992; Foa, Feske, Murdock, Kozak, & McNally, 1991) and ferry disaster (Thrasher, Dalgleish, & Yule, 1994).

Combat trauma (i.e. veteran studies) has been studied most frequently using the modified Stroop task. McNally et al., (1990) compared Vietnam veterans with and without PTSD and found that in comparison to veterans without PTSD, those with PTSD took longer to colour-name trauma words than they did to colour-name neutral, positive and obsessive-compulsive disorder (OCD) words. In this study, the PTSD group compared to the non-PTSD group were significantly younger [$t(28) = 3.10$, $p<0.004$], had fewer years of education [$t(28) = 2.11$, $p<0.04$] and scored significantly higher [$t(24) = 9.63$, $p<0.001$] on the Mississippi Scale for Combat-related PTSD (Mississippi Scale: Keane, Caddell, & Taylor, 1988). The Mississippi scale is a validated tool for diagnosing PTSD. Additional analysis revealed that Stroop interference for any word type did not correlate significantly with either age or years of education. Thus, selective processing

of PTSD words was not attributed to the PTSD group being younger or less educated than the group without PTSD. Stroop interference for PTSD words was found to correlate significantly with the Mississippi Scale scores [$r(24) = 0.64$, $p<0.001$] and remained significant when controlling for the extent of combat exposure [$r(18) = 0.59$, $p<0.01$], suggesting that the Stroop interference was related to PTSD, not the trauma. Participants also completed the Profile of Mood States (POMS: McNair, Lorr, & Droppleman, 1971) from which scores for tension, depression, anger, fatigue, confusion and vigour can be derived. All except 'vigour' correlated significantly with interference for the PTSD scores suggesting that selective processing of threat words is strongly related to emotional disturbance. However, these scores were not treated as covariates in the primary analysis comparing Stroop interference scores for those with and without PTSD, making it difficult to draw firm conclusions.

McNally et al., (1993) repeated their 1990 study, modifying only the size of the card used to present the stimulus words used in the Stroop task. Here, a consecutive sample of 24 male inpatients at a treatment unit for PTSD completed the same Stroop task. Results were consistent with the previous study; participants with PTSD exhibited Stroop interference for trauma words and no interference for positive, negative, or neutral words, or words related to other anxiety disorders. Given that their participants were veterans in an inpatient treatment centre, it is difficult to generalise their findings. Also, potential confounders were not considered in analyses, such as substance misuse, extent of combat exposure and co-morbid psychiatric problems. These factors therefore reduced the quality of the study.

Vrana et al., (1995) built on previous research by investigating whether response latencies on the Stroop differed between veterans with and without PTSD on trauma words with three levels of specificity: (1) Vietnam specific words, (2) Vietnam-general words and (3) Watts-Emotion words which were general negative words. The findings were consistent with previous studies in that the PTSD group took longer to colour-name all types of trauma words. The analysis comparing differences in response latencies between the PTSD and non-PTSD groups was

repeated controlling for depression, anxiety, and psychiatric medication, and the same findings were reported. However, the sample size for this additional analyses was small (PTSD group n=9, non-PTSD group n=14). Also, like McNally et al's., (1990, 1993) studies, there was no non-veteran control group. The quality of this study is reduced due to the lack of clarity regarding the extent to which the veterans were exposed to combat.

More recently, Constans et al., (2004) conducted a large cohort study investigating an attentional bias suppression effect in veterans with PTSD The suppression effect is a phenomenon whereby an individual can inhibit an attentional bias under certain contextual conditions (Mathews & Sebastian, 1993). In this study, veterans completed computerised Stroop tasks consisting of social threat, combat-related and neutral words. The sample was divided into four groups and each group, except the control group, was given an instruction prior to completing the Stroop task. Prior to starting the stroop task, the first group were told they would be required to watch a short combat video, the second group were told they would have to give a two minute speech, and the third group were told they would be given $10 once they completed the Stroop task. The fourth group (control) were given no instructions. The groups did not differ in age, depression severity, PTSD severity or social anxiety level. The findings suggested that attentional bias was suppressed when the participants were faced with the prospect of being exposed to a mildly threatening event after the Stroop task. The authors concluded that suppression effects may be secondary to either (1) a process in which attention is prioritised and awarded to the most potent threat, or (2) a process in which an upcoming stressful event leads to the narrowing of attentional focus, such that peripheral cues, like word meaning, are ignored. As expected, the control group did have longer response latencies for trauma-related words. Interestingly, the authors found little support for the prediction that the suppression effect would be strongest when the post-Stroop event matched the word content on the Stroop task. This study had reduced quality because it did not consider the extent to which the veterans were exposed to combat, and therefore the findings of the study may not be generalisable to other single event traumas.

Two studies (Cassiday et al., 1992; Foa et al., 1991) that investigated Stroop interference in victims of rape found that those with PTSD took longer to colour-name rape-related words compared to neutral and negative words which were not rape-related. Individuals who had not been raped showed no difference in response latencies for any word type. For rape victims without PTSD, the findings were less consistent. One study (Cassiday et al., 1992) found that these individuals took longer to colour-name rape-related words, although another study (Foa et al., 1991) did not report any Stroop interference. However, the latter study (Foa et al., 1991) scored less in terms of quality and therefore the findings of the former study (Cassiday et al., 1992) may be more reliable.

Thrasher et al., (1994) investigated whether attentional bias was present in individuals who had survived a man-made disaster, based on a nosological debate at the time (e.g. Davidson & Foa, 1991) regarding whether or not PTSD should be considered different in survivors of man-made disasters compared with PTSD resulting from rape and combat exposure. Participants of a ferry disaster were grouped by PTSD symptom severity as assessed using the Revised Impact of Events Scale (IES: Horowitz, Wilner, & Alvares, 1979) and a control group was matched to the PTSD groups by age, sex and verbal IQ as measured by the National Adult Reading Test (NART: Nelson, 1982). All participants completed the modified Stroop task which consisted of (1) semantically-unrelated neutral words, (2) semantically-related neutral words, (3) positive emotional words, (4) threat words and (5) disaster-related words. The findings were consistent with previous studies looking at attentional bias in rape victims and veterans; those with high PTSD symptomatology (i.e. >40 PTSD symptoms on the IES) took significantly longer to colour-name disaster words compared with general threat, neutral and positive words. The low PTSD group (i.e. <39 PTSD symptoms on the IES) and the controls showed no Stroop interference for threat words or disaster words. This study had a high quality score as it benefitted from controlling for potential confounding variables, like substance abuse, and was based on a single event trauma. However, diagnosis of PTSD was made using a self-report measure and may not be an accurate measure of the presence of PTSD symptoms.

Bryant and Harvey (1995) used a computerised Stroop task to compare attentional bias in individuals with PTSD and those with a simple phobia. The task consisted of four types of words: (1) strong threat, (2) mild threat, (3) positive and (4) neutral. All participants had been involved in a motor vehicle accident (MVA) and the groups did not differ significantly on age, time since MVA, severity of MVA or vocabulary score as measured by the vocabulary subtest of the Wechsler Adult Intelligence Scale – Revised (WAIS-R: Wechsler, 1981). The findings were consistent with previous studies which found that individuals with PTSD display Stroop interference for threat related stimuli. Specifically, the PTSD group took longer to colour-name strong and mild threat words compared to positive and neutral words, but there was no difference between strong and mild threat words. The Stroop interference effect was not found for the simple phobia group supporting the theory that Stroop interference for threat-related words is associated with PTSD symptomatology. However, this study did not have non-PTSD trauma group, which would have helped clarify the reported finding that attentional bias is a feature of PTSD.

The studies described so far demonstrate a supraliminal (words remain exposed until the participant correctly colour-names them) Stroop interference for trauma words in individuals with PTSD. However, Cassiday et al., (1992) commented that the use of computerised supraliminal Stroop tasks may mean that individuals ruminate about the meaning of threat words, or use avoidance strategies in response to such words. Indeed, one study found subliminal trauma-specific interference in PTSD and suggested that pre-attentive processing of threatening information may occur in PTSD (Harvey, Bryant, & Rapee, 1996). Paunovic et al., (2002) investigated whether individuals with PTSD compared to a matched control group displayed a pre-attentive bias on subliminally and supraliminally presented words. A computerised Stroop task was used to present words supraliminally, that is, words were presented until participants successfully colour-named each word. In the subliminal condition, words were presented for 17ms and then replaced with a string (mask) of either Xs or Os until the individual successfully colour-named the mask. It was hypothesised that previous findings

of Stroop interference occurring in individuals with PTSD would be replicated, and that individuals would display Stroop interference for subliminally presented words compared with controls. The findings suggested that the PTSD group did display Stroop interference for supraliminally presented trauma words compared with controls. However, no Stroop interference was apparent in the subliminal condition, suggesting pre-attentive processing was not present. Unfortunately, the participants with PTSD in this study were part of a treatment study of Cognitive-Behavioural Therapy (CBT) for acute PTSD with the mean duration of their disorder being 6.7 weeks (SD = 2.31), and therefore the PTSD symptoms may have been too short-lived to cause an absolute attentional bias towards threat-related words.

Although the modified Stroop task is the most frequently used paradigm, doubts have been raised as to whether the task constitutes a measure of attentional bias to threat stimuli because a similar degree of interference has been found for positive words (McNally, Riemann, Louro, Lukach, & Kim, 1992). Bryant and Harvey (1997) failed to find greater attentional allocation in individuals with PTSD when using the dot-probe paradigm; however, this study did not use trauma-relevant stimuli. Elsesser, Sartory & Tackenberg, (2004) also used the dot-probe paradigm to assess whether an attentional bias to trauma-pictures was present in individuals with chronic PTSD and recent trauma victims. Including a measure of heart rate (HR), the researchers found that both groups had increased HR reactions to trauma-pictures. Neither groups showed shortened reaction times whenever the probe appeared in place of the trauma picture, nor did they show avoidance, thus suggesting that neither group showed an attentional bias for trauma pictures. However, the extent of attentional bias did vary with HR reaction to trauma pictures. For the chronic PTSD group, increased HR occurred when individuals directed their attention towards the trauma-picture, and furthermore, the higher the HR reaction, the more unpleasant the trauma-picture was rated. Given this, the authors suggested that the attentional bias evident in some participants was due to the emotional impact of the picture rather than the cognitive impact.

Other, less used paradigms have also been employed to investigate whether or not an attentional bias is present in individuals with PTSD. Using a sentence priming paradigm, Weinstein, Lillywhite, & Nutt, (1996) found evidence for a general interference when a trauma sentence was followed by a trauma word. However, because the same phenomenon was evident in the control group, it was concluded that there was little evidence for a selective bias in the PTSD group. In contrast, Michael, Ehlers, & Halligan, (2005) used a word stem completion task and found that assault survivors with PTSD showed enhanced priming for trauma-related words compared with assault survivors without PTSD. Using a visual search task with a lexical decision component, Pineles, Shipherd, Welch, & Yovel, (2007) found that attentional biases in individuals with PTSD was due to attentional interference (difficulty disengaging from the threat-related stimuli) as opposed to attentional facilitation (being drawn to the threat-related stimuli). This study therefore offered support to studies using the modified Stroop task.

In summary, eight out of fourteen papers (57%) scored more than 10 points on the quality rating scale. The maximum score that could have been achieved was 17, however, no paper achieved this score. The highest score was 12 and this was awarded to a paper (Cassiday et al., 1992) investigating attentional bias and PTSD in rape victims. This study used a computerised Stroop task in which the trauma words were rated for 'stressfulness' by rape victims who did not participate in the study. This study also benefitted from having three groups: rape victims with PTSD, rape victims without PTSD and a non-victimised control group.

Overall, the evidence suggests that an attentional bias does exist in PTSD, and although the modified Stroop task is the most commonly used measure of attentional bias, other paradigms have provided confirmatory evidence. Given that other, disparate paradigms have been used to investigate attentional bias in PTSD, the remainder of this systematic review will focus on studies which employed the modified Stroop task.

3.2 Is the evidence for attentional bias dependent on methodology?

Questions have been raised regarding the methodologies employed, specifically with regard to the modified Stroop task. The most pertinent issues concern (1) the method for delivering the Stroop task, (2) types of words included and, (3) how the stimulus words were chosen. For all studies, it is also necessary to consider whether or not potentially confounding variables have been controlled for.

Insert Table 1.2

3.2.1 *Method for delivering the Stroop task*

Of the nine studies using the modified Stroop task, four presented the task manually using words printed on cards, and five administered the task using a computer (Table 1.2). Doubts have been raised regarding the reliability of using manual presentations for the Stroop task as all four studies displayed all the trauma words on one card. By doing this, it is difficult to rule out the possibility that rumination is taking place and consequently confounding the results. All five studies which used a computerised Stroop task presented their words individually and randomly. One study (Cassiday et al., 1992) which explicitly explored the issue of rumination compared Stroop interference for high threat words using a random and blocked format of presentation. The authors found no significant difference in the degree of interference, suggesting that rumination does not contribute to the Stroop effect. However, one cannot rule out the possibility that participants ruminate about threat words whilst other neutral or positive stimuli are presented. Based on this conclusion, Paunovic et al., (2002) used supraliminal and subliminal presentations of the Stroop task and found that participants with PTSD exhibited Stroop interference for trauma words which were presented supraliminally but not subliminally. Both studies (Paunovic et al., 2002; Cassiday et al., 1992) demonstrated high levels of quality, suggesting that their results were reliable.

Using a computer to administer a Stroop task therefore affords the researchers flexibility to manipulate the experimental paradigm. This is a luxury that cannot be achieved using manual presentations of the Stroop task. Computerised administration has also allowed for greater accuracy in recording reaction times and errors.

3.2.2 *Types of words included in the Stroop task*

Of the four manual Stroop task studies, two (McNally et al., 1990; Vrana et al., 1995) administered a task in which the participants had to rate how stressful they found each word. The purpose of such a task was to test whether or not the emotionality of the words included had an impact on the findings. The 'emotionality hypothesis' states that the magnitude of a word's personal significance determines its capacity to delay colour-naming in a Stroop task (Martin, Williams, & Clark, 1991). McNally et al., (1990) reported results that were inconsistent with the emotionality hypothesis because: (1) participants displayed greater interference for threat words than for positive words, (2) general emotionality was not correlated with interference, and (3) the control group did not exhibit interference for positive words even though they rated them as being 'highly emotional'. However, the results do not completely refute the emotionality hypothesis as the PTSD words were given higher emotionality ratings than the positive words, therefore it is unclear whether the positive words would have produced the same interference as the PTSD words if they had the same emotionality value. Vrana et al., (1995) did not include positive words in their Stroop task leaving it difficult to conclude if the results were due to the effects of threat, or emotionality. However, this study did reveal a free recall and recognition advantage for the emotion words. Specifically, there was greater recognition accuracy for the Watts-emotion (negative words) and Vietnam general words compared to the Vietnam specific words for both the PTSD and non-PTSD group. McNally et al., (1993) did not include a measure of how stressful participants found the words, therefore, the results are inconclusive with regards to whether the Stroop interference for trauma words, exhibited by the PTSD group, were due to the effects of the trauma words, or because of the effect of emotionality. Also, the latter study (McNally et al., 1993) had reduced methodological

quality compared to the former study (Vrana et al., 1995). Thrasher et al., (1994), did include positive words and found no Stroop interference for positive words in participants with PTSD. In addition, this study reported a large effect size for the finding that participants with 'high' PTSD symptomatology had longer latencies for disaster related words compared to positive words. No such differences were found for the 'low' PTSD symptomatology group. Therefore, it is clear that it is essential to include positive words in order to control for the potentially confounding effects of emotionality.

Of the five computerised Stroop task studies, only one study (Cassiday et al., 1992) found Stroop interference for positive words. Cassiday et al., (1992) reported that participants with PTSD exhibited longer response latencies for positive words compared to neutral words, thus lending support to the emotionality hypothesis (Martin et al., 1991). However, most of the positive words used in their study reflected interpersonal themes, and therefore may have been perceived as trauma-related by the participants who in this study, were rape victims. Bryant, & Harvey, (1995) did not find evidence for Stroop interference for positive words, suggesting the interference displayed for threat words was associated with the threat content of the words rather than emotionality. Paunovic et al., (2002) did not find a specific Stroop interference effect for trauma words relative to positive words, which suggested the trauma words may not have been threatening enough. However, in this study, the words were not rated for their level of threat by the participants.

Although the evidence is not conclusive, it does suggest that the important factor in selecting words concerns the level of threat trauma words pose to the participants. The emotionality hypothesis is also an issue that has to be considered when measuring attentional bias. Therefore, it is essential that positive and negative words are included in paradigms so the effects of threat and emotionality can be differentiated.

3.2.3 *Method of choosing stimulus words for modified Stroop paradigms*

The evidence seems to suggest that it is important that the words selected for the threat category of Stroop tasks are indeed perceived as threatening to the participant. If these words are not perceived as threatening, it is possible that no Stroop interference will be found. The most sensible method for selecting trauma words was demonstrated by studies in which pools of trauma words were created and then rated by victims of trauma who did not participate in the study (Foa et al., 1991; Cassiday et al., 1992; Bryant & Harvey, 1995). Other studies (McNally et al., 1991; McNally et al., 1993; Vrana et al., 1995; Constans et al., 2004) used words from previous research. One study (Paunovic et al., 2002) stated that the first author selected the trauma words, however the process for doing so was not clearly explained and consequently not replicable.

3.2.4 *Controlling for potentially confounding variables.*

Insert Table 1.3

Table 1.3 displays the confounding variables that each study controlled for. Of the fourteen studies included in this review, only two studies stated they excluded individuals who were colour blind (Thrasher et al., 1994; Cassiday et al., 1992); four studies excluded individuals with current and previous psychiatric illness (Cassiday et al., 1992; Paunovic et al., 2002; Constans et al., 2004; Michael et al., 2005); three studies excluded individuals with substance misuse problems (Paunovic et al., 2002; Constans et al., 2004; Michael et al., 2005) and only one study explicitly stated that previous head injury was part of the exclusion criteria (Bryant & Harvey, 1997).

Five studies controlled for depression in their analysis (Thrasher et al., 1994; Constans et al., 2004; Weinstein et al., 1996; Elsesser et al., 2004; Michael et al., 2005); and five studies controlled for time since the traumatic event (Cassiday et al., 1992; Bryant & Harvey, 1995; Bryant & Harvey, 1997; Elsesser et al, 2004; Michael et al., 2005).

4.0 Discussion

There are three key issues that arise from this systematic review: the limitations of the current research, whether or not attentional bias is an automatic or strategic process, and the implications for clinical practice and future research.

4.1 *Limitations of current research*

The most commonly used paradigm to investigate attentional bias in PTSD is the Stroop task. Nine of the 14 papers included in this review used this task. All (100%) of these papers provided evidence that an attentional bias to threat stimuli is a feature of PTSD and is consistent with PTSD symptomatology. However, there are methodological issues with these studies, particularly studies employing the Stroop task. Specifically, inconsistency in the types of words that were included, level of threat words evoke, and method for presenting the words. The higher rated studies seem to suggest that words should be rated for level of threat by victims of trauma (who do not participate in the study) and matched by frequency and word length to positive, neutral and negative words in order to consider the emotionality hypothesis. When delivering a Stroop task, it seems that words should be presented randomly to participants in order to reduce rumination effects. However, it is not clear whether or not rumination on trauma words persists when neutral and positive words are presented and therefore future research is necessary.

The most common population studied was the veteran population (i.e. 43% of studies and 40% of Stroop studies). These findings may not generalise to the wider population given the reportedly higher incidences of substance misuse and psychiatric illness compared with the general population (Wagner, Harris, Federman, Dai, Luna, & Humphreys, 2007). Another issue with this population regards the lack of clarity as to the degree of trauma these veterans were exposed to. Two (McNally et al., 1990; Vrana et al., 1995) of the four Stroop studies using a veteran population considered this potential confounder by using the Combat Exposure Scale (CES: Keane, Fairbank, Caddell, Zimering, Taylor, & Mora, 1989). Although CES scores were only obtained for 7/15 participants with PTSD, the correlation remained significant between

PTSD severity and Stroop interference for PTSD words when CES was controlled for, suggesting that combat exposure per se was not impacting on the degree of attentional bias. Vrana et al., (1995) also used the CES but failed to control for this measure in their analysis. Therefore it is difficult to conclude whether or not their findings support those of McNally et al., (1990). Given that the Vietnam War may have been considered unpopular by some members of the public, perhaps Vietnam veterans had difficulty adjusting to social situations following the war and as such, justified being in treatment for PTSD as means of coping with negative views.

Recruitment itself appears to give rise to methodological difficulties. All Veteran studies (Pineles et al., 2007; Weinstein et al., 1996; Constans et al, 2004; McNally et al., 1990; McNally et al., 1993; Vrana et al., 1995) recruited their samples from centres treating veterans with PTSD. It is difficult to conclude therefore whether these samples are representative of the general PTSD population as these participants had opted in for treatment. Likewise, the victims of rape in one study (Foa et al., 1991) were recruited from a group of victims undergoing investigations into psychopathological responses to rape. In this study, it was not clear what these 'investigations' entailed, leaving it difficult to ascertain the homogeneity of the sample.

A related issue is whether or not the participants had received treatment for PTSD. One study (Cassiday et al., 1992) reported that some of the participants in their sample had received 'supported psychotherapy'. Although they do not clarify what this was, or who provided it, they stated the psychotherapy was neither cognitive nor behavioural. It is imperative that the authors make it clear if participants have received treatment for PTSD and described the nature of the therapy. According to Dual Representation Theory (Brewin et al., 1996), treatment of PTSD involves integrating trauma memories into the individual's autobiographical memory. If treatment has been provided to individuals with PTSD, they may be displaying Stroop interference to a lesser extent. Indeed, one study (Paunovic et al., 2002) recruited participants from a treatment study of Cognitive Behavioural Therapy (CBT) for acute PTSD but failed to clarify what stage these participants were at in their treatment.

Co-morbid mood disorders also play a confounding role in attentional bias paradigms. Indeed depression severity has been consistently reported as significantly correlating with processing speed (McDermott & Ebmeier, 2009). Many of the studies included in this review conducted measures of mood, however, psychiatric history was not consistently reported and psychiatric medication was only controlled for in one study (Vrana et al., 1995) and formed part of the exclusion criteria in another (Constans et al., 2004).

Another issue is whether or not studies should include a control group consisting of individuals who have experienced the same type of trauma as the PTSD group, but without suffering from PTSD. By having this non-PTSD trauma control group in addition to a healthy control group, it may allow the investigator to identify what the specific characteristics of PTSD are, and be able to conclude whether or not the presence of an attentional bias is a feature of PTSD, or whether it is caused by merely experiencing a traumatic event.

There appears to be inconsistency in the assessment tools used for diagnosing PTSD in the sample of studies reviewed. Similarly, a variety of measures have been used for assessing PTSD symptom severity. In particular, five of the six Veteran studies (McNally et al., 1990; McNally et al., 1993; Vrana et al., 1995; Constans et al., 2004; Pineles et al., 2007) used measures of PTSD that are specific to individuals who have been involved in combat. Given the specificity of these tools, it is again questionable to what extent the findings in these studies are generalisable to the wider PTSD population.

4.2 *Attentional bias: Automatic or under strategic processing?*

The way people process information has generally been viewed as involving two broad classifications of processes: automatic and strategic. Automatic processes have traditionally been defined as those that occur without conscious effort, are involuntary, and capacity free (i.e., do not require additional resources that would detract from performance on a concurrent task). By way of contrast, strategic processing has been defined as involving conscious-controlled effort, and being capacity limited in nature (Posner & Snyder, 1975). However, there

is debate as to whether these are mutually exclusive, as many of the symptoms of PTSD are involuntary but not necessarily capacity free. That is, the presence of PTSD symptoms can detract attention from concurrent tasks (Buckley, Blanchard, & Neill, 2000).

Subliminal Stroop paradigms (e.g. Paunovic et al., 2002) investigated whether or not preconscious processing of threat stimuli is present in individuals with PTSD. Specifically, the authors investigated whether or not cognitive fear structures were easily primed for individuals with PTSD. It was hypothesised that preconscious processing is evidence of automatic processing of threat stimuli and also evidence that cognitive fear structures can be primed. Paunovic et al., (2002) did not find any evidence for pre-attentive processing, suggesting that automatic processing was not a feature of PTSD. One explanation for this finding relates to the acute nature of PTSD symptoms. Perhaps the PTSD symptoms were too short-lived to cause an absolute attentional bias to trauma-related information. Indeed, the trauma network may become more generalised over time, and as such, the trauma words for this study were not sensitive to the varying types of crime reported by this sample. This notion that the trauma-network can become more generalised over time is supported by a study (Foa et al., 1991) which found only a specific supraliminal Stroop interference effect in rape victims with PTSD within a year of their assault, while another study (Cassiday et al., 1992) found a more generalised PTSD effect in individuals with PTSD who were tested an average of nine years or more after their assault. Nevertheless, the findings of Paunovic et al's., (2002) study were consistent with a review of the literature which found that attentional bias for threat stimuli occurs at the post-recognition stages of information processing (Buckley et al., 2000).

Further support for attentional bias being characterised by strategic processing comes from a study (Constans et al., 2004) which investigated whether or not attentional bias could be suppressed in individuals with PTSD. Findings suggested that attentional bias could be inhibited when the individuals with PTSD anticipated exposure to a threatening event. This suppression effect was not evident when participants were offered a financial reward on completion of the

task. According to information processing models, attentional priority is given to the most threatening incoming information, whilst lesser threats are ignored while the more threatening information is being processed (Mathews & MacIntosh, 1998). This therefore, would suggest that attentional bias is under strategic control.

4.3 *Implications for clinical practice and future research*

The literature suggests that attentional bias is a feature of PTSD. Given that it can be readily measured using paradigms, like the modified Stroop task, clinicians may be able to utilise such paradigms to gather a more comprehensive clinical understanding of an individuals difficulties. It is essential however to develop word sets that are sensitive and specific to types of traumas in order for use in these paradigms. Further research is necessary to develop such resources.

Finally, this review included papers which investigated attentional bias in individuals who had experienced trauma in adulthood. Van der Kolk (2003) has suggested that trauma in childhood has significant effects on brain development due to heightened exposure to the stress hormone cortisol. Future studies of attentional bias in PTSD should consider investigating the differences in repeated exposure to trauma across the lifespan, and complex PTSD, compared to single event traumas,.

5.0 Limitations of review

Papers included in this review were rated using a modified quality rating scale. It needs to be acknowledged that although a paper may have scored low on this rating scale, this may not be an accurate reflection of the actual methodological quality. This is because papers may well have considered important ‘threats to validity’ but not reported this in their paper due to other factors, such a word limit as stipulated by the publishing journal.

6.0 Conclusions

The evidence suggests that attentional bias to threat stimuli on a Stroop task is a feature of PTSD in adults. However, there are several methodological concerns. The design of paradigms used to measure attentional bias can be criticised on the basis of how stimuli used in attentional bias tasks are created and presented. It is important that the 'emotionality hypothesis' is taken into account in the design but few studies do this. Few studies account for potentially confounding variables such as IQ, age, psychiatric illness, mood disorders, trauma history, time since trauma and trauma severity. Some samples studied are not representative of the population, limiting the generalisability of the findings. Finally the quality of the studies may not be reflected in the quality rating score systems used. This highlights a difficulty in selecting appropriate quality rating scales in this area. Future papers which aim to systematically review experimental paradigms would benefit from creating quality rating scales from the papers included.

Figure 1.1: Flowchart of article selection process

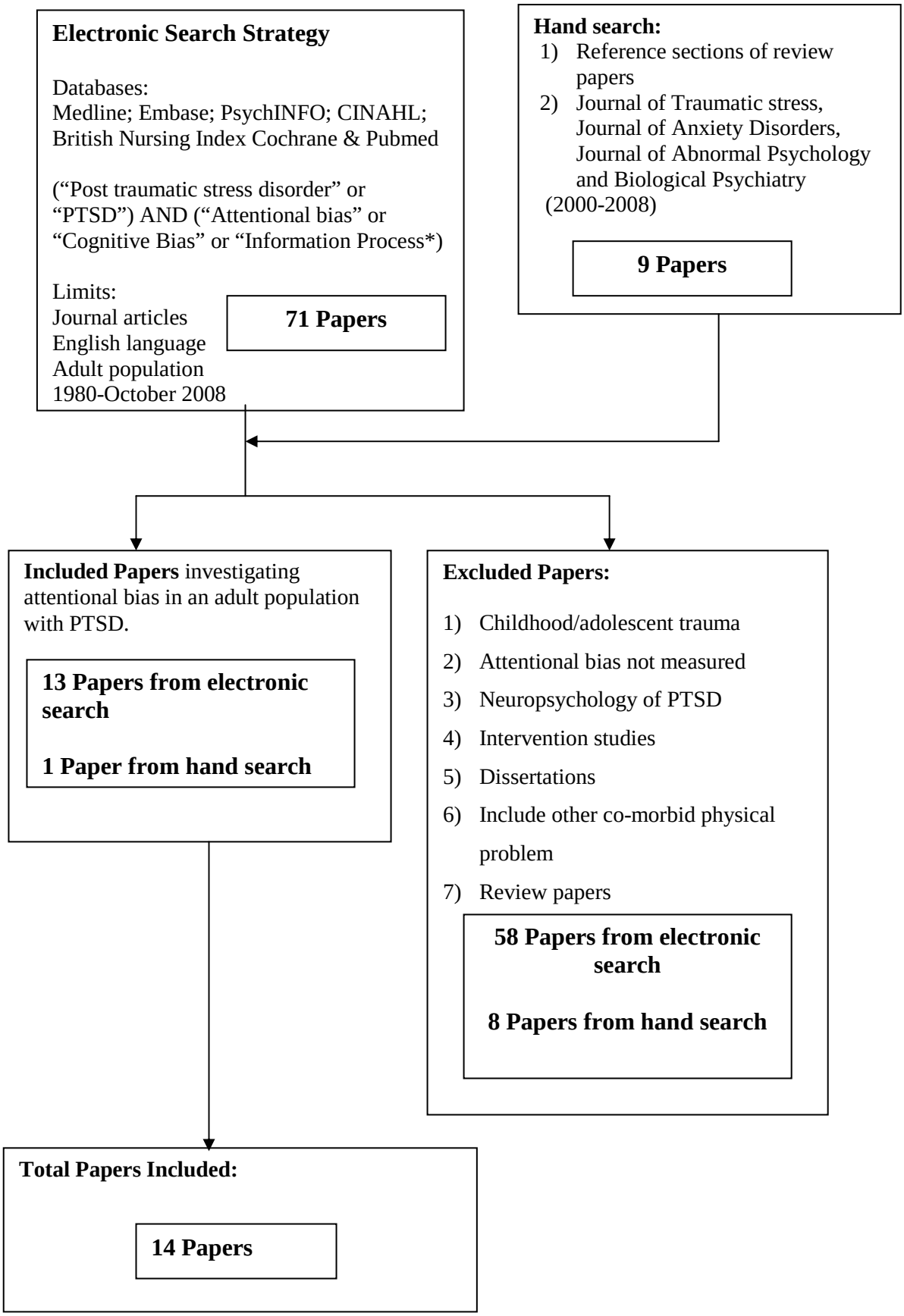

Table 1.1: Demographic information for studies included in systematic review

Study	Quality Rating	PTSD assessment	Attentional Bias measure	n (**case**/control**)**	Sample
Cassiday et al., (1992)	12	SCID (DSM-III-R)	Computerised Stroop task	***12**/12/12	Participants for each group were recruited from the community and through professionals (not specified) specialising in treatment of rape victims.
Elsesser et al., (2004)	11	Clinical interview and DIPS	Computerised dot-probe task	***18**/31	All participants recruited from the community through advertisements.
Paunovic et al., (2002)	11	CAPS	Computerised Stroop task	**39**/39	Case: Participants in a treatment study for CBT for acute PTSD Control: randomly selected from community
Thrasher et al., (1994)	11	Clinical interview and Revised Impact of Events Scale (IES)	Stroop presented manually on cards	***13**/20_a/12_b	Case: Ferry disaster survivors recruited through retrospective review of medical notes $Control_a$: Ferry disaster survivors recruited through retrospective review of medical notes $Control_b$: Randomly recruited from the community
Michael et al., (2005)	11	PDS	Word-stem completion task	**26**/43	All participants recruited from the community through advertisements and a Victim Support Charity.
Bryant & Harvey (1995)	10	PTSD-I and IES	Computerised Stroop task	***15**/15/15	All groups recruited from both (although not specified) an outpatient PTSD clinic and volunteer medical outpatient clinic.
Bryant & Harvey (1997)	10	PTSD-I	Computerised dot-probe task	***15**/15/15	All groups: Outpatients attending a PTSD clinic

Vrana et al., (1995)	10	SCID (DSM-III-R) & Mississippi Scale for Combat-Related PTSD	Stroop task presented manually on cards	**42**/15	Case: Outpatients attending PTSD clinic for veterans. Control: recruited from local veterans group
Foa et al., (1991)	9	SCID (DSM-III-R)	Computerised Stroop task	***15**/13/16	Case: Participants in a study of psychopathological responses to rape. Control: Rape victims without PTSD Control: non-traumatised individuals recruited from community
Pineles et al., (2007)	8	PTSD Checklist (PCL)	Visual search task with lexical decision component	**30**/27	All recruited from a Veterans Hospital
McNally et al., (1990)	7	SCID (DSM-III-R) & Mississippi Scale for Combat-Related PTSD	Stroop task presented manually on cards	**15**/15	Case: Volunteers at a Stress Disorder Treatment Unit for Veterans Control: Vietnam combat veterans
Weinstein et al., (1996)	7	Computerised Clinician Administered PTSD Scale-1	Sentence priming task	**15**/15	Case: Outpatients due to start group therapy for PTSD Control: administrative staff at site of research
McNally et al., (1993)	7	Clinical interview and Mississippi Scale for Combat-Related PTSD	Stroop task manually presented on cards	****24**	Consecutive sample PTSD patients referred for psychological testing
Constans et al., (2004)	7	SCID (DSM-IV)	Computerised Stroop task	****60**	Participants were taking part in an outpatient PTSD program at a veteran's medical centre.

*More than one control group

** Cohort study

Table 1.2: Included studies employing the modified Stroop task

Stroop Type	Study	Stimuli	Method for selecting words	Stroop Procedure	Main Finding and Effect Size (Cohen's *d*)
Manual	McNally et al., (1990)	Five cards were created containing the following types of words: neutral, positive, control, OCD and PTSD words. Each card had 5 items which were repeated 20 times in four colours.	Control card consisted of five os (i.e. ooooo), neutral words matched to PTSD words by syllable length and frequency of usage in American English. Unclear how positive words were selected and PTSD words were rated as 'high stress' words by veterans in a previous study.	Cards were presented in the following order: control, neutral, positive, OCD and PTSD. Time to complete each card was recorded using a stopwatch. Immediately after, participants rated each word on a 7 point emotionality scale from +3 (very positive) to -3 (very negative).	The PTSD group took significantly longer to colour-name PTSD words than to colour-name neutral, OCD and positive words. (cohen's *d*=1.35). No significant differences between word types were found for the control group.
	McNally et al., (1993)	Same as above	Same as above	Cards were presented in the following order: control, neutral, positive, OCD and PTSD. Time to complete each card was recorded using a stopwatch	*Individuals with PTSD exhibited stroop interference for PTSD words but not for control, OCD, neutral or positive words.
	Thrasher et al., (1994)	Five cards were created containing the following types of words: semantically-unrelated neutral, semantically-related neutral (musical instruments), positive emotional, general threat and disaster-related words. Each card contained 20 items.	Threat and positive words taken from a corpora of previously published emotional words. Unrelated neutral words taken from frequency norms (Francis & Kuera, 1982). Five independent raters classified words as emotionally positive and neutral. Two word groups were matched for frequency and syllable length. Semantically-related neutral words were selected from Bailie (1978), disaster words were selected by clinicians working with survivors of the ferry disaster.	Cards were presented in the following order: semantically-unrelated neutral, semantically-related neutral, positive, threat and disaster-related words. Time to complete each card was recorded using a stopwatch.	High PTSD symptomatology group had significantly longer response latencies for disaster-related words compared to response latencies for positive (d = 0.74), threat (d = 0.24), semantically-unrelated neutral (d = 0.87) and semantically-related neutral (d = 0.93) words. No significant differences in response latencies were found for the low PTSD symptomatology or controls group.

	Vrana et al., (1995)	Three emotion cards were created. Each emotion card had a corresponding control card containing neutral words. One emotion card contained 10 Vietnam specific words, one contained 10 Vietnam-general words and the third (labelled Watts-Emotion) contained five negative words.	The Vietnam specific and Vietnam-general words were taken from a previous study (McNally, Luedke, Besyner, Peterson, Bohm, & Lips, 1987). The Watts-Emotion card was used in a previous study on Stroop interference in simple phobia (Watts, McKenna, Sharrock, & Trezise, 1986). The neutral words on the corresponding control cards were matched for length and frequency for each emotion card according to Francis & Kuera, (1982).	All six cards were presented to each participant. A control card was always presented before an emotion card. The six possible orders in which the three pairs of cards were balanced across subjects. After completion of the Stroop task, each participant was given two minutes to write down as many words as they could remember from the cards. Next, the subjects were given a recognition sheet and instructed to circle all words which were on any of the cards. The participants then rated each of the words on all of the cards for level of stress (0 = not stressful to 4 = extremely stressful).	The PTSD group took significantly longer to colour-name all emotion cards compared to the no-PTSD group (cohen's *d*=0.95). Colour-naming, for both groups, was significantly slower for Vietnam general words than for Vietnam specific and Watts-Emotion words. The PTSD group recalled a greater percentage of, and recognised more emotion words compared to the No-PTSD group.
Computerised	Foa et al., (1991)	Ten rape-related words, general threat words, neutral words and non-words.	To select the rape-related words, 47 rape words were given to 30 rape victims and 30 non-victimised controls (none of whom participated in the study) who were asked to rate them based on their degree if threat and frequency of usage (0 = *not very threatening or frequent* to 8 = *very threatening or frequent*). General threat words and neutral words were taken from a previous study (McCarthy, Foa, Murdoch, & IIia, 1990). Non-words were created from changing one letter in ten English words (Becker, 1980).	Words were presenting randomly on a computer screen. Reaction times were recorded using a microphone. A total of 120 trials were presented to each participant.	The PTSD group took significantly longer to colour-name rape-related words compared to all other word types (cohen's *d*=0.9). Response latencies for rape victims without PTSD and non-victim controls did not differ across word types.

	Cassiday et al., (1992)	Four word categories: high-threat words, moderate-threat words, positive words, and neutral words.	To obtain high- and moderate-threat words, therapists experienced in treating sexual assault victims were asked to generate a list of words. These (51) words were rated on a stressfulness scale (0-5) by 12 sexual assault victims who did not participate in the study. The positive and neutral words were taken from a previous study (McNally et al., 1990).	25 words for each category were presented using a computer. There were two types of word presentation: random (words presented randomly) and block format (randomised presentation of words grouped by category.	In contrast to rape victims without PTSD and to non-traumatised controls, rape victims with PTSD took longer to colour-name high-threat words than moderate threat, positive, and neutral words (cohen's *d*=1.39).
	Bryant, & Harvey, (1995)	Four word categories: strong threat, mild threat, positive and neutral words.	Words were allocated to each category on the basis of ratings of emotionality made by 30 MVA victims. Words were matched for frequency and word length.	120 items were randomly presented to participants on a computer screen. Reaction times were recorded using a voice-activated microphone.	The PTSD group took significantly longer to colour-name strong threat words compared to the simple phobia (*d* = 0.76) and control (*d* = 1.44) groups.

	Paunovic et al., (2002)	Three word categories: trauma-related, positive and neutral. 24 words for each category.	The first author chose the trauma words. The neutral and positive words were matched to the trauma words by word length and word frequency.	The 24 words in each category were subdivided into 3 groups, A, B and C. Each group contained eight trauma, positive and neutral words. Group A was presented supraliminally, group B was presented subliminally and group C was used in a tachistoscopic identification task. In the supraliminal task, words were presented randomly on the computer screen and reaction times were recorded with a voice-activated microphone. In the subliminal task, words were presented for 17ms and then replaced with a mask (ooooo). The mask was the same colour as the word it replaced and reaction time was recorded using a voice activated microphone. A free recall task, with a time limit of five minutes, was administered at the end of the procedure.	The PTSD group took significantly longer to colour-name trauma (d = 0.39) and positive words (d = 0.47) compared to the control group on the supraliminal task. No significant differences were found between groups on the subliminal task. The PTSD group did not show an implicit memory bias to trauma-related words on the tachistoscopic task, but did display an explicit memory bias for trauma words compared to positive (d = 1.15) and neutral words (d = 1.44) and compared with the control group (d = 0.54)

	Constans et al., (2004)	Three word categories: social threat, combat-related threat and neutral words.	Social threat and combat-related threat words had been used in previous studies. The neutral words were selected by the authors and comprised of household furnishings.	Participants completed the computerised Stroop task in one of three conditions. The 'combat-threat' condition involved the participants being told they would have to watch a video of Vietnam combat footage after the Stroop task, the 'social-threat' condition participants were told they would have to give a five minute speech after the Stroop task, the participants in the 'reward' condition were told they would receive monetary reimbursement after the Stroop task, and participants in the 'control' condition were given no contextual condition.	Participants with PTSD were able to inhibit the Stroop inference effect (i.e. attentional bias) when performed under conditions involving future threat. The PTSD group with no condition of future threat took significantly longer to colour-name combat-related threat words compared to neutral words (d = 0.44).

*Effect size was not reported and could not be calculated due to lack of sufficient data.

Table 1.3: Confounding and excluded variables

Study	Sample	Paradigm	Excluded Variables	Controlled variables	Measures
McNally et al., (1990)	Veterans	Stroop	-	Combat exposure Education Age Mood	[i]M-PTSD [ii]CES [iii]POMS
McNally et al., (1993)	Veterans	Stroop	-	Age Education	M-PTSD
Thrasher et al., (1994)	Ferry disaster survivors	Stroop	Colour-blind	IQ Age Sex Depression Anxiety	[iv]IES [v]PTSD-I [vi]NART [vii]BDI [viii]STAI
Vrana et al., (1995)	Veterans	Stroop	-	Age Months in combat Education Psychiatric medication	[ix]SCID CES M-PTSD BDI STAI
Foa et al., (1991)	Rape victims	Stroop	Psychiatric history	Age verbal IQ	Vocabulary subtest of WAIS-R IES BDI STAI Rape Aftermath Symptom Test
Cassiday et al., (1992)	Rape victims	Stroop	Colour-blind Psychosis Friend/relative rape victim	Time since trauma Age Education	SCID STAI BDI [x]ASI

					[xi]FNE IES
Bryant, & Harvey, (1995)	MVA survivors	Stroop	-	Age Severity of PTSD Severity of trauma Time since trauma Vocabulary Anxiety	IES PTSD-I STAI
Paunovic et al., (2002)	Crime victims	Stroop	Depression Substance misuse Bipolar disorder Psychotic disorder	Age Sex Anxiety	BDI BAI PSS IES ADIS-IV CAPS
Constans et al., (2004)	Veterans	Stroop	Bipolar disorder Psychosis Neuroleptic medication Substance misuse	Depression PTSD severity Age Social Anxiety	SCID BDI [xii]SPAI [xiii]PCL-M
Bryant & Harvey (1997)	MVA survivors	Dot probe	Head injury	Age Time since trauma Severity of trauma Verbal IQ Anxiety	PTSD-I STAI Vocabulary subtest of WAIS-R
Weinstein et al., (1996)	Veterans	Sentence Priming	-	Age Education Depression Anxiety	STAI BDI [xiv]CC-1-R
Pineles et al., (2007)	Veterans	Visual search task with lexical decision task	-	Age Education	PCL-M

Elsesser et al., (2004)	Variety of trauma victims	Dot probe	-	Age Time since trauma Anxiety Depression	[xv]DIPS STAI BDI IES
Michael et al., (2005)	Variety of assault victims	Word stem completion	Domestic violence victims History of psychosis substance misuse Poor knowledge of English language	Age Gender Education Ethnic origin Alcohol consumption Type of assault Severity of assault Time since assault PTSD symptom severity Depression Anxiety	PDS BDI STAI

[i] Mississippi Scale for Combat-related PTSD (Keane et al., 1988)
[ii] Combat Exposure Scale (Keane et al., 1989)
[iii] Profile of Mood States (McNair et al., 1971)
[iv] Impact of Events Scale (Horowitz et al., 1979)
[v] Semi-structured interview based on DSM-III-R criteria for PTSD
[vi] National Adult Reading Test (Nelson, 1982)
[vii] Beck Depression Inventory(Beck, Ward, Mendelsohn, Mock, & Erbaugh, 1961)
[viii] State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970)
[ix] Structured Clinical Interview for Diagnosis (Spitzer, Williams, Gibbon, & First, 1989)
[x] Anxiety Sensitivity Index (Reiss, Peterson, Gursky, & McNally, 1986)
[xi] Fear of Negative Evaluation questionnaire (Watson, & Friend, 1969)
[xii] Social Phobia and Anxiety Inventory (Turner, Beidel, Dancu, & Stanley, 1989)
[xiii] PTSD checklist for Military Personnel (Weathers, Litz, Herman, Huska, & Keane, 1993)
[xiv] Computerised structured clinical interview for PTSD criteria using DSM-III-R
[xv] German version of the Anxiety Disorders Interview Schedule – Revised (DiNardo, & Barlow, 1988)

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CHAPTER 2

MAJOR RESEARCH PROJECT

Traumatic Brain Injury, Post-traumatic Stress Disorder Symptom Reporting and Attentional Bias: Unravelling the Misidentification of Post-traumatic Stress Disorder in People with a Traumatic Brain Injury.

Written according to guidelines for submission to the British Journal of Psychiatry

(Notes for contributors Appendix 2.1)

Address for Correspondence:

Division of Community Based Sciences
Section of Psychological Medicine
Gartnavel Royal Hospital
1055 Great Western Road
Glasgow, G12 0XH

Abstract

Background*:* Post-traumatic stress disorder (PTSD) can occur following a traumatic event that has led to moderate to severe traumatic brain injury (TBI) even when there is little or no memory for the event. The incidence of PTSD is higher when diagnosed by self-report questionnaires compared to structured clinical interview. Previous studies suggest PTSD can be misdiagnosed in a significant proportion of cases and the incidence is in fact low. To explore this issue further there is a need to not only understand whether there are differences between cases that do and do not fulfill symptom criteria for PTSD, but also whether some cases have 'partial PTSD'; that is to say they have PTSD symptoms but do not fulfill the DSM-IV symptom criteria exactly.

Aims: The study aims to establish whether an attentional bias to trauma related words exists in people with TBI who report PTSD symptoms and to investigate the relationship between physiological arousal and attentional bias in people with a TBI reporting PTSD symptoms.

Method: Forty-one participants with severe-extremely severe TBI were recruited from the community and completed measures of cognitive functioning. Attentional bias was measured using a Stroop task in which trauma, negative, neutral and positive words were administered randomly. Physiological reactivity (heart rate) was recorded and PTSD 'caseness' was established using a self-report questionnaire and a clinician-administered structured interview.

Results: No significant relationship between PTSD symptom severities and attentional bias to trauma stimuli was apparent. Those with 'PTSD' demonstrated significantly slower reaction times to negative words however; this bias was associated with self-report of depression rather than PTSD symptomatology. Heart rate decreased throughout the interview and was not associated with PTSD symptom severities.

Conclusions: Greater PTSD symptom reporting was not associated with an attentional bias to trauma words. Heart rate decreased over the course of the interview, independent of PTSD severity and diagnosis. This suggests that 'partial' PTSD was not present, and instead those who reported PTSD symptoms were curious about the gap in memory caused by amnesia without the associated fear response.

1. Introduction

1.1 Definitions and Clinical Characteristics

Post-traumatic stress disorder (PTSD) is an anxiety disorder according to DSM-IV [1], with symptoms including intrusion, hyperarousal and avoidance following exposure to a traumatic event. Symptoms must have been present for at least one month in duration and have had an adverse impact on daily functioning. The traumatic event is perceived as frightening and threatening to the life or physical integrity of the self or others. PTSD can be diagnosed when criteria A-F are satisfied within DSM-IV (Appendix 1.2).

A traumatic brain injury (TBI) can occur from a penetrating object (an 'open' TBI) or from a blow to the head, rapid acceleration-deceleration, or severe rotational forces ('closed' TBI). A TBI typically produces cognitive impairments, and longer lasting memory impairments that are clinically defined as Post-traumatic Amnesia (PTA) [2]. TBI severity can be defined by duration of PTA, duration of loss of consciousness, abnormalities on a CT scan, or by score range on the Glasgow Coma Scale (GCS). Duration of PTA (which begins at the time of injury and includes the coma period) correlates well with GCS ratings and both are commonly used to define TBI severity [3]. PTA is defined as the length of time after the traumatic event during which the individual is (almost) completely unable to store current events in memory [4]. According to the clinical definition, the end of PTA is identified by the return of continuous personal memories [5]. The literature suggests however, that 'islands of memory' or brief periods of apparently normal encoding and retrieval during PTA are apparent in approximately one third of mild to moderate TBI [6].

1.2 Prevalence Rates

Early studies suggested that PTSD did not [e.g. 7] and later could not [e.g. 8] co-exist with TBI. The latter was based on the premise that PTSD and TBI were 'mutually incompatible disorders' since individuals with PTSD do not 'forget' the traumatic event, whereas those who have sustained a mild-severe TBI have no memory for the traumatic event [8]. More recently, there is

growing acceptance that PTSD, in principle, can occur after a (severe) TBI [9,10]. Evidence for this acceptance comes from a significant number of single case studies [11] and group-based studies [e.g. 12], however, the incidence rates for PTSD after TBI vary widely in the literature, with rates of 0-56% being reported [9].

1.3 Mechanisms for PTSD following TBI

Four potential mechanisms have been identified [10,11] which aim to explain why PTSD and TBI can co-occur. Firstly, in mild TBI there is little or no organic amnesia (PTA or retrograde amnesia) and as such, the individual has conscious memories for all or part of the traumatic event [13]. Secondly, an individual can have conscious memories for part of the traumatic event where there are one or more 'islands' of memory during PTA in an otherwise amnesic period [14]. Thirdly, the traumatic event can be re-experienced as an unconscious/implicit fear response when there is no conscious/explicit memory of the event. These are said to be triggered when the individual is exposed to stimuli reminiscent of the event [15]. Finally, PTSD can occur when the individual creates 'pseudomemories', which are based on what the individual believes has happened, or has been told what happened. These 'pseudomemories' can occur when the individual has little or no memory of the traumatic event and can therefore become a central feature in PTSD [11,16].

1.4 Conceptual Models

Dual Representation Theory [17] is an information processing model that suggests that traumatic memories are stored in a fundamentally different way to ordinary memories. Here, two memory systems are said to be working in parallel, but one may take precedence over the other at different times. The Verbally Accessible Memory (VAM) system involves the conscious storage of narrative memories of the trauma. The information stored in the VAM system can be consciously accessed when required. The second system, called the Situationally Accessible Memory (SAM) system involves implicit (unconscious) processing. The SAM system contains information from lower level perceptual processing of the traumatic scene, such

as sights and sounds which were too briefly attended to in order for them to be contained in the VAM system. Flashbacks are thought to represent the operation of SAM system in that they are triggered involuntarily by situational reminders of the trauma [18].

Information processing theorists [17,19] suggest that anxiety disorders, like PTSD, arise from the activation of cognitive structures (i.e. the SAM system), concerned with the processing of information related to personal threat or danger. These theorists argue that the presentation of information represented in cognitive 'fear' structures activates it, and evokes a fear response and triggers strategies of escape or avoidance. As such, it is posited [e.g. 19] that anxious individuals, including those with PTSD, demonstrate a bias in attention to stimuli represented in the fear structure, and in turn, allocate more resources to the processing of fear-relevant information. Therefore, in terms of information processing theories, the symptoms of PTSD are conceptualised as indicating the presence of unprocessed trauma-related information in memory.

1.5 Proposed Explanations for the Misidentification of PTSD occurring after TBI

A number of explanations have been proposed to explain the relatively high incidence of PTSD after TBI found using self-report questionnaires and relatively low incidence using structured clinical interview. Two recent studies propose complimentary explanations for the discrepancy. One study [20] suggested that PTSD is misdiagnosed in patients with a severe TBI when using self-report questionnaires compared to structured clinical interview. They found PTSD 'caseness' to be 3% using a structured clinical interview and 59% on a self-report questionnaire. In concordance with another study [9], this over-diagnosis on the self-report questionnaire was attributed to the similarity in symptoms seen in both PTSD and TBI alone. For example, a person with a TBI may display "avoidance" symptoms according to a PTSD diagnostic questionnaire however, the person may be 'avoiding' a situation as a result of their injury (e.g. 'avoiding' driving because their licence has been revoked).

A further consideration is whether it is appropriate to consider a continuum of PTSD symptomatology. 'Partial PTSD' is the notion whereby some individuals may fall short of diagnostic criteria, but suffer from symptoms attributable to PTSD [21]. This means that after head injury, PTSD symptom number or severity may fall short of DSM-IV criteria [1], but PTSD may nevertheless be present in a milder or partial form. Hence, differences in diagnostic rate of PTSD reported after TBI might be explained by different rates of 'partial PTSD' being reported as PTSD.

A recent study [22] considered whether the concept of 'partial PTSD' can explain the discrepancy. The authors hypothesised that self-report of greater PTSD symptom severity would be associated with increased heart rate and movement when responding to questions about the traumatic event, if 'partial PTSD' was an explanation. They found that self-report of greater PTSD symptom severity was not associated with increases in heart rate or movement during questions about the traumatic event, and in fact heart rate decreased from baseline in those with higher self-report scores for PTSD. The finding was therefore consistent with notion that individuals may be curious about the gap left in memory by PTA [20], rather than 'partial PTSD' being an explanation. This conclusion may be consistent with other findings which suggest that curiosity about the gap left in memory by PTA, might be self-reported as intrusive, due to a desire to recover lost memory but is not fear provoking [20].

1.6 Role of attentional bias

Attentional bias is believed to be important in the development and maintenance of PTSD because chronic over-arousal to mild threat stimuli can occur when attention is constantly directed to such stimuli [23]. Attentional bias is frequently measured using the modified Stroop task in which participants are instructed to colour-name emotionally laden words. This task is based on the hypothesis that longer response latencies indicate attentional resources being preferentially allocated to the meaning of the word and thus, interfering with the task of colour-naming [24].

In non-PTSD populations it has been shown that attentional bias is associated with increased anxiety [25]. One study [26] found that individuals with high levels of anxiety displayed an attentional bias on a Stroop task compared to individuals with low levels of anxiety. Anxiety is a psychophysiological state characterised by a number of physiological symptoms including muscle tension, twitching and shaking, restlessness, fatigue and heart palpitations [27]. PTSD is an anxiety disorder with prominent psychophysiological symptoms including elevated heart rate and hyperarousal to threat stimuli [28]. Patients with PTSD are known to have an attentional bias to threat stimuli [e.g. 29] and physiological anxiety symptoms. The literature on heart rate and PTSD following TBI is scarce. However, one study [30] found that increased heart rate one week after severe TBI was predictive of PTSD six months following the traumatic event.

The aim of this study is to investigate the findings of a study described previously [22] which suggested that individuals with PTA following a TBI are curious about the amnesic gap. It is unclear from this previous study whether or not there was an attentional bias to stimuli which may act to remind the individual of the traumatic event, and if indeed the desire to recover lost memory is intrusive. The literature is sparse with regard to this issue.

The present study considers the notion of 'partial PTSD' as well as identifying those who are PTSD 'cases' and will investigate whether or not an attentional bias to trauma-related stimuli exists in TBI patients reporting PTSD symptoms. No other study has specifically investigated whether or not an attentional bias is related to PTSD symptom severity in patients with TBI. If greater PTSD symptom severity is related to an attentional bias for trauma-related stimuli, then the disparity between the number of people self-reporting PTSD symptoms after head injury and the smaller number diagnosed by structured clinical interview, may reflect 'partial PTSD' in the former. That is, the self-reported PTSD symptoms are attributable to PTSD and not head injury. This will further our understanding as to why PTSD is misidentified in people with TBI. This study will subsequently question whether attentional bias might be utilised as an indicator of PTSD for this population. Physiological arousal (heart rate) will also be examined in relation to

PTSD severity and attentional bias. If 'partial PTSD' is present, then an increase in heart rate is expected during the administration of measures of PTSD severity and caseness.

2. Aims & Hypotheses

2.1 Aims

1. To establish whether an attentional bias exists in people with a TBI and PTSD symptoms.

2. To investigate the relationship between physiological arousal (heart rate) and attentional bias in people with a TBI and PTSD symptoms.

2.2 Hypotheses

1. People with a higher frequency or severity of PTSD symptoms have an attentional bias to trauma related stimuli.
2. Increased physiological arousal is associated with greater attentional bias to trauma related stimuli.
3. H_1 is associated with increased physiological arousal (heart rate).

3. Design

A cohort study, consisting of within group comparisons on an experimental task was employed.

4. Method

4.1 Participants

Participants were recruited from a neuropsychology department of a brain injury rehabilitation unit and from a brain injury charity which offers support to individuals with head injuries. 258 individuals who were discharged from the neuropsychology department and 11 individuals attending outpatient neuropsychology appointments were invited to take part. Five outpatients and twenty-seven discharged patients consented to take part. Presentations were given to two

brain injury charity organisations across Scotland and a total of eleven participants consented to take part. A total of 43 participants were included in the study (See Appendix 2.2 for full details of recruitment and attrition). Ethical approval was granted from Lothian and Research Ethics Committee (02).

Participants were considered eligible according to the following inclusion and exclusion criteria:

Inclusion:
- Aged 18 years and over
- TBI occurred at least 3 months ago (to meet DSM-IV criteria for PTSD)
- TBI occurred in adulthood
- Living independently
- Moderate and severe TBI as defined by the Glasgow Coma Scale (GCS<13) and/or documented loss of consciousness

Exclusion:
- Currently receiving psychiatric treatment for PTSD
- Colour-blind

Participants receiving treatment for any other psychiatric illness were considered on a case-by-case basis.

4.2 Estimation of required sample size

When comparing non-TBI PTSD samples with controls, previous studies on attentional bias have found a variety of effect sizes, ranging from medium [dot-probe paradigm: 31]) to large (modified Stroop task e.g. 32, 33]. The modified Stroop task has only been used once in a between-group investigation of attentional bias in individuals with a TBI [34]; however, the sample consisted of individuals with Acute Stress Disorder rather than PTSD so data from that study may not generalise to PTSD. In the present study efforts were made to increase power by rigorous sample selection and by incorporating measures of cognition which would be controlled for during the analysis. Therefore, specifying power = 0.8, alpha = 0.05 and $f^2 = 0.15$

(medium effect size), a total sample of 68 participants needed to be recruited to reliably reject the null hypothesis when using linear regression for data analysis.

Measures

4.3.1 Cognitive Measures

Pre-morbid IQ

Premorbid intelligence was measured using the Wechsler Adult Reading Test (WTAR) [35]. The test consists of a list of 50 irregular words. The participant is instructed to read each aloud and is given one point for each correct pronunciation. A standard score can be derived from the raw score from which Performance IQ, Verbal IQ and Full-Scale IQ can be obtained. Normative data indicates a mean of 100 and standard deviation of 15.

Executive Function

The Hayling (Hayling and Brixton Tests) [36] is a measure of executive function and therefore is capable of highlighting any frontal lobe damage. The test consists of two subtests, each consisting of 15 sentences with the last word omitted. In the first subtest, the participant is instructed to provide a word which completes the sentence. The time taken to respond is converted into a scaled score which provides a measure of response initiation speed. In the second subtest, the participant is instructed to provide a word that is unconnected to the sentence. Response times and errors are recorded and a scaled score is computed to provide a measure of suppression ability and thinking time. A total score (1 = impaired to 10 = very superior) is calculated by summing the scaled scores for each subtest.

Attentional Bias

Attentional bias was measured using a modified Stroop task. The Stroop task is a reaction time task which requires participants to colour-name congruent and incongruent words. The Stroop task was modified to include the following word types: trauma, negative, neutral and positive. Fifteen words for each word type were repeated four times in each of the following colours: red,

blue, yellow and green (see Appendix 2.3 for details of design). A practise task consisting of the numbers *one, two, three, four* and *five* were presented randomly in red, blue green and yellow. The task was created using computer software (Superlab version 4.0) and was presented on a Fujitsu Siemens Laptop Computer. Words were presented randomly, with no same word or colour appearing consecutively. Reaction times were recorded using a response box (CEDRUS: RB-730 Model)

Information Processing Speed

The Digit Symbol subtest of the Wechsler Adult Intelligence Scale-III (WAIS-III) [37] was used to measure information processing speed. Participants are presented with the numbers one to nine. Each number has a corresponding symbol. On a separate grid, the numbers one to nine are presented randomly. The participant is instructed to write down the corresponding symbols underneath each number within two minutes. The total number of correctly matched symbols are totalled giving the raw score.

The Digit Symbol task has a graphomotor component. Therefore, to control for physical problems affecting the participant's ability to complete the task, an additional measure was used. The Digit Cancelling subtest of the Adult Memory and Information Processing Battery (AMIPB) [38] requires the participant to cross out as many '11's as possible in 30 seconds. The total number scored out was then regressed against the Digit Symbol score to obtain a Z score.

Declarative Memory

The Logical Memory subtest of the Wechsler Memory Scale-III (WMS-III) [39] provided a measure of short-term memory retention and recall. Participants are read two short stories and asked to repeat them immediately and again after a delay of 30 minutes. The total number of elements recalled in each story, for both immediate and delayed conditions are summed to provide a raw score. Scaled scores can be obtained, but for the purpose of this study, raw scores were used in the analysis.

4.3.2 PTSD Severity and Caseness Measures

Post-traumatic Diagnostic Scale (PDS) [40]

The PDS is a self-report questionnaire, based on DSM-IV criteria for PTSD, consisting of 49 items. Each item is rated for frequency of presence over the past month (0 = not at all/only one time, 1 = once a week or less/once in a while, 2 = two to four times a week/half the time, 3 = five or more times a week/almost always). Impact on functioning along with duration and onset of symptoms are rated. PTSD 'caseness' is achieved if criterion B to F are met ('diagnosis' by PDS symptom number). Criterion A, feeling helpless or terrified during the traumatic event, is not considered essential with a TBI population [9]. PTSD 'caseness' can also be achieved by having a symptom severity score greater than 23 ('diagnosis' by PDS symptom severity) [40]. Severity scores (ranging from 0 to 51) are obtained by summing the frequency scores.

Clinician Administered PTSD Scale (CAPS) [41]

The CAPS is a structured clinical interview that includes a measure of previous trauma history. It is based on DSM-IV criteria for PTSD. The clinician asks the participant if a symptom has been present during the past month using a standard prompt question and rates the frequency and intensity on a scale of 0 to 4. A symptom is considered present if the frequency is rated as 1 and the intensity is rated as 2. A total score is obtained by summing the frequency and intensity scores for all 17 symptoms. The range for these scores is 0-136. The clinician also rates the impact symptoms have on functioning and overall distress. Caseness is met by fulfilling criteria B to F.

4.3.3 Depression and Anxiety

The Hospital Anxiety and Depression Scale (HADS) [42] is a self-report questionnaire that assesses for the presence of anxiety and depression symptoms. It has been found to be reliable for the medical outpatient population [42]. Participants are asked to rate symptoms that have been present over the past week on a scale from 0 to 3, and total scores for anxiety and depression are calculated by summing each item. For both the anxiety and depression scales,

raw scores between 8-10 identify mild cases, 11-15 moderate cases and 16 or above, severe cases [42].

4.3.4 Physiological Measure

Heart rate was measured using a Garmin Forerunner 50 Heart Rate Monitor (https://buy.garmin.com/shop/shop.do?cID=142&pID=10527) at 5 second intervals throughout the interview. Mean heart rate was calculated for each assessment measure separately. A baseline for heart rate was calculated using data collected at the beginning of the interview when the participant was completing the consent forms, when the traumatic event was not discussed.

4.3.5 TBI Measures

TBI Severity

TBI severity was estimated using retrospective questioning of Post-traumatic Amnesia (PTA). PTA is defined as the return of continuous memory [43] and can be established by questioning the participant about their memory of events following return to consciousness [44]. Russell and Nathan [43] classified severity in terms of number of days of PTA: mild = <24 hours, moderate = 1-24 hours; severe = 1-7 days; very severe = 8-28 days; extremely severe = >29days. PTA was used as a measure of severity as opposed to other measures, such as the Glasgow Coma Scale (GCS) score, because such information was not available for all participants. In addition, PTA is considered a more reliable measure of severity and one that better predicts outcome [45].

Memory for traumatic event

The Traumatic Memory Inventory (TMI: unpublished paper obtained directly from the author) [46] is a structured interview that measures sensory, affective and narrative memory for the event (see Appendix 2.4 & 2.5). The TMI assesses memory at three different time frames: initial post-trauma memory, memory at the time when PTSD symptoms were most severe, and current memory. In this study, current memory was assessed as retrospective recall of memory may not

reliably distinguish between these three time frames [47]. A participant will receive a score of 0 if they are unable to reproduce any memory for the event. They will score one point for each memory that is recalled visually, as a physical sensation, as smells, as sounds, and as emotions. One point is also awarded if the memory is integrated, and narrative. The total score ranges from 0 to 7. The TMI also assesses for the presence of intrusive symptoms but given that these are accounted for in the PDS, this information will not be detailed in the current study.

Disability following TBI

The Glasgow Outcome Scale-Extended (GOS-E) [45] is a clinician rated scale that assesses functional and social disability following TBI. A total score from 0 (dead) to 8 (good recovery) is given based on the participants ability to engage in leisure activities, return to work, self care and remaining symptoms of TBI.

4.4 Procedure

Participants attended for one individual interview which lasted approximately 1.75 hours. The heart rate monitor was worn throughout the interview and started along with the stopwatch. Times at the beginning and end of each assessment measure were recorded. Consent forms were completed initially followed by collection of demographic information. The assessment measures were then administered in the following order: HADS, WTAR, Digit Cancelling, Digit Symbol, Hayling, Stroop, Logical Memory (immediate), PTA assessment, PDS, CAPS, Logical Memory (delayed), GOS-E and TMI. A break of 15 minutes was given during the Stroop task. The procedure was piloted on a non-TBI individual (a colleague of the researcher) to ensure the timings and heart rate monitor were reliable.

4.5 Data Analysis Plan

Data was analysed using SPSS v15.0. Kolmogorov-Smirnov tests were conducted on each variable to check whether the data were normally distributed. Demographic and injury information and scores on cognitive measures were initially considered descriptively.

Hypotheses 1 was investigated using linear regression analysis consisting of two models. Preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity, multicollinearity and homoscedasticity. In model 1, PDS score and reaction time were entered. In model 2, age, time since trauma (months since injury), scores on measures of depression, anxiety and cognition were added. This analysis was repeated for each word type. Hypothesis 2 was investigated by correlating (Spearman's Rank) PDS scores and mean heart rate during administration of trauma measures with the Stroop task. For technical reasons it was not possible to establish mean heart rate for each word type. Hypothesis 3 was to be investigated using Spearman correlations if evidence to support Hypothesis 1 was found.

5. Results

5.1 Demographic and Injury Information

Demographic information is displayed in Table 2.1. Two participants opted out of the study during the interview due to literacy problems and distress caused by completing the Stroop task. In total, data from 41 participants were included in the analyses (26 discharged patients, 5 outpatients and ten individuals attending Headway). Thirty-two males (78%) and nine females (22%) participated.

Insert Table 2.1

Retrospective questioning of PTA estimated that 14 participants had suffered an extremely severe (34%), 11 a very severe (27%), and 16 a severe TBI (39%). Causes of TBI were road traffic accident (49%), fall (34%) and assault (17%). For road traffic accidents, eight were the driver (20%), six were a passenger (15%) and six were a pedestrian (15%).

5.2 Clinical Caseness

Fourteen participants achieved PTSD 'caseness' (34.1%) on the PDS by fulfilling criteria B-F (PDS symptom number). Of these, six sustained a severe, three a very severe, and five an extremely severe TBI. Nine participants (21.9%) fulfilled 'caseness' on the PDS according to

symptom severity (PDS symptom severity). Of these, four sustained a severe, two a very severe and three an extremely severe TBI. Three participants fulfilled criteria for caseness on the CAPS (7.3%) and all had sustained a severe TBI. All who reached PTSD 'caseness' on the CAPS were 'cases' on the PDS. All participants completed the HADS; fourteen (34%) were abnormally anxious (29% mild, 50% moderate, 21% severe) and ten depressed (80% mild, 20% moderate).

5.3 Assessment Measures

Insert Table 2.2

Table 2.2 displays the descriptive data for scores on cognitive measures and questionnaires. Scaled scores on the Hayling ranged from 1-9, with two participants scoring 1 (impaired), one scoring 2 (abnormal), five scoring 3 (poor), one scoring 4 (low average), five scoring 5 (moderate average), eighteen scoring 6 (average), four scoring 7 (high average), three scoring 8 (good) and two scoring 9 (superior). Clinician ratings on the GOS-E ranged from 4-8, with seven participants rated as 4 (Upper severe disability), six rated as 5 (Lower moderate disability), six rated as 6 (Upper moderate disability), nine rated as 7 (Lower good recovery) and thirteen rated as 8 (Upper good recovery). The mean severity score on the PDS was 11.88 (SD 9.67), range 0-31. The mean CAPS total score was 16.80 (SD 17.25), range 0-65. TMI scores ranged from 0-6, mean 2.76 (SD 1.76) with three individuals having no memory of the trauma (one had a severe, one very severe and one an extremely severe TBI).

5.4 Hypothesis Testing

5.4.1 Hypothesis One

"People with a higher frequency or severity of PTSD symptoms have an attentional bias to trauma related stimuli"

Insert Figure 2.1

Mean reaction times to each word type are displayed in figure 2.1. Reaction times for each word type had non-significant Kolmogorov-Smirnov values allowing for parametric tests to be conducted. Reaction time to trauma words significantly correlated with the reaction time to negative (r = 0.994, p<0.01), neutral (r = 0.997, p<0.01), and positive words (r = 0.992, p<0.01). A one way within subjects repeated measures ANOVA revealed no significant difference in reaction time on trauma, negative, neutral or positive words [Wilks' Lambda = 0.851, F(3,38) = 2.22, p = 0.101, multivariate partial eta squared = 0.149]. Confidence intervals were adjusted due to multiple comparisons using a Bonferroni test.

Insert Figure 2.2

The distribution of PDS scores are displayed in figure 2.2. In order to consider whether 'partial PTSD' could explain the findings, correlations between reaction time for each word type and PTSD severity measures were undertaken. If 'partial PTSD' was a phenomenon, greater PTSD symptom severity scores would significantly correlate with reaction times to trauma words. No significant correlation (one-tailed) between PDS symptom severity score and reaction time to trauma (r=0.127, p=0.215), negative (r=0.159, p=0.160), neutral (r=0.130, p=0.209) or positive words (r=0.125, p=0.219) was found.

Scores on a structured clinical interview (CAPS), in which the clinician adjudged PTSD symptoms, significantly correlated with anxiety (r=0.697, p<0.001) and depression scores (r=472, p=0.001). The correlation between the CAPS total score and reaction time to trauma words was of borderline significance (r=0.255, p=0.054). Significant correlations were found between CAPS scores and reaction times to negative (r=0.281, p=0.038), neutral (r=0.271, p=0.043) and positive words (r=0.268, p=0.045). However, all of these correlations became non-significant when the correlation was controlled for depression scores (p>.05).

Insert Table 2.3

Results of linear regression modelling (see table 2.3) suggest no significant relationships between PTSD symptom severity (PDS score) and reaction time for trauma (β=0.127, *p*=0.430), negative (β=0.159, *p*=0.320), neutral (β=0.130, *p*=0.418) or positive words (β=0.160, *p*=0.328) when the model was unadjusted (Model 1). Specifically, PDS scores explained 12.5% of the variance [*F*(1,39) = 0.637, *p*=0.430] in reaction time for trauma words, 15.9% of the variance in reaction time for negative words [*F*(1,39) = 1.014, *p*=0.320], 13% of the variance in reaction time for neutral words [*F*(1,39) = 0.669, *p*=0.418] and 12.5% of the variance in reaction time for positive words [*F*(1,39) = 0.617, *p*=0.437]. When the model was adjusted for cognitive variables, time since injury, age, and mood and depression scores (Model 2) the non-significant relationship between PDS symptom severity scores and reaction time for trauma (β=-0.251 , *p*=0.245) negative (β=-0.230, *p*=0.285) neutral (β=-0.252 *p*=0.235) and positive words (β=-0.248, *p*=0.259) remained. Therefore, no attentional bias to threat stimuli (trauma words) was evident.

Insert Table 2.4

As PTSD symptom severities were derived from a self –report questionnaire (the PDS), linear regression modelling was repeated using PTSD symptom scores derived from a structured clinical interview (CAPS scores). Results are displayed in table 2.4. There was no significant relationships between CAPS score and reaction time for trauma (β=0.255, *p*=0.107), negative (β=0.281, *p*=0.076), neutral (β=0.271, *p*=0.086) or positive words (β=0.268, *p*=0.090) when the model was unadjusted (Model 1). Specifically, CAPS scores explained 25.5% of the variance [*F*(1,39) = 2.721, *p*=0.107] in reaction time for trauma words, 28.1% of the variance in reaction time for negative words [*F*(1,39) = 3.333, *p*=0.076], 27.1% of the variance in reaction time for neutral words [*F*(1,39) = 3.100, *p*=0.086] and 26.8% of the variance in reaction time for positive words [*F*(1,39) = 3.024, *p*=0.090]. When the model was adjusted for cognitive variables, time since injury, age, and mood and depression scores (Model 2) the non-significant relationship between CAPS scores and reaction time for trauma (β=-0.195 , *p*=0.387), negative (β=-0.198, *p*=0.375), neutral (β=-0.177 *p*=0.426) and positive words (β=-0.136, *p*=0.554) remained.

5.4.2 Hypothesis Two

"Increased physiological arousal is associated with greater attentional bias to trauma related stimuli"

Insert Figure 2.3

Analysis of heart rate over the course of the interview was carried out to establish the overall trend. Mean heart rate significantly decreased between baseline and TMI administration (t=8.66, df=40, p=0.000) for the entire sample (see figure 2.3). The relationship between baseline heart rate and PTSD symptom severity scores was examined to establish whether those reporting greater PTSD symptom severities had higher baseline heart rates. Baseline heart rate was not associated with PDS symptom severity scores (r=-0.059, p=0.714) or CAPS total score (r=0.070, p=0.664).

It was not possible to determine mean heart rate for each word type because the 720 stimulus words in the Stroop task were presented randomly. To investigate whether those reporting greater PTSD symptom severities had higher mean heart rates on measures in which the trauma was recalled, PTSD symptom severities (PDS) were correlated with the following measures: (1) mean heart rate during the completion of the PDS (2) mean heart rate during administration of the CAPS (criterion A: when details of the traumatic event were discussed in detail), (3) mean heart rate during the assessment of PTA and (4) mean heart rate during completion of the Stroop task. Results indicated that there was no significant correlation between PDS scores and (1) mean heart rate during completion of the PDS (*rho* = -0.92, p=0.566), (2) mean heart rate during administration of CAPS A (*rho* = -0.117, p=0.467), (3) mean heart during assessment of PTA (*rho* = -0.155, p=0.334) and (4) mean heart rate during completion of the Stroop task (*rho* = -0.102, p=0.524).

5.4.3 Hypothesis Three

"Hypothesis One is associated with increased physiological arousal (heart rate)".

No attentional bias to threat stimuli was detected. Given that Hypothesis Three relies on Hypothesis One being accepted, this final hypothesis was not investigated. In addition, analysis conducted in section 5.4.1 indicated that there were no significant differences in reaction time between word types. Furthermore, no significant relationship was found between mean heart rate on measures where the trauma is discussed and recalled and PTSD symptom severity.

5.5 Exploratory Analysis

5.5.1 Attentional bias and participants 'diagnosed' with PTSD

For the fourteen participants 'diagnosed' with PTSD using the PDS, no significant correlation (one-tailed) was found between the PTSD symptom severities (PDS score) and reaction time for trauma (r = 0.154, p=0.300), negative (r = 0.167, p=0.284), neutral (r = 0.143, p=0.313) or positive words (r = .167, p=0.284). Similarly, no significant correlation was found between CAPS score and reaction time for trauma (r = 0.161, p=0.291), negative (r = 0.146, p=0.310), neutral (r = 0.177, p=0.273) or positive words (r = 0.200, p=0.246).

To investigate whether individuals 'diagnosed' with PTSD according to PDS symptom number took longer to respond to trauma words than other words, a within group one way repeated measures ANOVA was conducted. This revealed a significant main effect for word type [Wilks' Lambda = 0.462, F(3,11) = 4.267, p=0.032, multivariate partial eta squared = 0.538]. Participants took longer to colour-name negative words compared to trauma words only (p=0.022). There were no other significant differences between word types for this group. Confidence intervals were adjusted due to multiple comparisons using a Bonferroni test.

6. Discussion

The aim of this study was to investigate if an attentional bias to trauma stimuli was related to greater PTSD symptom reporting, and consequently, if 'partial PTSD' could explain why PTSD is misdiagnosed in people with TBI. PTSD symptom severity scores did not significantly correlate with reaction time to trauma words and increased PTSD symptom severities was not associated with reaction time for any word type. Therefore, no attentional bias to threat stimuli (i.e. trauma words) or any other word type was apparent. Therefore, self-report of PTSD symptoms was not explained by the presence of 'partial' PTSD, and consequently, attentional bias to threat stimuli does not explain why participants met PTSD diagnostic criteria on a self-report measure of PTSD but not according to a structured clinical interview. In summary, no attentional bias to trauma stimuli was detected in individuals with a TBI reporting PTSD symptoms.

Previous studies have suggested that individuals who have sustained a TBI with resultant PTA may focus their attention on information of particular salience to them, due to a desire to fill the memory gap [48]. Indeed, they appear to be curious about the gap in memory caused by PTA [20] and report symptoms of PTSD but without the associated fear response. The modified Stroop task operates at an implicit and explicit level [32] and works on the premise that for individuals with PTSD, the threatening/trauma information presented will evoke a fear response, by triggering trauma-related cognitive 'fear' structures [19]. Consequently, the fear response disrupts ongoing cognitive tasks and attention is preferentially allocated to processing the fear-relevant information. As such, individuals displaying a fear response take longer to colour-name trauma words compared to other non-threatening words. In the current study, it may be that individuals did not display an attentional bias to trauma words because PTA prevented them from storing significant amounts of information from the traumatic event for them to be able to have a fear response. Perhaps a fear response is integral to an attentional bias and curiosity itself is not sufficient to produce an attentional bias.

In this current study, severe-extremely severe TBI may offer some, but not complete protection against the development of PTSD, and this finding is consistent with previous conclusions [10] Indeed, one study [49] found that only 6% of participants with 'no memory' of the head injury developed PTSD compared to 23% of participants with a 'good memory'.

Due to the expected small number of people meeting PTSD 'caseness' on the structured clinical interview and the apparent absence of 'partial PTSD', it was not possible, nor within the scope of this study to definitively state what mechanism caused these individuals to develop PTSD. It is of interest however, that all three participants meeting PTSD 'caseness' on the structured clinical interview, had some memory for the traumatic event. Perhaps these individuals added to, and embellished their 'little memory' and created 'pseudomemories' based on what they believed happened to them in order to form complete memories [16]. Indeed rumination over the traumatic event, in which the event is elaborated to include a catastrophic outcome, has been associated with poorer outcome [50]. Another possible explanation for the development of PTSD following (severe-extremely severe) TBI considers that the recovery period following a TBI can be perceived as a traumatic event, for example, experiencing painful medical procedures whilst emerging from PTA [10]. Indeed, persistent medical problems have been implicated as a predictor of PTSD one year post-injury [50]. In the current study however, the Stroop task did not contain words related to the post-injury recovery period, leaving it difficult to conclude whether or not PTSD can develop in the TBI population as a result of post-injury traumatic experiences during the recovery period.

The main finding of no significant relationship between PTSD symptom severity scores and reaction time to trauma stimuli on a Stroop task are inconsistent with a recent study [34] which investigated whether or not implicit memory was the mechanism for the development of acute stress disorder (ASD) in patients who suffered a closed head injury. Acute stress disorder (ASD) is an anxiety disorder characterized by a cluster of dissociative and anxiety symptoms that occur within a month of a traumatic stressor. ASD, like PTSD, begins with exposure to an extremely

traumatic, horrifying, or terrifying event. Unlike PTSD, however, ASD emerges sooner and abates more quickly. However, if left untreated, it can progress to PTSD [1]. This study compared performance on an emotional Stroop task between road traffic accident (RTA) victims with brain injury, without brain injury and controls. Individuals were recruited from a hospital within one month post-trauma. The results suggested that both RTA victims with and without brain injury demonstrated an attentional bias to RTA-related words within one month of experiencing the trauma. The results between this published study, and the current study may be inconsistent because of the difference in brain injury severity, as measured by PTA, and time since trauma.

An interesting finding from explorative analysis is that individuals with PTSD, 'diagnosed' according to self-report symptom number, did display an attentional bias towards negative words. Those without 'PTSD' did not demonstrate this bias. This phenomenon seems to be consistent with the 'emotionality hypothesis' which states that the magnitude of a words personal significance determines its capacity to delay colour-naming in a Stroop task [51]. Therefore, the negative words may have been emotionally significant to the individuals with 'PTSD'. The negative words included in the Stroop task may have triggered thoughts about how participants view themselves. The literature suggests [52] that individuals who have sustained a TBI mourn over parts of their lives which have been altered. This loss of sense of self may take different forms, including loss of self-comparison, loss of self-knowledge, and loss of self in the views of others [53]. This, along with the reported co-morbidity of depression and PTSD [54], may explain why participants with 'PTSD' had an attentional bias for negative words.

In the current study, only those participants with 'mild' depression met 'PTSD' diagnostic criteria. That is, of the fourteen individuals 'diagnosed' with PTSD according to symptom number, five had mild depression. Of the three 'diagnosed' with PTSD according to a structured clinical interview, two had mild depression. In order to clarify if the attentional bias to negative words was a PTSD phenomenon, or a feature of depression, scores on the PTSD structured

clinical interview (CAPS) were correlated with reaction time for each word type. The results demonstrated that the significant correlations found disappeared when depression scores were controlled for. This finding, along with the significant associations between scores on the structured clinical interview and measures of depression and anxiety, suggest that slower reaction times to negative words are apparent when high levels of mental health problems, like depression are present. This finding is consistent with a substantial body of evidence [e.g. 55] reporting that individuals with depression demonstrate a significant Stroop interference effect for negative words.

6.2 Physiological Response

Consistent with a previous study [22], the results of this current study demonstrated a general decline in heart rate over time. Given that heart rate is known to increase in response to anxiety [28], it is possible that participants were anxious about taking part in the study and consequently demonstrated increased heart rate at the beginning of the interview. Thus, the decline in heart rate observed over the course of the interview may indicate a reduction in anxiety.

Previous studies investigating physiological responses in non-TBI PTSD populations have demonstrated that heart rate increases during the recall of traumatic events [e.g. 56]. As such, in this current study, heart rate was expected to increase when individuals self-reporting greater PTSD symptom severities were required to think about and recall details of their traumatic event, if 'partial PTSD' was present. No increase in heart rate was demonstrated in participants meeting PTSD diagnostic criteria on the self-report questionnaire (PDS) when they completed the attentional bias task, the self-report questionnaire for PTSD (i.e. the PDS), or when they were interviewed in detail about the traumatic event which caused their head injury. It is suggested therefore that the findings in this current study are consistent with previous studies that posit that individuals with a TBI orientate their attention to trauma-related information but without the associated fear and subsequent physiological response, due to a desire to integrate their unknown experience in order to evaluate future threat [22].

6.3 Limitations

The study has a number of limitations that need to be acknowledged. Firstly, the anticipated sample size, as recommended by the power calculation was not achieved. Secondly, although demographically the sample was fairly representative of the population of people with TBI in the community, participants did have severe to extremely severe head injuries [57]. However, this bias is useful in this study given the controversy surrounding whether or not PTSD can occur after severe TBI. Thirdly, the measure of attentional bias was created by the author following a brief pilot study completed by trainee clinical psychologists. It may have been helpful to conduct this pilot study on a clinical sample but there was insufficient time to do this. Also, the Stroop task was designed in such a way that the mean heart rate for each word type could not be established. This would have been helpful in investigating the impact of trauma words on heart rate. Fourthly, participants in the study were not instructed to rate the emotionality of each word presented during the modified Stroop task. This would have been helpful in furthering our understanding of this notion that individuals are curious about what happened to them during the traumatic event. And finally, future studies may benefit from adding stimulus words related to the process of recovery following TBI, e.g. surgery and coma, in order investigate whether or not the recovery period following TBI in which the individual is emerging from PTA is itself considered as a traumatic experience and as such, reflects fear or horror as described in Criterion A of DSM-IV diagnostic criteria [1].

6.4 Conclusions & Directions for Future Research

The aim of this study was to investigate whether an attentional bias to trauma-related stimuli was associated with greater PTSD symptom reporting. An attentional bias to trauma-related stimuli as measured using a Stroop task, was not detected. 'Partial PTSD' therefore did not explain why some individuals in this sample self-reported greater PTSD symptoms. That is, individuals self-reporting PTSD symptoms were not definitively reporting PTSD symptoms. It is more likely that the 'PTSD' symptoms they self-reported were attributable to head injury symptoms. Post-injury recovery events, such as medical procedures, and adjustment to

disability with associated losses, may be experienced as traumatic and be implicated in the development of PTSD. This hypothesis warrants further investigation as it was not within the scope of this current study to assess the issue of adjustment to disability (as assessed by the GOS-E) following head injury and if there is a relationship with greater self-report of PTSD symptoms.

As demonstrated in previous studies, PTSD can be misidentified depending on the diagnostic tool used. In line with previous studies [20, 22], the number of individuals with a TBI meeting PTSD 'caseness' is higher when using self-report measures of PTSD than using a structured clinical interview. The findings support the use of clinician administered assessment tools in order to reliably establish whether or not PTSD is present in individuals with severe-extremely TBI. It is unclear whether or not measures of attentional bias are sensitive to the presence of PTSD, when PTSD is measured using a structured clinical interview. This warrants further research.

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Online power calculator:

http://www.psycho.uni-duesseldorf.de/aap/projects/gpower/

Figure 2.1: Mean reaction time for each word type (n41)

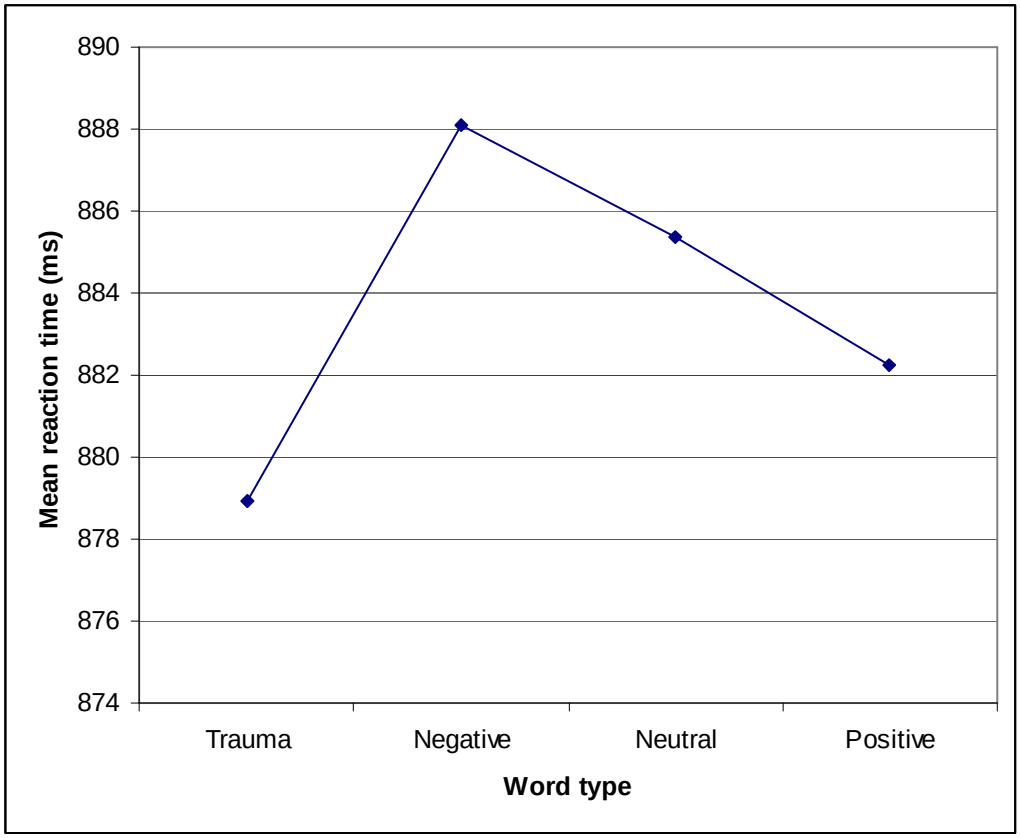

Figure 2.2: Distribution of PDS scores

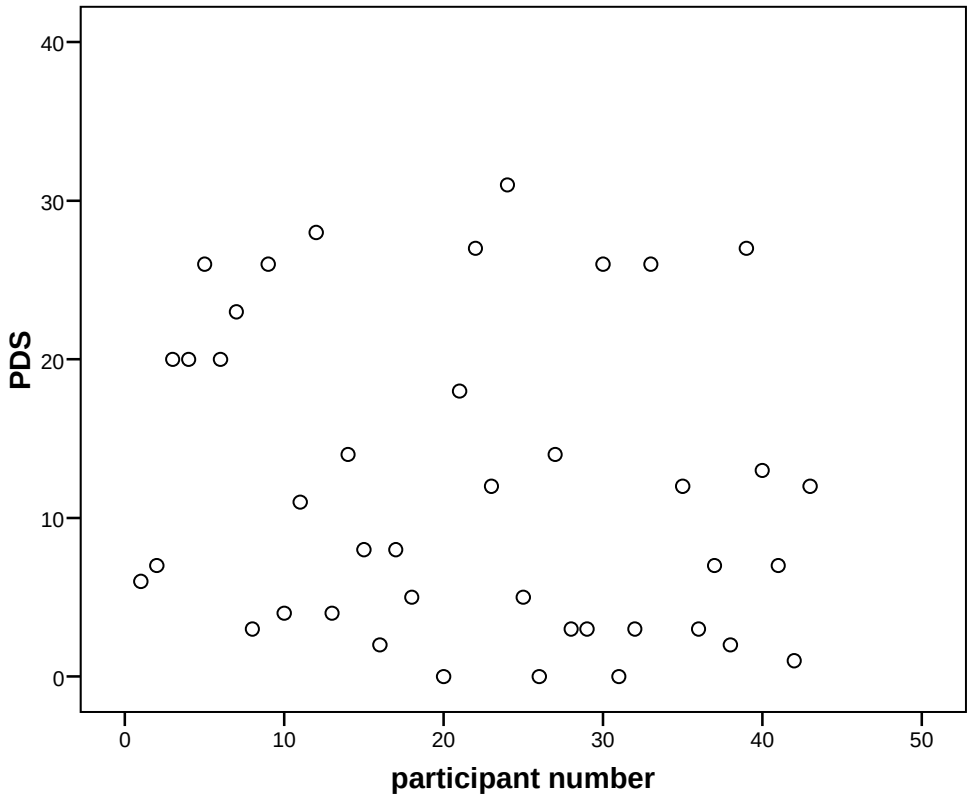

Figure 2.3: Mean Heart Rate (bpm) for each assessment measure (n41)

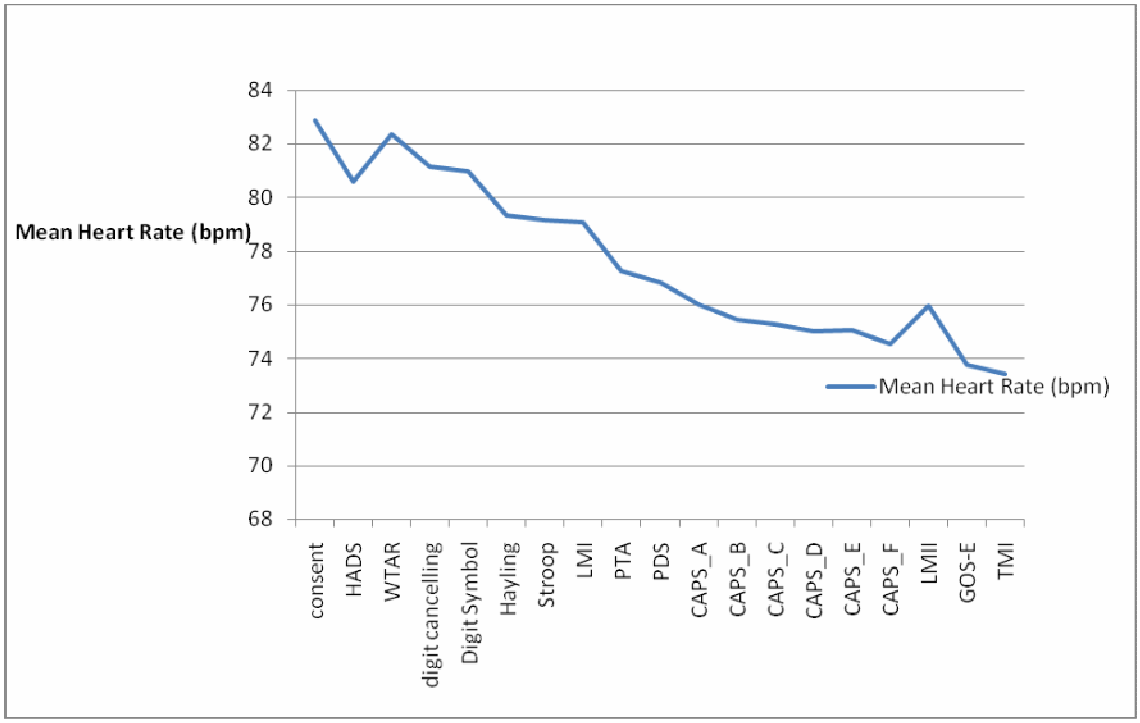

Table 2.1: Demographic Information (n41)

	Mean (SD)	**Range**
Age (years)	42.56 (12.72)	18-76
Time since head injury (months)	*69	21-396 months
PTA	20.71 days (20.61days)	1-87 days
Gender (male/female)	32/9	-
	YES	**NO**
Previous Trauma	7 (17%)	34 (83%)
Previous TBI	11 (27%)	30 (73%)
Currently Employed	12 (30%)	29 (70%)
TBI Severity	**N**	**% of Sample**
Severe (PTA 1-7days)	16	39
Very Severe (PTA 8-28 days)	11	27
Extremely severe (PTA >29days)	14	34
TBI cause		
RTA (total)	20	49
RTA (driver)	8	20
RTA (passenger)	6	15
RTA (pedestrian)	6	15
Fall	14	34
Assault	7	17

*Median

Table 2.2: Cognitive Measure and Questionnaire Results

	Mean (SD)	**Range**
Estimated Verbal IQ	102.63 (9.99)	76-115
Estimated Performance IQ	103.83 (9.14)	80-115
Estimated Full Scale IQ	102.49 (9.93)	75-115
Digit Symbol (raw score)	64.93 (17.93)	22-98
Digit Cancelling (raw score)	63.63 (18.11)	18-90
Logical Memory (Immediate)	21.80 (9.23)	6-46
Logical Memory (Delayed)	16.98 (10.01)	0-40
Hayling (total scaled score)	5.51 (1.89)	1-9
Anxiety (HADS)	6.61 (4.92)	0-18
Depression (HADS)	4.83 (3.55)	0-13
CAPS symptom number	16.80 (17.25)	0-65
PDS symptom severity score	11.88 (9.67)	0-31
Traumatic Memory Inventory	2.76 (1.76)	0-6

Table 2.3: Results of linear regression (PDS and reaction time) for total sample

Word type	Regression Variables for Predictor (PDS)	Model 1 PDS	Model 2 (PDS, Age, Months since injury, anxiety, depression, Verbal IQ, Hayling, Logical Memory, Digit symbol.
Trauma	β	0.127	-0.251
	95% Confidence intervals	-5.20 - 11.98	-18.28-4.85
	p value	0.430	0.245
	Variance Inflation Factor (VIF)*	1.000	2.643
Negative	β	0.159	-0.230
	95% Confidence intervals	-4.26 – 12.71	-17.54-5.33
	p value	0.320	0.285
	Variance Inflation Factor (VIF)*	1.000	2.643
Neutral	β	0.165	-0.252
	95% Confidence intervals	-5.26 – 12.41	-18.63-4.74
	p value	0.418	0.235
	Variance Inflation Factor (VIF)*	1.000	2.643
Positive	β	0.125	-0.248
	95% Confidence intervals	-5.51 – 12.51	-19.32-5.39
	p value	0.437	0.259
	Variance Inflation Factor (VIF)*	1.000	2.643

*****Collinearity statistic

Table 2.4: Results of linear regression (CAPS score and reaction time) for total sample.

Word type	Regression Variables	Model 1 **CAPS**	Model 2 (**CAPS**, Age, Months since injury, anxiety, depression, Verbal IQ, Hayling, Logical Memory, Digit symbol.
Trauma	β	0.255	-0.195
	95% Confidence intervals	-0.866 – 8.521	-9.714 – 3.869
	p value	0.107	0.387
	Variance Inflation Factor (VIF)*	1.000	2.845
Negative	β	0.281	-0.198
	95% Confidence intervals	-0.450 – 8.794	-9.639 – 3.740
	p value	0.076	0.375
	Variance Inflation Factor (VIF)*	1.000	2.845
Neutral	β	0.271	-0.177
	95% Confidence intervals	-0.622 – 8.992	-9.607 – 4.158
	p value	0.086	0.426
	Variance Inflation Factor (VIF)*	1.000	2.845
Positive	β	0.268	-0.136
	95% Confidence intervals	-0.688 – 9.118	-9.433 – 5.151
	p value	0.090	0.554
	Variance Inflation Factor (VIF)*	1.000	2.845

***Collinearity statistic

CHAPTER 3

ADVANCED CLINICAL PRACTICE I

REFLECTIVE CRITICAL ACCOUNT

Are stereotypes helpful in forming a therapeutic relationship?

LOUISE MARIE REID

Submitted in part fulfilment of the requirements for the degree of Doctorate in Clinical Psychology (D Clin.Psy)

Address for correspondence:

Division of Community Based Sciences
Section of Psychological Medicine
University of Glasgow
Gartnavel Royal Hospital
1055 Great Western Road
Glasgow
G12 0XH

Abstract

The learning experience described provides the context to this reflective account. It demonstrates how reflection-in-action can lead to further reflection on broader issues and help identify training needs. The experience itself emerged from a clinical interview in which I found myself using older adult stereotypes to facilitate a therapeutic relationship with a client attending a Memory Clinic. Using the Framework for Reflexive Practice (Rolfe et al, 2001), I was able to; explore the thoughts and feelings associated with this learning experience; reflect on how my clinical and professional competencies have developed over the course of training; reflect on my attitudes towards older adults; and acknowledge the role of supervision in developing a new understanding of the learning experience. The process of reflection has allowed me to identify how I have developed to date and what actions I must take to continue this development in my next placement and as a qualified clinical psychologist.

CHAPTER 4

ADVANCED CLINICAL PRACTICE II

REFLECTIVE CRITICAL ACCOUNT

Developing a Sex Offenders Treatment Programme (SOTP):

acknowledging personal beliefs, values and fears.

LOUISE MARIE REID

Submitted in part fulfilment of the requirements for the degree of Doctorate in Clinical Psychology (D Clin.Psy)

Address for correspondence:

Division of Community Based Sciences
Section of Psychological Medicine
University of Glasgow
Gartnavel Royal Hospital
1055 Great Western Road
Glasgow
G12 0XH

Abstract

The learning experience described provides the context for this reflective account. It demonstrates how personal beliefs and values can impact on the development of what has been identified as a service need. The experience itself emerged from my involvement in the development of a Sex Offenders Treatment Programme (SOTP) in which I found myself feeling antipathy towards sex offenders, and consequently, not wanting to be involved in the SOTP. Using Boud et al's (1985) Model of Reflection, I was able to explore where my feelings were stemming from, reflect on what factors were influencing my beliefs and values, and appreciate the role of previous experiences in my understanding of the learning experience. The reflective process allowed me to understand how my clinical and professional competencies have developed over time and acknowledge the role of supervision in developing a new understanding of the learning experience. The process of reflection has allowed me to identify how I have developed to date and what actions I must take to continue this development as a qualified clinical psychologist.

APPENDICES

Appendix 1.1: Notes for contributors for submission to the Journal of Traumatic Stress

Authors must submit manuscripts in a form appropriate to blind review (i.e., identifying information should appear *only* on the title page). Manuscripts should use nonsexist language. Three paper formats are accepted. *Regular articles* (no longer than 6,000 words, *including* references, figures, and tables) are theoretical articles, full research studies, and occasionally reviews. Purely descriptive articles are rarely accepted. *Brief reports* (2,500 words, *including* references and tables) are for case studies that cover a new area, preliminary data on a new problem or population, condensed findings from a study that does not merit a full article, or methodologically oriented papers that replicate findings in new populations or report preliminary data on new instruments. *Commentaries* (1,000 words or less) cover responses to previously published articles or, occasionally, essays on a professional or scientific topic of general interest. Response commentaries, submitted no later than 8 weeks after the original article is published (12 weeks if outside the U.S.), must be content−directed and use tactful language. The original author is given the opportunity to respond to accepted commentaries.

Submission is a representation that the manuscript has not been published previously and is not currently under consideration for publication elsewhere. A statement transferring copyright from the authors (or their employers, if they hold the copyright) to the International Society for Traumatic Stress Studies will be required before the manuscript can be accepted for publication. The Editor will supply the necessary forms for this transfer. Such a written transfer of copyright, which previously was assumed to be implicit in the act of submitting a manuscript, is necessary under the U.S.Copyright Law in order for the publisher to carry through the dissemination of research results and reviews as widely and effectively as possible.

Type double−spaced on one side of 8½ × 11 inch or A4 white paper using generous margins on all sides and a font no smaller than 10−point, and submit the original and four copies (including copies of all illustrations and tables).

A title page is to be provided and should include the title of the article, author's name (no degrees), author's affiliation, acknowledgments, and suggested running head. The affiliation should comprise the department, institution (usually university or company), city, and state (or nation) and should be typed as a footnote to the author's name. The suggested running head should be less than 80 characters (including spaces) and should comprise the article title or an abbreviated version thereof.

Also include the *word count*, the complete mailing address, telephone and fax numbers, and e−mail address for the corresponding author during the review process, and, if different, a name and address to appear in the article footnotes for correspondence after publication.

An abstract is to be provided, no longer than 120 words. A list of 4-5 key words is to be provided directly below the abstract. Key words should express the precise content of the manuscript, as they are used for indexing purposes.

Illustrations (photographs, drawings, diagrams, and charts) are to be numbered in one consecutive series of Arabic numerals. The captions for illustrations should be typed on a separate sheet of paper. Photographs should be large, glossy prints, showing high contrast. Drawings should be prepared with India ink. Either the original drawings or good quality photographic prints are acceptable. Identify figures on the back with author's name and number of the illustration. Electronic artwork submitted on disk should be in the TIFF or EPS format (1200 dpi for line and 300 dpi for half−tones and grayscale art). Color art should be in the CYMK color space. Artwork should be on a separate disk from the text, and hard copy ***must*** accompany the disk.

Tables should be numbered (with Arabic numerals) and referred to by number in the text. Each table should be typed on a separate sheet of paper. Center the title above the table, and type explanatory footnotes below the table.

List references alphabetically at the end of the paper and refer to them in the text by name and year in parentheses. In the text, all authors' names must be given for the first citation (unless six or more authors), while the first author's name, followed by et al., can be used in subsequent citations. References should include (in this order): last names and initials of *all* authors, year published, title of article, name of publication, volume number, and inclusive pages. The style and punctuation of the references should conform to strict APA style; illustrated by the following examples (however, use indentation below):

Journal Article

Friedrich, W. N., Urquiza, A. J., & Beilke, R. L. (1986). Behavior problems in sexually abused young children. *Journal of Pediatric Psychology, 11*, 47−−57.

Book

Kelly, J. A. (1983). *Treating child−abusive families: Intervention based on skills−training principles*. New York: Plenum Press.

Contribution to a Book

Feindler, E. L., & Fremouw, W. J. (1983). Stress inoculation training for adolescent anger problems. In D. Meichenbaum & M. E. Jaremko (Eds.), *Stress reduction and prevention* (pp. 451−−485). New York: Plenum Press.

Footnotes should be avoided. When their use is absolutely necessary, footnotes should be numbered consecutively using Arabic numerals and should be typed at the bottom of the page to which they refer. Place a line above the footnote, so that it is set off from the text. Use the appropriate superscript numeral for citation in the text.

Appendix 1.2: DSM-IV Diagnostic Criteria for PTSD

A. The person has been exposed to a traumatic event in which both of the following were present:
    1. the person experienced, witnessed, or was confronted with an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others;
    2. the person's response involved intense fear, helplessness, or horror. **Note:** In children, this may be expressed instead by disorganized or agitated behaviour.

B. The traumatic event is persistently re-experienced in one (or more) of the following ways:
    1. recurrent and intrusive distressing recollections of the event, including images, thoughts, or perceptions. **Note:** In young children, repetitive play may occur in which themes or aspects of the trauma are expressed.
    2. recurrent distressing dreams of the event. **Note:** In young children, there may be frightening dreams without recognizable content.
    3. acting or feeling as if the traumatic event were recurring (includes a sense of reliving the experience, illusions hallucinations, and dissociative flashback episodes, including those that occur on awakening or when intoxicated). **Note:** In young children, trauma-specific re-enactment may occur.
    4. intense psychological distress at exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event; physiological reactivity on exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event.

C. Persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness (not present before trauma), as indicated by three (or more) of the following:

1. efforts to avoid thought, feelings, or conversations associated with the trauma;
2. efforts to avoid activities, places, or people that arouse recollections of the trauma;
3. inability to recall an important aspect of the trauma;
4. markedly diminished interest or participation in significant activities;
5. feelings of detachment or estrangement from others;
6. restricted range of affect (e.g. unable to have loving feelings);
7. sense of a foreshortened future (e.g. does not expect to have a career, marriage, children, or a normal life span);

D. Persistent symptoms of increased arousal (not present before trauma) as indicated by two (or more) of the following:
    1. difficulty falling or staying asleep;
    2. irritability or outbursts of anger;
    3. difficulty concentrating;
    4. hypervigilence;
    5. exaggerated startle response;

E. Duration of the disturbance (symptoms in Criteria B, C and D) is more than 1 month.

F. The disturbance causes clinically significant distress or impairment in social, occupational, or other important areas of functioning.

Specify if:

- **Acute:** if duration of symptoms is less than 3 months.
- **Chronic:** if duration of symptoms is 3 months or more.

Specify if:

- **With Delayed Onset:** if onset of symptoms is at least 6 months after the stressor.

Appendix 1.3: Quality Criteria Rating Form

Class of Validity	Threat	Description	Threat or not enough information (0)	No threat (1)
Statistical conclusion validity	Low statistical power	Have they reported a power calculation prior to starting and got appropriate numbers?		
	Violation of assumptions of statistics	Are statistics assuming normal distribution without checking this and using parametric statistics?		
	Inflated error rate	Are they more likely to have made a type one error (rejecting null when it is true) – is alpha higher than (P)0.05?		
	Unreliability of dependent or independent variable measures	Have they used a PTSD assessment tool with established reliability or have they provided reliability data?		
	Unreliability of rater assessment	Were the measures administered consistently: was the person who administered the measures reportedly competent to do so and was inter-rater reliability checked (if applicable)?		
	Heterogeneity of participants	Have the PTSD group been matched to controls (age, gender, IQ, education level)?		
		To what extent is the sample representative of PTSD arising from a single event trauma? E.g. is it a veterans study?		
Internal validity	History	Have they considered the events occurring before the testing – previous psychiatric history, head injury, effects of medication, , co-morbid disorder? (need all 4 for a point, record which ones tests have considered)		
	Instrumentation	Is there a clear explanation as to how attentional bias has been measured?		
	Selection	Is there any bias in how the control group were selected? i.e. all students/medical staff		

Construct validity	The main potential confounders are identified and taken into account in the design and analysis	Have they taken into account current co-morbidity e.g. substance misuse		
	Inadequate pre operationalisation explication	Have they clearly described what they mean by information processing/attentional bias and are the tests they used measures of it?		
	Experimenter expectancies	Are testers aware of the research hypothesis and could the construct be potentially manipulated? i.e. was the person who administered the attentional bias task blind to whom was in the PTSD and control groups?		
	Interaction of treatments	Are the participants being exposed to multiple tests, which could potentially lead to inaccurate results? i.e. through fatigue. Have they put in a break, swapping order of tests, should not be testing for longer than approx. 40 minutes without break. Are there any learning and test repetition errors?		

Face Validity	The clinical validity of the assessment tool	Is the PTSD assessment tool able to detect and not detect people with and without PTSD? Or have they reported the specificity and sensitivity of the tool?		

External validity	Interaction of selection and treatment	Limited generalisability of effect to other samples – i.e. have they selected people who have opted in for PTSD treatment?		
	Interaction of history and treatment	Limited generalisability of effect to other time frames – e.g. if a veteran study, was the control group exposed to same length of exposure as PTSD group? E.g. how long ago did trauma take place?		
Final Score				

Appendix 1.4: Studies which met exclusion criteria

Exclusion Criteria	Article
Childhood trauma	Vythilingam, Blair, McCaffrey, Scaramozza, Jones, Nakic, et al., (2007)
Attentional Bias not assessed	Ehring, Ehlers, & Glucksman. (2008) Elwood, Williams, Olatunji, & Lohr. (2007) Cottencin, Vaiva, Huron, Devos, Ducrocq, Jouvent et al. (2006) Bryant, Felmingham, Kemp, Barton, Peduto, Rennie, et al. (2005) Vasterling, Duke, Tomlin, Lowery, & Kaplan E. (2004) Miller, & Litz. (2004) Engelhard, Macklin, McNally, van den Hout, & Arntz. (2001) Field, Classen, Butler, Koopman, Zarcone, & Spiegel. (2001) Jenkins, Langlais, Delis, Cohen. (2000) Chemtob, Roitblat, Hamada, Muraoka, Carlson, Bauer. (1999) Golier, Yehuda, Cornblatt, Harvey, Gerber, & Levengood. (1997) Trandel, & McNally. (1987) Holmes, Brewin, & Hennessy. (2004) Buckley, Galovski, Blanchard, & Hickling. (2003) Amir, Coles, & Foa (2002) Davis, Adams, Uddo, Vasterling, et al. (1996)
Neuropsychology of PTSD	Stewart, & White. (2008) Leskin, & White. (2007) Koso, & Hansen. (2006) Neylan, Lenoci, Rothlind, Metzler, Schuff, Du, et al. (2004) Crowell, Kieffer, Siders, & Vanderploeg. (2002) Stein, Kennedy, & Twamley. (2002) Vasterling, Duke, Brailey, Constans, Allain, & Sutker. (2002) Sachinvala, von Scotti, McGuire, Fairbanks, Bakst, & Brown. (2000) Kimble, Kaloupek, Kaufman, & Deldin. (2000) Vasterling, Brailey, Constans, & Sutker. (1998) Gilbertson, Gurvits, Lasko, & Pitman. (1997) McFarlane,Weber, & Clark. (1994) Twamley, Hami, & Stein. (2004) David, Farrin, Hull, Unwin, Wessely, & Wykes. (2002) Brandes, Ben-Schachar, Gilboa, Bonne, Freedman, & Shalev. (2002) Sutker, Vasterling, Brailey, Allain. (1995) Uddo, Vasterling, Brailey, & Sutker. (1993)

Intervention study	Devineni, Blanchard, Hickling, & Buckley. (2004)
Dissertations	Harris, (2006) Young, (2003) Sawhney, (2003) Kaufman, (2002) Mathiesen, (2000) Buckley, (2000) Johnson, (1999) Lambourn-Kavcic, (1999) Davis, (1996) Russell, (1993) Kapsi, (1991)
Include other psychiatric/physical problems	Litz, Weathers, Monaco, Herman, Wulfsohn, Marx, et al., (1996)
Review articles	Asmundson, Stapleton, & Taylor. (2004) McFarlane, Yehuda, & Clark. (2002) Buckley, Blanchard, & Neill. (2000) vanOyen, (1997) Mathews, & MacLeod. (2005) Horner, & Hamner. (2002) Golier, & Yehuda. (2002) Seaman, (2007) Brewin, & Holmes, (2003) McNally, (1998) Paunovic, (1998) Litz, Keane, & Terence, (1989)

Appendix 1.5: Reference list for excluded papers

Excluded from electronic search (n58)

1. Amir, N., Coles, M. E., & Foa, E. B. (2002). Automatic and strategic activation and inhibition of threat-relevant information in posttraumatic stress disorder. *Cognitive Therapy and Research, 26(5),* 645-655.
2. Asmundson, G.J., Stapleton, J. A., & Taylor, S. (2004). Are avoidance and numbing distinct PTSD symptom clusters? *Journal of Traumatic Stress, 17(6),* 467-75.
3. Brandes, D., Ben-Schachar, G., Gilboa, A., Bonne, O., Freedman, S., & Shalev, A.Y. (2002). PTSD symptoms and cognitive performance in recent trauma survivors. *Psychiatry Research, 110(3),* 231-238.
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6. Buckley, T. C. (2000). Automatic and strategic processing of threat stimuli: A comparison between PTSD, panic disorder, and non-anxiety controls. *Dissertation Abstracts International: Section B: The Sciences and Engineering., 60(11-B),* 5764.
7. Buckley, T. C., Blanchard, E. B., & Neill, W. T. (2000). Information processing and PTSD: a review of the empirical literature. *Clinical Psychology Review, 20(8),* 1041-65.
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15. Devineni, T., Blanchard, E. B., Hickling, E. J., & Buckley, T.C. (2004). Effect of psychological treatment on cognitive bias in motor vehicle accident-related Posttraumatic Stress Disorder. *Journal of Anxiety Disorders, 18(2),* 211-31.
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Appendix 2.1 Notes for contributors for submission to the British Journal of Psychiatry

Structure of manuscripts

Papers

A structured abstract not normally exceeding 150 words should be given at the beginning of the article, incorporating the following headings: Background; Aims; Method; Results; Conclusions; Declaration of interest. The abstract is a crucial part of the paper and authors are urged to devote some care to ensuring that all the important findings are within the word limit.

Introductions should normally be no more than one paragraph; longer ones may be allowed for new and unusual subjects. This should be followed by Method, Results and Discussion sections. The Discussion should always include limitations of the paper to ensure balance. Use of subheadings is encouraged, particularly in Discussion sections. A separate Conclusions section is not required.

The article should normally be between 3000 and 5000 words in length (excluding references, tables and figure legends) and normally would not include more than 25 essential references beyond those describing statistical procedues, psychometric instruments and diagnostic guidelines used in the study. All large tables (exceeding half a *Journal* page) will be published only in the online version of the *Journal* (see Online data supplements, below). Authors are encouraged to present key data within smaller tables for print publication. This applies also to review articles and short reports.

References

Authors are responsible for checking all references for accuracy and relevance in advance of submission. Reference lists not in the correct style will be returned to the author for correction. From January 2008, all references should be numbered in the order in which they appear in the text and listed at the end of the article using the Vancouver style (see below), in which the names and initials of all authors are given after the appropriate reference number. If there are more than six authors, the first six should be named, followed by 'et al'.

The authors' names are followed by the full title of the article; the journal title abbreviated (in italics) according to the style of Index Medicus; the year of publication; the volume number (in bold type); and the first and last page numbers. References to book or book chapters should give the titles of the book (and the chapter if selected), names of any authors, name of publisher, names of any editors, and year.

Examples are shown below.

1 Kapusta ND, Etzersdorfer E, Krall C, Sonneck G. Firearm legislation reform in the European Union: impact on firearm availability, firearm suicide and homicide rates in Austria. *Br J Psychiatry* 2007; **191**: 253-7.

2 Thornicroft GJ. *Shunned: Discrimination Against People with Mental Illness.* Oxford University Press, 2006.

3 Casey P. Alternatives to abortion and hard cases. In *Swimming Against the Tide; Feminist Dissent on the Issue of Abortion* (ed AB Kennedy): 86–95. Open Air Books, 1997.

4 Lancet. Burnished or burnt out: the delights and dangers of working in health (editorial). *Lancet* 1994; **344**: 1583-4.

5 Pharmaceutical Research and Manufacturers of America (PhRMA). *PhRMA Guiding Principles on Direct to Consumer Advertisements About Prescription Medications*. PhRMA, 2005. http://www.phrma.org/publications/policy//2005-08-02.1194.pdf

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7 Viding E, Frick P, Plomin R. Aetiology of the relationship between callous-unemotional traits and conduct problems in childhood. *Br J Psychiatry* 2007; **190** (suppl 49): s33–8.

Personal communications need written authorisation (email is acceptable); they should not be included in the reference list. Unpublished doctoral theses may be cited (please state department or faculty, university and degree). No other citation of unpublished work, including unpublished conference presentations, is permissible.

Tables

Tables should be numbered and have an appropriate heading. The tables should be mentioned in the text but must not duplicate information. The heading of the table, together with any footnotes or comments, should be self-explanatory. The desired position of the table in the manuscript should be indicated. Do not tabulate lists, which should be incorporated into the text, where, if necessary, they may be displayed.

Authors must obtain permission from the original publisher if they intend to use tables from other sources, and due acknowledgement should be made in a footnote to the table.

Figures

Figures should be clearly numbered and include an explanatory legend. Avoid cluttering figures with explanatory text, which is better incorporated succinctly in the legend. 3-D effects should generally be avoided. Lettering should be parallel to the axes. Units must be clearly indicated and should be presented in the form quantity (unit) (note: `litre' should be spelled out in full unless modified to ml, dl, etc.). All figures should be mentioned in the text and the desired position of the figure in the manuscript should be indicated.

Authors must obtain permission from the original publisher if they intend to use figures from other sources, and due acknowledgement should be made in the legend. Colour figures may be reproduced if authors are able to cover the costs.

Statistics

Methods of statistical analysis should be described in language that is comprehensible to the numerate psychiatrist as well as the medical statistician. Particular attention should be paid to clear description of study designs and objectives, and evidence that the statistical procedures used were both appropriate for the hypotheses tested and correctly interpreted. The statistical analyses should be planned before data are collected and full explanations given for any *post hoc* analyses carried out. The value of test statistics used (e.g. *t*, *F*-ratio) should be given as well as their significance levels so that their derivation can be understood. Standard deviations and errors should not be reported as ± but should be specified and referred to in parentheses.

Trends should not be reported unless they have been supported by appropriate statistical analyses for trends.

The use of percentages to report results from small samples is discouraged, other than where this facilitates comparisons. The number of decimal places to which numbers are given should reflect the accuracy of the determination, and estimates of error should be given for statistics.

A brief and useful introduction to the place of confidence intervals is given by Gardner & Altman (1990, *British Journal of Psychiatry*, **156**, 472-474). Use of these is encouraged but not mandatory.

Authors are encouraged to include estimates of statistical power where appropriate. To report a difference as being statistically significant is generally insufficient, and comment should be made about the magnitude and direction of change.

Randomised controlled trials

The *Journal* recommends to authors the CONSORT guidelines (1996, *Journal of the American Medical Association*, **276**, 637-639) and their basis (2001, *Annals of Internal Medicine*, **134**, 663-694) in relation to the reporting of randomised controlled clinical trials; also recommended is their extension to cluster randomised controlled trials (2004, *BMJ*, **328**, 702-708). In particular, a flow chart illustrating the progress of participants through the trial (CONSORT diagram) must be included.

Abbreviations, units and footnotes

All abbreviations must be spelt out on first usage and only widely recognised abbreviations will be permitted. The generic names of drugs should be used.

Generally, SI units should be used; where they are not, the SI equivalent should be included in parentheses. Units should not use indices: i.e. report g/ml, not gml^{-1}.

The use of notes separate to the text should generally be avoided, whether they be footnotes or a separate section at the end of a paper. A footnote to the first page may, however, be included to give some general information concerning the paper.

Materials, equipment and software

The source of any compounds not yet available on general prescription should be indicated. The version number (or release date) and manufacturer of software used, and the platform on which it is operated (PC, Mac, UNIX etc.), should be stated. The manufacturer, manufacturer's location and product identification should be included when describing equipment central to a study (e.g. scanning equipment used in an imaging study).

Proofs

A proof will be sent to the corresponding author of an article. Offprints, which are prepared at the same time as the *Journal* is printed, should be ordered when the proof is returned to the Editor. Offprints are despatched up to 6 weeks after publication.

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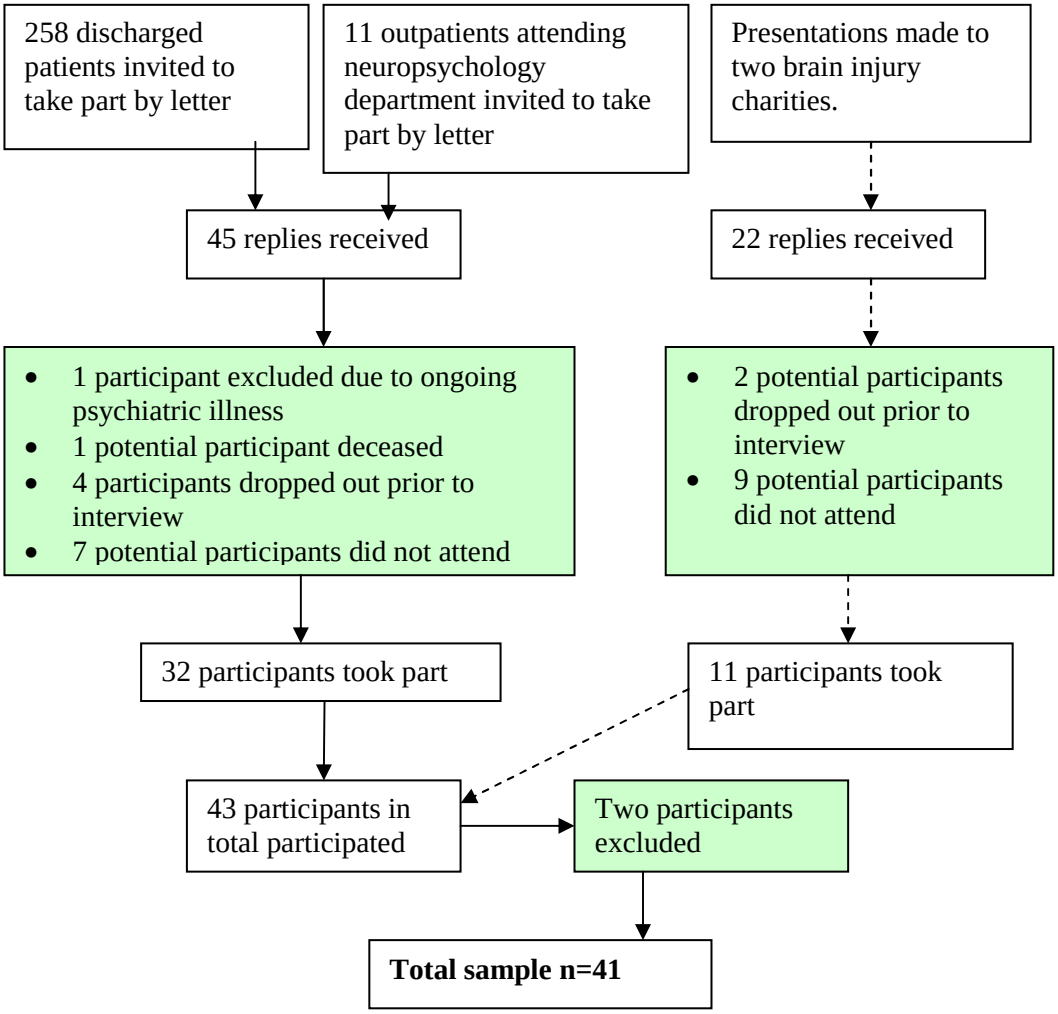
Appendix 2.2: Recruitment Procedure

Timeline

July 2008:	Major Research Project Proposal approved by the D.Clin Psy programme at the University of Glasgow.
August 2008:	Application for Ethical and Research & Development approval (NHS Lothian).
September 2008:	Ethical approval and Research & Development approved pending minor changes.
November 2008:	Full ethical approval granted.
December 2008:	Recruitment started.
01 April 2009:	Application to NHS Greater Glasgow & Clyde and NHS Ayrshire & Arran ethical approval.
05 June 2009:	Approval received from NHS Greater Glasgow & Clyde.
24 July 2009:	Approval received from NHS Ayrshire & Arran

Recruitment Process & Attrition



Appendix 2.3: Development of modified Stroop task

A pilot study, consisting of two parts, was conducted to create the emotional Stroop paradigm which was the measure of attentional bias. Part one of the pilot aimed to generate a pool of 'trauma' words, and part two involved matching the selected trauma words to negative, neutral and positive words.

Part 1

Fourteen trainee clinical psychologists (trainees) were asked to list as many (1) Assault, (2) road traffic accident (RTA) and (3) 'Fall' words they could think of. Participants were given one minute for each word type. The words generated are listed below:

ROAD TRAFFIC ACCIDENT		**ASSAULT**		**FALL**	
windscreen	gore	blood	bottled	pain	embarrassment
seatbelt	guts	police	cut	hospital	break
skid	brains	scream	assault	cut	unpredictable
screech	impact	attacked	power	broken	shock
smash	squashed	mugged	cruel	stairs	surprise
crash	boom	knife	torture	step	hurt
blood	fear	stabbed	tears	cut	scar
unconscious	terror	punch	begging	blood	turn
siren	noise	scarred	break	doctor	steep
ambulance	tyres	frightened	hurt	ambulance	grave
doctor	cut	run	jumped	hit	fright
glass	thrown	violence	behind	smash	concussion
death	launched	kicking	bottled	bang	floor
dying	traffic	stitches	cut	slip	sore
injured	lorry	gang	assault	crack	careful
amnesia	bus	hit	power	thump	embarrassment
blind	emergency	blindness	cruel	bruise	break
rubber	police	stroke	torture	swollen	unpredictable
petrol	break	teenager	tears	paralysed	shock
ice	wreckage	robbery	begging	immobile	surprise
speeding	insurance	fight	break	incapacitated	hurt
driver	killed	threaten	hurt	drunk	scar
hospital	gore	aggression	jumped	dizzy	turn
accident	guts	shouting	behind	rehabilitation	steep
airbag	brains	swearing	hurt	accident	grave
whiplash	impact	beaten	jumped	clumsy	fright
brake	squashed	unconscious	behind	cliff	concussion
doors	boom	wounds	hurt	stairs	floor
window		pain	jumped	balcony	sore
wheel		head		heights	careful
road		rape		unexpected	
corner		beating		head	
pedestrian		anger		injury	
collision		injury		icy	
motorway		head		walking	
safety		club		pavement	
fear		shoeing		scrape	
car		bruise		bones	

shatter		broken		bumped	
collide		bleeding		trip	
gore		fear		stick	

Words generated by the trainees were added to using words from published studies. 'Road traffic accident' words were taken from the only known study of attentional bias in the TBI population (Coates, 2008). 'Assault' words were selected from a study (Mathews et al, 1989) that used 'physical threat' words. Not all physical threat words were added if not deemed suitable by the author e.g. 'cancer'. Words were not added if they overlapped with words created by the trainees. No known published study used 'Fall' words and therefore no words were added the list generated by the trainees.

Part 2

The same fourteen trainees were emailed the completed list of words (words they generated plus published words) and given the following instruction:

> *Please rate the words below based on how strongly you think each word would produce and emotional response in an adult who has been hospitalised as a result of: (1) being involved in **Road Traffic Accident**, (2) been **physically assaulted** or (3) had a **fall**.*
>
> *Please rate each word on a scale 0-3. Please indicate your response by circling a number for each word (or highlighting if completing electronically).*

Thirteen trainees completed the task. Words were scored and ranked by the author according to the trainees' responses. The top fifteen words for each category were selected and matched to published negative, positive and neutral words. All words were matched for syllable and word length. A total of 45 trauma, negative, neutral and positive words were programmed to create the Stroop task using Superlab (version 4.0). The words are presented below.

Number	Trauma	Negative	Neutral	Positive
1	crash	dread	cream	whole
2	wreckage	brooding	routines	peaceful
3	smash	alone	point	clean
4	trapped	tricked	scarves	praised
5	collision	abandoned	intellect	vivacious
6	motorway	ridiculed	currency	glorious
7	killed	failed	height	pleased
8	airbag	guilty	signal	secure
9	whiplash	deprived	sandwich	inspired

10	brake	scorn	quote	charm
11	fatal	upset	study	merry
12	windscreen	friendless	thresholds	energised
13	death	wrong	queen	trust
14	siren	awful	handy	enjoy
15	impact	dismal	button	joyful
16	attack	stupid	window	lively
17	stab	lost	same	calm
18	punching	hopeless	fountain	tranquil
19	victim	reject	nation	lovely
20	beating	forlorn	shuffle	fortune
21	hit	sad	pod	joy
22	mugging	unloved	address	healthy
23	knife	gloom	locks	sound
24	bleeding	betrayed	painting	cheering
25	screaming	destroyed	substance	surprised
26	violence	deserted	tendency	jubilant
27	kicking	mistake	outside	rejoice
28	assault	useless	drawing	special
29	scar	dull	leaf	neat
30	gang	loss	bath	ease
31	fall	fail	pear	good
32	trip	wilt	turn	glad
33	painful	despised	mushroom	greeting
34	broken	lonely	cherry	beauty
35	ambulance	tormented	balconies	efficient
36	hospital	pathetic	alphabet	beautiful
37	cracking	dreadful	wardrobe	applause
38	stairs	stress	cruise	smiles
39	concussion	depression	changeable	passionate
40	accident	offended	holidays	brilliant
41	step	fool	team	luck
42	blood	guilt	coins	trust
42	slip	blue	pour	free
44	bruise	fooled	fringe	wealth
45	swollen	traitors	balanced	prosper

Appendix 2.4 Traumatic Memory Inventory

TRAUMATIC MEMORY INVENTORY

Patient name_____ Patient ID# _____
Interviewer_____ Date of interview___/___/___
DES Score_____ PDEQ Score _____

PART I: TRAUMATIC MEMORY

I. INTRODUCTION

1) Age_____
2) Sex ___Male ___Female

Indicate age(s) of trauma(s) on the timeline below

BIRTH_____NOW

Type of trauma(s)

__Sexual abuse/assault
__Physical abuse/assault
__Accident
__Witness death
__Natural disaster
__Being injured (as the trauma)
__Injured/killed someone
__Combat
__Imprisonment/torture
__Emotional abuse
__Death of child
__Other (Specify)

3) Which trauma has had the greatest effect on your life?_____

☞ Focus on the memories for this trauma for the entire interview.

4) _____ Age of onset of trauma

5) _____ Total duration of trauma (put X for one-time event)

6) If interpersonal violence is involved, relationship to perpetrator

__1) father
__2) stepfather/mother's boyfriend
__3) grandfather
__4) brother
__5) other male relative
__6) mother
__7) other female relative
__8) family "friend"
__9) teacher or priest
__10) stranger
__11) spouse
__12) acquaintance
__13) other (Specify_____)

_____Total number of perpetrators

II. HISTORY OF MEMORY (write narrative of memory here and on the opposite blank page; be sure to include the information necessary to answer the following questions):

7) Have you always known that this trauma happened to you?
(Was there a time that you had no recollection that these things ever happened to you?)

0	1	2	3
no recollection at times	<---->		always known what had happened

☞ **If answer is 3, skip to question #10**

8) How have you remembered the event(s) over time ?

__1) always had memories, but did not think of events as trauma
__2) always had some memories, but details were filled in later
__3) had period of complete amnesia, now have clear memories
__4) had complete amnesia, filled in some blanks, but missing pieces remain
__5) have fragments of memories, but no coherent picture of what happened
__6) have no clear memories, but feelings, or other evidence makes me believe that I was traumatized

9) Under what circumstances did forgotten memories come up ?

__1) related to anniversary
__2) related to emotions having to do with the trauma (such as intimacy, trust, power, fear, anger)
__3) related to sensory reminders (eg sounds, sights, smells, etc)
__4) retrieved in talking therapy
__5) retrieved in altered state of consciousness (hypnosis, meditation, drugs)
__6) spontaneous (no awareness of precipitants)
__7) other (specify)_____

III. Awareness of Memories

10) How have you remembered the event(s)?

Initially

When you first became aware of what had happened, how was the memory registered in your mind?
(Listen for patient's report first, then probe for specific details, ie What did you see?)

___ (X) As visual images (What did you see?)_____

___ (X) As physical sensations (kinesthetic) (What did you feel?)_____

___ (X) As smells (Olfactory) (What did you smell?)_____

___ (X) As sounds (Auditory) (What did you hear?)_____

___ (X) As intense emotions (Affective) (How did you feel?)_____

___ (X) All of them together (Did you see, feel, smell, and hear at the same time?)_____

___ (X) As a story (Narrative) (Were you capable of telling other people what had happened?)_____

Peak

When you were most haunted by the memories, how was the memory registered in your mind? **(Listen for patient's report first, then probe for specific details, ie What did you see?)**

___ (X) As visual images (What did you see?)_____

___ (X) As physical sensations (kinesthetic) (What did you feel?)_____

___ (X) As smells (Olfactory) (What did you smell?)_____

___ (X) As sounds (Auditory) (What did you hear?)_____

___ (X) As intense emotions (Affective) (How did you feel?)_____

___ (X) All of them together (Did you see, feel, smell, and hear at the same time?)_____

___ (X) As a story (Narrative) (Were you capable of telling other people what had happened?)_____

Currently

When the event(s) come(s) to mind, how do you remember it? **(Listen for patient's report first, then probe for specific details, ie What do you see?)**

___ (X) As visual images (What do you see?)_____

___ (X) As physical sensations (kinesthetic) (What do you feel?)_____

___ (X) As smells (Olfactory) (What do you smell?)_____

___ (X) As sounds (Auditory) (What do you hear?)_____

___ (X) As intense emotions (Affective) (How do you feel?)_____

___ (X) All of them together (Do you see, feel, smell, and hear at the same time?)_____

___ (X) As a story (Narrative) (Are you capable of telling other people what had happened?)_____

How long did it take before you could talk to someone else about what had happened in a coherent fashion ?

___ immediately ___ les than a day
___ less than a week ___ less than a month
___ I still cannot tell the whole story of what happened

How long did it take before you could talk to someone else about what had happened without being interrupted by intense feelings or sensations related to the event ?

___ immediately ___ les than a day
___ less than a week ___ less than a month
___ I still cannot tell the whole story of what happened without getting intense feelings or sensations

11) FLASHBACKS

A. Do you have flashbacks in which the event(s) comes back as if it were happening all over again (while you are awake) ?

__1) yes, currently
__2) used to, no longer
__3) no

☞ **skip to 12 if no flashbacks at all**

B. If yes, does the entire event come back, or only parts of it (ie. just the smell, sound or the hand of the perpetrator)?

__1) entire trauma
__2) fragments
__3) both

☞ **Complete next question only if the flashbacks are fragments of the trauma**

C. If fragments, does the event come back as (check all that apply):

__1) Visual (as images)
__2) Tactile/kinesthetic (physical sensations)
__3) Olfactory (smells)
__4) Auditory (sounds)
__5) Affective (emotions)
__6) All of them together
__7) As a story (narrative)

Compare the modalities from Question #10 (Initially/Peak/Current) with the modalities of the flashback. If different, explain the discrepancies._____
_____
_____
_____
_____
_____

12) How often do memories (flashbacks, nightmares, unwanted memories, etc) of the trauma come to mind without your wanting them to?

A __0) never
__1) daily
__2) 2-4/wk
__3) weekly
__4) monthly
__5) less than once a month

B. Longest intrusion free period
__1) more than a week
__2) more than a month
__3) more than a year

13) CURRENT TRIGGERS
What sort of things trigger memories of the event ?

__1) anniversaries
__2) being upset with people
__3) people being upset with me
__4) other emotions
__5) sensory reminders (such as sounds, sights, smells)
__6) being touched in certain ways
__7) in talking therapy
__8) relived in altered state of consciousness (hypnosis, mediation, drugs)
__9) getting off alcohol or drugs
__10) spontaneous (no awareness of precipitants)
__11) other (specify) _____
__12) nothing triggers memories

14) NIGHTMARES

Do you have nightmares about the trauma ?

__1) yes , currently
__2) used to, but have not had them in 3 months
__3) no

If yes, are they :
__1) Dreamlike (bizarre, illogical)
2) Lifelike: exact representations of some aspect of the trauma- no admixture of other elements
__a) replay of entire trauma
__b) fragments (sights, smells, feelings, etc)
__3) Combination of dreamlike and lifelike

15) If you have both nightmares and flashbacks, do they have the same content?

__1) same
__2) different
__3) do not have both

If answer is 2, how are they different?_____
_____

IV. CONTROL AND MASTERY

16) What do you do to control the intrusive memories ?

	in past (X)	currently (X)
1) eating	___	___
2) talking with people	___	___
3) alcohol or drugs (which ones)_____	___	___
4) work, keeping busy	___	___
5) cleaning	___	___
6) religion	___	___
7) being with friends	___	___
8) music	___	___
9) therapy (what sort)_____	___	___
10) self harm (how)_____	___	___
11) sex	___	___
12) sleeping	___	___
13) television	___	___
14) other _____	___	___
15) nothing helps to control the memories	___	___

17) Interviewer

A On the basis of subject's narrative rate for:

__1) Significant functional impairment in effort to avoid re-exposure
__2) Avoids exposure, but no significant effects on occupational or interpersonal functioning
__3) Find self in situations reminiscent of trauma, but unaware of setting it up
__4) Attracted to trauma-related feelings, thoughts or actions.

B. On the basis of subject's narrative, rate cohesiveness of narrative:

0 1 2 3
Least cohesive <---> Most Cohesive

IV. ACCURACY AND CONFIRMATION

Use this scale for question #18 through #19

0 1 2 3
Not at all <---> Completely

18) Do you think that your perceptions of the event(s) have changed over time (ie the role in the trauma or the extent of the trauma)?

0 1 2 3

If yes, in what way ?_____
_____
_____

19) How sure are you that your memories are accurate in regards to:

a) time	0 1 2 3
b) place	0 1 2 3
c) person	0 1 2 3
d) events	0 1 2 3

20) Have you ever checked out what you remember with others ?

__1) Not tried to confirm
__2) Disconfirmed by others only
__3) No confirmation, but no alternative versions are offered by other potential witnesses
(what _____
_____)
__4) Others who knew subject at time of trauma support subject and BELIEVE it is true
__5) Clear confirmatory evidence
(what _____
_____)
__6) Adult trauma; No delayed memories, issue of confirmation not relevant
__7) Other _____
_____
_____

Interviewer's comments about reliability of information

_____
_____
_____
_____
_____
_____

PART II: NON-TRAUMATIC MEMORY

Now I would like you to remember another event in your life that made a deep impression on you, but that was not traumatic. For example, the birth of a child, an illness, wedding, a vacation, graduation, a particularly important relationship, an accomplishment in school or at work. Please tell me what event you'd like to pick, and how old you were when it happened.

Event

_____

_____

_____

_____

_____Age at the time of experience

1) _____Total duration of event in months (put X for one-time event)

Use this scale for questions #2 through #3

0 <----> 3

no / not at all yes / completely

2) Have you been continuously aware that this event has happened to you?

0 1 2 3

3) Have there been times that you put it out of your mind and were surprised that it came up?

0 1 2 3

4) How do you remember the event(s)?

Initially: **When you first became aware of what had happened, how was the memory registered in your mind?**

Peak: **When you were most haunted by the memories, how was the memory registered in your mind?**

Currently: **When the experience comes to mind now, how do you remember it?**

	Initially (X)	Peak (X)	Currently (X)
1. As visual images (what did/do you see?)	___	___	___
2. As physical sensations (kinesthetic) (what did/do you feel?)	___	___	___
3. As smells (Olfactory) (what did/do you smell?)	___	___	___
4. As sounds (Auditory) (what did/do you hear?)	___	___	___
5. As intense emotions(Affective) (how did/do you feel?)	___	___	___
6. All of them together (did/do you see, feel, smell, and hear at the same time?)	___	___	___
7. As a story(narrative) (were/are you capable of telling other people what had happened?)	___	___	___

How long did it take before you could tell it as a coherent story to someone?

___ immediately ___ less than a day
___ less than a week ___ less than a month
___ I still cannot tell the whole story of what happened

How long did it take you before you were able to talk about what had happened, without being interrupted by intense feelings or sensations related to the event ?

___ immediately ___ less than a day
___ less than a week ___ less than a month
___ I still cannot tell the whole story of what happened without getting intense feelings or sensations

5) Have you always known that this event happened to you?
(Was there a time that you had no recollection that these things ever happened to you?)

0	1	2	3
no recollection at times	<---->		always known what had happened

☞ **If answer is 3, skip to question #8**

6) How have you remembered the experience over time?

__1) always knew what happened, and think about it with the same emotional intensity as I do now
__2) always knew it, but but details have changed over time
__3) had period of complete amnesia, now have clear memories
__4) had complete amnesia, filled in some blanks, but missing pieces remain
__5) have fragments of memories, but no coherent picture of what happened
__6) have no clear memories, but feelings, or other evidence makes me believe it happened.

7) Under what circumstances do memories of this event come up ?

__1) anniversaries
__2) being upset with people
__3) people being upset with me
__4) other emotions
__5) sensory reminders (such as sounds, sights, smells, etc)
__6) being touched in certain ways
__7) in talking therapy
__8) relived in altered state of consciousness (hypnosis, mediation, drugs)
__9) getting off alcohol or drugs
__10) spontaneous (no awareness of precipitants)
__11) other (specify) _____
__12) None

8) How often do memories of the experience come to mind without your wanting them to ?

A.__1) daily
__2) 2-4/wk
__3) weekly
__4) monthly
__5) less than once a month

B. Longest period that you have not thought about this event.
__1) more than a week
__2) more than a month
__3) more than a year

9) A. Are there times that the experience comes back as if it were happening again, while you are awake ?

__1) yes
__2) no

B. If yes, does the entire experience come back, or only parts of it?

__1) entire experience
__2) fragments

☞ **If entire experience, skip to question #10**

C. If fragments, does the experience come back as:
__1) Visual (as images)
__2) Tactile/kinesthetic (physical sensations)
__3) Olfactory (smells)
__4) Auditory (sounds)
__5) Affective (emotions)
__6) All of them together
__7) As a story (narrative)

10) Do you have dreams about the experience ?

__a) yes
__b) no

If yes, are they

__1) Dreamlike (bizarre, illogical)
2) Lifelike exact representations of some aspect experience - no admixture of other elements
__a) replay of entire experience
__b) fragments (sights, smells, feelings, etc)
__3) Combination

11) If you have both dreams and intense waking re-experiences, do they have the same content ?
__1) same
__2) different
__3) not both

Use this scale for questions #12 through #14
0 1 2 3
Not at all <---> Completely

12) Do you think that your perceptions of the trauma have changed over time ?

0 1 2 3

If yes, in what way?_____
_____

13) How accurate do you believe your memories are in regards to:

1) time	0 1 2 3
2) place	0 1 2 3
3) person	0 1 2 3
4) events	0 1 2 3

14) Have you ever found that what you remember about this experience is quite different from what other people remember ?

0 1 2 3

What do you make of that ?_____

15) We now have come to the end of our interview, please tell me what it was like for you ?

16) What lessons do you feel you have learned that would help other people who have gone through experiences similar to yours ?

Summary and interviewer's comments (Including whether subject was capable of telling non-traumatic story which remained uncontamined by previous telling of traumatic experience- comment on this in detail).

TMI Score Sheet

Date of interview___/____/____

Patient Name_____ ID Number_____ (id) Age_____ (age) Interviewer_____

Traumatic Memory

Gender (0=male 1=female) 0 1 (gender)

Age of onset of trauma _____ (ageons)
Duration of trauma (in years; _____ (durat)
99=Less than one year, 0=one time event)

PDEQ Score _____ (pdeq)
DES Score _____ (des)

Type of trauma (0=no 1=yes)

Sexual abuse/assault	0 1	(type1)
Physical abuse	0 1	(type2)
Accident	0 1	(type3)
Witness death	0 1	(type4)
Natural disaster	0 1	(type5)
Being injured	0 1	(type6)
Injure/kill other	0 1	(type7)
Combat	0 1	(type8)
Imprison/torture	0 1	(type9)
Emotional abuse	0 1	(type10)
Death of Child	0 1	(type11)
Other(Specify_____	0 1	(type12)
_____)		

If abuse, w/in family (0=no 1=yes 2=no abuse)
0 1 2 (famil)

Childhood trauma (0=no 1=yes) Childhood is age<14
0 1 (child)

Number of perpetrator(s) _____ (perp)

Amnesia (0=total amnesia 3=no amnesia)
0 1 2 3 (knew)

How memories came up(0=no 1=yes 2=no amnesia)

Anniversary	0 1 2 (memup1)
Emotions	0 1 2 (memup2)
Sensory	0 1 2 (memup3)
Therapy	0 1 2 (memup4)
Altered states	0 1 2 (memup5)
Spontaneous	0 1 2 (memup6)
Other(Specify_____	0 1 2 (memup7)
_____)	

Sensory modalities (0=no 1=yes)

	Initially	Peak	Currently
Visually	0 1 (init1)	0 1 (peak1)	0 1 (curr1)
Tactile	0 1 (init2)	0 1 (peak2)	0 1 (curr2)
Olfactory	0 1 (init3)	0 1 (peak3)	0 1 (curr3)
Auditory	0 1 (init4)	0 1 (peak4)	0 1 (curr4)
Affective	0 1 (init5)	0 1 (peak5)	0 1 (curr5)
All together	0 1 (init6)	0 1 (peak6)	0 1 (curr6)
Narrative	0 1 (init7)	0 1 (peak7)	0 1 (curr7)

Flashbacks (1=yes 2=used to 3=no)
1 2 3 (flash1)

Form of flashback (0=no flashback 1=entire trauma 2=fragments 3=both)
0 1 2 3 (flash2)

Modalities of flashback (0=no 1=yes 2=no flashback)

Visual	0 1 2 (flash3)
Tactile	0 1 2 (flash4)
Olfactory	0 1 2 (flash5)
Auditory	0 1 2 (flash6)
Affective	0 1 2 (flash7)
All together	0 1 2 (flash8)
Narrative	0 1 2 (flash9)

Frequency of intrusion (0= no intrusions 1=daily 2=2-4/wk 3=weekly 4=monthly 5=less than 1/month)
0 1 2 3 4 5(intrus)

Triggers (0=no 1=yes)

Anniversaries	0 1 (trigg1)
Upset with others	0 1 (trigg2)
Others upset w/ me	0 1 (trigg3)
Other emotions	0 1 (trigg4)
Sensory reminders	0 1 (trigg5)
Being touched	0 1 (trigg6)
Therapy	0 1 (trigg7)
Altered states	0 1 (trigg8)
Off EtOH/drugs	0 1 (trigg9)
Spontaneous	0 1 (trigg10)
Other(Specify_____	0 1 (trigg11)
_____)	
None	0 1 (trigg12)

Nightmares (1=yes 2=not in 3 months 3=none)
1 2 3 (night1)

Form of nightmare (0=no nightmare 1=dreamlike 2=lifelike & entire trauma 3=lifelike & fragments 4=both)
0 1 2 3 4(night2)

Content of nightmare compared to flashbacks (0=don't have both 1=same 2=different)
0 1 2 (nigth3)

Avoidance (0=no 1=yes)

Eating	0 1 (avoid1)
Talking w/ others	0 1 (avoid2)
EtOH/drugs	0 1 (avoid3)
Keeping busy	0 1 (avoid4)
Cleaning	0 1 (avoid5)
Religion	0 1 (avoid6)
Being with friends	0 1 (avoid7)
Music	0 1 (avoid8)
Therapy	0 1 (avoid9)
Self-harm	0 1 (avoid10)
Sex	0 1 (avoid11)
Sleeping	0 1 (avoid12)
Television	0 1 (avoid13)
Reading	0 1 (avoid14)
exercise	0 1 (avoid15)
dissociating	0 1 (avoid16)
other	0 1 (avoid17)
None	0 1 (avoidl 18)

Perception of the trauma changing over time (Scale 0-3: 0=not at all 3=definitely)
0 1 2 3 (change)

Confirmation of trauma (0=no 1=yes 2=not relevant)
0 1 2 (cnfrm)

Degree of narrative (Scale 0-3: 0=no narrative 3=coherent narrative)
0 1 2 3 (narr)

Non-traumatic memory

Age of onset of experience _____ (age2)

Amnesia (0=no 1=yes) 0 1 (amnesia)

Modalities of non-traumatic memory (0=no 1=yes)

Visual	0 1 (prisen1)
Tactile	0 1 (prisen2)
Olfactory	0 1 (prisen3)
Auditory	0 1 (prisen4)
Affective	0 1 (prisen5)
All together	0 1 (prisen6)
Narrative	0 1 (prisen7)

Comments
_____
_____

van der Kolk

Appendix 2.5 Permission from author to use Traumatic Memory Inventory

From:	Joe Spinazzola
To:	mzucker@jri.org l.reid.1@research.gla.ac.uk
Cc:	
Date:	10/09/08 02:27 am
Subject:	Fw: TMI
Attachments:	

Hi Louise,

Yes, this is one of our Center's measures, and you most certainly have our permission to use it.

Keep us posted on what you find in your study!

Thanks, Joseph Spinazzola

Joseph Spinazzola, Ph.D.
Executive Director
The Trauma Center at JRI
1269 Beacon St.
Brookline, MA 02446
(617) 232-1303 ext. 215
(617) 232-1280 (fax)
www.traumacenter.org

The Trauma Center is a Division of Justice Resource Institute,
A member of the National Child Traumatic Stress Network
and the Hamilton Fish Youth Violence Prevention Consortium,
and an Affiliate of Boston University School of Medicine
& the Boston Children's Foundation

>>> Marla Zucker 10/6/2008 12:09 PM >>>
Joe,
All they need is permission to use the measure. Can you get back to them about this?
Thanks,
Marla

Appendix 2.6

Major Research Proposal

Traumatic Brain Injury, PTSD and Attentional bias: unravelling the misidentification of PTSD in people with a TBI.

Louise M. Reid

1. Abstract

Background

The prevalence of PTSD after a TBI is subject to debate with rates of 0-56% being reported (McMillan, 2001). It has been proposed that this range is due to the overlap of symptoms seen in both TBI and PTSD, which consequently results in the misidentification of PTSD in people with a TBI (McMillan, 2001). An attentional bias and anxiety when exposed to threat stimuli has been shown to exist in people with PTSD alone. No study has investigated whether an attentional bias exists in people with a TBI and PTSD symptoms.

Aims

The study aims to establish whether an attentional bias to trauma related words exists in people a TBI and PTSD symptoms and to investigate the relationship between physiological arousal and attentional bias in people with a TBI and PTSD symptoms.

Methods

Participants aged 18+ admitted to hospital with a moderate/severe TBI at least 3 months prior to recruitment will be invited to take part. Participants will be asked to attend one appointment in which they will be interviewed and will complete a number of cognitive assessments and a measure of mood. During the appointment, participants will be asked to wear a heart rate monitor.

Application

The purpose of the study is to better understand why PTSD is misidentified in people who have a TBI. It has been shown that people who have a sustained a TBI may display symptoms similar to PTSD, e.g. avoidance, and hence appear to have PTSD without meeting diagnostic criteria. Instead, it is the TBI that is causing such symptoms. Should an attentional bias exist with greater PTSD symptom severity, then using a measure of attentional bias may help clinicians to identify PTSD in people with a TBI.

2. Introduction

The prevalence of PTSD following traumatic brain injury (TBI) varies throughout the literature with a range of 0-56% being reported (McMillan, 2001). The first evidence for PTSD after TBI was published in the early 1990s (McMillan, 1991) however other earlier studies suggested that PTSD did not (e.g. Mayou et al, 1993) and later could not (e.g. Sbordone et al, 1995) co-exist with TBI. More recently research suggests that PTSD can occur after TBI (King, 2008). For example, Bryant et al (2004) reported that patients can experience physiological arousal when exposed to trauma related stimuli even though they have no conscious memory of the trauma. Thus fear conditioning can occur out-with the level of conscious awareness and contribute to the development of PTSD.

Two recent studies propose complimentary explanations for the discrepancy in prevalence rates reported. Sumpter and McMillan (2005) suggested that PTSD was misdiagnosed in patients with a severe TBI when using self-report questionnaires compared to structured clinical interview. They found PTSD caseness to be 3% using a structured clinical interview. In concordance with McMillan (2001), this misdiagnosis is attributed to

the similarity in symptoms seen in both PTSD and TBI alone. For example, a person with a TBI may display "avoidance" symptoms according to a PTSD diagnostic questionnaire however, the person may be 'avoiding' a situation as a result of their injury (e.g. 'avoiding' driving because their licence has been revoked).

This phenomenon by which people with a TBI can experience PTSD symptoms even without a conscious memory of the trauma can be conceptualised using Dual Representation Theory (Brewin et al, 1996). This neurocognitive model posits that conscious memory is stored in what is termed "verbally accessible memory". The information stored in VAMs can be consciously accessed by an individual when required. Implicit (unconscious) processing is also known to take place in parallel to explicit (conscious) processing. Such information processed in this fashion is termed "situationally accessible memory" and can be accessed unintentionally by stimuli, in particular sensory stimuli that are associated with this memory. Thus, patients with amnesia can present with PTSD symptoms due to implicit processing that is triggered by trauma-related sensory cues.

The notion that trauma-related cues can trigger flashbacks is in keeping with the Cognitive Model of PTSD proposed by Ehlers and Clark (2000) as a framework for understanding the development and maintenance of PTSD. They proposed that hypervigilence to threat stimuli is a key maintaining factor in PTSD. That is, individuals are on 'high alert' for potential danger and engage in behaviours such as scanning the environment. This hypervigilence can be considered in terms of an attentional bias to threat stimuli. An attentional bias itself refers to a phenomenon in which an individual can redirect attentional resources to the most salient task with the resultant disruption to other ongoing cognitive activities (Mogg and Bradley, 1998). Many studies have reported that an attentional bias is present in patients with PTSD (e.g. Williams et al, 1996 & Beck et al, 2001). A recent study (Pineles et al, 2007) investigated whether this attentional bias is indeed acting as an interference to other ongoing cognitive tasks as suggested by Mogg and Bradley (1998), or whether the attentional bias facilitates detection of threat stimuli for individuals with PTSD. It was found that attentional interference as opposed to attentional facilitation was present in patients with PTSD and is thus in keeping with Ehlers and Clark's (2000) model. Furthermore, it was suggested that attentional interference may be associated with difficulties experienced by patients with PTSD, for example, intrusions and avoidance.

In non-PTSD populations it has been shown that attentional bias is associated with increased anxiety (Bar-Haim et al, 2007). Mogg et al (1993) found that individuals with high trait anxiety displayed an emotional Stroop effect compared to low trait anxiety individuals. Anxiety is a psychophysiological state characterised by a number of physiological symptoms including muscle tension, twitching and shaking, restlessness, fatigue and heart palpitations (Clark, 1989). PTSD is an anxiety disorder with prominent psychophysiological symptoms including elevated heart rate and hyperarousal to threat stimuli (Blechert et al, 2007). Therefore patients with PTSD are known to have an attentional bias for threat stimuli (e.g. Pineles et al, 2007) and physiological anxiety symptoms.

The aim of this study is to provide further support for previous work that has acted to identify the reasons for a wide range of reported incidences of PTSD in patients with a TBI. It is suggested that for patients with a TBI,

PTSD should be considered as a continuum. That is, some patients will have some PTSD symptoms but not meet diagnostic criteria and others will fulfil diagnostic criteria for PTSD. No study has investigated whether or not an attentional bias exists in TBI patients reporting PTSD symptoms. This study will specifically investigate whether or not an attentional bias is related to PTSD symptom severity in patients with a TBI and subsequently question whether attentional bias might be utilised as an indicator of PTSD for this population. Physiological arousal (heart rate) will also be examined in relation to PTSD severity and attentional bias.

3. Aims & Hypotheses

3.1. *Aims*

To establish whether an attentional bias exists in people with a TBI and PTSD symptoms.

To investigate the relationship between physiological arousal (heart rate) and attentional bias in people with a TBI and PTSD symptoms.

3.2. *Hypotheses*

1. People with a higher frequency or severity of PTSD symptoms have an attentional bias to trauma related stimuli.
2. Increased physiological arousal is associated with greater attentional bias to trauma related stimuli.
3. H_1 is associated with increased physiological arousal (heart rate).

4. Plan of Investigation

4.1 *Participants*

Participants aged 18+ admitted to hospital with a moderate/severe TBI at least 3 months prior to recruitment (to fulfil DSM-IV criteria for PTSD) will be invited to take part. TBI severity will be defined as Glasgow Coma Scale (GCS) less than 13 and documented loss of consciousness. Males and females will be included.

4.2 *Inclusion and Exclusion Criteria*

Participants with a TBI that occurred at least 3 months prior to recruitment and who are living independently and are able to consent will be included. Participants receiving psychiatric treatment for PTSD will be excluded. Participants who are receiving psychiatric treatment for problems other than PTSD will be considered on a case by case basis. Participants under the age of 18 years will be excluded.

4.3 *Recruitment Procedures*

Participants will be recruited from Edinburgh Headway and the Scottish Brain Injury Rehabilitation Centre at the Astley Ainslie Hospital in Edinburgh. Patients who are currently receiving treatment and those discharged from the head injury outpatient clinic will be invited to take part.

A Consultant Clinical Neuropsychologist will be asked to approach patients who are receiving treatment and those who have been discharged from the Scottish Brain Injury Rehabilitation Centre with a letter detailing the purpose of the study. The letter will have a reply slip stating whether the individual wishes to hear more about the study. The reply slip will be returned to the researcher and contact will be made if requested.

A talk will be given to the Edinburgh Headway group and an advertisement will be placed on the notice board inviting individuals to consider taking part in the study. An email address, contact phone number and reply slips (with stamped addressed envelopes) will be provided for replies.

4.4 *Measures*

4.4.1 Physiological measures:

1. Heart rate – using the Polar Heart Rate monitor.

4.4.2 Cognitive measures:

1. Wechsler Test of Adult Reading (WTAR: Wechsler, 2001) – to assess premorbid intellectual functioning
2. Emotional Stroop (computerised) – to assess attentional bias
3. Digit Symbol substitution test [Wechsler Adult Intelligence Scale-III (WAIS-III: Wechsler, 1997)] – to assess information processing speed
4. Logical memory [Wechsler Memory Scale-III (WMS-III: Wechsler, 1997)] – to assess declarative memory.
5. The Hayling (Hayling and Brixton Test, Burgess & Shallice, 1997) – to assess executive function.

4.4.3. PTSD severity and caseness measures:

1. Post-traumatic Diagnostic Scale (PDS: Foa et al, 1997) – self report
2. Clinician Administered PTSD Scale (CAPS: Blake et al, 1995) – a structured clinical interview that includes a measure of previous trauma history. This measure will highlight if there are any conscious memories or more than one event.

4.4.4 TBI measures:

1. Post-traumatic Amnesia (PTA) – collected via retrospective questioning to measure TBI severity.
2. Traumatic Memory Inventory [TMI: van der Kolk, 1990 (unpublished paper)] – a structured interview that measures sensory, affective and narrative memory for the event.
3. Glasgow Outcome Scale-Extended (GOS-E: Wilson et al, 1998) – a clinician rated scale that assesses functional and social disability following a TBI.

4.4.5. Depression and Anxiety

1. Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983)

4.5 *Design*

A single sample within subjects design will be employed.

4.6 *Research Procedures*

Participants will be invited to take part via the procedure described above. One visit will be required for each participant. Participants will be seen at the Astley Ainslie Hospital.

When a participant contacts the researcher to register interest, the researcher will telephone the participant and provide information about what will be required. An appointment will be arranged and a letter confirming this time will be sent along with an information sheet to the participant.

The appointment is expected to last approximately 1.5 hours. During the appointment participants will first be given an opportunity to ask any questions before being asked to provide informed consent. Next the heart rate monitor will be fitted and started at the same time as a digital stopwatch. The heart rate monitor will be worn throughout the interview and the time for the beginning and end of each test/scale will be recorded. The tests/scales will then be administered in the following order:

1. HADS
2. PTA assessment
3. PDS
4. WTAR
5. LM I

BREAK 10mins

6. Digit symbol substitution test
7. Hayling
8. Emotional Stroop
9. Logical Memory II
10. CAPS
11. GOS-E
12. TMI

4.7 ***Justification of sample size***

Power was calculated for the primary hypothesis based on data from Bryant and Harvey (1997). Here, Bryant and Harvey (1997) investigated the attentional bias towards threat stimuli in subjects with PTSD and subclinical PTSD using a dot-probe paradigm and found that the PTSD group had an attentional bias compared to the subclinical PTSD group (cohen's $d = 0.46$).

Effect size for hypothesis two was calculated based on data from Bradley et al (1995) who predicted that people with Generalised Anxiety Disorder (GAD) would show greater colour-naming interference for negative words than neutral words compared with controls. Results suggested that people with GAD had greater colour-naming interference due to negative words compared with the control group and the effect size was large ($d = 0.8$).

Power for hypothesis three was calculated from a paper investigating physiological responsiveness among survivors of motor vehicle accidents with chronic PTSD (Veazey et al, 2004). The study compared heart rate reactivity between groups with chronic PTSD, subsyndromal PTSD and non-PTSD and found a significant

difference in heart rate reactivity between the chronic PTSD group and non-PTSD group, the effect size was medium (cohen's $d = 0.5$).

Specifying power = 0.8, alpha = 0.05 and f = 0.15, a sample of 68 participants will need to be recruited to reliably reject the null hypothesis when using linear regression for data analysis. The data for the power calculation was computed using G*Power 3.0.

4.8 *Settings & Equipment*

All scales and tests will be administered at the Astley Ainslie Hospital. A stopwatch and a Polar Heart Rate monitor (S610i) will be required. The cognitive tests will be requested from the University of Glasgow, Psychological Medicine department.

4.9 *Data Analysis*

Data will be analysed using SPSS v15.0. Kolmogorov-Smirnov analysis will be conducted for each variable to check whether the data are normally distributed. This will allow a decision as to whether parametric or non-parametric tests should be carried out. Hypotheses 1 and 2 will be investigated using a linear regression model. For hypothesis 3, a correlation will be used to investigate whether there is a relationship between physiological arousal and attentional bias. If an association is found, an interaction term will be added to the regression model.

5. Health and Safety Issues

5.1 *Researcher Safety Issues*

The researcher will be conducting appointments in a hospital setting the researchers field supervisor will be informed as to when and where the appointments are taking place. All appointments will be conducted between 9am and 5pm to correspond with working hours of staff to ensure that another member of staff will be on the premises when the appointments are being conducted.

5.2 *Participant Safety Issues*

The appointments will be conducted on NHS premises and the health and safety protocols of the premises will be followed at all times to ensure the safety of the participant if an emergency were to occur (e.g. fire evacuation procedures).

6. Ethical Issues

Ethics approval will be sought from Edinburgh LREC. Recruitment will be conducted by asking the participants if they wish to be contacted. Part of the study will require participants to recall the event that caused their TBI. This may be distressing for the participant and they will be afforded the opportunity to discuss their distress after the session, or if preferred, they will be given the chance to terminate the session. Such an event is unlikely and has not occurred in a previous trainee project of a similar design (Smith et al, 2007). Some participants may be identified as having PTSD as determined by the diagnostic scales used. If a

participant is identified as having PTSD, abnormal depression or anxiety and would like help, their GP will be informed with the recommendation of a referral being made to the appropriate service.

7. Financial Issues

7.1 *Equipment Costs, travel etc*

Participants will not be reimbursed for their travel to their appointment. Costs are for questionnaires and stationery.

8. Timetable

- July-September 08: Application for ethical approval
- September-April 09: Data collection
- April-July 09: Data analysis and write-up.
- August 09: Submit portfolio

9. Practical Applications

The aim of this study is to investigate whether an attentional bias to threat stimuli is contributing to the reported large range of PTSD in patients with a TBI. The findings of the study will help clinicians better understand whether or not a patient does indeed have PTSD, or whether they are experiencing head injury symptoms. The study will help to understand why some patients with a TBI present on self-report questionnaires as having PTSD when they do not have the associated psychophysiological symptoms e.g. anxiety or meet diagnostic criteria when interviewed by a clinician. It is hypothesised that an attentional bias will be associated with PTSD symptom severity in patients with a TBI and that this will help distinguish whether or not a person does have PTSD or whether they are just interested in knowing what happened during an amnesic gap. Overall, clinicians will be able to test patients with a TBI for an attentional bias to help them to understand what a patient is experiencing and allow them to provide the appropriate intervention and care package.

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