Social cognition and interpersonal relationships in individuals with Post-traumatic stress disorder (PTSD)

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Abstract

Social cognition is an area of growing interest in mental health research. Impairments in social cognition have been found in a variety of conditions. Impairments in these processes can lead to relationship difficulties; relationships are instrumental in the management and recovery from difficulties. Few studies have focused on emotional recognition in a PTSD population, this study aimed to expand on the current literature by looking at the associations between emotional recognition and interpersonal relationships. Twenty-seven individuals were recruited to participate, along with age and gender matched healthy controls. They completed two emotional recognition tasks (auditory and facial) and self-report questionnaires measuring views on interpersonal relationships and social support.

Those with PTSD were found to have generalised impairments in facial recognition when compared to controls and specific impairments in auditory recognition. The emotions of fear, sadness and disgust were consistently recognised with less accuracy across tasks. No gender differences in accuracy on tasks were found in the PTSD group performance. Comparisons between trauma groups (childhood or adulthood traumas) found no differences in accuracy rates. Significant differences were found between the clinical and control groups on the interpersonal relationship questionnaires, with the PTSD group reporting greater difficulties. Partial associations were found between lower accuracy scores on recognition tasks and reported difficulties in interpersonal relationships. The emotion of sadness on the auditory recognition task mediated the relationship between trauma and interpersonal difficulties. These findings support the view that interventions should also target interpersonal difficulties in PTSD.

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Introduction

1. Thesis Overview

This study sought to investigate aspects of social cognition, namely the perception and judgement of social affective stimuli in individuals with Post-traumatic stress disorder (PTSD). It also sought to establish if a relationship existed between performance on social cognition tasks and self reported function on measures of interpersonal relationships. An age matched control group was used to assess if individuals with PTSD showed significantly different patterns of prosodic recognition to controls and if interpersonal relationships differ between the two groups.

Chapter one gives a brief introduction to the diagnostic classifications of simple and complex PTSD, please refer to the Glossary for definitions of key terminology (Appendix 1), the cognitive and social cognitive models of PTSD, and the effects of trauma on interpersonal relationships and functioning. It also introduces social cognition research more broadly in mental health. Chapter two concludes the introduction section, with a systematic review that aims to critically appraise the literature on the assessment of social cognition in individuals with PTSD. This will lead to a rationale and summary of the present study and an outline of the hypotheses. Chapter three will discuss the study's methodology, the development of a verbal prosody measure, specific measures used in this study, and the procedures that were followed. Chapter four will outline the study's findings, including descriptive and statistical analyses. Chapter five will discuss the study's findings, its limitations, and identify implications for future research and clinical practice. It will also consider current interventions and propose areas of consideration for future interventions.

1.1. Why study PTSD?

1.1.1. What is Post-traumatic stress disorder (PTSD)?

Post-traumatic stress disorder (or PTSD) is an anxiety based disorder characterised by a person continuing to feel threatened, distressed, or in danger after experiencing an ordeal that involved physical harm or the threat of physical harm. The person may have personally experienced harm or the threat of harm or this may have happened to someone close to them, or in proximity to them. Whilst feeling afraid is a normal reaction to threat, this reaction is altered in the person and they continue to experience feeling frightened long after the event has passed (NIMH, 2015).

PTSD can be diagnosed using two separate classification systems. The Diagnostic and Statistical Manual of Mental Disorders (DSM-V) (DSM, 2013) diagnostic criteria for PTSD include; *"a history of exposure to a traumatic event that meets specific stipulations and symptoms from each of four symptom clusters: intrusion, avoidance, negative alterations in cognitions and mood, and alterations in arousal and reactivity. The sixth criterion concerns duration of symptoms; the seventh assesses functioning; and, the eighth criterion clarifies symptoms as not attributable to a substance or co-occurring medical condition"*. Prior to the latest update of the DSM in 2013, the DSM-IV had slightly different criteria (DSM-IV, 2000); due to this update being so recent, the majority of research in this area will relate to the previous diagnostic criteria.

The International Classification of Diseases-10 (ICD-10, Volume II) state that PTSD *"Arises as a delayed or protracted response to a stressful event or situation (of either brief or long duration) of an exceptionally threatening or catastrophic nature, which is likely to cause pervasive distress in almost anyone"* (WHO, 1992). The ICD-10 has five diagnostic criteria; the first four relate to symptoms, the fifth discusses late onset symptoms of more than six months and how to define this. The first four categories are similar to those listed in DSM IV and V; there are however some distinctions between the classification systems. The ICD-10 categories are listed below;

"A. Exposure to a stressful event or situation (either short or long lasting) of exceptionally threatening or catastrophic nature, which is likely to cause pervasive distress in almost anyone.

B. Persistent remembering or "reliving" the stressor by intrusive flash backs, vivid memories, recurring dreams, or by experiencing distress when exposed to circumstances resembling or associated with the stressor.

C. Actual or preferred avoidance of circumstances resembling or associated with the stressor (not present before exposure to the stressor).

D. Either (1) or (2):

(1) Inability to recall, either partially or completely, some important aspects of the period of exposure to the stressor

(2) Persistent symptoms of increased psychological sensitivity and arousal (not present before exposure to the stressor) shown by any two of the following:

a) difficulty in falling or staying asleep;

b) irritability or outbursts of anger;

c) difficulty in concentrating;

d) hyper-vigilance;

e) exaggerated startle response"

Whilst both classification systems are similar there are some distinctions, for example the ICD-10 does not state what the stressor might be, whereas DSM-V is more specific about the types of stressors it feels meet the criteria. The DSM-V was

recently updated in 2013 and there were revisions to the criteria, with one criterion being removed and three new symptoms being added (Friedman, 2014). ICD are set to release ICD-11 by 2017, this latest revision will have notable changes in comparison to the DSM-V; for example ICD-11 will introduce complex PTSD as a separate diagnosis, where DSM-V failed to include this in its update (Friedman, 2014).

1.1.2. Prevalence Rates

The prevalence of PTSD in the general population varies widely between and within countries. For example, high income countries such as the USA suggest lifetime prevalence rates of 7.8%, whilst a recent UK population study in a borough of London found the monthly prevalence rate to be 5.5% (Dorrington et el, 2014). Tolin and Foa (2006) in their review investigated sex differences in PTSD rates; they found that females were more likely to experience PTSD despite being less likely to experience potentially traumatic events (excluding sexual assault or abuse). Paolucci et al (2001), in a meta-analysis of the effects of childhood sexual abuse, found that survivors of childhood sexual abuse had a 143% increase in risk for developing PTSD when compared to the normal population.

Due to the nature of the work, PTSD is also found in military and frontline services. Iversen et al (2009), looking at military personnel, found that the weighted prevalence rate of PTSD was 4.8% -- cohort studies have found PTSD prevalence rates for UK military personnel to range between 3-6% (Fear et al, 2010; Richardson et al, 2010; Hotopf et al, 2006). This is contrasted with US rates, which vary between 2-17% for conflicts since the Vietnam War (Richardon et al, 2010). Bennet et al (2004) examined the prevalence rates of mental health conditions in an ambulance service; they found the prevalence rate amongst males to be 23%, compared to a lower rate of 15% in females. McFarlane and Pappay (1992) found a 10% prevalence rate for chronic PTSD in volunteer fire fighters. Carlier et al (1997) found a prevalence rate of 7% in Dutch police officers, with a rate of 34% for sub clinical or partial PTSD.

1.1.3. Complex PTSD

Complex trauma or disorders of extreme stress not otherwise specified refers to a trauma based reaction that is thought to exceed that of PTSD. Complex trauma is felt by many to describe repeated and prolonged exposure to trauma, rather than a single time limited event, such as a car accident; this classification was felt to be warranted to capture the trauma experiences of individuals from abusive childhoods, prolonged abusive relationships, those held in captivity, the experiences of refugees, etc. (Herman, 1992). Some argue that complex PTSD describes trauma events that stem from childhood (Cloitre et al, 2009), whilst others argue that complex PTSD should encapsulate all forms of prolonged trauma experiences (Roth et al, 1997; van der Kolk et al, 2005). Complex PTSD does not currently exist as a sub or separate classification (Reswick et al, 2012) -- DSM IV field trials found 92% of individuals who would meet the criteria for complex PTSD also met the criteria for PTSD (Roth et al, 1997).

Despite its lack of recognition in formal diagnostic classification, complex PTSD was felt to encompass additional symptomology not commonly associated with simple PTSD; symptoms such as issues with emotional regulation, difficulties with self concept and self perception, greater difficulties relating to others, dissociation and distorted perceptions of the perpetrator of abuse (Herman, 1997). Herman (1992) reviewed the literature pertaining to complex PTSD; the review concluded that individuals with complex PTSD have marked disturbances in their relationships. Relationships are described as being viewed through “a lens of extremity”, which is characterised as shifting between intense attachments and withdrawal; often idealised relationships occur, but boundaries are thought not to be observed in such relationships.

1.2. PTSD or Complex PTSD?

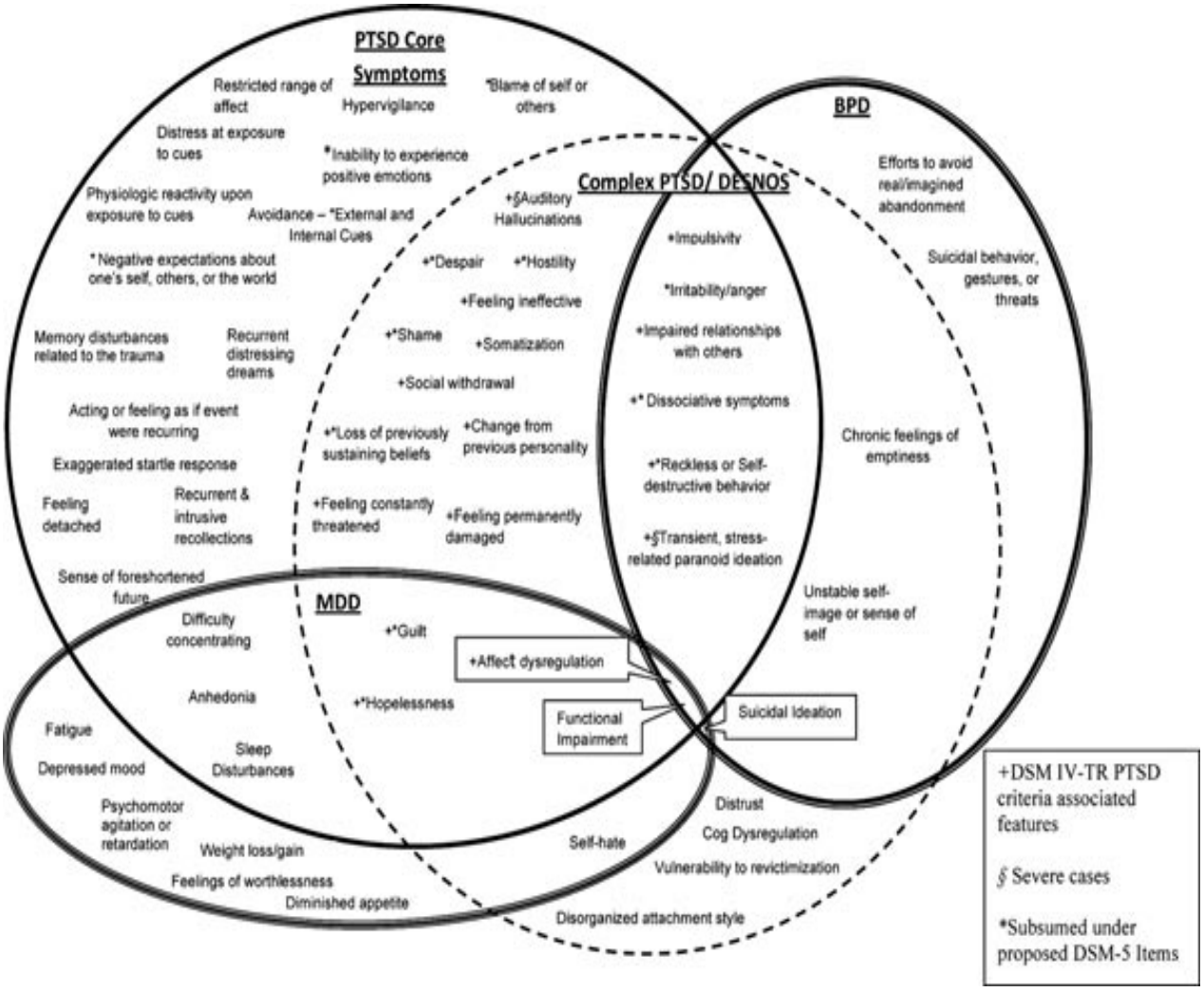
Resick et al (2012), in their review of the literature pertaining to complex PTSD and whether it fulfilled a distinct diagnostic category of its own, felt that whilst the current evidence does highlight the limitations in trauma literature, they felt a

further diagnostic category was unwarranted. When reviewing the symptoms associated with a number of disorders, for example PTSD, borderline personality disorder (BPD), and major depressive disorder (MDD) (see Figure 1), they felt that the symptoms felt to be associated with complex PTSD were captured by these other diagnoses.

As can be seen from the Venn diagram (Figure 1), complex PTSD was argued by Reswick et al (2012) to differ from simple PTSD due to disorganised attachment style, an unstable sense of self or self-image, cognitive dysregulation, distrust, self-hate, chronic feelings of emptiness, suicidal ideation, and vulnerability to re-victimisation (Resick et al, 2012). The disorganised attachment style could in part explain some of these difficulties and might also highlight childhood adversity; conversely trauma in childhood may also seek to explain difficulties with attachments (Ford & Courtois, 2008).

Authors often cite complex PTSD as arising from childhood adversity and insecure attachment styles (Ford & Courtois, 2008; Cloitre et al, 2009). This may lead to an increased vulnerability to re-victimisation and subsequent traumas (Resick et al, 2012). The cumulative effect of trauma in childhood may go some way to explaining how complex PTSD develops, with cumulative trauma exposure in childhood leading to an increase in complex PTSD symptomology, both in childhood and adulthood (Cloitre et al, 2009). Maercker et al (2013) argue along with Cloitre that the revised ICD-11 should include stress related reactions, which would require a narrowing of the PTSD criteria, so that this diagnosis is not overused. They argue that there needs to be an addition of complex PTSD as a diagnosis, the inclusion of a prolonged grief disorder and that acute stress reactions and adjustment disorder should remain within this sub-set of diagnoses. The authors felt complex PTSD to be a separate diagnosis to personality disorder, as complex PTSD exhibits different responses to treatment.

Figure 1. Venn diagram of the overlap between PTSD core symptoms, PTSD associated symptoms, complex PTSD, borderline personality disorder and major depressive disorder



N.B. Disorder of extreme stress not otherwise specified (DESNOS)

Whilst PTSD and complex PTSD highlight the difficulties individuals have in relationships, complex PTSD is felt to be characterised in more extreme interpersonal relationships difficulties -- hence its overlap with borderline personality disorder. Attachment style has also been examined in relation to PTSD. Research points to individuals with insecure attachment styles being more vulnerable to negative reactions after traumatic events than those with PTSD (Mikulincer et al, 1993; O'Connor & Elklit, 2008). O'Connor & Elklit (2008) found

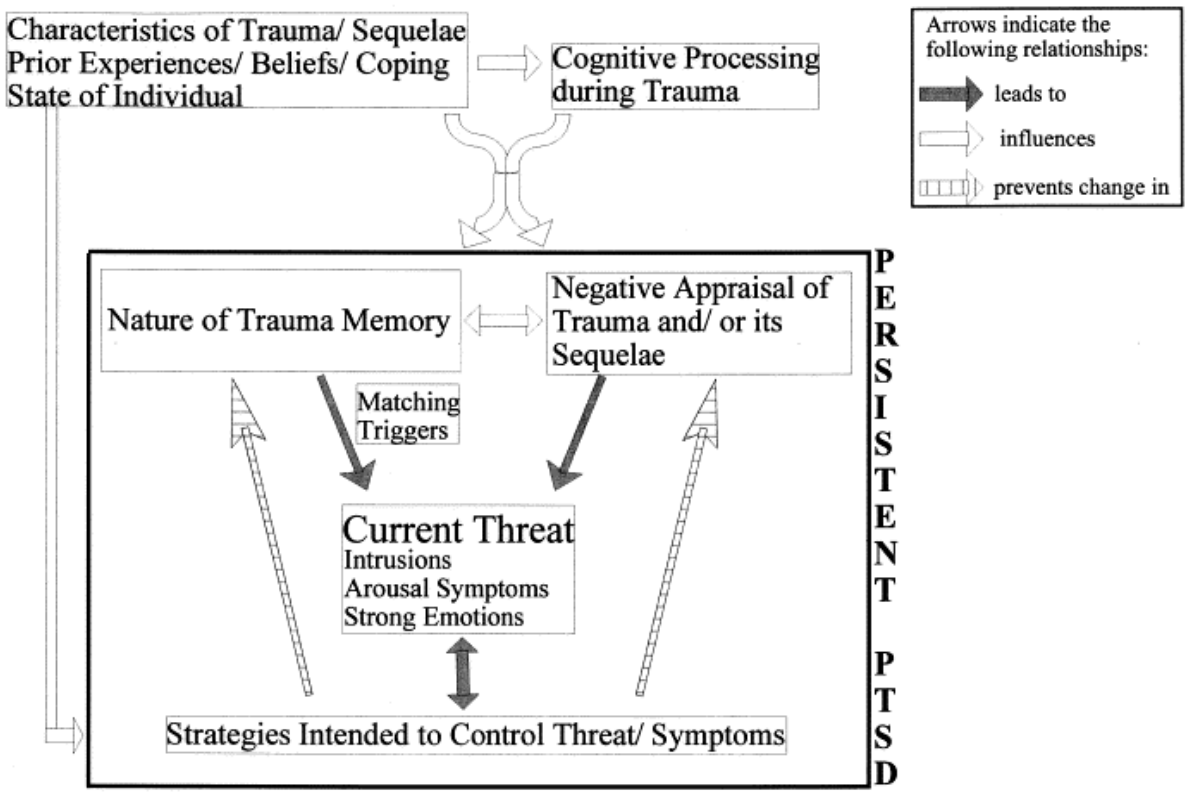
that secure attachment styles may be a protective factor from developing PTSD, whilst avoidant and dismissive attachment styles were associated with increased PTSD symptomology.

Individuals thought to be affected by complex PTSD display complexity in terms of symptomology and treatability (Bryant, 2010; Cloitre et al, 2011); childhood trauma is thought to result in increased symptom complexity in adulthood (Cloitre et al, 2009). Currently individuals still undergo cognitive treatments for PTSD (although these are often combined with emotional regulation strategies or elements of mindfulness (Cloitre et al, 2011)). Outcome studies for complex PTSD often discuss a stabilization phase (managing emotional dysregulation) that precedes the cognitive trauma work component of treatment (Ford et al, 2005; Cloitre et al, 2002).

1.3.A Cognitive Model of PTSD

Ehlers and Clark (2000) proposed a cognitive model for PTSD (shown in Figure 2). This model posits that individuals who develop PTSD process the traumatic event in such a way that it produces a state of current threat. As a result of this state of threat persisting in the individual, cognitive and behavioural strategies are activated to reduce the sense of threat, but also reduce the likelihood of the trauma being processed and resolved, thus maintaining the sense of threat in the long term. It is thought that the initial sense of threat stems from "*individual differences in the appraisal and/or its sequelae*" and "*individual differences in the nature of the memory for the event and its link to other autobiographical memories*" (Ehlers & Clark, 2000, p.320). Dissociation is thought to play a part in the *"fragmentation of trauma memories"* (Ehlers & Clark, 2000).

Figure 2. Ehlers and Clark's (2000, p.321) Cognitive Model of PTSD



Ehlers and Clark's model considers factors that may have an influence on processing. Amongst these are cognitive processing, the nature of the trauma memory, a person's appraisal of the event, and sequelae and the strategies they use to control the symptoms.

Ehlers and Clark's model is used extensively in the field, and is the basis for many clinical interventions. Their model is still very relevant in the treatment of all forms of traumatic reactions; with recent reviews highlighting that trauma focused cognitive behavioural therapy programmes are effective (Ehlers et al, 2010). Cloitre et al (2011) discuss how some practitioners have indicated that those with complex PTSD may not respond as optimally to conventional trauma treatments. There has been a move towards including stabilisation work either prior to the commencement of trauma focused cognitive behavioural therapy (TFCBT) or alongside a TFCBT programme for those with complex presentations; eight studies included in their review cited improvements in PTSD and complex PTSD symptoms with stabilisation

work (Cloitre et al, 2011). Stabilization work refers to an initial phase of treatment, prior to trauma based work whereby psycho-education is provided and strategies are taught to help individuals manage their distress or dissociation, along with work to tackle irrational beliefs, this prepares individuals for the subsequent trauma treatment (Harned et al, 2010). Whilst there is a wealth of evidence to support the TFCBT model by Ehlers and Clark and the cognitive interventions based on it (Ehlers et al, 2005; Bisson et al, 2007; Stallard, 2003; Ehlers et al, 2010; Foa et al, 2000), a range of other models focus more on interpersonal relationships (Brewin, 2005 a; De Prince, 2005; Nietlisbach & Maercker, 2009). Whilst it can be argued that the strategies intended to control the threat stem from an individual's underlying beliefs about the world, current coping styles and early experience, Ehlers and Clark's (2000) model pays little attention to social support and the effect this can have on the process.

1.4.Early life adversity and its link to the development of PTSD

Early life adversity is here defined as events that occur in childhood that act as a stressor on the child or could impact on their physical and mental well-being, for example this may be forms of abuse, neglect, loss, poverty, chronic illness, divorce or any other significant life event that could detrimentally impact on the child etc. Research has looked at possible predisposing factors to PTSD and considered whether certain groups have a vulnerability to developing the condition; for example, Yehuda et al (1995) found that childhood trauma predisposes adults who later suffer subsequent traumas to develop PTSD. In a meta-analysis investigating risk factors, Brewin et al (2000) found that factors such as previous trauma and general childhood adversity (particularly childhood sexual abuse) had predictive power, as did education, age at trauma, and gender, albeit it to a lesser extent. They also found that post trauma effects, such as lack of social support, had larger effects than pre trauma factors. In combination, Brewin argued that this may explain why some develop PTSD and others do not. Ozer et al's (2003) meta-analysis also found prior trauma to be a predictive factor, with family psychopathology and prior psychological adjustment yielding smaller effect sizes whereas peri-traumatic dissociation yielded the largest effect size.

Lupien et al (2009) discuss how prolonged chronic exposure to stress hormones impacts on the brain structures involved in cognition and mental health. They discuss how reduced hippocampal volume and function is often evident in individuals with PTSD. However, this may be a result of developmental factors for example childhood adversity or trauma and thus a predisposing factor for PTSD in adulthood. Pechtel and Pizzagalli (2011) in their review discuss how exposure to early life stress impacts on a range of functions, leading to deficits in cognitive functioning (cognitive performance, executive functioning, and memory), along with affective functioning (processing of social and affective stimuli, rewards, and emotion regulation). They found that early life stress (ELS) can impact for years on affective functions (processing of social and affective stimuli, reward processing, and emotional regulation) and that ELS can also affect the amygdala; they also comment on whether this could be a factor in the development of later psychopathology.

Such research, as introduced above, has identified that early adversity and trauma may play a role in the development of PTSD in later life. Conversely, other research has investigated the effects of trauma on the developing child. Masten and Narayan (2012), in a review of how exposure to trauma in a range of situations and extreme childhood adversity can impact on all areas of a child's functioning, discuss reduced brain volume and frontal cortex abnormalities in children with PTSD symptomology. Glaser (2000) reviews the evidence on child abuse and neglect on the brain and its development. Glaser's review discusses how sensitive periods occur within development, and indicates that either a lack of input at these critical points or abuse may lead to permanent changes in cognitive abilities. Good care giving provides the infant with regular interactions and information about the social world (Bornstein & Putnick, 2012). These interactions serve to label emotions as a child grows, and thus help to regulate a child's emotions through self-soothing and self-regulation. Such support also teaches emotional awareness with regard to prosodic realizations (Brinton & Fujiki, 2011). Neglectful or abusive care giving does not provide these things, thus impairments in social cognitive processes can ensue (Pechtel & Pizzagalli, 2011). It is difficult to determine the relative contribution of maltreatment and the lack of secure attachment relationships in the development of social cognitive problems, as more often, they go hand in hand. Pechtel and Pizzagalli

(2011) reviewed a number of studies and found that social cognitive problems persisted, despite children being removed from "noxious" environments. They also comment that whilst some cognitive problems may improve after removal from these environments, emotional problems may remain. Their review found that maltreated and abused children showed impairments in recognising and responding to negative facial expressions; although those who have experienced physical abuse showed greater attention to angry faces.

1.4.1. Summary

As highlighted, there is disparity between the diagnostic definitions used to define PTSD as a disorder. There is also current debate around complex PTSD and the inclusion of this in the diagnostic manuals as a separate diagnosis. Some clinicians and researchers argue that complex PTSD should be used to classify individuals who have suffered trauma in childhood, whilst others feel that this term has a broader definition which includes repeated and prolonged exposure to traumatic events, whether that is in childhood or adulthood. Currently researchers are also interested in the distinction between simple and complex PTSD and the debate as to the extent of their similarity or difference.

The question of whether accuracy rates on emotional recognition tasks are lower for individuals with a diagnosis of PTSD compared to healthy controls is the primary focus of this study but as a secondary focus comparison will be made between accuracy rates of participants with simple versus complex PTSD (when this is defined as having suffered trauma in childhood).

1.5. A Social Cognitive Perspective on PTSD

A number of models have been proposed from a social cognitive perspective, such as De Prince's (2005) model of re-victimisation risk for persons with PTSD, and Maercker and Horn's (2013) Social Facilitation Model of PTSD. These models propose that social cognition can have an influence on PTSD, and both suggest how

the development of PTSD may be mediated by interpersonal factors (Sharp et al, 2012). Maercker and Horn's (2013) model proposes that a person's perceptions about themselves, others, and the world interact to either increase or decrease the symptoms and course of PTSD. This is proposed to occur through social relationships, where such relationships are thought to enable the person to integrate trauma memories into their personal experience by acting on the fear network of trauma memories (Sharp et al, 2012).

De Prince's (2005) model of re-victimisation risk for person's with PTSD proposes social cognition also plays a role; in this model it is proposed that individuals who have suffered prolonged exposure to trauma, for example childhood abuse, have impairments in their social cognitive processes, which in turn then make them more vulnerable in subsequent relationships. For example, the model theorises that, due to social cognitive impairments, these individuals lack the ability to recognise violations in social contracts, and thus accept far less in a relationship than another individual would. This could effectively prolong a relationship, making such individuals more vulnerable to re-victimisation (Sharp et al, 2012). Whilst both of these models cite social cognition as being influential in PTSD, one argues that social cognition can enable processing of the trauma event (Maercker & Horn, 2013), whilst the other highlights how social cognition can inhibit an appropriate response (De Prince, 2005; Sharp et al, 2012).

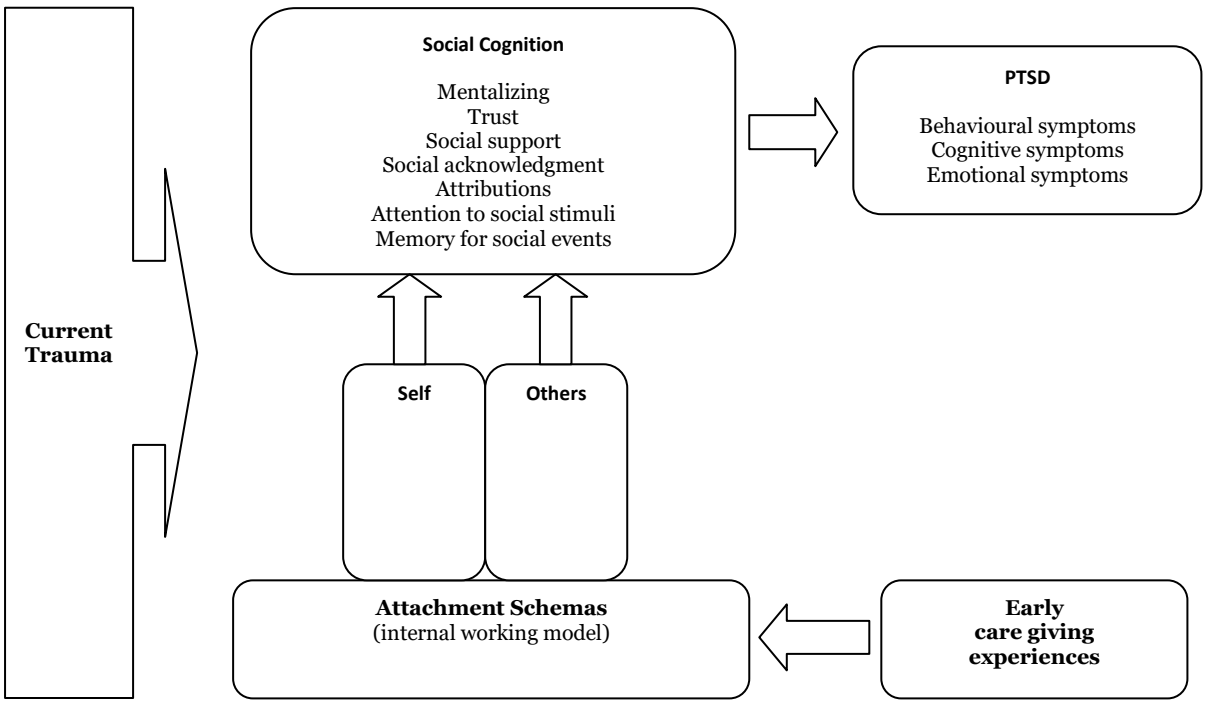
1.5.1. A Social Cognitive Model of PTSD

Stemming from the models proposed above, Sharp et al (2012) developed a social cognitive model of PTSD (Figure 3). This model is fundamentally based on cognitive schema based models (cf. Foa et al, 1997; 2006; 2007). By adding a social cognitive perspective Sharp et al (2012) are proposing that early attachment based experiences can lead to a set of attachment based schemas of self or others that are maladaptive. These attachment based schemas form as a result of traumatic early experiences, where the child (through repeated negative interactions with a caregiver) develops a schema that the caregiver is uncaring, unavailable, frightening, unresponsive, etc. These schemas develop over time into adulthood and "*operate on attachment*

relevant information"; this is particularly thought to be the case when an interpersonal trauma event occurs, which can subsequently activate a schema and lead to "*maladaptive social cognitive processing at the procedural level of automatic thoughts*".

This model incorporates both Maercker and Horn (2013) and De Prince's (2005) model in so much as it identifies that early adversity leads to schemas that affect social cognitive processes. Due to these schemas developing, and their effects on social cognition, impairments can lead an individual in the face of a trauma being unable to gain social support from current interpersonal relationships. Being unable to gain appropriate support can then lead to the symptoms mentioned below (Sharp et al, 2012) -- lack of support may also prevent a person from being able to integrate new information into the appraisal of the trauma memory through discussions and reactions from others (Nietlisbach & Maercker, 2009).

Figure 3. A Social Cognitive Model of PTSD



Research into the influence of interpersonal relationships and PTSD is growing. As outlined above, early attachment processes may influence the development of PTSD (De Prince, 2005) and can also act as a moderator for PTSD (Maercker & Horn, 2013). Research into PTSD from a social cognitive perspective investigates how impairments in social cognition can impact on the symptoms seen in PTSD (Sharp et al, 2012), and potentially the social support they require to recover from the condition. Maercker & Horn (2013) discuss how Brewin et al's (2000) and Ozer et al's (2003) meta-analyses found social support to be one of the biggest predictors of PTSD. Citing two large scale reviews (Brewin et al, 2000; Ozer et al, 2003), Maercker & Horn (2013) suggest that there is evidence that social interpersonal factors can either influence or prevent the development of PTSD. They suggest that there is evidence that social interpersonal factors can either influence or prevent the development of PTSD.

1.6.PTSD and Interpersonal Relationships

1.6.1. Alienation

One of the many symptoms that individuals who are diagnosed with PTSD experience is "*Feeling alienated from others (e.g. detachment or estrangement)*"; this falls under the "*negative alterations in cognitions and mood*" criteria from the DSM-V (DSM, 2013). Ehlers et al. (2000) found that individuals with chronic or remitted PTSD were more likely to experience alienation when compared to those without PTSD. Alienation has been shown to negatively affect treatment outcomes (Ehlers et al, 1998). Individuals with PTSD have more problems with sociability and intimacy (Roberts et al, 1982) and have lower levels of marital adjustment (Carroll et al, 1985). Jobson and O'Kearney (2009) found that when comparing individuals with PTSD to those without PTSD from independent and interdependent cultures, participants from both cultures reported feelings of alienation; independent cultures also reported negative cognitive appraisals. Independent cultures are often described as Western cultures that believe in the distinctiveness of the individual; whereas interdependent cultures are collectivist and often Asian cultures that believe in the "*connectedness*" of people (Matsumoto, 1999).

Elliot et al (2011), looking at veterans who had returned to education, found that individuals who had experienced combat had greater levels of PTSD and alienation (this was also true for those who sustained injuries). Social support was found to be a moderator of PTSD and subsequent alienation. Brewin et al (2011), looking at a UK military population, found that PTSD did not always lead to negative views of the self, rather it lead to negative views of civilian life, often with it being rejected and a disillusionment about human nature in general.

1.6.2. Social Support

A meta-analysis by Brewin et al (2000) found that a lack of social support was the strongest predictor of PTSD. Conversely, support (informal and formal) has been associated with positive adjustment outcomes for instance in adults who have experienced sexual assault (Borja et al, 2006). Guay, Billette and Marchand (2006) discuss the links between social support and PTSD, highlighting the differences in how much support individuals with different traumas receive, the gender differences in how much support is provided, and whether that support is beneficial. They highlight that women are more likely to benefit from support and receive support compared to men, although they also add that men perceive support as being useful. Andrews et al (2003) found that both genders reported a similar level of social support in general and also received similar levels of social support post trauma. However, females reported more negative responses from family and friends. The authors consider whether this finding goes some way in explaining why females have a higher rate of PTSD in community samples, as negative responses were felt to have a greater impact than positive support.

A wide range of other studies have also looked at social support as a factor in the development and maintenance of PTSD (Ozer et al, 2003; Schnurr et al, 2004), where the quality of social support is seen to significantly predict the severity of PTSD (Guay et al, 2006). These findings were similar across a range of traumatic events including violent crime, disasters, conflict situations, and cancer (Guay et al, 2006). Iversen et al (2008) found that low morale and social support within military personnel units was associated with a greater risk of developing PTSD, along with a

range of other factors such as lower educational status, childhood adversity, and being unmarried. Pietrzak et al (2009) found that post-deployment military personnel with PTSD reported lower levels of social support from their military unit, post-deployment social support from others, and resilience when compared to personnel without PTSD. Ultimately, it appears that there is growing evidence for a lack of social support being of significance in the development and maintenance of PTSD.

Studies have also found that positive social support can be a protective factor in PTSD (Ozer et al, 2003; Guay et al, 2006; Iversen et al, 2008). Some theorists have proposed models to explain these findings. Joseph et al, (2005), for example, propose a model that indicates how social support can act both positively and negatively on an individual's interpretation of events and thus can, ultimately, impact PTSD symptoms. For example, an individual may interpret that they acted inappropriately, but social support and conversations about the event may highlight that others would have acted in a similar way. Such support and interaction, then, could change a person's interpretation and allow them to re-appraise. Lepore (2001) proposed a similar model for emotional adjustment in cancer sufferers; Lepore argues that conversations about cancer with others can aid cognitive processing, although this was mitigated by others reactions to the diagnosis. Lepore postulates that unhelpful reactions to trauma will work in two ways: (1) By encouraging avoidance of trauma memories, and by reducing the likelihood that the person will discuss the situation with others, cognitive processing of the memory can be reduced; (2) by seeking advice and alternative interpretations from others, further processing and acceptance can be engendered. Guay et al (2006) discuss how both Lepore (2001) and Joseph et al's (2005) models explain how social support acts on emotional, cognitive, and behavioural processes in PTSD.

1.7. Investigating Social Cognition

Social cognition has been investigated in a range of disorders, including autism and frontal lobe damage in head injury (Adolphs, 1999). Social cognition is felt to encompass a wide range of abilities such as emotional awareness of self and others,

social emotional processing (Green et al, 2008), emotional literacy, emotional regulation, mentalizing, and self-referential processing (Lanius et al, 2011), as well as theory of mind (Green et al, 2008). Social cognition has also been investigated from an affective neuroscience, social cognitive, psychological, and cognitive neuroscience perspective (Lanius et al, 2011). For the purpose of this research specific elements of social cognition were investigated, namely emotional recognition.

Impairments in social cognitive functions and their impact on interpersonal functioning have been investigated in a number of areas: Fett et al (2011), in their meta-analysis investigating the relationship between social cognition (refers to the mental operations underlying social behaviour), neuro-cognition (cognitive abilities such as processing speed, working memory, attention etc), and functional outcomes, found that social cognition had a stronger association with functional outcomes than neuro-cognition. This was particularly true with regard to theory of mind, emotional perception and processing, and social perception and knowledge. Pinkham and Penn (2006) found that deficits in social cognition were strongly associated with impairments in interpersonal functioning. Hooker and Park (2002) found that deficits in affect recognition led to impairments in social functioning. Couture et al (2006), in their review, found a relationship between social functioning and social cognition. Sibley et al (2010) found that deficits in social cognition were linked to functional impairments in adolescents with ADHD. Addington et al (2006) found that social cognition was significantly associated with quality of life scores and symptomology in schizophrenia.

1.7.1. Prosody

Prosody is the non-verbal message conveyed in speech. Affective prosody refers to the affective (emotional) message that is conveyed non-verbally through speech. This affective message is conveyed through tone of voice, pauses, pitch, volume, and other features of sound. Affective prosody has been investigated within linguistics, cognitive neuroscience, computer science, and psychology (Zeng, 2009; Hoekert et al, 2007; Mitchell et al, 2005). Methods of assessing prosody have included fMRI (Murphy et al, 2003; Wildgruber et al, 2005), algorithms and technological methods

(Zeng, 2009), and through participants providing forced choice responses from a list of pre-determined emotions after listening to audio statements (Bowers et al, 1999). It is this latter method that has been used in the context of this research.

1.7.2. Emotional Facial Recognition

Ekman & Friesen (1971) conducted research that discovered there were a set of universal emotions that were recognised across a range of cultures and groups. This finding has been replicated widely over the years, with a consensus that there appears to be an in-group advantage for people within the same cultural group; i.e. in-group participants recognise each other's emotions at a greater accuracy than between groups (Elfenbein & Ambady, 2002). The universal emotions are believed to be happy, sad, fear, anger, surprise and disgust, with the initial four being recognised at a higher rate than the latter two (Kohler et al, 2004; Russell, 1994). Research in this area has looked at emotional recognition in a host of areas and with a variety of variables, such as gender differences in recognition rates (Thayer & Johnson, 2000; McClure, 2000), age differences (Suzuki et al, 2007; Calder et al, 2003), in-group and between-group differences (Elfenbein et al, 2002; 2007; Russell, 1994), and differences in a range of conditions; for example autism (Harms et al, 2010; Wallace et al, 2008), conduct disorder (Fairchild et al, 2009), attention deficit hyperactivity disorder (ADHD) (Pelc et al, 2006), and a broad spectrum of adult mental health conditions. The research investigating both emotional facial recognition and prosody recognition in mental health conditions is outlined below.

1.8. Emotional Awareness and Prosody research in Mental Health

Whilst there has been high levels of interest in how individuals recognise their own emotions and label them (alexithymia) (Kee et al, 2009; Frewen et al, 2008), there has been less research on how individuals diagnosed with mental health conditions recognise other people's emotions. Prosody, for example, has been investigated via face emotion recognition tasks and auditory emotional recognition tasks. To date studies have been conducted widely in schizophrenia (Chan et al, 2010; Leitman et

al, 2010; Kohler et al, 2010) and there is growing research in the areas of borderline personality disorder (Domes et al, 2009; Minzenberg et al, 2006; Wagner & Linehan, 1999), alcohol dependence (Monnot et al, 2001; Foisy et al, 2007; Kornreich et al, 2003), eating disorders (Harrison et al, 2010; 2010; 2009), anxiety disorders (Quadflieg et al, 2007), and depressive disorders (Schaefer et al, 2010; Mitchell et al, 2004; Deveney et al, 2012).

1.8.1. Schizophrenia

Emotional recognition has been widely researched within schizophrenia. The main findings will be summarised here. Chan et al (2010) conducted facial emotion recognition studies specifically to answer the question of whether those with schizophrenia displayed a general deficit or a specific emotional perception deficit. They outlined a general deficit as a problem with emotional perception and also a more basic deficit in face processing. The review found that participants with schizophrenia had a moderate to severe deficit in facial emotion perception when compared to controls. The review also found that participants with more severe negative symptoms were poorer in their performance; this was also found to be the case with a longer duration of illness. The review found no significant effect of gender on facial emotional perception. Medication was also not associated with recognition performance.

Kohler et al (2010) conducted a review of 86 studies in this area between 1970 and 2007. Their meta-analysis found a large deficit in emotional perception; this was found to be the case irrespective of the task undertaken. A number of factors were found to moderate this impairment, among them demographic and clinical factors. A diagnosis of schizophrenia or schizoaffective disorder yielded similar deficits in emotional perception. Comparisons could not be made to first episode participants due to the lack of studies in this area. Furthermore, inpatients, greater age of onset of illness, higher scores on both positive and negative symptoms on specific measures (SAPS and SANS), un-medicated patients, medication type (first generation anti-psychotics), and greater age in general were found to lead to greater emotional perception difficulties. In contrast, gender, education, race, second generation anti-

psychotics, and total number of hospitalizations were not associated with poorer recognition.

Hoekert et al (2007) in their review and meta-analysis of impaired recognition and expression of emotional prosody in schizophrenia found that participants with schizophrenia displayed significant impairments in the perception and expression of emotional prosody, which was also the case in the early stage of the illness. The authors discuss whether deficits in social cognition may be a predictor of social outcome. Kohler et al (2003) found that participants with schizophrenia had lower rates of recognition on facial emotional recognition tasks on all emotions and neutral when compared to healthy controls. This was found to be the case in both low and high intensity expressions, with participants performing particularly badly on fear, disgust and neutral expressions. Increasing the intensity of the expression still led to the schizophrenia group performing at a lower level than the controls -- the effects being more pronounced for fear. Kohler et al (2010) in a further meta-analysis found when reviewing 86 studies that individuals with schizophrenia when compared to healthy controls displayed a large deficit in emotion perception. Factors were found to moderate the severity of the impairment; among them were current age, hospitalisation status age at onset, medication and positive and negative symptoms. Chan et al (2010) also found in their meta-analysis that patients with schizophrenia have a general, rather than a specific deficit in facial emotion perception when compared to healthy controls.

Edwards et al (2002) conducted a review of the literature on emotional recognition, including studies that looked at recognition of voice as well as face. They found that participants with schizophrenia experience emotional recognition deficits in both areas. Studies have generally found an overall deficit in emotional recognition, with few studies publishing the findings of participant's performance on each emotion.

1.8.2. Eating Disorders

Harrison et al (2010) found small-medium effect sizes in emotional facial recognition rates for an eating disorders group compared to normal controls; this was particularly evident in the group that restricted their food. The eating disorders group also showed an attentional bias towards angry faces compared to controls. Harrison et al (2009) found that participants with anorexia nervosa (AN) had difficulties in emotional recognition and regulation, although they were unable to determine whether these issues were related to starvation. Harrison et al (2010) also compared participants with AN, to participants recovered from AN and healthy controls. They found that the AN group had significantly lower emotional facial recognition scores with a medium effect size compared to controls -- the same effect size was also found for an attentional bias towards social and angry-threat in this group. The recovered group showed no differences when compared to controls in terms of emotional regulation, although the recovered group scored significantly lower than the controls on the recognition task.

1.8.3. Alcohol Dependence

Monnot et al (2001) looked at emotional auditory recognition in participants with alcohol dependence at 39 days sobriety, comparing them to foetally exposed individuals and normal controls. The alcohol dependent group scored two standard deviations lower than the controls, with the foetally exposed group scoring five standard deviations below. The control group had a 93% recognition accuracy rate, the alcohol dependency group a 79% accuracy rate, and the foetally exposed group a 62% accuracy rate. The foetal exposure group's results would be similar to results found in individuals who sustain certain types of brain injuries.

Foisy et al (2007) found that mid-term abstinence (three months) did not improve recognition rates in an alcohol dependent group; participants had greater deficits on tasks of facial emotional recognition. Participants, who dropped out of the detoxification programme, thus only completing the initial measure, had greater deficits initially than the group who remained in the programme and the study.

Kornreich et al (2002) found that recently detoxified alcohol dependents performed poorer on facial emotional recognition tasks, and also reported greater interpersonal problems. The authors discuss whether impaired emotional recognition may play a part in interpersonal problems and whether this may constitute a relapse factor.

Kornreich et al (2003) investigated whether differences occurred in facial emotional recognition in recently detoxified alcohol dependents, opiate addicts on a methadone programme, detoxified opiate addicts, detoxified alcohol and opiate addicts, and normal controls. They found that detoxified alcohol dependents and detoxified alcohol and opiate addicts performed at a significantly lower rate than normal controls. The opiate groups also performed at a lower rate than controls but to a lesser degree than the alcohol groups. The authors argue that both alcohol and opiate dependence could have a detrimental effect on emotional recognition, with alcohol causing the greater damage. Martin et al (2006) found in their study comparing opiate addicts on a methadone programme with normal controls and ex users (abstinent for six months or more) on facial emotion recognition tasks, that those on opiate replacement therapy were more accurate at recognising disgust than ex users. The opiate replacement group was generally slower in recognising emotions than controls, and slower than ex users in recognising happy, surprise and fearful expressions.

Townshend and Duka (2003) found when comparing social drinkers to alcoholic inpatients that the inpatient group had an enhanced recognition of fear compared to controls. There were no differences in the recognition of sad, happy and surprised emotions; with differences found for the recognition of anger and disgust. Fernandez-Serrano et al (2010) found in their study of emotional recognition in abstinent polysubstance abusers (PSA) who were compared to non-drug using comparisons (NDCI), that PSA participants had significantly poorer recognition of fear, sadness, anger and disgust than the NDCI group. The quantity of alcohol consumed (units per month) showed a significant correlation with impairments in the recognition of fear, anger and disgust in the alcoholic misuse group. In this study

severity of cocaine use predicted overall recognition accuracy, followed by the severity of alcohol use.

1.8.4. Borderline Personality Disorder

Wagner and Linehan (1999) compared women with borderline personality disorder (BPD) with women with a history of sexual abuse but who were not diagnosed with borderline personality disorder, and with healthy controls. They found that participants with BPD were accurate at perceiving emotions, but had a heightened sensitivity and recognition of fear when compared to the other groups. There were no significant differences on the remaining emotions when the BPD group was compared to the healthy controls; the sexual abuse group recognised the emotion happiness with more accuracy than the controls.

Domes et al (2009) reviewed the literature on emotional recognition in individuals with a diagnosis of borderline personality disorder. The review found that individuals with BPD have a negative bias towards perceiving expressions more negatively or angrily. The authors proposed that this bias was due to emotional hyperactivity that led to inaccurate emotional recognition and a tendency towards a negative bias. Domes et al (2008) found that participants with BPD had no general deficit in the emotional recognition tasks, but did show a bias towards the perception of anger, but not fear. Mizenberg et al (2006) studied participants with BPD's ability to recognise facial, prosodic and integrated facial/prosodic tasks along with non-emotional facial feature recognition and interpersonal antagonism. For isolated facial and vocal emotions the BPD group showed no significant differences in terms of accuracy when compared to the control group. Whereas for the integrated facial/prosodic recognition task the BPD group had impaired recognition compared to healthy controls. In the BPD group impairments in integrated tasks were associated with interpersonal antagonism, particularly the suspiciousness and assaultiveness sub-scales on a measure of interpersonal antagonism (BDHI). The authors conclude that participants with BPD demonstrated deficits in higher-order integration of social information, which they thought may be related to some of the more serious symptoms of the disorder.

Research is lacking in emotional recognition in the other personality disorders. Some research has looked at schizotypal personality disorder: Mikhailova et al (1996) found that participants showed some slight impairment in the recognition of sad and happy expressions, in remission these participants showed similar impairments.

1.8.5. Unipolar and Bipolar Disorders

Deveney et al (2012) studied youths with bipolar disorder and found that they did not perform as well as healthy controls on auditory emotional recognition tasks. Schaefer et al (2010) studied participants with unipolar and bipolar depression, using the universal emotions at differing intensities to determine recognition rates. They found that the bipolar group required greater intensity of expression to recognise all emotions; no differences were found between the unipolar and healthy controls in the recognition of, or intensity of an emotion. Happy was recognised at lower intensities than other emotions, with disgust requiring greater intensities to be recognised, this is in line with recognition rates found in the general public. Gur et al (1992) found that participants with depression had a higher negative bias across facial recognition tasks, with the severity of depression being associated with poorer performance across tasks.

Lembke and Ketter (2014) looked at emotional recognition in mania, and found that manic participants had the worst overall recognition of emotions compared to other groups. Compared to healthy controls they also showed poorer recognition of fear and disgust; the euthymic bipolar II participants, in contrast, showed greater recognition of fear than the euthymic bipolar I or manic group. Leppanen et al (2004) found that patients with remitted depression still attributed happiness or sadness to neutral faces, having difficulties perceiving neutral faces.

1.8.6. Social Phobia

To date a single pilot study has investigated if difficulties in auditory emotional recognition existed in social phobia. The study used a small clinical sample (n=15)

and compared them to healthy controls. Participants were asked to identify five of the universal emotions plus neutral (surprise being omitted). The study found that the participants with social phobia had enhanced recognition of a sad and fearful voice compared to controls, and a decreased identification of happy. The results on the remaining emotions showed no differences. This study's findings supported previous findings, and the authors discuss whether disorder specific differences in the recognition of prosody exist (Quadflieg et al, 2007).

Research has also looked at facial emotion recognition in individuals with social phobia. Studies have found that participants required less intensity to be able to recognise anger when compared with normal controls or participants with depression (Joormann & Gotlib, 2006). Studies looking at children and adolescents with social phobia found poorer recognition of happy, sad, and disgust compared to normal controls (Simonian et al, 2001). Other studies have also found abnormal processing of anger (Kolassa & Miltner, 2006), with some believing that a recognition bias for critical emotions exists due to fears of negative evaluation by others (Lundh & Ost, 1996).

1.8.7. Obsessive Compulsive Disorder

Kornreich et al (2001) compared recovering alcoholics, participants with obsessive compulsive disorder (OCD), and normal controls. They found that participants with OCD showed no significant differences in facial emotional recognition to normal controls, except for the recognition of 'disgust'. Disgust was recognised at a lower accuracy rate than other emotions, but as this was recognised at a lower accuracy to controls, again this may be a disorder specific finding. Other studies have also found poorer recognition of disgust (Sprengelmeyer et al, 1997). Berle and Phillips (2006) reviewed the literature on disgust and recognition in OCD and found that studies are divided on the issue of disgust, with some studies stating that it is recognised at a lesser rate, whilst other studies disagree with this assertion. Some argue that disgust may be implicated particularly in OCD with a contamination or religious basis, whereas others argue that this finding is only found in participants with the severest of symptoms. Aigner et al (2007) found few differences on facial emotional

recognition when comparing participants with OCD to normal controls. However, they also found that the OCD group perceived neutral faces as sad, which again maybe a negative emotional recognition bias.

1.8.8. Conclusion

In conclusion, the evidence that exists in relation to emotional recognition in mental health conditions looks at either more general deficits in recognition or disorder specific deficits. Whilst a wealth of evidence exists in relation to certain conditions such as schizophrenia, which would suggest a broad deficit in emotional recognition, evidence is less conclusive and less abundant in other disorders. There does however appear to be a trend towards difficulty recognising negative emotions, although this in itself varies according to which negative emotions (anger, sadness, disgust) are affected for which mental health difficulty. One criticism is that evidence is lacking in certain areas and also does not appear to be replicable, with different studies producing differing results. This could be due to the stimulus modality chosen (auditory, visual or both), the variety of measurement methods of emotional recognition used or limitations inherent in the design of studies. There is also inadequate control of confounding variables such as perceptual bias toward negative material which is congruent with beliefs and schema, fluctuations in distress levels or treatment exposure.

To draw firmer conclusions studies need to be more rigorous in their sampling and more transparent in their design and general methodology. There are no standardised and agreed measures or sampling criteria. The evidence in relation to emotional recognition in schizophrenia is extensive and has been investigated in a number of modalities. Future research in this area needs to be more robust, ideally with controls used and confounding factors controlled for.

1.8.9. PTSD

As the current study aimed to establish if individuals with a diagnosis of PTSD had impairments in social cognition, a systematic review was conducted. The review aimed to identify literature pertaining to emotional recognition and PTSD. For a full description of the review process and the findings, please refer to Chapter two.

Chapter 2

Systematic Review

2. Review Methodology

Search terms were combined to establish if social cognition had been investigated within mental health (Appendix 2); articles were reviewed using inclusion and exclusion criteria (Appendix 3), whilst articles were found relating to PTSD and social cognition, articles returned in this search were predominantly in the area of schizophrenia.

Specifically the current study aimed to address the question "*What is the relationship between emotional recognition (facial recognition and prosodic recognition) and PTSD in adults?*" On the 28th December 2014 a further two combinations of the search terms (Appendix 2) were used therefore to conduct a review of the literature. Combinations were as follows "*PTSD AND prosodic recognition*" and "*Prosod* AND emotion* AND PTSD OR recognition OR face* OR affect* OR relationship OR trauma*". The databases searched are listed below (Table 1);

Table 1. Databases searched in the systematic review process

• ProQuest dissertations and theses - UK and Ireland, • AMED Ovid, • Science Direct (Elsevier), • MEDLINE Ovid, • PsycINFO Ovid, • Psych articles Ovid, • CINAHL, • Social Sciences Citation Index (Web of Science), • ORCA Online Research@Cardiff, • Journals@Ovid Full Text (Ovid), • British Nursing Index (ProQuest,	• Google Scholar, • Scopus (Elsevier), • Cochrane Library - Cochrane Database of Systematic Reviews Wiley), • JSTOR - Arts & Sciences I ASSIA Collection, • Arts & Humanities Citation Index (Web of Science), • ASSIA Aplied Social Sciences Index and Abstracts (ProQuest), • Combined Health Information Database, • EMBASE: Excerpta Medica (Ovid).

Searching the databases above resulted in a total of 140 peer reviewed journals being located, along with 3030 titles being found through Google Scholar. All of these papers (3170) were screened by reading the titles to determine if they were relevant to the current study; where necessary the abstracts were read for further information and to screen out articles that were not relevant (see Figure 4 below). The remaining 97 articles that had been screened were then read in greater detail, applying the exclusion criteria. Duplicate articles were removed during this process. During this process articles referred to in the text and references were noted; these articles then underwent the same procedure outlined here, to establish if any articles had been missed through the database search. Authors who had published relevant research were also contacted to obtain further articles and to ensure no papers had been missed.

After excluding papers due to a variety of factors (exclusion criteria listed below), five papers remained for the review. The papers were reviewed using the Critical Appraisal Skills Programme's (CASP) Case Control Study Checklist (Appendix 4). Hannes (2011) discusses the selection of a quality appraisal tool; commenting that *"Critical appraisal involves (i) filtering against minimum criteria, involving adequacy of reporting detail on the data sampling, -collection and-analysis, (ii) technical rigour of the study elements indicating methodological soundness and (iii) paradigmatic sufficiency, referring to researchers' responsiveness to data and*

theoretical consistency". The author goes on to comment that researchers *"should use a critical appraisal instrument that is underpinned by a multi-dimensional concept of quality in research and hence includes items to assess quality according to several domains including quality of reporting, methodological rigour and conceptual depth and breadth"*.

When determining which quality appraisal tool to use for the systematic review, the CASP checklists were recommended for use in public health research (Ciliska et al, 2008). Zeng et al (2015) suggest that three tools are available for this type of review, the CASP checklist, SIGN and Newcastle-Ottawa Scale (NOS). The CASP checklist chosen in this review demonstrated the elements cited by Hannes (2011) and was recommended for use in health research. Zeng et al (2015) argue for quality of healthcare research to be appraised against 11 elements; the CASP and SIGN checklists each contain these 11 items, whereas the NOS contains fewer items. Arguably it is not the number of elements which is of importance but the quality of the tool and Zeng et al (2015) conclude that the NOS is the best quality appraisal tool. The CASP was chosen for this study over the other two tools as it was felt to cover the necessary items to ensure quality, it was recommended for use in health research and as the researcher felt the items were more comprehensive than the other tools, providing more depth as well as breadth in the review. Hannes (2011) comments that choice of tool ultimately should lie with the researcher and how appropriate they feel it is to their research. The CASP was felt to be rigorous, comprehensive and was favoured in terms of its usability.

Figure 4. Systematic Review Process

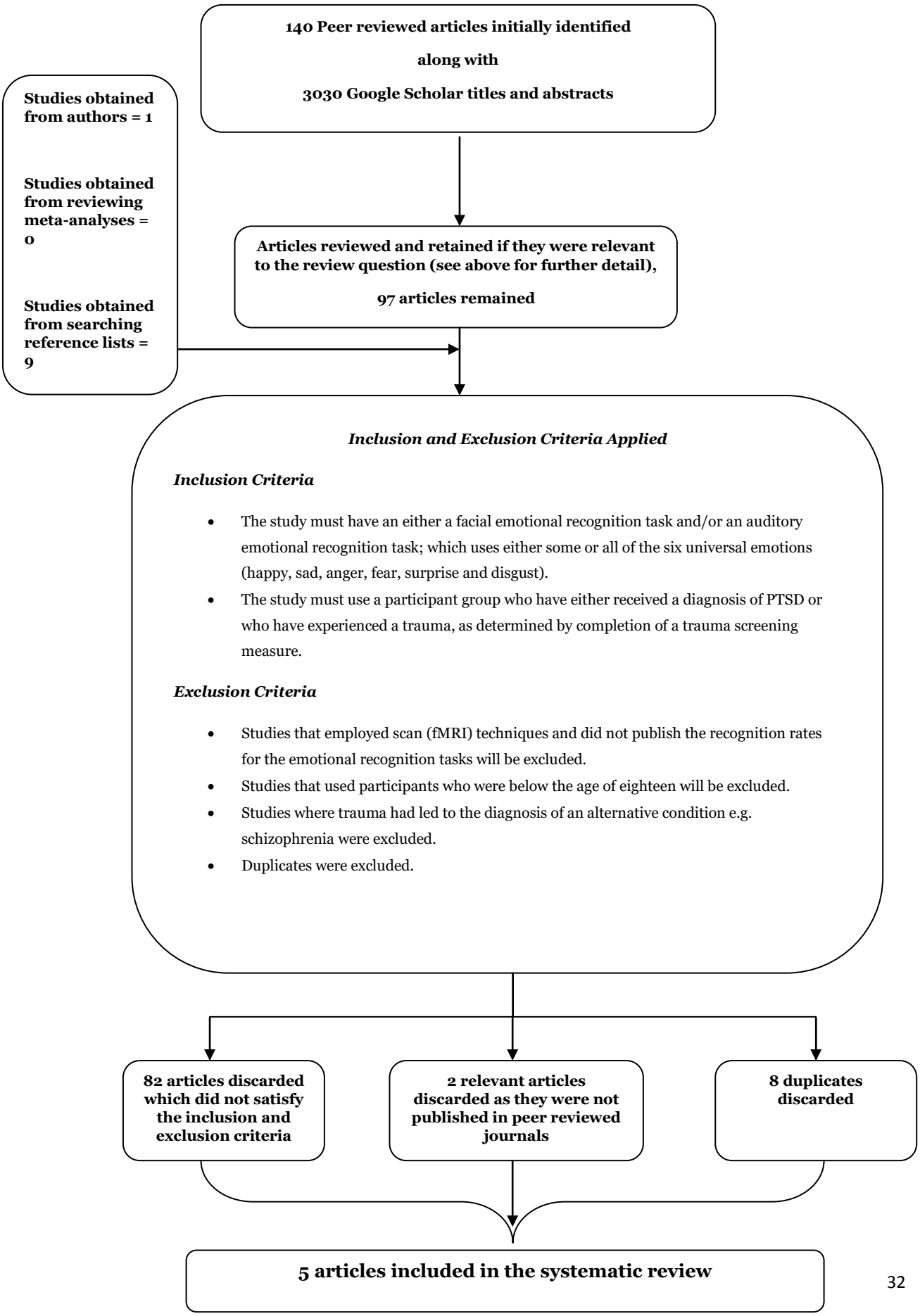


Figure 5. Systematic Review Results

Study	Sample	Control Group	Design and Aim	Measures	Results	Limitations of study
Nazarov, A., Frewen, P., Oremus, C., Schellenberg, E.G., McKinnon, M.C, and Lanius, R. (2014)	N=50 Overall N=29 PTSD diagnosis PTSD – Childhood abuse. 100% female Mean age 42.0 SD 12.3 No details of ethnicity Place study was conducted - Canada	N=21 controls Healthy – No psychiatric history, no childhood maltreatment, no significant medical illness, substance misuse related disorder in the previous 6 months, history of head injury with loss of consciousness (60 secs+), history of neurological disease, knowledge of Hebrew 100% female Mean age 39.9 SD 14.7 No details of ethnicity	Case control study The study aimed to establish if comprehension of affective prosody in speech would be disrupted due to early life adversity. The risk factors studied by the authors included PTSD, childhood adversity, the severity of adversity and dissociative symptoms.	Structured Clinical Interview for DSM-IV (SCID) Clinical-Administered PTSD Scale (CAPS) Beck Depression Inventory (BDI) Multi-scale Dissociation Inventory (MDI) Childhood Trauma Questionnaire (CTQ) Affective Prosody Task	PTSD group had significantly higher scores on all clinical variables (CAPS, BDI, CTQ, MDI) ($p<0.05$) No differences on recognition accuracy Recognition accuracy 89% (anger), 84% (sadness), 83% (happiness), 54% (fear), with chance=25% A main effect of group on RT's ($p<0.001$). PTSD group significantly slower at identifying emotions Interaction between group and emotion approached significance ($p<0.057$) RT's were slower in the PTSD group for fear ($p<0.001$), happy ($p<0.001$), and sad ($p<0.001$) but not for angry ($p>0.05$) No significant difference in accuracy between groups on the discrimination task Significant main effect of diagnosis on RT's, those with PTSD slower at discriminating emotions ($p<0.001$) Negative associations between severity of childhood trauma and RT's on identification task; negative associations differed between trauma types.	This study only used one gender in the sample It only investigated participants from one trauma group (childhood abuse). Did not match groups for education Small sample size Only investigated emotional recognition through one modality (auditory) Tasks were not counterbalanced Emotional recognition task developed for the study, no details of the piloting, reliability or validity Groups not equal in numbers, regression analysis required Details of ethnicity not obtained

					For the discrimination task, longer latencies associated with physical abuse; also an association between trauma type and accuracy on discrimination type, with different traumas leading to different problems PTSD participants ability to discriminate between emotions was negatively associated with identity dissociation (*r*s=-0.484, p=0.008), depersonalisation (*r*s=-0.429, p=0.020) and derealisation (*r*s=-0.345, p=0.067)	
Considine, C.M, and Paivio, S. (2013)	N= 53 Overall N=53 1st year undergraduate psychology students screened positively for trauma exposure Details of specific traumas students were exposed to was not provided	No control group	Correlational/Cross sectional Aimed to test an explanatory model, that impaired social cognition may mediate the relationship between trauma exposure, alexithymia, interpersonal problems and depression. The risk factors they investigated were trauma, interpersonal problem,	Demographic questionnaire Childhood Trauma Questionnaire (CTQ) Trauma Questionnaire (TQ) Exposure to Trauma (ET) – composite of above two measures Twenty-item Toronto Alexithymia Questionnaire	As the TQ and CTQ measures were normally distributed and statistically related ($p<0.001$) , these were combined to form ET for analysis. Participants endorsed minimal-low levels of exposure to traumatic events and a similar amount of distress from exposure, this was still significantly above average scores for populations without exposure to trauma. Elevated levels of alexithymia were endorsed, but these fell below clinical levels (<56). For interpersonal problems, the sample scored near the cut-off for above-average in a non-clinical population (81-85). For auditory affective perception, the sample made a similar amount of errors to a healthy control group (previous findings as no control group in this study)(12 errors or less).	No control group for comparisons Small age range (student sample) No details of specific traumas provided; only mild-moderate levels of distress reported, sample may not be representative of traumatised individuals No trauma symptom measures used in the study Sample used only psychology undergraduates

	85% female Mean age 23.36 SD 6.92 females Education 14.89 years Mean age 27.38 SD 8.85 Education 14.75 years 71.7% Caucasian 94.3 heterosexual 7.5% veterans Place study was conducted - Canada		alexithymia, emotional auditory perception and depression.	(TAS-20) Sixty-four item Inventory of Interpersonal Problems (IIP-64) The Beck Depression Inventory-Second Edition (BDI-II) Emotional Perception Task (EPT)	Internal reliability of the EPT measures was (a=0.58) A bivariate correlation matrix was conducted to investigate which variables should be controlled for in later analysis; gender, age, sexual orientation and disability all correlated with at least one primary variable (>.30) Bivariate correlation showed that the majority of measures were related to one another, with the exception of the EPT, which was not related to any other measure. The TAS and TQ were not related to one another. CTQ to TQ (p<=.0010), CTQ to ET (p<=.0010), CTQ to TAS (p<.01), CTQ to IIP (p<=.0010), CTQ to BDI (p<=.0010), TQ to ET (p<=.0010), TQ to IIP (p<.01), TQ to BDI (p<=.0010), ET to TAS (p<.01), ET to IIP (p<=.0010), ET to BDI (p<=.0010), TAS to IIP (p<=.0010), TAS to BDI (p<=.0010), IIP to BDI (p<=.0010), providing partial support for the hypotheses. ET was found to significantly predict depression, but only one moderator appears to significantly predicted by ET and also predict for depression, the IIP predicted by ET. After controlling for the effect of three potential mediators, ET remains a significant predictor of depression. The indirect effect of ET on depression via the TAS-20 was significant, the model was significant at (p<.001).	
Marshall,	N=185	No control group	Correlational/Cro	Screening	47% of the sample reported they were	No control group

A.D., Robinson, L.R, and Azar, S.T. (2011)	Overall N=185 university students screened positively for trauma exposure Traumas included; 40.5% sudden death friend/loved one 12.4% life threatening/ disabling event to a loved one 9.8% unwanted sexual contact 7.6% witnessed or experienced family violence 7.0 car or		ss sectional Aimed to investigate the relationship between exposure to traumatic events and the perpetration of intimate partner violence The risk factors investigated were exposure to traumatic events, maladaptive cognitions, the perception of auditory emotional stimuli and emotional regulation deficits	measure to determine if they participated in physical or psychological relationship aggression (no further details) Traumatic Life Events Questionnaire The Posttraumatic Cognitions Inventory The Aprosodia Battery The Inventory of Altered Self Capacities The Revised Conflict Tactics Scale	currently experiencing at least moderate distress in response to the trauma they identified On average participants engaged in at least one act of intimate partner violence and nearly 14 acts of psychological aggression in their current relationship. 92% reported violence more severe than throwing something at a partner that could hurt. All primary variables were significantly correlated; PTCI (total score) to IPV ($p<.001$), PTCI to psychological aggression ($p<.001$), PTCI to anger misappraisal ($p<.01$), PTCI to emotional dysregulation ($p<.001$). Anger misappraisal to psychological aggression ($p<.01$), emotional dysregulation to psychological aggression ($p<.05$). Anger appraisal to IPV ($p<.01$). Gender did not significantly moderate the effect of trauma on the other variables. Trauma cognitions were directly associated with psychological aggression perpetration and this was mediated by anger misappraisal and emotional dysregulation. Mediation was present for the full model, each mediator contributed to this effect. The pattern of results remained when accounting for differing relationships lengths.	Many confounding variables not discussed or controlled for Limited details of sample, so unable to establish biases Small age range (students) Sample may not be representative of traumatised population by diagnostic criteria No trauma symptom measures employed

	other accidents 61% female Mean age 19.00 SD 1.26 91% Caucasian 64% rural communities Mean relationship length 6.25 months SD 3.33 Range 1-15 months Place study was conducted – United States					
Poljac, E., Montagne, B, and de Haan, E.H.F. (2011)	N=40 Overall N=20 PTSD diagnosis War	N=20 controls Healthy – no psychiatric history, no diagnosis of	Case control study The study aimed to examine individuals with	Emotion Recognition Task Benton Facial Recognition	Significant differences observed between the two groups on the recognition of fear ($p<0.01$) and sadness ($p<0.05$) There were significantly higher BDI scores in the PTSD group (mean=11.50, SD=3.90)	Only used one gender in the sample (males) It only investigated participants from one trauma group (combat related PTSD)

	veterans from Bosnia 100% male Mean age 42.05 SD 4.16 No further details of ethnicity Place study was conducted - Bosnia	alcohol or substance disorders War veterans from Bosnia 100% males Mean age 41.65 SD 4.72 No further details of ethnicity	PTSD's recognition of facial expressions as to compared to healthy controls, specifically looking at accuracy (number which they judged correctly) and sensitivity (at what percentage of emotional intensity could they recognise emotions). The main risk factor studied was a diagnosis of PTSD, although the authors considered the confounding affects of depression and generalised disorders of face perception.	Test Beck Depression Inventory Structured Clinical Interview for DSM-IV (SCID) Minnesota Multiphasic Personality Inventory (MMPI)	compared to the controls (mean=3.50, SD=1.60) (p<0.01) Analysis showed a significant difference between groups on the BDI scores (p<.05). No significant interaction effects observed on recognition tasks There were no significant differences between the groups on the Benton Facial Recognition Test (p=> .60) Accuracy fluctuated for different emotions (p<.01), the most accurate recognition performance was observed for happiness (significantly more accurate than all other emotions, all F values >19.09), followed by anger, surprise and disgust Group differences found in the level required to correctly identify emotions (p<.01). Differences found in the level s for fear (p<.01) and sadness (p<.01). PTSD sample requiring more expression (91% fear) and (87% sadness) to identify the emotion Further analysis, including DBI scores as a covariate, still showed a significant overall difference between groups (p<0.05), again due to performances on fear and sadness	Clinical sample had a limited age range Small sample size Only investigated emotional recognition through one modality (facial) No details of ethnicity No details of the reliability or validity of the emotional recognition task Measures not counterbalanced Factors that could have affected the controls performance were not screened for, neurological conditions, head injuries etc
Freeman, T.W., Hart, J.,	N=37 Overall N=11 PTSD	N=26 controls (3 groups)	Case control study	Structured Clinical Interview for	An omnibus repeated measure ANOVA with subject groups as the IV and the three identification tasks and the discrimination	Only used one gender in the sample (males)

Kimbrell, T, and Ross, E.D. (2009)	diagnosis Vietnam veterans America 100% males Mean age 57.5 SD 4.1 No details of ethnicity Place study was conducted – United States	N=6 left hemisphere brain damage 50% males Mean age 53.2 SD 9.1 N=8 right hemisphere brain damage 62.5% males Mean age 56.8 SD 6.4 Brain damaged controls had focal ischemic infarctions predominantly involving cortex and adjacent white matter, native English speakers, strongly right-handed, no major psychiatric illness, severe medical conditions, alcoholism, previous strokes or neurological	The study examined participants with PTSD's ability to comprehend and discriminate affective prosody in voice compared to either healthy controls, participants with left or right brain damage. The authors aimed to determine if emotional perception was impaired in those with chronic PTSD. This study investigated impairments; and the risk factor under investigation was chronic PTSD.	DSM-IV (SCID) Michigan Alcoholism Screening Test (MAST) Obsessive Compulsive Drinking Scale (OCDS) Clinical-Administered PTSD Scale-Second Edition (CAPS-2) Edinburgh Handedness Scale Aprosodia Battery	task as the DV found; significant group by task interactions (p=0.004), a main effect for group (p<.00001). The main effect for task was not significant (p=.08), but showed a small effect size. The interaction appears to be the result of improvement across tasks by the left brain damaged group, whereas the performance of the right brain damaged group and PTSD group appear identical. A post-hoc repeated measure ANOVA was used to test this observation, this included the healthy control, the right brain damaged group and PTSD group as IV's; results revealed a non significant group by task interaction (p=.39), with a robust main effect for groups (p<.000001) and a significant main effect for task (p=.02). The group by task interaction found in the earlier analysis was due to the performance of the left brain damaged group. A second post-hoc repeated measure ANOVA was conducted, including only the right brain damaged group, PTSD group as IV's; results demonstrated a non significant group by task interaction (p=.88), a non significant main effect for groups (p=.75), which indicated the performance of the two groups was statistically identical across tasks. There was a significant main effect for task (p=.02), because of an overall worsening of performance on the Asyllabic and Discrimination tasks compared to the Word and Monosyllabic tasks for both	It only investigated participants from one trauma group (Veterans with PTSD) Clinical sample had a limited age range Small sample size Groups not matched for education or gender Unequal numbers in groups; requiring regression analysis The majority of PTSD participants (82%) had a history of alcohol abuse; alcohol abuse has been found to cause deficits in emotional comprehension

		conditions affecting the CNS, excluded for taking certain medications N=12 healthy controls 33.3% males Mean age 54.1 SD 7.8 No details of ethnicity All ----native English speakers, strongly right-handed, no major psychiatric illness, severe medical conditions, alcoholism, previous strokes or neurological conditions affecting the CNS, excluded for taking certain medications			groups. A multiple stepwise linear regression analysis found that none of the alcohol/abuse indicators predicted performance on any of the comprehension subtests in the PTSD group.	

2.1.Systematic Review

For a full description of the individual studies, please refer to Figure 5 above. The review will now provide a critical evaluation of the studies.

2.1.1. Did the study address a clearly focused issue?

All of the studies in this review provided a full description of their aims and hypotheses, addressing clearly focused issues. Only three of the studies focused on the emotional recognition abilities of those diagnosed with PTSD (Nazarov et al, 2014; Poljac et al, 2011; Freeman et al, 2009); which is the focus of the present study. The remaining studies focused on testing meditational models, where social cognitive abilities were one element of the models being investigated (Considine & Paivio et al, 2013; Marshall et al, 2011).

Nazarov et al's (2014) objectives were to examine the affective comprehension abilities of females with PTSD related to childhood abuses; namely their abilities to discriminate on an affective prosody measure. The study aimed to establish if comprehension of affective prosody in speech would be disrupted due to early life adversity; childhood being the time when our abilities in interpreting prosody develop. One criticism is that the authors made assumptions about the impact of social cognition on interpersonal functioning, whilst there may be literature to support their claims, no attempts were made to evidence this as part of their research. Whilst this study addressed a clearly focused question, its focus was narrow, only investigating PTSD from childhood trauma, one gender and using an auditory emotional recognition task.

Considine and Paivio (2013) sought to evidence their explanatory model, they hypothesised that impaired social cognition may mediate the relationship between trauma exposure, alexithymia, interpersonal problems and depression. The authors comment that neuropsychological tests which measure affective processing may be a

more appropriate measure of alexithymia; although a criticism of this is that emotional perception is just one aspect of alexithymia, and that the tests used only tapped into emotional recognition and not the other aspects of alexithymia. Their second aim was to explore the extent to which auditory emotional recognition is a component of alexithymia. This study however focussed narrowly on emotional recognition in the auditory modality to test their model of impaired social cognition. Another flaw with this model is that trauma exposure in itself may not lead to problems in other areas; whereas individuals with PTSD or other problems of a clinically significant level are more likely to experience problems in other areas.

Marshall et al's (2011) study sought to investigate the relationship between exposure to traumatic events and the perpetration of intimate partner violence. The risk factors investigated by Marshall et al (2011) were exposure to traumatic events, maladaptive cognitions, the perception of auditory emotional stimuli and emotional regulation deficits. They postulated that auditory emotional perception would potentially mediate the relationship between exposure to trauma and the perpetration of intimate partner violence (IPV). The authors discuss that exposure to trauma can lead to a host of negative reactions including interpersonal difficulties such as IPV, occurring along a dimension of severity. The authors considered whether maladaptive post-traumatic cognitions play a role in behavioural and emotional responses, and could therefore be associated with the perpetration of IPV. They hypothesised that maladaptive cognitions include a selective misappraisal of threat, particularly misappraisal of anger; the authors comment that deficits in the recognition of emotion have been associated with PTSD (Freeman et al, 2009). They also hypothesised that maladaptive cognitions could lead to strong emotional reactions and dysfunctional strategies for regulating these emotions. They hypothesised that misappraisal of anger and poor emotional regulation strategies would mediate the relationship between maladaptive post-traumatic cognitions and the perpetration of IPV.

Poljac et al's (2011) study aimed to examine individuals with PTSD's recognition of facial expressions as compared to healthy controls; specifically looking at accuracy

(number which they judged correctly) and sensitivity (at what percentage of emotional intensity could they recognise emotions). The authors hypothesised that PTSD participants performance on recognition of facial expressions would be less accurate and require greater sensitivity levels to identify emotions than the control groups. Whilst the authors did not comment about impairments in social cognition, they did discuss alexithymia and emotional numbing. However, it is unclear how the authors' felt emotional perception and an awareness of one's own emotions might be linked. This was not discussed in detail, or investigated in this research. A criticism of this study's aims is that they are fairly broad in their focus, but the authors chose to sample just one trauma group, male war veterans. The authors either needed to narrow their aims or widen their sample to achieve generalisable results. Moreover, the study focused exclusively on the recognition of facial emotional expressions.

Freeman et al's (2009) study examined veterans with PTSD's ability to comprehend and discriminate verbal affective prosody compared to healthy controls, or to the performance of those who had sustained left or right brain damage. The authors aimed to determine if emotional perception was impaired in those with chronic PTSD. A criticism of this study is that whilst the authors' stated aim was to investigate impairments in emotional perception, they used only one modality (facial expression of emotions), one gender and one trauma exposed group to realise this aim.

2.1.2. Did the authors use an appropriate method to answer their question?

In all five studies using a case control study design would have been an appropriate method of investigating the questions posed. Whilst improvements could be made to the methods used within these studies (see later sections for a full discussion and critique), the inclusion of control groups would have improved Marshall et al's (2011) and Considine & Paivio's (2013) studies and allowed comparisons to be made with healthy participants to strengthen or refute their conclusions. Three of the studies recruited homogeneous participant groups who had diagnoses of PTSD but, for example, represented only one gender and one trauma type, often within a small age range. Whilst this allowed consideration of the restricted hypotheses the authors

posed, their results were generalisable only to those groups and not the wider PTSD population (Nazarov et al, 2014; Poljac et al, 2011; Freeman et al, 2009).

All studies employed a quantitative method; examining emotional recognition experimentally. Three studies used a between groups design, comparing a clinical sample sourced through outpatient programmes, self-help groups or veterans associations with a healthy control group (Nazarov et al, 2014; Poljac et al, 2011; Freeman et al, 2009). The authors in these studies wished to investigate emotional recognition, but failed to look at recognition in both facial expressions and auditory presentation forms. Nazarov et al (2014) and Freeman et al (2009) used an auditory emotional recognition task, whereas Poljac et al (2011) used a facial emotional recognition task.

Power calculations were not provided for any of the studies (Nazarov et al, 2014, Considine & Paivio et al, 2013, Marshall et al, 2011, Poljac et al, 2011, Freeman et al, 2009). Details of non-respondents were not provided in any of the five studies.

2.1.3. Were the cases recruited in an acceptable way?

There were limitations in the recruitment practices used in each of the studies. Considine and Paivio et al's (2013) used a trauma exposed student sample drawn from a psychology undergraduate programme who participated in return for bonus points in their final mark. Marshall et al's (2011) study did not provide adequate details as to their student sample's recruitment or origin, leaving it difficult to determine if demand characteristics could have influenced the study. Trauma exposure in itself does not equate to resultant problems, these studies did not gather sufficient information around the effect that the trauma exposure had on the students to demonstrate their explanatory models.

All five studies, providing a clear description of the demographics of the sample under investigation and three provided information about the population from which

it was recruited (Nazarov et al, 2014, Considine & Paivio et al, 2013, Poljac et al, 2011, Freeman et al, 2009). For a full description of the samples, please refer (Section 2.1.4).

Participants were recruited in the following countries; Canada (Considine & Paivio et al, 2013; Nazarov et al, 2014), the United States (Marshall et al, 2011; Freeman et al, 2009) and Bosnia (Poljac et al, 2011). Clinical cases were recruited from outpatient programmes, self-help and veterans associations, in specific localities, being representative of geographically defined populations. Each of the studies were narrow in their recruitment of participants because their target population was small and restricted to those for instance attending outpatients in one geographical location or one self-help group etc. The PTSD samples were small with the highest number of participants being n=29 (Nazarov et al, 2014; Poljac et al, 2011; Freeman et al, 2009).

Screening was used to ensure those recruited met the clinical inclusion criteria in relation to diagnosis (Nazarov et al, 2014; Poljac et al, 2011; Freeman et al, 2009) and in one study the sample was drawn from a participant pool who had already consented to research involvement (Freeman et al, 2009). Veteran cases were representative of specific wars, for example the Bosnian (Poljac et al, 2011) and Vietnam wars (Freeman et al, 2009). PTSD cases were recruited by virtue of their diagnosis and contact with services.

Both studies recruiting university students were interested in prior trauma exposure; participants were not screened or recruited for a diagnosis of PTSD, but rather self-reported exposure to a traumatic event. As participants were asked if they had experienced a trauma in their lifetime, traumas may be from both childhood and adulthood; traumas may have also occurred in different geographical locations (Considine & Paivio, 2013; Marshall et al, 2011). Marshall et al (2011) identified students who had been in a relationship during the past year, they then screened students for relationship aggression; participants were then invited to participate on the basis of a current relationship status and history of trauma exposure. Trauma

exposure was screened using a questionnaire. Individuals with no trauma exposure but relationship aggression were excluded. As mentioned previously the cases recruited may not have been a representative sample of traumatised individuals due to the trauma exposure measures used in these studies and minimal trauma symptom screening measures.

2.1.4. Demographics of the clinical sample

Below are the demographics of the clinical samples; the demographics establish the representativeness of each sample and whether comparisons can later be made to the PTSD population. Homogeneous samples compromise the generalisability of the findings. Authors should ideally provide sufficient detail around their clinical and control samples to establish if the two groups are comparable; inclusion and exclusion criteria enable the researchers to recruit comparable samples to reduce error variance.

Although attempts were made to recruit representative PTSD samples and disclose their demographic details, studies were not entirely representative of PTSD populations. Clinical participants' ages ranged from 18 to 61 years of age, although this span exists from the combined data of these studies; individual studies age ranges were cohort specific and limited. Participants in two of the studies were entirely males (Poljac et al, 2013; Freeman, 2009) and in a further study entirely female (Nazarov et al, 2014); these studies were not individually representative of the PTSD population. Both genders were represented in the student samples, with 85% females in the psychology undergraduate group (Considine & Paivio, 2013) and 61% females in the student sample (Marshall et al, 2011), whilst this percentage may be representative of psychology undergraduates, it is not representative of those with PTSD . In total 298 participants who had been exposed to trauma(s) were sampled. Sample sizes in the clinical groups varied considerably across the studies; 53 students (Considine & Paivio, 2013), 185 students (Marshall et al, 2011), 11 PTSD participants (Freeman et al, 2009), 20 PTSD participants (Poljac et al, 2011) and 29 PTSD participants (Nazarov et al, 2014).

In terms of the clinical samples ethnicity, Marshall et al's (2013) sample were predominantly Caucasian (91%); Considine and Paivio's (2013) study's sample were 71.7% Caucasian; Poljac et al's (2011) study did not provide details of the clinical samples ethnicity; no details of ethnicity were provided by Freeman et al (2009), and no details were provided by Nazarov et al (2014). As PTSD is found across ethnicities, these samples are not representative of a trauma exposed population. The current studies samples were comprised of those with unique cultural and ethnic experiences, which again make generalising the findings more difficult; for example the demographics of the war veterans are cohort specific. Freeman et al (2009) measured the PTSD sample's years of education (12.6 +_ 1.7); Poljac et al (2011) also measured the PTSD group's years of education and matched this with the control groups, although did not provide the number of years in the article. Nazarov et al's (2014) PTSD sample's number of years of education was (13.7 +_2.3). Considine & Paivio (2013) measured both genders years of education, with females having (14.89, SD 0.96) and males having (14.75, SD 0.98). Marshall et al's (2011) study averaged the education between genders, whom had 19.00, years of education (SD 1.26). The university student samples had considerably more education than the PTSD samples; Marshall et al's (2011) sample being the most educated. Using samples of educated participants is not representative of the PTSD population, it also highlights the issues with matching to healthy control groups who will have higher levels of education.

2.1.5. Trauma Types

When examining the role of emotional recognition in the difficulties experienced by those with PTSD it is important to note that the expression of prosodic difficulties may be different dependent on the type, intensity and prolonged nature of the trauma exposure history. Thus it could be that childhood trauma (Nazarov et al, 2014) may predispose individuals to respond differently to emotional stimuli than does combat trauma in adulthood (e.g. Poljac et al, 2011). Prosodic difficulties arising from childhood trauma may arise from trauma exposure at critical periods in a child's development. Veterans who developed PTSD from combat-related PTSD may have different experiences and prosodic difficulties to those who have not experienced front line exposure. Individuals, who have sustained prolonged exposure

to traumatic events, may display more prosodic difficulties than those who have developed PTSD from singular events in adulthood. It is important to look at the nature of the trauma and the length of trauma exposure in the interpretation of the findings.

Trauma types differed across studies; Nazarov et al (2014) sampled women who had been subject to childhood trauma. Trauma categories included emotional abuse, physical abuse, sexual abuse, emotional neglect and physical neglect; whilst this is a good representation of traumas experienced in childhood, this study failed to include adult exposure, limited numbers due to the sample size would have led to small number in each trauma represented making it more difficult to generalise the findings. Poljac et al's (2011) sampled war veterans from the war in Bosnia who had been exposed to prolonged traumatic events. No details were provided as to whether all participants had combat-related PTSD or whether some veterans had been traumatised through other duties. Freeman et al (2009) sampled male veterans from the Vietnam era who all had combat-related PTSD. The findings from these latter studies could only be generalised to other veteran PTSD populations, equally PTSD may be specific to the theatre of war and type of exposure, for example combat related versus other veteran trauma experiences.

Considine and Paivio (2013) sampled students who had been screened for prior trauma exposure; participants were screened for specific childhood traumas and other traumatic events they may have been exposed too, for example physical violence or threat, transport accidents, natural disasters, sexual abuse or assaults, captivity, military combat, industrial accidents and fire related injuries or near drowning. Marshall et al (2011) sampled students with prior exposure to trauma; participants were screened for a range of traumas which included assaults, sexual assaults, partner abuse, warfare or combat, motor or other accidents, natural disasters, sudden deaths, threat or death or bodily harm, robberies, stalking, childhood sexual abuse and witnessing family violence. Participants most frequently reported the sudden death of a loved one as being their most distressing traumatic event (40.5%), followed by a life threatening or disabling event to a loved one

(12.4%), unwanted sexual contact (9.8%), witnessing family violence (7.6%) and car or other accidents (7.0%). Whilst these studies do provide information for a range of trauma types, their samples were not representative in terms of the age range sampled. The majority of those sampled were thus likely to have experienced childhood traumas, due to those sampled being predominantly below 21 years of age.

2.1.6. Were the controls recruited in an acceptable way?

Only three studies used controls (Nazarov et al, 2014; Poljac et al, 2011; Freeman et al, 2009). For a full description of the control groups and their demographics, please refer to Figure 5 above. The three studies used a control group of healthy controls; Freeman et al (2009) also used a further two control groups who had left and right hemisphere brain injuries. All controls were recruited from the same geographical areas as the clinical groups. Details of non-respondents were not provided in any of the studies, making it impossible to establish if non-respondents differed in any way to those recruited. Two studies matched for age and gender (Nazarov et al, 2014; Freeman et al, 2009), with the third study also matching for education (Poljac et al, 2011). The control group numbers were not matched to the clinical group numbers in two of the studies (Nazarov et al, 2014; Freeman et al, 2009), unequally matched groups may confound the results. Controls were screened for the presence of problems that could confound the results, undergoing the same procedure as the clinical groups in two studies (Nazarov et al, 2014; Freeman et al, 2009). Poljac et al's (2011) control group did not undergo the same procedures; this control sample may not be representative of healthy controls, as limited information was provided to evidence this. This study's control group were defined as war veterans who were exposed to prolonged traumas during the Bosnian war.

Nazarov et al's study (2014) recruited controls through word of mouth and local advertisements at a healthcare centre; this study attempted to recruit healthy volunteers and screened appropriately to establish this. Poljac et al (2011) did not provide details for how the control group was recruited, although it could be presumed that they were also recruited at the same self-help group as the clinical group. In (Freeman et al's 2009) study controls were recruited from a laboratory

research database which had been set up to help investigate affective prosody; this was part of the Veterans Association. It is assumed that all control participants in Freeman et al's (2009) study were veterans, although no specific details were provided of their military service. These latter studies failed to provide sufficient detail around recruitment and (Poljac et al's, 2011) also failed to fully establish that their sample were representative of a healthy sample. The studies also did not provide detail around their samples military service and trauma exposure, which may make comparisons between groups more difficult.

The remaining studies in this review (Considine & Paivio et al, 2013; Marshall et al, 2011) did not use control groups, so no comparisons could be made, these authors cannot establish that confounding variables were eliminated and demonstrate that their findings were solely due to the factors under investigation. Controls groups provide researchers with a means of increasing the statistical validity of the data.

2.1.7. Was the exposure accurately measured to minimise bias?

Control and clinical group membership was established according to validated methods using psychometric tools and clinical opinion in line with the recruitment criteria specified in each study (Poljac et al, 2011; Freeman et al, 2009; Nazarov et al, 2014). Nazarov et al, (2014), Poljac et al, (2011) and Freeman et al, (2009) used control groups to reduce bias. In all studies control groups underwent the same procedures as the clinical group; although in one study, controls did not complete clinical measures (Poljac et al, 2011). None of the studies in this review used blinding; all participants underwent the same procedures to investigate differences between the group with trauma exposure and the controls (Nazarov et al, 2014; Considine & Paivio et al, 2013; Marshall et al, 2011; Poljac et al, 2011; Freeman et al, 2009). Studies did not attempt to reduce order effects by counterbalancing or randomising; this may have led to bias through boredom or priming effects.

Controls and the clinical groups all underwent the same procedures to minimize bias. Details of testing environments were not provided; but the procedures indicated that

participants all underwent the same conditions (Nazarov et al, 2014; Freeman et al, 2009; Poljac et al, 2011).

2.1.8. What confounding factors have the authors accounted for?

The majority of studies, within the caveats outlined above, considered the reliability and validity of the measures and tests employed and provided sufficient detail. Studies that used PTSD participants completed additional screening to establish that the disorder was still present (Nazarov et al, 2014; Poljac et al, 2011; Freeman et al, 2009). Studies also provided descriptions of inclusion and exclusion criteria for their samples. For a full description of confounding factors, please refer to Figure 5 above.

Nazarov et al (2014) counterbalanced the discrimination test, and items within tests were presented in a randomised order; practice tests were provided prior to each test being administered. The testing environment was controlled for across groups. Considine and Paivio (2013) considered the following confounding factors in their study; age, education, ethnicity, sexual orientation, veteran status, disability status, and dominant hand, as the authors state that these factors have been found to influence alexithymia and depression. Participants were tested in a group setting, completing the measures employed in the study in a randomised order. Marshall et al (2011) only considered gender and the reliability and validity of measures as potential confounds. No other details were provided about the demographics of the sample, the procedure, or the exclusion criteria that applied. Lack of disclosure of potentially confounding factors is a major limitation of this study.

Poljac et al (2011) screened for disorders of face perception using the Benton Facial Recognition Test, a perceptual test that is designed to assess face recognition abilities or identify possible clinical problems, namely prosopagnosia; the authors also measured participants' levels of self reported depressive symptoms. Practice trials for the tests were provided, items were randomized within measures and the procedure was standardised for both groups. Freeman et al (2009) considered the following confounding factors in the brain injured controls; medications that could affect the

results, prior strokes, spontaneous recovery, and potentially reversible patho-physiologic processes. All controls were screened for neurological, psychiatric and medical illnesses that could be associated with cognitive decline or alterations in affect and alcoholism. Other confounding factors considered were the randomisation of items within the prosody test and the environment where the testing took place; participants were all tested under the same conditions.

2.1.9. Have the authors taken account of the potential confounding factors in the design and/or in their analysis?

For a full list of the confounding factors considered in each of the studies in this review, please refer to Figure 5 above. None of the studies provided details about treatment, whether their sample had received treatment and what support participants were offered. Confounding factors not considered by Nazarov et al (2014) were matching for education, as educational differences may affect the results; Freeman et al (2009) also did not match groups for education. Only females with childhood traumas were sampled, males may have produced different results, as emotional recognition has been argued to have gender differences. Freeman et al (2009) and Poljac et al (2011) both only sampled males, which may have confounded their results, for the above reason. Two groups did not match group numbers; power is calculated conservatively based on the smallest sample size, so not matching groups may have reduced power in both of these studies (Nazarov et al, 2014; Freeman et al, 2009). Poljac et al's (2011) study did not apply the exclusion criteria to both groups during recruitment. The control was not screened for neurological conditions, head injuries, substance misuse and major illness, these conditions if present may confound their results. Using a further control group of healthy, non-trauma exposed participants would have aided comparisons further. Whilst it is also possible to recruit people who have had trauma exposure but not gone on to meet criteria for psychiatric diagnosis, the use of such control groups is under-researched, it is possible that they may provide a better comparator than healthy controls. Freeman et al's (2009) study did not match for education and gender; although they comment that educational and gender differences were not found on the Aprosodia Battery Comprehension test, these factors were not considered as confounding

effects in the authors' analyses. The authors did find a sex difference in their sample with older males performing slightly better than on Asyllabic Repetition sub-test when compared to females.

All three studies had a narrow focus in terms of their samples; PTSD can arise from a range of different traumatic events across the lifespan, variations in trauma type, age at trauma exposure etc may produce different findings. Whilst the authors wished to look at whether deficits in emotional recognition existed, they only investigated this through one modality, either facial expression recognition (Poljac et al, 2011) or auditory emotional recognition (Nazarov et al, 2014; Freeman et al, 2009). Poljac et al's (2011) did not provide details of the testing environment; equally tests and measures were not counterbalanced throughout the study. No details were provided about the reliability and validity of the emotional recognition test. The authors attempted to statistically control for differences between the two groups by running independent sample t-tests to look for differences in age and education. They also ran a further analysis with depressive symptoms as a covariate due to the differences in scores on the BDI for the two groups. Nazarov et al (2014) devised the affective prosody task for their study, but no details of piloting or the measures reliability or validity were provided; it is therefore unclear whether this test is a reliable or valid measure of affective prosody. The authors had to log transform reaction time measures as they were not normally distributed; they also had to use non-parametric statistics due to identification accuracy measures being integers and therefore not suitable for log transformations. Multiple tests were conducted and a Bonferroni correction was used but the authors chose two tailed tests and did not consider education in their analyses or correct for this.

Neither Considine and Paivio (2013) or Marshall et al (2011) used a control group and both sampled from a narrow age range. Marshall et al (2011) did not control or consider many confounding variables in their design. A sample of individuals who perpetrated intimate partner violence with no trauma exposure could have been used as a comparison. The study provided no details of what level of study (undergraduate or community college) or programmes of study the student sample came from, so it

is impossible to ascertain what biasing effects, if any, these factors may have led to. The authors note that they oversampled men due to an unequal sex distribution of eligible participants, but their final sample was still weighted towards females, with 61% female participants. The literature is divided with regards to which gender perpetrates more violence towards the other. Marshall's sample may not be truly representative of those who commit intimate partner violence, or may be unrepresentative of the spectrum of violence that is perpetrated in relationships. The sample was predominantly Caucasian and from rural communities which may affect the traumas disclosed and people's reactions to the trauma, due to levels of social support potentially differing between urban and rural communities.

Marshall et al (2011) measured how affected participants were at the time of the study; but Considine and Paivio et al (2013) did not. One of the trauma exposure measures asked a question around distress and how distressing participants found the traumatic event; however, it did not specify the timeframe of reference so it is unclear if participants were reporting current distress levels. Using trauma symptom questionnaires may have captured current PTSD status, improved sampling and reduced confounding variables. Similarly choice of screening tools, and clear inclusion and exclusion criteria may have allowed Considine and Paivio et al (2013) to avoid confounding variables potentially contributing to their conclusion that their student participants did not show impaired emotional recognition or meet clinical levels of alexythymia. Marshall et al (2011) did not provide details of how the data were captured, under what conditions, what order the measures were presented to participants and what incentives were used to recruit participants. The authors also did not account for age in their analyses.

2.1.10. What are the results of this study?

Please refer to (Figure 5 – Systematic Review Results) for a full description of all the study's findings, including significance levels.

Considine & Paivio (2013) were interested in testing their mediation model of emotion recognition (see Section 2.1.2 for a full description). The analysis was appropriate to their design, the authors controlled for demographic variables that correlated with primary variables. They found that the majority of their measures were significantly and positively related; although the relationship between the measure of alexithymia and trauma, as measured by one of their trauma questionnaires, was not significant. The emotional processing task (EPT) was not significantly related to any of the other primary variables (trauma measures, measure of alexithymia, depression measure, inventory of interpersonal problems). The study's sample made a similar number of errors on the EPT as had been found for healthy controls in previous studies during the tasks development (Considine & Paivio et al, 2013). The authors aim to establish if alexithymia (assessed by a performance based measure – EPT) contributes to the relationship between trauma and depression. Further regression analysis found that exposure to trauma was a significant predictor of depression. The indirect effect of exposure to trauma on depression via the alexithymia measure was also significant. There was partial support for their proposed hypotheses. The overall results found were significant at either the $p<.05$, $p<.01$ or $p<.001$ levels.

Nazarov et al (2014) found no group differences on the emotional recognition accuracy task; with recognition accuracy scores being very good across the four emotions for each group, although fear was recognised at a lower rate to the other three emotions. The clinical group's reaction times were however significantly slower than the controls; with fear, happy and sad being recognised at a slower rate by the clinical group. There were no differences between groups for accuracy on the discrimination task; again reaction times were significantly slower for the clinical group. The authors found associations between severity of trauma and reaction times; trauma types led to different outcomes in terms of which emotions were recognised at which rates. There were associations between dissociation and the clinical group's ability to discriminate between emotions. The analysis was appropriate to the design; it also considered the effects of trauma severity, dissociation and trauma types on the results. Results were often significant at the $p<.001$ level.

Poljac et al (2011) found differences between the clinical and control groups on the recognition of fear and sadness at the $p<.01$ and $p<.05$ levels respectively. The clinical group had significantly higher scores on the depression measure so after controlling for this the authors did not find a significant interaction effect, but the authors did find a significant difference between groups on recognition accuracy. Accuracy fluctuated for different emotions, with the most accurate performance being found for happiness. Group differences were also found for recognition sensitivity, which is described as the percentage intensity of emotional expression required before an emotion was correctly identified. Again the clinical group required more expression in the emotions of fear and sadness, which corresponds to the accuracy finding; this was found at the $p<01$ level. The authors found differences between groups on the recognition rates and sensitivity rates across all emotions.

Freeman et al (2009) looked at the interactions between groups on the emotional comprehension tasks; they found a significant group by task effect. They found that the interaction results were attributable to the performance of the left brain damaged group and that the performance for the PTSD and right brain damaged group were almost identical. The authors conducted a second post-hoc repeated measures ANOVA excluding the left brain damaged group and found a non significant group by task interaction. The potential confounding effects of a history of alcohol abuse on performance was considered, but further analysis showed that this did not predict performance on any of the emotional comprehension tests.

Marshall et al (2011) found significant support for their full model with mediating effects of anger misappraisal and emotion dysregulation on the relationship between trauma cognitions and intimate partner violence perpetration; all primary variables were significantly correlated. Mediation was present for the full model, with each mediator contributing to the effect; these mediating effects were found at the $p<.01$ and $p<.001$ levels. Gender was not found to significantly moderate any of the mediator effects of trauma on the other variables. The pattern of results remained even when differing lengths of relationships were accounted for.

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2.1.11. How precise are the results?/How precise is the estimate of risk?

A criticism of the five studies is that they failed to provide details of individuals who refused to participate or who did not meet the inclusion criteria; so the studies did not evaluate the effect of these individuals' non-participation (Nazarov et al, 2014; Considine & Paivio et al, 2013; Marshall et al, 2011; Poljac et al, 2011; Freeman et al, 2009). It is therefore unclear how biased the samples may have been and how this may have impacted on the results.

The majority of studies adopted 95% confidence intervals (Nazarov et al, 2014; Considine & Paivio et al, 2013; Marshall et al, 2011; Freeman et al, 2009); Marshall et al's study (2011) had the largest sample size and therefore more power to detect small effects. Poljac et al (2011) did not provide a confidence interval, so we cannot establish how precise their estimate is. As the remaining studies had small sample sizes, particularly those studies sampling PTSD participants, there estimate of risk would not be as precise. The authors in these studies selected homogenous samples, as one way of improving power but this limited the generalisability of their findings.

All studies were precise in the reporting of P values; please refer to Figure 5 for a full description of each study's results. Studies predominantly used parametric analysis, as sample sizes were small in the majority of studies (Nazarov et al, 2014; Considine & Paivio et al, 2013; Poljac et al, 2011; Freeman et al, 2009), little attention was paid to the assumptions of normality in these studies, with few corrections for Type 1 errors.

Considine and Paivio (2013) looked at demographic variables that could correlate with the primary variables under investigation; these were controlled for in subsequent analyses. Marshall et al (2011) considered variables such as gender and length of relationship on the dependent variable under investigation. They did not consider all factors such as age, family violence, participant's sexual orientation, prolonged exposure to trauma or childhood adversity on the dependent variable; these factors may impact on their reported results. These two studies also neglected

to consider how current trauma symptoms may be associated with greater impairments on prosody tasks

Freeman et al (2009) considered alcohol abuse and its impact on the clinical group under investigation; the authors did not consider trauma severity, as mentioned above this may impact on the study's findings. Nazarov et al (2014) used two tailed tests in their analyses. Variables that the authors considered were the severity of trauma history, type of trauma suffered, levels of reported dissociation, depersonalisation and derealisation and their effects on the primary variables. Poljac et al (2011) considered depression as a potentially confounding variable and this was corrected for; the authors did not consider variables such as trauma severity or presence of pre-existing childhood trauma on the dependent variable. Studies that recruited from clinical PTSD groups considered the majority of variables that could impact on their results, although trauma severity was again neglected.

2.1.12. Do you believe the results?

When considering Nazarov et al's (2014) results, it is unsurprising that they found the clinical group with PTSD had slower reaction times; as PTSD has been shown to impact cognitively on individuals. There are many factors that may have influenced PTSD participants' overall reaction times. Poljac et al's (2011) findings replicate previous research using this emotional recognition tool; with participants being less accurate for fear and sadness on the recognition task and being more accurate for happiness. The results of this study are believable; with significant findings of interest and support for the hypotheses.

Freeman et al's (2009) findings are very detailed and their results were significant. Due to variations in the data, (for example, gender differences and educational differences in the control and clinical groups), a number of data transformations and regressions were required to adjust for their statistical effects. Little discussion or information was provided as to how this may have affected the results. For instance, it would have been useful to know how groups had performed on the Aprosodia

Battery without these transformations. The authors used complex statistical procedures to make inferences from a very small sample of participants with PTSD. It would be interesting to see if these results could be replicated with a larger sample, controlling for some of the confounding factors in the design. The authors argue on the basis of their statistical correction procedures that alcohol use did not account for any of their findings. As the majority (81%) of their PTSD sample had a history of substance misuse, again controlling for this in their design or in future research would be beneficial.

Marshall et al's (2011) study aimed to extend previous research that found a link between PTSD and the perpetration of intimate partner violence (Marshall et al, 2005). A major criticism of this study is the lack of detail given to describe the sample, its recruitment and what was considered to be a traumatic event. Insufficient detail was given about the sampling process and how demand characteristics were managed. Moreover, the authors did not control for a variety of factors that could have confounded their results, for example other contributors to intimate partner violence, substance use, other mental health conditions, witnessing violence during development etc. There was no way of establishing if the onset of perpetration of violence within relationships had preceded or followed the trauma experience. Whilst the authors reported significant correlations between their primary variables, they appeared not to have controlled for a variety of confounding factors that could have impacted on the results. Despite this, the authors concluded that the findings and their significance provided support for their model of PTSD's mediating role in intimate partner violence.

Whilst Considine and Paivio (2013) concluded that there was partial support for their hypotheses it is possible that this was only achieved through judicious combination of measures to examine trauma exposure in the absence of a significant association between alexithymia (TAS-20) and the trauma questionnaire (TQ). Had this measure been used in isolation, it seems unlikely that their model and hypotheses would have been supported. Another criticism of the results is the lack of significant difference between the undergraduate participants and a normative reference group of healthy

controls performance on the emotional processing task. The internal reliability of the emotional processing task was poor when derived for this sample (Cronbach's alpha=.58), despite the test's author claiming internal reliability as high (a=.80) and satisfactory test-retest reliability (a=.78). Given these methodological limitations it would seem premature to conclude that the model proposed in the study (explanatory model for the relationship between trauma exposure and the subsequent development of alexithymia, interpersonal problems and depression) was significant.

2.1.13. Can the results be applied to the local population?

The majority of studies have chosen to recruit specific groups diagnosed with PTSD, for example PTSD as a result of childhood adversity (Nazarov et al, 2014) or military trauma (Poljac et al, 2011; Freeman et al, 2009) and to include participants from one gender only. The studies in this review derived samples from Western populations in the United States of America (Marshall et al, 2011; Freeman et al, 2009), Canada (Nazarov et al, 2014; Considine & Paivio et al, 2013) and Bosnia (Poljac et al, 2011). It can be argued that there are differing rates of PTSD across cultures and countries. Generalisation of findings in the studies reviewed is possible only to the narrow cohorts studied and potentially not applicable to those living with PTSD in the UK or other countries.

This review produced evidence that males diagnosed with PTSD have deficits in recognising emotions, particularly fear and sadness (Freeman et al, 2009; Poljac et al, 2011). Interestingly females were found to have similar accuracy in emotional recognition as healthy controls, although they were significantly slower in terms of recognition rates, again for fear, sadness and happiness (Nazarov et al, 2014).

Studies using student populations with prior trauma exposure (Marshall et al, 2011; Considine & Paivio, 2013) may not generalise to a community dwelling population with diagnosed PTSD. Moreover, neither study published its findings for participant's performance on the individual emotion recognition tasks, which makes

applying the results to the local population impossible. If the findings of the tasks had been published, the results would still be difficult to generalise to the present study due to the participants not reaching a clinical threshold of distress for the trauma they were exposed to, equally the study's findings could only be applied to a similar age cohort.

2.1.14. Do the results of this study fit with other available evidence?

As the evidence around emotional recognition in trauma exposed samples is limited, and confined to the few studies that this systematic review identified, it would be premature to conclude that their findings align well or otherwise with other available evidence. Whilst the studies described suggest that military samples comprised of males show some deficits in emotional recognition (Poljac et al, 2011; Freeman et al, 2009); only one study identified which emotions were significantly affected (Poljac et al, 2011). This finding is consistent with previous findings that the accuracy of emotional expression recognition is compromised in men, with lower educational abilities and PTSD compared to the performance of healthy controls. As the other two studies included in this review do not provide the results of the emotional recognition tasks (Considine & Paivio et al, 2013; Marshall et al, 2011), it is difficult to ascertain how they fit with the body of evidence that exists.

As mentioned above, research in this area is in its infancy, so it would be premature to make a decision around how well the evidence aligns. It is currently worth considering all the findings from these studies, particularly the three studies focusing on PTSD participants, as these authors published their findings for the emotional recognition tasks. Further research in this area is required to establish if differences do exist between emotional recognition tasks, trauma types, age of exposure to trauma, genders, and prolonged exposure to trauma and single trauma events. This study sought to add to this area by investigating some of these factors with a view to adding to the growing evidence base.

2.2. Summary of review results

In summary, there is growing evidence that differences exist between healthy controls and individuals with PTSD on emotional recognition tasks. Evidence is strongest in male veterans with PTSD, with findings that the emotions of fear and sadness are less accurately recognised in both auditory and facial emotional recognition tasks. Females' reaction times in an auditory emotional recognition tasks were slower when compared to healthy controls, differences in reaction times for those with PTSD appeared to depend on the emotions presented and the trauma exposure history.

Research in this area is still accumulating but suggests associations between emotional recognition and the type of trauma an individual is exposed to, the number of traumas an individual experiences, gender, trauma symptom severity and whether an individual has received treatment. The current research sought to address some of these variables in an attempt to further develop the evidence base around PTSD and emotional recognition.

2.3. Introduction to the current study

This current study aimed to add to the growing research into aspects of social cognition in mental health conditions. Social cognition has been investigated widely in mental health conditions such as schizophrenia; and to a lesser extent in a number of anxiety disorders. The aim was to pilot a new auditory recognition task and thereby investigate if emotional recognition performance, both verbal and visual, differs in a trauma exposed sample compared to healthy controls. It incorporated both facial and auditory emotional recognition tasks, included male and female control and experimental participants and adopted criteria which matched for age and trauma history to create representative samples from healthy and PTSD exposed populations.

PTSD and social support has been researched widely, with positive social support known to be important for recovery (Ozbay et al, 2007). Chronic PTSD tends to be associated with poor levels of perceived social support. This study aimed to investigate associations between emotional recognition, PTSD and interpersonal

relationships; with a view to discovering whether deficits in emotional recognition in a PTSD population were associated with poorer interpersonal relationships, perceived satisfaction in interpersonal relationships and perceived social support.

2.4. Hypotheses

2.4.1. Hypotheses 1 – Emotional Recognition Tasks

The rationale for the emotional recognition hypotheses will be discussed in relation to the evidence base. The evidence base suggests that emotional recognition can be disrupted in mental health conditions (Hoekert et al, 2007; Kohler et al, 2010; Harrison et al, 2010; Deveney et al, 2012; Sprengelmeyer et al, 1997), with individuals with mental health conditions having lower accuracy rates on emotional recognition tasks than healthy controls. When looking at trauma populations or individuals with a diagnosis of PTSD, they too have been found to have lower accuracy on emotional recognition tasks (Freeman et al, 2009; Poljac et al, 2011; Marshall et al, 2011; Considine & Paivio et al, 2013; Nazarov et al, 2014), with specific deficits found for the emotions of fear and sadness (Poljac et al, 2011). This led to the inclusion of hypotheses 1a-1c (see below) that individuals with PTSD were hypothesised to have lower emotional recognition accuracy, specifically lower accuracy of the emotions of fear and sadness.

As gender differences have been found in the literature for emotional recognition accuracy (Thayer & Johnson, 2000; McClure, 2000), with males having lower accuracy, it was hypothesised that males will have lower accuracy than females (hypothesis 1d). Literature on complex PTSD discusses how individuals are affected by further symptomology (Reswick et al, 2012) and have greater difficulties in relationships (Herman, 1997); as relationships are thought to be more affected, it was hypothesised that this group may have greater recognition problems when compared to those with simple PTSD (hypothesis 1e). As the emotions predicted to be affected were fear and sadness (Poljac et al, 2011), it was hypothesised that individuals with complex PTSD from childhood trauma would have greater recognition problems (hypothesis 1f) than those with adulthood traumas (simple PTSD) due to the previous hypothesis (hypothesis 1e).

Null Hypothesis H10. There will be no difference between the two groups in terms of accuracy on the emotional recognition tasks (auditory and facial).

H1a. The clinical groups accuracy rates on the emotional recognition tasks (auditory and facial) will be lower than the control groups.

H1b. There will be a significant difference between the accuracy rates of the clinical and control groups, for the emotions of fear and sadness, on the auditory emotional recognition task.

H1c. There will be significant differences between the accuracy rates of the clinical and control groups, for the emotions of fear and sadness, on the facial emotion recognition task.

H1d. Males with PTSD will have lower accuracy scores on the emotional recognition (auditory and facial) tasks than females with PTSD.

H1e. Clinical group participants who have been exposed to prolonged trauma (since childhood) will have lower accuracy scores on the emotional recognition tasks, than participants who developed PTSD due to adult trauma(s).

H1f. Participants with PTSD who have been exposed to prolonged trauma (since childhood) will have lower accuracy scores than participants with PTSD who have been exposed to adulthood traumas, for the emotions of fear and sadness on both emotional recognition tasks.

2.4.2. Hypotheses 2 – Interpersonal Relationships

The evidence base discusses how individuals with a diagnosis of PTSD have difficulties with interpersonal relationships (MacDonald et al, 1999; Cloitre et al, 2002), this led to the inclusion of hypothesis 2a. As the evidence base discusses around complex PTSD (childhood trauma) discusses how this group of individuals are felt to have specific difficulties with interpersonal relationships (Herman, 1997), Reswick et al (2012) cites in his review that individuals have *"impaired relationships with others"*. This group are thought to have disruptions to the attachment processes that develop during childhood (Ford & Courtois, 2008; Cloitre et al, 2009), this led to the inclusion of hypothesis 2b. As complex PTSD was felt to potentially have affected attachments, whereas individuals with adulthood traumas may have developed within secure environments and therefore have secure attachments, it was hypothesised that individuals with childhood trauma would report more difficulties with interpersonal relationships than individuals with adult traumas (hypothesis 2b).

As discussed above, those in the PTSD group are hypothesised to have lower recognition accuracy than healthy controls (hypothesis 1a), in addition they are hypothesised to report more problems with interpersonal relationships (hypothesis 2a) than controls. Therefore, it is hypothesised that lower emotional recognition and reports of greater difficulties in interpersonal relationships will be associated (hypothesis 2c). The evidence base demonstrates that impairments in emotional recognition and difficulties in interpersonal relationships have been found in substance misuse populations (Kornreich et al, 2002), and more specifically in relation to problematic drinking. Research has looked at the association between impaired emotional recognition and interpersonal relationships (Hooker and Park, 2002; Sibley et al, 2010; Couture et al, 2006). A meta-analysis found that social cognition had a stronger association with functional outcomes than impairments in neuro-cognition; this was found to be the case with emotional and social perception (Fett et al, 2011). Addington et al (2006) found that social cognition was significantly associated with quality of life scores and symptomology in schizophrenia. As the evidence base suggests that deficits in emotional recognition are associated with poorer interpersonal and social outcomes, it was hypothesised that emotional

recognition performance would mediate the relationship between PTSD and difficulties in interpersonal functioning (hypothesis 2d).

Null Hypothesis H20. There will be no associations between difficulties in interpersonal relationships and emotional recognition accuracy scores for the PTSD group.

H2a. Participants with PTSD will report more difficulties in interpersonal relationships than controls.

H2b. Participants with PTSD related to childhood trauma will report more difficulties in interpersonal relationships than those who were exposed to trauma in adulthood.

H2c. There will be an association between difficulties in interpersonal relationships and accuracy scores on the emotional recognition tasks for the PTSD group. Such that, lower accuracy will be associated with greater levels of interpersonal relationship difficulty.

H2d. Emotional recognition performance will mediate the relationship between PTSD and difficulties in interpersonal relationships.

Chapter 3
Methodology

This chapter describes the methods used in this study, and includes a description of the study's design. It also outlines the participant recruitment procedure and protocols followed with respect to confidentiality, anonymity, informed consent, and the welfare of participants and the researcher. It provides details of the procedure undertaken and the measures used within the study, citing how the data was managed, stored and analysed.

3. Design

This study is a quantitative case-control study, which sought to explore possible relationships between social cognition and interpersonal relationships for participants diagnosed with post-traumatic stress disorder (PTSD). Measures of social cognition were obtained through computer-based tasks. These tasks required participants to indicate which emotion was being conveyed via (a) images of facial expressions, and (b) through spoken statements. Participants were required to indicate which emotion (from a choice of seven) best represented the emotion being conveyed; responses produced a percentage accuracy rate for each participant. Standardised questionnaires were used to obtain information about the participants' views of their interpersonal relationships (Zimet et al, 1988; Barkham et al, 1996; Wei et al, 2007). Statistical analysis of the results enabled the researcher to examine whether associations were present between relationship difficulties and difficulties with emotional recognition. Between groups MANOVA's were used to analyse the data set.

3.1.Participants

3.1.1. Power Analysis/Sample Size Calculations

Sample size was calculated using G*Power Version 3.1.9.2 (Faul, 2007). As Independent Sample T-Tests were used in this study, sample sizes were calculated for this test in G*Power. To obtain the means and standard deviations for the control (healthy controls) and clinical groups (PTSD participants), the findings from previous studies were initially used. Freeman et al's (2009) study published the mean and SD's for the two groups; based on these figures, sample sizes calculated were six participants per group, with power set to 0.95 and alpha=0.05. To ensure that sufficient numbers of participants were recruited to each group, the means and SD's for normative samples were sought from tests of emotional recognition. The Florida Affect Battery provided these norms both for a facial emotion recognition task and for a prosodic (auditory) recognition task. Norms were used for the normal population and for individuals with right hemisphere brain damage, as this group has specific problems on emotional recognition tasks akin to those found in a PTSD sample (Freeman et al, 2009). With power set to 0.95 and alpha=0.05, group sizes were calculated at nine participants per group on the facial emotion recognition task and 25 participants per group on the prosodic recognition task.

As normative data did not exist for the tests used in this study, it was felt that these calculations provided the best estimate of sample sizes. As sample sizes differed in the above calculations, a minimum sample size was set at n=25 per group. As this was a pilot study, a smaller number of participants were deemed sufficient to establish if the experimental procedure was robust and if it was likely to produce an effect. It is recognised that future studies would need to recruit larger samples. Whilst power was calculated for a T test, MANOVAs were used in the later analysis. The measures used to estimate parameters were similar to those used in this study; reliability and validity has been found to vary very little between measures of prosody. As several estimates of sample size were sought, ultimately the largest estimate was used, to recruit a greater number of participants.

3.1.2. Sample

A total of 55 participants were recruited, with data for 54 participants used in the final analyses, there being equal numbers of participants in both the clinical (PTSD) and control group, n=27. The control group and clinical group were matched for age and gender. The mean age of PTSD participants was 53 years; (mean 52.88, SD 9.9). Descriptive statistics for each group showing gender, age and background is presented below (Figure 6).

Figure 6. Descriptive statistics for the sample

	Gender – Females (%)	**Age range**	**Age – Mean (SD)**	**Ethnicity – Caucasian (%)**	**Relationship status – Married (%)**
Control group	11 (41%)	21-65	52.92 (9.9)	27 (100%)	15 (56%)
PTSD Group	11 (41%)	22-65	52.88 (9.9)	24 (89%)	14 (52%)

All participants resided within the south Wales community; being recruited either from the National Centre for Mental Health (NCMH) PTSD registry or from Cardiff University's community panel.

3.1.3. Controls

The Cardiff University community panel is comprised of individuals interested in taking part in research studies, and is made up of 700 members (members *are not* students or staff at the University) paid for their time. These members specify the type of research in which they are interested in taking part. Researchers can only access members' details after they have satisfied the necessary University checks and gained ethical approval (Appendix 5).

3.1.4. Clinical group

The National Centre for Mental Health (NCMH) is currently collecting a range of phenotyped samples for mental health research from across Wales (Bisson et al, 2013). This collection includes data samples from conditions such as PTSD. Researchers in the field of PTSD aim to recruit 1,000 individuals to form a PTSD register and thereby help facilitate research in this area. The clinical group in this study were all individuals listed on this growing PTSD registry and thus have all agreed to take part in associated research projects, for further details regarding recruitment and the NCMH PTSD registry, please refer to Section 3.1.9 below.

3.1.5. Matching participants

The clinical and control groups were matched for age and gender; this was achieved by initially recruiting the clinical group. Once clinical group participants had been identified and tested, the researcher contacted the community panel administrator seeking potential participants who were of the same gender and born in the same year of within a five year range of that year (date of birth). A list of names were provided and participants were contacted from the list, starting with the first name on the list from the year of birth and working through the list until a participant had been sourced (had agreed to take part in the study). If someone from the same year of birth could not be sourced, then the same procedure was applied to the next closest year(s). This procedure was conducted until all clinical participants were matched with a control participant.

3.1.6. Inclusion criteria

Individuals were able to participate in the study if they met the following criteria:

- Aged 18 or above (with no upper age limit).
- Able to provide valid informed consent (see Section 3.3 below)

- Able to participate appropriately in the assessment process and have a sufficient command of English

- In addition individuals in the clinical group (PTSD sample) were required to have a diagnosis of PTSD and to be listed on the NCMH (PTSD) registry.

3.1.7. Exclusion criteria

Individuals were excluded from the study on the following criteria:

- If they were currently suffering with a substance misuse problem, or had previously suffered with a substance misuse problem (e.g. drugs, alcohol, or prescription medications).

- If they had suffered a head injury, or had been diagnosed with a neurological condition such as dementia, Parkinson's, epilepsy, etc.

- If they had a diagnosed learning disability.

- If they had vision related problems that could not be corrected by spectacles or contact lenses.

- If they had a hearing related problem that may cause difficulty hearing audio statements.

<u>The following additional criterion for exclusion was also applied to the control group:</u>

- If they were currently suffering from <u>any</u> mental health problem(s), or had a mental health diagnosis for which they were currently receiving ongoing support and/or medication.

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The following additional criterion for exclusion was applied to the clinical group:

- If they had received a mental health diagnosis which is not PTSD or connected to their PTSD, for which they were receiving ongoing support or medication. For example, Bipolar Disorder, Schizophrenia or Autistic Spectrum Disorders.

3.1.8. Rationale for exclusion criteria

The above exclusion criteria were based on the following rationale:

It was felt that impairments of sight and/or hearing that could not be corrected would impair an individual on the auditory and visual tasks.

Previous research has found that substance misuse, neurological conditions, learning disability, and other mental health conditions can impact an individual's abilities in the areas of social cognition. Therefore, these factors were excluded due to their confounding nature. It is felt that these conditions warrant separate investigation.

3.1.9. Participant Recruitment

The control group were recruited via Cardiff University's Community Panel. Individuals on the panel range between 18 and 90 years of age. Individuals in this study were matched by age and gender to the clinical group; those on the panel that matched the age/gender requisite were contacted via telephone (Appendix 6) to ascertain if they wished to learn more about the research. Interested parties were emailed (Appendix 7) or posted a participant information sheet outlining the study (Appendix 8). Follow up phone calls identified individuals who wished to proceed, and appointments were then made for the interested individuals to visit the University, where they could complete the questionnaires and prosody tests.

Individuals who had experienced trauma or a series of traumas were recruited from the NCMH (PTSD) registry. Individuals recruited from the NCMH registry were initially contacted by a member of their team, and were given a brief outline of the current study. Those individuals that expressed an interest in participating were asked for their consent to allow their contact details to be forwarded to the researcher. Following this individuals were then initially contacted by phone with further information about the study; those that expressed interest were then sent information via post or email (Appendix 9). The following week those who agreed to participate were invited to either Cardiff University or a local community mental health team (CMHT) to complete the same prosody assessments and questionnaires as the control group.

3.2. Procedure

The data was collected from December 2014 to March 2015. The data was collected at one of multiple sites: (1) the University's laboratories, (2) private clinical rooms at a local CMHT's premises. Participants completed the computer based tasks in the order detailed below (Measures section - 3.9), with the researcher taking them through each task in turn, providing instructions and answering any questions. The software programme that was used to present tasks, presented the tasks in a specific order. Items were randomised within the tasks, although the order task items were presented remained the same during presentations. Emotions were number coded differently on each task, this was highlighted to participants prior to them commencing task two, coding the emotions differently on tasks aimed to improve concentration and responses. Questionnaires were given to participants to complete in whichever order they preferred; questionnaires were presented to participants between the two tasks to reduce the effects of boredom.

Questionnaires relating to participants interpersonal relationships, their trauma symptomology and their background were completed in paper format, by either the participant or by the researcher under their direction. A total of five questionnaires were completed by all participants. The two computer based tasks required participants to respond using the number keys. Responses were recorded by the

media lab software programme that ran each computer based task and automatically transferred to a database (Excel spreadsheet). For more information about the measures used in this study, please refer to (Measures – section 3.9) below. Tasks took approximately one hour to complete, with participants being fully debriefed at the end of each session.

The remainder of the session took the form of enquiring how the participants found the tests and whether this had brought any changes to the way they were feeling. They were given the opportunity to ask any questions about the tests and then provided with a brief outline of what the research was investigating, along with an information sheet (Appendix 10). Participants who expressed an interest in finding out more about the study and its findings were added to a list so that further information could be emailed at a later date. They were informed about confidentiality and anonymity and that the researcher would need to keep their personal details to provide them with additional information, to which they consented. Participants were made aware of the numbers of supportive agencies they could contact, should they need to. The GPs for all participants in the clinical group were advised that they had taken part in the research (Appendix 11).

3.3. Consent and participants' rights

Individuals were informed of the study's aims, participant's role, right to withdraw, confidentiality, how their information would be used, the potential risks and benefits of participation, and payment through the participant information sheet (Appendix 8 & 9); thus obtaining consent via this process. Participants were then provided with this information verbally prior to testing commencing at their appointment, they were provided with opportunities to ask questions at every stage. Prior to written consent being obtained, participants were asked to verbally provide their understanding of the information that had been presented to them in writing and verbally by the researcher, to ensure that they were providing valid, informed consent.

A participant's ability to provide valid informed consent was assessed in line with the provisions laid out in the Mental Capacity Act (2005); the researcher ensured that she followed the provisions and obtained verbal and written consent prior to initiating any testing (Appendix 12 & 13).

3.4. Confidentiality

THE NHS and Cardiff University's code(s) of confidentiality were adhered to. The NHS code superseded the University's where there was any disparity. NHS patient's personal information was not screened by the researcher; potential participants were identified by the PTSD registry team and potential participants were initially contacted by this team.

All participants were provided with written and verbal information about confidentiality and its limits (Appendix 8 & 9). Participants were informed that their personal details would be destroyed once the data had been inputted for analysis. The anonymised data from this study was viewed by the research team, academic staff, and external markers involved in the study (consent for this was obtained in writing) (Appendix 12 & 13).

3.5. Data handling and storage

Once the NCMH (PTSD) registry team had obtained interested parties consent, their details were securely forwarded through an encrypted file and secure email to the researcher. Once the data was collected it was assigned a unique number denoting group. This was to ensure participants' confidentiality. Once the data was coded, any identifying information was destroyed and the unique identifier was used to organize the data. All the data was stored securely until this stage in line with NHS requirements.

The data will be kept for fifteen years in line with NHS and University requirements and will then be destroyed. During this time the data will be stored securely in the University's School of Psychology, remote personal storage area.

3.6. Payment

The clinical group *were not* paid for their time because these individuals had previously agreed to volunteer for health care research projects without payment. However travel expenses were provided at the standard NHS rate (car users), or payment of public transport expenses (bus fares or train fares).

The control group *were* paid for their time because Cardiff University's community panel is a paid panel, whereby participants agree to a set hourly rate. The panel also sets a travel expenses rate of £2.50 per person. An expense log was kept throughout the study. Those who received expense payments signed the log to ensure a written record was kept of all payments made.

3.7. Research sites

A number of research sites were utilised for the study. Sites were located throughout south Wales so as to reduce travelling time/effort for participants. Participants had the option of choosing which site they wished to attend. They primarily chose the site nearest their home. All sites provided access for individuals with disabilities and this was considered when inviting participants for testing.

The majority of testing took place in a laboratory at the School of Psychology, Cardiff University. However, local NHS Community Mental Health Teams (CMHT's) also provided room space for testing sessions. Members of the clinical group seemed to prefer this latter option as they were more familiar with these sites, which in turn seemed to improve their comfort during participation. Personal safety was ensured through following NHS protocols, for example the "Lone Working policy".

3.8. Ethical considerations

3.8.1. Ethical approval

Ethical approval for the control groups was obtained from Cardiff University School Research Ethics Committee (SREC). Ethical approval for the clinical group was granted by the NHS National Research Ethics Service (NRES) committee (Appendix 14) and Cardiff and Vale University Health Board Research and Development Office (R&D) (Appendix 15).

3.8.2. Participant well-being

Although participants were encouraged to attend their most local site – to reduce the effort, time and risk involved in travelling – they were free to choose whichever site they preferred. If a participant had any form of disability, steps were taken to ensure that the site chosen had adequate provision and access for their given condition. Participants, who asked for a third party to be present (e.g., were actively encouraged to bring a supportive person along with them to the testing site).

The measures used in this study asked questions concerning the participants' relationships and the quality and respondent's view of those relationships. Because the computer based tasks required participants to identify emotions, they could have potentially caused distress to some participants. Therefore a risk management plan was put in place. This procedure followed recommendations from the University's and SREC ethics panel and complied with NHS policies concerning vulnerable adults. Participants were reminded of the limits to confidentiality and that if anyone was at risk, then the researcher would need to inform their supervisor.

The participant information sheet contained details of the research team who are part of the Traumatic Stress Service. All the clinical groups' participants GP's were written to, advising them that the person had taken part in the research and outlining the research (Appendix 11). GP's were provided with the research teams contact details, so that if anyone were to present distress the research team could be

informed. Details of the research team were provided for participants, along with details of supportive agencies listed on the debrief information (Appendix 10). In addition, if a member of the clinical group required additional support the research team notified their respective general practitioner (GP). GP's were also notified if any concerns became apparent during a testing session, and if any referrals were made for participants requiring further support. All participants were debriefed at the end of a session and their welfare checked.

Risks around confidentiality, data handling, and storage are outlined in the (Confidentiality - section 3.4) above and (Data handling and storage - section 3.5) above.

3.8.3. Researcher well-being

To ensure the researcher's well-being the following risk management procedures were followed. A full risk assessment was devised for meeting participants at the University (Appendix 16). This was in accordance with the University's research health and safety policy. Appointments were made within working hours, and supervisory staff were in close proximity to the researcher during these appointments. The clinical group had previously been interviewed by the NCMH (PTSD) registry team; the majority of these participants were seen in NHS CMHT's. This procedure reduced any risk to the researcher due to the presence of other staff. Standard NHS procedures applied with regards to health and safety, and risk management for these sites.

Travelling was kept to a minimum throughout the study to reduce the risks involved to the researcher. Wherever possible, participant appointments were clustered, so as to maximise the number of people that could be seen at each site on a given day.

3.9. Measures

3.9.1. Trauma Screening Questionnaire (TSQ)

The TSQ (Appendix 19) is an empirically validated 10 item symptom screen for all types of traumatic stress. The instrument consists of five items covering re-experiencing, and five items covering arousal symptoms. The items allow a binary response ("Yes" or "No"). Respondents are asked to indicate whether they have experienced the items at least twice in the previous two weeks.

Symptoms of PTSD are felt to be present if the respondent endorses at least six re-experiencing or hyperarousal items in any combination (Brewin et al, 2002). This measure was found to have a sensitivity of 0.76 and specificity of 0.97, with an overall efficiency of 0.92 when using six items as a cut-off (Brewin, 2005). Those that screen "positive" (six items or more) should be assessed with a structured interview for PTSD. All PTSD participants had undergone a structured interview for PTSD to establish their diagnosis prior to their inclusion on the NCMH PTSD register.

3.9.2. The Facial Emotion Recognition Task (FER)

The Facial Emotion Recognition Task (FER) is a 194 item computer-based assessment. The FER uses the Ekman and Friesen (1975) pictures of universal facial affect to assess affective prosody. It asks respondents to rate how trustworthy they feel each face is. Six universal emotions (happiness, sadness, fear, anger, disgust and surprise) are portrayed in a series of images depicting male and female faces. Six faces (images of both genders) displaying neutral expressions of six emotions are used and are then morphed using their matching neutral expressions (0%) to display faces at percentage gradients (25%, 50%, 75%, 100%), making them harder to distinguish. Participants were asked to indicate from a list of possible responses which one best matched the face on the screen, as per standard procedure outlined by the tasks authors (Bowen et al, 2014). Participants' responses were then recorded and a percentage of correct recognition scores were produced for analysis.

Proceeding the test is a short practice test; both the practice and actual test have the same instructions and ask respondents to indicate which emotion they think is being portrayed. The six universal emotions are displayed on the screen next to a corresponding number. Participants were asked to press the number which best described the emotion of the face. For more information about the development of the FER please refer to, (Bowen et al, 2014). The FER has been used with young offenders and socially-economically matched controls to date (Bowen et al, 2014).

The FER was modified for use with this study's population. The original test is comprised of 192 items. Forty two items relating to how trustworthy a face is were removed, due to this factor not being under investigation in the present study, leaving 150 items. Due to the length of the test and its inclusion in a wider battery of tests, a further eight items were removed per emotion (48 items), along with two neutral presentations. This left a remaining 100 item assessment, with eight presentations per emotion (four emotional presentations per gender). The test had six emotion variables (six universal emotions), within each emotion variable there were four sensitivity levels (25%, 50%, 75% and 100%). The same number of items had to be removed from each emotion variable and each sensitivity level, so that each emotion variable was equal. As eight items were removed per emotion, this meant removing two items per sensitivity level. As items were presented by both genders, items removed had to ensure that equal presentations per gender were still achieved. Therefore, for each sensitivity level, one male and one female item were removed. Within the FER there were four actors, two male and two female. Therefore there needed to be equal presentations from each actor within an emotion variable, so two from each actor. Items were selected for removal based on these considerations, so that there were equal gender presentations, equal sensitivity presentations, each presentation from each actor etc. The removal of items occurred in a systematic way with item codes being specifically selected to ensure that the test was reduced in length but equal presentations of the variables were retained; items were put into an Excel spreadsheet and removed based on the criteria above. This left the test with 100 items; 16 items per emotion (eight per gender) and four neutral items.

Whilst reliability and validity data does not exist for the FER as a test, the items contained with the FER are well validated and reliable; Ekman and Friesen (1975) pictures of universal facial affect have been included in the majority of facial emotional recognition tests. Wilhelm et al (2014) in his review of emotional recognition measures discusses how the psychometric coefficients improve with increasing task items; whilst items were removed to reduce the number of items in the FER, the task still had a large number of items, which should have improved its psychometric properties. The meta-analysis found that *"accuracy and reaction time measures for emotion-general scores showed acceptable and high estimates of internal consistency and factor reliability. Emotion-specific scores yielded lower reliabilities, yet high enough to encourage further studies with such measures. Analyses of task difficulty revealed that all tasks are suitable for measuring emotion perception and emotion recognition related abilities in normal populations"*. As the review indicates that the majority of tasks available are suitable for measuring emotional recognition and the FER had a large number of items, improving its psychometric properties, it was deemed an appropriate measure for the research. Whilst a large number of items ask respondents to look at faces displaying the six universal emotions and make a forced choice, the FER goes further by adding in the sensitivity levels, to look at recognition rates at different emotion intensities. Wilhelm et al (2014) reported higher mean accuracy rates for five out of six emotions when comparing sensitivity levels to standard facial expressions.

3.9.3. Demographic Questionnaire

A short demographic questionnaire was compiled to collect information pertaining to the participant's ages, relationship status, vocational status, well-being, and education (Appendix 20). The questionnaire was a shorter version of the one used by the NCHM (PTSD) registry. However, information not relevant to the present study was removed, and some questions were re-worded to improve anonymity - this included amendments to information concerning postal codes and employment.

3.9.4. Multi-Dimensional Scale of Perceived Social Support

The Multidimensional Scale for Perceived Social Support (Appendix 21) is a widely used12-item Likert scale, measuring the subjective assessment of adequacy for social support from family members, friends, and partners. This measure asks respondents to indicate on a seven point scale from 1 (very strongly disagree) to 7 (very strongly agree) on how they feel about each of the 12-items. These items include statements such as "I have a special person who is a real source of support to me" and "My family really tries to help me".

The internal reliability of the entire scale is r =.88, test-retest reliability is r =.85 after two to three months. The scale has been shown to have strong factorial validity yet moderate construct validity (Zimet et al, 1988; 1990).

3.9.5. Inventory of Interpersonal Problems (IIP-32)

The IIP -32 is a short 32 -item version of the Inventory of Interpersonal Problems (IIP) (Appendix 22), which consists of 127 items. The IIP-32 can be rated in terms of an overall score and/or in terms of 8 subscales: *domineering/controlling; vindictive/self-centred; cold/distant; socially inhibited; non-assertive; overly accommodating; self-sacrificing* and *intrusive/needy*. The IIP-32 enables respondents to indicate the types of interpersonal problems they have encountered across a range of situations. Respondents are asked to read the statements and indicate whether they feel that the problem has affected them in relation to any significant person in their life. Responses are on a four point scale ranging from zero (not at all) through to three (extremely). Examples of statements include, "It is hard for me to be firm when I need to be" and "I tell personal things to other people too much".

The IIP-32 has been found to have high reliability (r =.86), and confirmatory analysis of the new instrument replicated the IIP-32 structure well (Barkham et al, 1996).

3.9.6. Experiences in Close Relationship Scale-Short Form (ECR-S)

The Experiences in Close Relationship Scale and the Experiences in Close Relationship Scale-Revised are both well validated and widely used measures of attachment, with two subscales: *attachment avoidance* and *attachment anxiety*. The Experiences in Close Relationship Scale-Short Form (ECR-S) (Appendix 23) is a 12 item short form, which includes items from these two original scales. The ECR-S asks respondents to respond to items considering how they *"generally experience relationships, not just what is happening in a current relationship"*. The authors of the questionnaire comment that *"the scale is designed to assess a general pattern of adult attachment as independently as possible from idiosyncratic influences of respondents' current circumstances. These instructions also allow respondents who are not currently in a close romantic relationship to provide valid responses"*; therefore it was considered fit for use with single participants.

Respondents are asked to indicate how strongly they agree or disagree to a series of statements on a seven point scale, from one (strongly disagree) through to seven (strongly agree). Examples of statements include "I want to get close to my partner, but I keep pulling back", and "I need a lot of assurance that I am loved by my partner". The ECR-S is seen as reliable, with a test-retest reliability of r=.80 at a one month interval and good construct validity (Wei et al, 2007). It has also been validated in a series of studies, and is considered to have equivalent psychometric properties to the ECR.

3.9.7. Affective prosody measure

An affective prosody assessment was specifically developed for this study. Whilst other assessments (Aprosodia Battery, Florida Affect Battery-Revised) exist to capture data for prosodic recognition, these were not felt to be culturally valid (and thus contextually) invalid for the current sample – mainly because the actors' accents used in previous assessments do not match those of the locale of this study. Consequently, the following assessment was devised to improve ecological validity.

3.10. A Measure of Affective Prosody

3.10.1. Measures aims

Previous affective prosody assessments such as the Aprosodia Battery (Ross, Thompson & Yenkosky, 1997), Bell-Lysaker Emotion Reognition Test (BLERT) (Bell, Bryson & Lysaker, 1997), and Florida Affect Battery-Revised (Bowers, Blonder & Heilman, 1999) measure a person's ability to identify emotional expression in speech. The current measure also seeks to measure affective prosody in a person's voice when portraying one of the six universal emotions: happiness, sadness, anger, fear, surprise, disgust. It also seeks to measure neutral voice. These emotions have been used extensively in research on emotion, and are seen as universal to human beings (Ekman & Keltner, 1970). A meta-analysis also found them to be cross-culturally recognised through images, albeit with improved in-group recognition (Elfenbein & Ambady, 2002). These emotions are recognised through speech in a variety of cultures, again with recognition rates improving within culture (Thompson & Balkwill, 2006; Bryant & Barrett, 2008; Riviello & Esposito, 2012). The measure designed here is aimed to be a more culturally valid measure of emotional recognition in the population under investigation. To achieve this, it uses actors with Welsh/UK accents, as recognition of vocal prosody is seen as being enhanced within cultures (Thompson & Balkwill, 2006; Riviello & Esposito, 2012).

As the development of this measure sought to create a measure of affective (auditory) prosody that replicated those in existence, but was a culturally valid measure to use with the current population, it followed a similar procedure to previous measures. The measures discussed above used the Ekman universal emotions, of combinations of them (for example five of them), presenting spoken clips of neutral sentences, with the actor inferring the emotion through the tone of their voice. Measure use either three or four presentations of each emotion, generally leading to approximately 20 presentations, where the participants is provided with the number of emotion options and asked to indicate which emotion is being portrayed by the actor(Bell, Bryson & Lysaker, 1997; Bowers, Blonder & Heilman, 1999; Ross, Thompson & Yenkosky, 1997) . Many of these tests also measure reaction time. These measures use both male and female actors, to limit the risk of an interaction between the

respondents and the stimuli. The measure developed for this present study sought to replicate these procedures, using both male and female actors, having a minimum of three presentations of each emotion, using a neutral sentence so that the only emotion conveyed is via the tone of voice. This measure differed from previous measures marginally, as it presented three presentations per gender, per emotion; this was felt to be warranted as one presentation per gender could be a guess, whereas a number of presentations enables further data for examination.

3.10.2.Measures development - Neutral statements

Statements that were deemed to be neutral were used in the development of the measure to reduce the likelihood that participants would be cued to a specific emotion via the lexical content of the statement. The measure was designed to separate the phonetic from affective prosody components, in line with previous studies in this area such as (Wildgruber et al, 2005).

Previous studies have aimed to produce statements that separate the lexical content and prosody by producing a set of validated statements representing the six universal emotions and neutral (Russ et al, 2008; Ben-David et al, 2011). As validated neutral statements already existed that were designed specifically for use in prosody research (Appendix 24), examples of neutral statements designed by the previous research were used in this study.

The following statements were used in the measures development:

"His glasses are on the table", (Ben-David et al, 2011)

"The aeroplane is almost full", (Russ et al, 2008).

Two statements were initially used so that the reliability for each emotion in both statements could be compared. This improved the chance of gaining good reliability for all six emotions in a male and female voice for a statement.

3.10.3.Item development

A total of five actors were used in developing the measures test; two males and three females. Three of the actors were either currently enrolled in, or had recently completed, a degree in performing arts. The other two actors were employed as drama therapists in the health service. Both genders were represented as there remains some debate over whether gender differences exist for prosodic recognition. Schirmer et al (2005), for example, discuss how females use additional processing resources when a voice is conveying emotion, despite both genders detecting a change in voice. Similarly, Besson et al (2002) found that men are slower to process prosody, although they are still sensitive to changes in it.

Each actor was asked to produce between three and five examples of each emotion in two separate statements. Only one statement would be used in the finished measure. This would be the statement with the highest inter-rater reliability for all six emotions and neutral voice. The actors either recorded the statements in a sound lab at Cardiff University using the software programme Audacity® Version 2.0.5 (Audacity, 2013), or on a voice recorder app on a smart phone. All of the resulting sound files were transferred into Audacity. However, the data from one of the male actors was lost due to technical problems in transferring the data from the sound lab to Audacity.

Initially, items were filtered by the researcher and a colleague specializing in linguistics, who was recruited to assist with this process. This method was an initial attempt to categorise the statements into one of the seven categories (emotions and neutral voice). However, for the first two female actors the researcher did not feel there were clear examples of each of the seven categories for either statement. To combat this, two further actors were recruited: one male and one female, and further

recordings were made. Following this, both the researcher and the other party recruited to assist with inter-rater reliability were able to agree on suitable exemplars that represented six emotions and neutral voice for both male and female actors. These items were then selected for piloting.

3.10.4.Piloting

Items were piloted on ten individuals. Items that were not recognisable as the target emotion were discarded and replaced with a further example. Following this, actors were asked to record further examples of fear, happiness, and surprise. Once agreement had been reached for all items for both statements, two further individuals were asked to rate the items on a scale of 1-10 (10= sounds most like the emotion), and to state which emotion they felt it most sounded like. At this stage there was more than one example of each emotion. Therefore, from this selection, items were selected that had reliability of .8 or above. This resulted in the following statement that had high reliability for all emotions for both a male and female voice: "His glasses are on the table".

The resulting fourteen items (male and female actors reading this statement in six emotions plus a neutral voice) were randomised, and a further 10 people piloted these items. The reliability of each item is listed below.

Figure 7. Reliability for each emotion, when reading "His glasses are on the table"

	Anger	Disgust	Happiness	Sadness	Surprise	Fear	Neutral
"Glasses" Male	.8	.8	.9	1	.8	.8	.9
"Glasses" Female	.9	.9	1	.9	.9	.9	.8

The measure was judged to have face validity, as it was felt to be a measure of a person's ability to identify emotions in voice clips. Further development of this measure might involve testing concurrent validity through administering this measure along with another measure of affective prosody, or more generally, to use the appropriate range of methods to establish its full psychometric properties.

3.10.5.Measure

As shown above, all items had were reliable at r = .8 and above, and thus were deemed suitable for inclusion in the measure. In total, then, the measure contained 42 items; six repetitions of the statement in each of the six emotions and the neutral voice (6 x 7); three repetitions for the male and three for the female actor. It was felt three responses for each gender would enable any variability in responses without the test being overly lengthy. Items were randomised using the random function in excel, giving the final order for the measure.

Media lab (2012 Version) software (Jarvis, 2012) was used to build the experiment, due to the FER also using this package. The decision to use this software was based on the simplicity for the user, and the need to combine both measures into a finished experiment. Replicating the methods used in the FER, this measure also included a practice session of seven items, one example of each of the six emotions and a neutral voice example. The practice test included the following instructions for participants:

"In this computer task you will hear male and female actors speaking a series of statements. Your task is to correctly identify their emotion. You will be given seven options to choose from".

The seven options were listed on the screen for each item in the same order at each presentation. Each item had a corresponding number that participants were required to press on the computer to indicate their response. The instructions for the practice test and the final assessment were identical, as were the corresponding numbers for

each emotion. The embedded audio files played each time a response for the previous item was given. No time limits applied and audio statements were played only once. The responses for each item were recorded via media lab and the data automatically recorded in an Excel spreadsheet for later analysis.

3.11. Statistical Analysis

The data was initially captured in an Excel spreadsheet for the computer based tasks. The data underwent a number of initial procedures and checks using descriptive statistics to ensure that the data were encoded correctly and entered accurately. The data was then transferred to, and further analysed using the Statistical Package for Social Sciences Version 20 (IBM, 2011; IBM, 2011). Demographic information was also analysed using descriptive statistics such as Independent T Tests and Chi Square to establish if differences or associations existed between the clinical and control groups. The data was initially examined to establish if it met the assumptions for subsequent parametric analyses. Despite a number of violations to the assumptions being found during this process, the literature suggested that subsequent analyses such as multivariate analysis of variance (MANOVA) were suitable and robust against certain violations; MANOVA's were therefore deemed appropriate for analysing the emotional recognition data. A between subjects MANOVA was used in the analysis, despite participants being matched in pairs; this was due to participants only being matched on demographic variables, for example gender and age. (Rather than on variables which might for instance have indexed their exposure to trauma).

A number of hypotheses sought to establish if associations existed between recognition accuracy and the interpersonal relationship questionnaire data; therefore Pearson's correlations were employed, as the data was continuous and parametric. A mediation model was also run to test if emotional recognition mediated the relationship between trauma and interpersonal relationship difficulties.

Chapter 4
Results

4. Introduction

This chapter will report on the outcomes of descriptive and interential statistical analyses which were employed to examine each of the hypotheses and on how the assumptions underpinning choice of statistical methods have been explored prior to those being undertaken. The results will be presented in relation to the individual hypotheses, detailing the specific analyses undertaken and concluding with whether the hypotheses were supported.

As discussed in chapter 3, section 3.1.1, power was set to 0.95 and alpha=0.05, this was based on a sample size calculation of n=25. Power was calculated using G*Power Version 3.1.9.2 (Faul, 2007). Sufficient numbers were recruited to both groups in this study, with the final sample sizes for each group being n=27.

4.1.Data Exclusion

The data was obtained for 28 PTSD participants and 27 control participants. The data for one of the PTSD group was excluded from the final analyses. This participant's data was chosen for exclusion as the software programme only recorded part of the emotional recognition task data, therefore the data was incomplete. The groups were matched for age and gender, as discussed in the method (Section 3).

4.2. Data Analyses

The data was analysed using SPSS Version 20 (IBM Corp, 2011) and Microsoft Office Excel 2007 (IBM Corp, 2011).

4.3. Preliminary Analysis

The following variables were assessed for bias and to ascertain if they met the assumptions for parametric statistics; the auditory emotional recognition task, the facial emotional recognition task, the Experiences in Close Relationships-Short Form questionnaire, the Inventory of Interpersonal Problems-Short Form (IIP-32) questionnaire and the Multi-Dimensional Scale of Social Support (MSPSS) questionnaire.

4.4. Outlier check

Oultiers are described as data points that deviate from the rest of the data set and affect the mean of the scores. Outliers can bias a parameter estimate and exert a greater influence on the error associated with that estimate (Field, 2013). The interpersonal relationship questionnaires were checked for outliers, by visually inspecting the raw data and by visually inspecting box plots, no outliers were found on the overall scales of the three questionnaires. For the emotional recognition tasks, outliers were not changed, as they were a reflection of a participant's accuracy on each task. As the purpose of the study was to identify differences between the clinical and control group's accuracy on emotional recognition tasks, transforming outliers was felt to alter the true relationship between the two groups. For the auditory task, participants could obtain a score between 0-6 on each variable (emotion); for the facial task, participants could obtain a score between 0-16 for six emotion variables and 0-4 for the variable of neutral.

4.5. Missing Data and its management

As discussed in section 4.1 above, upon inspecting the data for all participants it became apparent that the computer software for the emotional recognition tasks had not recorded information for a PTSD participant. Due to this, that participants data was excluded from the analyses. No other issues with missing data were found.

4.6. Assumptions

Field (2013) argues that certain assumptions must be met in order to use parametric tests; there are four main assumptions that this author argues need to be met, to ensure that the results from the statistical test chosen can be deemed accurate. Hoekstra et al (2012) when reviewing the evidence around researchers testing assumptions highlights that not checking that assumptions are met increases the chance of Type I and Type II errors. Although the authors comment that either assumptions should be met or it should be proven that a test is "*robust against a violation of assumption, that the assumption is not violated too extremely"*. The four assumptions relevant to parametric tests are described below. Olson (1974) argues that a Pillai's Trace is the most robust MANOVA test, even when certain assumptions have been violated, with it having *"adequate power to detect true differences in a variety of situations"*. Finch (2005) also comments that Pillai's Trace should be reported if there are violations to assumptions; also commenting that parametric tests often outperform non-parametric tests, despite assumptions being violated.

4.7. Normality

Normality can be assumed if the pattern of the data is normally distributed and fits the normal curve; this is important in hypothesis testing (Field, 2013). The dependent variables were screened for normality using histograms and P-P plots. Skewness and kurtosis values were also calculated, along with computing a Shapiro-Wilks test.

Upon inspecting the results from Shapiro-Wilks, three out of seven variables on the facial emotional recognition task were normally distributed (sadness, fear and anger). None of the seven variables for the auditory emotional recognition task met the assumption of normality.

For the interpersonal relationship questionnaire data, the Experiences in Close Relationship-Short Form (ECR-S) overall scale was normally distributed when inspecting Shapiro-Wilks, (p=.341). The Inventory of Interpersonal Problems-Short

Version (IIP-32) overall scale was normally distributed (p=.442), whereas the Multi-Dimensional Scale of Perceived Social Support's (MSPSS) was not normally distributed (p<.000).

4.8. Homogeneity of Variance

In designs involving several groups, as is the case in this study, homogeneity of variance means that each of the samples comes from a population with equal variances (Field, 2009). Homogeneity of variance was assessed by running a Levene's test in SPSS. To accept the null hypothesis that there are no differences in the variances between groups, the results need to be non-significant p>.05. The results from Levene's test are listed below.

Equality of variance was found for the interpersonal relationship questionnaires overall scales.

Table 2. Homogeneity of variance for the interpersonal relationship questionnaires

Interpersonal Relationship Questionnaire	Levene statistic	Outcome
ECR-S	F (1, 52) = .548	*p = .462*
IIP-32	F (1, 52) = .020	*p = .888*
MSPSS	F (1, 52) = .009	*p = .924*

*Significant at the *(p<0.5) level*

There were equal variances for five out of the seven variables on the auditory task; happiness and sadness had unequal variance.

Table 3. Homogeneity of variance for the auditory emotional recognition task variables

Emotion	Levene statistic	Outcome
Anger	F (1, 52) = .674	p=.415
Fear	F (1, 52) = .002	p=.968
Happiness	F (1, 52) = 6.44	p<.014*
Sadness	F (1, 52) = 5.19	p<.027*
Disgust	F (1, 52) = .287	p=.594
Surprise	F (1, 52) = 1.12	p=.294
Neutral	F (1, 52) = 2.44	p=.124

*Significant at the *(p<0.05) level*

For the accuracy data on the facial emotional recognition task, six out of the seven variables had equality of variance; only anger had unequal variance.

Table 4. Homogeneity of variance for the facial emotional recognition task variables

Emotion	Levene statistic	Outcome
Anger	F (1, 52) = 4.299	*p < .043**
Fear	F (1, 52) = 1.088	*p = .302*
Happiness	F (1, 52) = 1.742	*p = .193*
Sadness	F (1, 52) = .318	*p = .575*
Disgust	F (1, 52) = 1.337	*p = .253*
Surprise	F (1, 52) = 2.797	*p = .100*
Neutral	F (1, 52) = 2.659	*p = .109*

*Significant at the *(p<0.05) level*

4.9. Independence of the Data

Independence of the data is the assumption that any errors in the model are unrelated to each other. Independence of the data is required to accept the confidence intervals and the results from the significance tests (Field, 2013). In this study the data was independent, due to the data being collected from two separate independent groups, with the data being collected from each participant individually at one test session.

4.10. Descriptive Statistics

Fifty-five participants were recruited for this study, with 28 participants in the control group and 27 in the clinical (PTSD) group. As mentioned above, data was analysed for 54 participants. A table summarising the descriptive statistics for both groups can be seen below (Table 5). Descriptive statistics were performed to summarise the sample and to provide information on the clinical and control groups demographic information, for example age, gender, educational achievements and health status. Independent t tests were run to establish if differences existed between the clinical and control groups for the parametric data. Chi square analysis was used to determine if frequencies differed between groups for the categorical data.

4.11. Summary of findings

As participants were matched for age and gender, there were no significant differences between the groups. Despite best efforts to try to match both groups on education, significant differences remained on education, with the clinical group being less educated than the controls. There were no significant differences between the groups in terms of their ethnicity or relationship status. Significant differences existed between the groups for employment, with 85% of the clinical group not currently in employment, compared to 44% of the control group. The groups also had significant differences in terms of their health status, with 78% of the clinical group having physical health problems in the previous twelve months, compared to 26% of the control group and 81.5% of the clinical group reporting they were suffering with a long term health condition.

Table 5. Descriptive statistics for the demographic information for the PTSD group and control group using Chi squared (x2), t tests etc

	PTSD Participants	Healthy Controls	Test outcomes
Gender			
Male	16 (59%)	16 (59%)	*X^2=.000, p=1.000 ns*
Female	11 (41%)	11 (41%)	
Mean age, years (SD), range	52.88 (9.9) 22-65	52.92 (9.9) 21-65	*t=-.014, p=.989 ns*
Age group			
18-34	2 (7%)	2 (7%)	*X^2=.000, p=.001****
35-50	7 (26%)	7 (26%)	
51-65	18 (67%)	18 (67%)	
Level of Education			
Left <16	5 (18.5%)	0 (0%)	*X^2=21.090, p=.001****
GCSE	6 (22.2%)	0 (0%)	
A Level	5 (18.5%)	2 (7%)	
Diploma	5 (18.5%)	7 (26%)	
Undergrad degree	6 (22.2%)	11 (41%)	
Postgrad degrees	0 (0%)	7 (26%)	
Ethnicity			
Caucasian	24 (89%)	27 (100%)	*X^2=3.176, p=.075 ns*
Mixed race	3 (11%)	0%	
Asian	0%	0%	
Black	0%	0%	
Chinese	0%	0%	
Other	0%	0%	
Relationship status			
Single	5 (19%)	7 (25.9%)	*X^2=4.701, p=.453 ns*
Married	14 (52%)	15 (55.6%)	
Cohabitating	2 (7%)	1 (3.7%)	

Divorced	6 (22%)	2 (7.4%)	
Widowed	0 (0%)	1 (3.7%)	
Separated	0 (0%)	1 (3.7%)	
Employment			
Not employed	23 (85%)	12 (44%)	*X^2=9.826, p=.002***
Current employment	4 (15%)	15 (56%)	
Range, months employed	1-15	0-298	*t=-1.334, p=.197 ns*
Mean employment, months, (SD)	7.25 (5.9)	72.89 (96.6)	t=-1.334, *p=.197 ns*
Physical health problems (last 12 mths)			
None	6 (22%)	20 (74%)	*X^2=14.538, p=.000****
Yes	21 (78%)	7 (26%)	
Long term conditions			
None	5 (18.5%)	23 (85%)	*X^2=24.033, p=.000****
Yes	22 (81.5%)	4 (15%)	
Psychological treatment status			
Waiting list/None	3 (11%)	N/A	N/A
In treatment	4 (15%)		
Post treatment	20 (74)		

*Significant at the *(p<.05), **(p<.01), ***(p<.001) levels*

All participants completed a trauma screening questionnaire to ensure that the groups differed in their trauma status; as expected there were significant differences between the two groups, with the clinical group reporting significantly higher levels of trauma symptomology.

Table 6. Descriptive statistics for the Trauma Symptom Questionnaire (TSQ) data and psychological treatment status for the clinical and control groups

	PTSD Participants	Healthy Controls	Significant differences
TSQ (threshold)			
Below (0-5)	4 (15%)	26 (96%)	*X^2=36.300, p=.000***
Above (6-10)	23 (85%)	1 (4%)	
Range of TSQ scores	2-10	0-6	
Mean TSQ score (SD)	7.7 (2.4)	1.9 (1.6)	*t=10.401, p=.000****
Psychological treatment status			
Waiting list/None	3 (11%)	N/A	N/A
In treatment	4 (15%)		
Post treatment	20 (74)		

*Significant at the *(p<.05), **(p<.01), ***(p<.001) levels*

TSQ scores range from 0-10, with a score of 6 or above being considered as above the threshold for trauma symptomology (Brewin et al, 2002).

Significant differences were found between the trauma sample, when re-classifying them as either meeting the criteria for complex PTSD or the standard (simple) PTSD diagnosis. The complex group reported significantly more trauma symptomology than the simple PTSD group. There was not a significant difference between the groups for treatment status.

Table 7. Descriptive statistics for the simple and complex PTSD groups, the TSQ data and psychological treatment status

	Meets ICD-11 Complex PTSD criteria (Complex PTSD)	Does not meet ICD-11 Complex PTSD criteria (Simple PTSD)	Outcomes
Number of participants (%)	19 (70%)	8 (30%)	**N/A**
TSQ (threshold)			
Below (<6)	1 (5.3%)	3 (37.5%)	*X^2=4.636, p=.031**
Above (>6)	18 (94.7%)	5 (62.5%)	
Range of TSQ scores, mean score (SD)	3-10 8.0 (1.8)	2-10 6.88 (3.6)	*t=-.842, p=.423 ns*
Psychological treatment status			
Waiting list/None	1 (5.3%)	2 (25%)	*X^2=3.659, p=.160*
In treatment	4 (21%)	0	*ns*
Post treatment	14 (73.7%)	6 (75%)	

*Significant at the *(p<.05), **(p<.01), ***(p<.001) levels*

No significant differences were found between the simple and complex PTSD groups on the interpersonal relationship questionnaires.

Table 8. Descriptive statistics for the simple and complex PTSD groups on the interpersonal relationship measures

	Simple PTSD Group (N=8)			Complex PTSD Group (N=19)			Outcomes
	Mean	SD	Range	Mean	SD	Range	
ECR-S							
Overall	47.63	10.20	29-60	47.63	11.91	23-69	*t=-.001, p=.999*
Anxiety	22.63	5.37	18-34	23.00	6.88	8-40	*t=-.137, p=.892*
Avoidance	25.00	7.19	11-33	24.63	9.46	12-42	*t=.098, p=.922*
IIP-32							
Overall	2.08	.61	.84-2.72	1.87	.44	1.03-2.66	*t=.997, p=.328*
Assertive	11.63	2.50	6-14	9.11	5.44	0-19	*t=1.648, p=.112*
Sociable	10.38	4.14	3-15	11.47	4.26	1-16	*t=-.617, p=.543*
Supportive	6.75	4.77	1-13	3.95	2.86	0-10	*t=1.548, p=.155*
Caring	9.75	4.86	4-16	8.05	4.05	0-14	*t=.938, p=.357*
Dependent	4.38	4.50	0-12	5.16	2.85	0-11	*t=-.547, p=.589*
Aggressive	8.00	5.04	1-14	6.53	4.62	0-15	*t=.737, p=.468*
Involved	9.75	1.91	6-12	8.84	4.54	1-16	*t=.732, p=.471*
Open	5.63	2.39	2-10	4.11	4.59	0-12	*t=1.126, p=.272*
MDSSS							
Overall	1.38	.92	0-2	1.42	.61	0-2	*t=-.154, p=.878*
Significant	1.25	.89	0-2	1.68	.48	1-2	*t=-1.308, p=.224*
other	1.25	.89	0-2	1.05	.78	0-2	*t=.577, p=.569*
Family	1.12	.35	1-2	1.11	.81	0-2	*t=.088, p=.930*
Friends							

*Significant at the *(p<.05), **(p<.01), ***(p<.001) levels*

4.12. Summary of descriptive statistics

As detailed above the sample size has sufficient power, therefore in terms of probability any subsequent analysis will detect differences between the groups if they exist (Dorey, 2011). As can be seen from the descriptive statistics above, the samples were equally matched for gender, age, ethnicity and relationship status. Differences emerged, however, in terms of education, health status and employment; with employment potentially being affected by the clinical group's poorer health status. Whilst all of the assumptions for the data were not met, often there were only minor violations. When considering Levene's tests, all the interpersonal questionnaires met this assumption, along with 11 out of 14 of the emotional recognition variables for the two tasks. All the data was independent and variables were at the interval level. Whilst the assumption of normality was not met for any of the emotional recognition

variables for the auditory task, three of the variables for the facial task were normally distributed, two of these (fear and sadness) being variables of particular interest for the hypotheses in question. Whilst corrections could have been performed to obtain normality, as the scores on these tasks represented performance on emotional recognition tasks, the author did not wish to lose any data in subsequent analysis that corresponded to the differences between the groups. As often, participants in the clinical group performed with low levels of accuracy (scoring zero or near to zero), transforming the data would move it nearer the mean and increase the scores, thus reducing the differences found between groups. The assumption of homogeneity of variance was met for the variable neutral on both tasks, although neutral was not normally distributed for either task. Two of the interpersonal relationship questionnaires overall scales were normally distributed (ECR-S and MSPSS).

Due to sufficient power being achieved and a sufficient sample being recruited who were matched for age and gender, subsequent inferential statistics were conducted. As discussed earlier (Section 3.1.1) Hoekstra et al (2012) discuss that certain tests are more robust to violations of the parametric assumptions, for example ANOVAs and MANOVAs. As differences between the groups were being investigated in the majority of hypotheses, MANOVAs were used to perform subsequent analysis, as this test looks for differences between groups on several variables simultaneously. As each emotional recognition task contained seven variables of interest, MANOVA's were chosen to perform subsequent analyses. Olson (1975) and Field (2005) both discuss that when using MANOVA's, if assumptions are violated, the more conservative test Pillai's Trace should be reported; for the remainder of the analyses, Pillai's Trace was reported for this reason.

4.13. Multivariate analyses

The data was analysed using a series of MANOVAs due to this study having several dependent variables. MANOVA was also used to examine between subject variables and contrasts were run to establish the emergent differences where significant main effects or interactions were observed (Field, 2013). It is recommended that if there are violations to the assumptions of MANOVA that outliers are either dealt with or

more robust tests are reported, for example Pillai's Trace. As any errors in the data had been rectified, outliers inspected, assumptions explored and descriptive statistics applied, scores on the tasks and psychometric tests represented the participants' performance therefore, where necessary Pillai's Trace was used in the presence of violations of the assumptions in the MANOVA analyses to follow. Despite there being inequality of variance when inspecting Levene's test on certain analyses, the F test is robust against these violations, if sample sizes are equal (Field, 2013). Sample sizes were equal for all analyses relating to the control and clinical groups.

4.13.1.1. *Hypothesis 1a*

Hypothesis 1a: That the clinical group's accuracy rates on the emotional recognition tasks (auditory and facial) will be lower than the controls was supported.

A MANOVA was conducted to establish if differences existed between the two group's accuracy scores on the facial emotional recognition task. Groups (PTSD and control group) were entered into MANOVA along with the accuracy scores for each emotion variable from the facial recognition task. Levene's test was used to establish if the variances of the two groups differed significantly for each of the emotion variables, for full details of the Levene's test, please refer to the descriptive statistics section above. Pillai's Trace found significant difference between groups on the facial emotional recognition task, V=.464, F (7, 46) = 5.70, p=<.000. A MANOVA was also conducted on the auditory emotional recognition task which showed that there was a significant difference between the clinical and control groups for accuracy on the auditory emotional recognition task, V=.267, F (7, 46) = 2.39, p=.036 (Table 9) .

4.13.1.2. *Hypothesis 1b*

Hypothesis 1b: There will be significant difference between the accuracy rates of the clinical and control groups, for the emotions of fear and sadness, on the auditory emotional recognition task. To establish where the differences between groups existed, contrasts were applied to the earlier MANOVAs (Hypotheses 1a). The grouping variable (PTSD and clinical groups) were entered, with the seven auditory emotion variables (six emotions plus neutral) to perform the contrasts.

Simple contrasts were applied to the MANOVA; the results are detailed in Table 10. As shown, significant differences existed between the two groups for three out of the seven emotion variables. On average, the clinical group had lower accuracy scores than the control group on the following emotions; disgust, sadness and fear. This supports the hypothesis that there will be significant differences between the clinical and control groups for the emotions of fear and sadness on the auditory task. As Table 9 below shows, there is no significant difference between the groups for the variable neutral, this highlights that the two groups' performance is comparable on a "control" condition, and demonstrates that differences occur between the groups at the emotion level.

Table 9. Differences in accuracy rates between the clinical and control group on the auditory task

Emotions	Levene's test	Clinical group mean	Control group mean	95% confidence interval	Sig
Anger	p>.415	M=3.70	M=4.48	-1.76 - .20	F=2.55 p=.116 ns
Fear	p>.968	M=1.52	M=2.81	-2.46 - -.14	F=5.02 p<.029*
Happiness	p<.014*	M=1.85	M=2.56	-1.68 - .27	F=2.09 p=.154 ns
Sadness	p<.027*	M=4.00	M=5.11	-2.16 - -.07	F=4.55 p<.038*
Disgust	p>.594	M=2.56	M=4.04	-2.33 – -.63	F=12.26 p<.001***
Surprise	p>.294	M=2.67	M=3.30	-1.38 - .12	F=2.85 p=.097 ns
Neutral	p>.124	M=4.63	M=5.19	-1.42 - .31	F=1.66 p=.203 ns

Levene's test is significant, homogeneity has been violated *p<.05, therefore results based on equal variances not assumed.
F test = p<.05*, p<.01**, p<.001***

4.13.1.3. *Hypothesis 1c*

Hypothesis 1c: That there will be significant differences between the accuracy rates of the clinical and control groups for the emotions of fear and sadness, on the facial emotional recognition task. To establish where the differences between groups existed, simple contrasts were conducted with the MANOVAs (Hypothesis 1a). The grouping variable (PTSD and clinical groups) were entered, with the seven facial emotion variables (six emotions plus neutral) to perform the contrasts.

Simple contrasts found that the accuracy rates were significantly lower for the clinical group when compared to the controls, for six of the seven emotion variables; the results are shown in Table 10. The hypothesis was supported, as the clinical group's accuracy rates were significantly lower than the control groups for the emotions of fear and sadness on the facial emotional recognition task.

Table 10. Differences in accuracy rates between the clinical and control group on the facial task

Emotions	Levene's test	Clinical group mean	Control group mean	95% confidence interval	Sig
Anger	P<.041*	M=6.67	M=9.26	-4.19 - -1.00	F=10.65 P<.002**
Fear	p>.294	M=4.93	M=8.22	-4.81 - -1.78	F=19.14 p<.000**
Happiness	P>.179	M=11.48	M=13.33	-3.03 - -.67	F=9.92 p<.003**
Sadness	P>.572	M=7.07	M=10.04	-4.65 - -1.28	F=12.41 p<.001***
Disgust	p>.206	M=9.81	M=11.41	-3.08 – -.11	F=4.63 p<.036*
Surprise	P<.022*	M=9.41	M=10.96	-2.63 - -.49	F=8.52 p<.005**
Neutral	p>.294	M=3.07	M=3.44	-.91 - .17	F=1.91 p=.173 ns

Levene's test is significant, homogeneity has been violated *p<.05, therefore results based on equal variances not assumed.
F test = p<.05*, p<.01**, p<.001***

4.13.1.4. *Hypothesis 1d*

Hypothesis 1d: That males with PTSD will have lower accuracy scores on the emotional recognition (auditory and facial) tasks than females with PTSD was not supported. There were no male-female group differences on either emotional recognition task.

A MANOVA was conducted to establish if differences occurred between the accuracy rates of males and females with PTSD on the auditory emotional recognition task. Variables entered into the MANOVA were the grouping variable of gender (male and female participants with PTSD), along with the accuracy scores on the seven emotion variables (six emotions plus neutral) from the auditory emotional recognition task. Pillai's Trace found no significant differences between the accuracy rates of males and females with PTSD, on the auditory emotional recognition task, V=.398, F (7, 19) = 1.80, p=.147.

A MANOVA was conducted to establish if differences existed between the accuracy rates of males and females with PTSD on the facial emotional recognition task. Variables entered into the MANOVA were the grouping variable of gender (male and female participants with PTSD), along with the accuracy scores on the seven emotion variables from the facial emotional recognition task. Pillai's Trace found no significant difference between the accuracy rates of males and females with PTSD on the facial emotional recognition task, V=.124, F (7, 19) = .384, p=.900.

4.13.1.5. *Hypothesis 1e*

Hypothesis 1e: Clinical group participants who have been exposed to prolonged trauma (since childhood) will have lower accuracy scores on the emotional recognition tasks, than participants who have developed PTSD due to adult trauma(s). This hypothesis was partially supported; there were no significant differences in the accuracy rates between the trauma groups on the facial task, but there were significant differences between the groups on the auditory task.

One way between groups MANOVAs were performed to establish if differences existed in accuracy rates between the two trauma groups (simple and complex PTSD) on the emotional recognition tasks. The grouping variable (simple and complex

PTSD participants) was entered into the MANOVAs along with the accuracy scores for the seven emotion variables (six emotions plus neutral); these were added for both the auditory and facial emotional recognition tasks. Pillai's Trace found that there were no significant differences between the accuracy rates for the trauma groups on the facial task, V=.301, F (7, 19) = 1.17, p=.364; there were however significant differences between the accuracy rates for the trauma groups on the auditory task, V=.514, F (7, 19) = 2.87, p=.032.

4.13.1.6. *Hypothesis 1f*

Hypothesis 1f: That participants with PTSD who have been exposed to prolonged trauma (since childhood) will have lower accuracy scores than those with PTSD who have been exposed to adulthood traumas, for the emotions of fear and sadness on both emotional recognition tasks. This hypothesis was not supported, as differences found between the groups on the auditory task were not related to the emotions of fear or sadness.

Simple contrasts were run with the MANOVAs (Hypothesis 1e) to establish where the differences existed between the trauma groups on the auditory task. The grouping variable (simple and complex PTSD participants) was entered into the MANOVA, along with the accuracy scores from the seven emotion variables (six emotions plus neutral) from the auditory recognition task. The hypothesis that differences would exist between the two groups for the emotions of fear and sadness was not supported. Table 11 shows a significant difference was found between the groups for the emotion of happiness. Contrasts were not run on the facial task, as no group differences were found in the earlier hypothesis 1e.

Table 11. Differences in accuracy rates between the simple and complex PTSD groups on the auditory task

Emotions	Levene's test	group mean	Control group mean	95% confidence interval	Sig
Anger	P<.047*	M=3.75	M=3.68	-1.34 – 1.47	F=.009 p=.924 ns
Fear	p>.895	M=1.50	M=1.53	-1.87 – 1.82	F=.001 p=.977 ns
Happiness	P>.522	M=1.00	M=2.21	-2.40 - -.02	F=4.37 p<.047*
Sadness	p>.844	M=3.63	M=4.16	-2.49 – 1.42	F=.316 p=.579 ns
Disgust	p>.548	M=2.75	M=2.47	-1.14 – 1.96	F=.162 p=.691 ns
Surprise	p>.158	M=3.25	M=2.42	-.298 – 1.96	F=2.30 p=.142 ns
Neutral	p<.042*	M=3.88	M=4.95	-2.54 - .40	F=2.25 p=.146 ns

Levene's test is significant, homogeneity has been violated *p<.05, therefore results based on equal variances not assumed.
F test = p<.05*, p<.01**, p<.001***

4.13.1.7. *Hypothesis 2a*

Hypothesis 2a: Participants with PTSD will report more difficulties in interpersonal relationships than controls. This hypothesis was supported, with significant differences found between the two groups on the interpersonal relationship questionnaires.

A one way between groups MANOVA was performed to look for differences between the two groups on the interpersonal relationship questionnaires. The grouping variable (PTSD and control participants) was entered into the MANOVA, along with the overall scores from the interpersonal relationship questionnaires (ECR-S, IIP-32, MSPSS) and their individual sub-scale scores. Pillai's Trace found significant group differences between the two groups overall scores on these measures, V=.513, F (3, 50) = 17.56, p<.000.

Simple contrasts were performed on the data to establish where differences existed between the clinical and control groups on the ECR-S questionnaire. The grouping variable (PTSD and clinical group participants) was entered to perform the contrasts, along with the overall ECR-S score and the two sub-scale scores (avoidance and anxiety sub-scale scores). When looking at the ECR-S data, there are significant differences between the overall scores on the measure between the two groups, with the clinical group reporting significantly more problems in close relationships (as indicated by their higher scores) than the control group. No significant differences were found between the two groups on the anxiety sub-scale, with both groups reporting a similar amount of anxiety experienced in close relationships. Significant differences were found between the two groups on the avoidance sub-scale, with the clinical group reporting greater avoidance in close relationships than the controls (indicated by higher scores).

Participants could obtain scores in the range of 12-84 for the overall scale on the ECR-S and 4-28 for the three sub-scales. They were able to obtain scores of 0-128 on the IIP-32, with individual sub-scale scores of 0-16, for the eight sub-scales.

Table 12. Differences between the clinical and control group on the Experiences in Close Relationships-Short Form questionnaire

Measure	Levene's test	Clinical group mean	Control group mean	95% confidence interval	Sig
ECR-S					
Overall	p>.462	M=47.63 (11.23) (23-69)	M=35.93 (12.16) (12-56)	5.31 – 18.10	F=13.49, p<.001***
Anxiety	p>.505	M=22.89 (6.37) (8-40	M=19.52 (7.00) (6-32)	-.29 – 7.03	F=3.42, p>.070
Avoidance	p>.481	M=24.74 (8.72) (11-42)	M=16.41 (7.72) (6-33)	3.84 – 12.83	F=13.83, p<.000***

Levene's test is significant, homogeneity has been violated *p<.05, therefore results based on equal variances not assumed.
F test = p<.05*, p<.01**, p<.001***

The grouping variable (PTSD and clinical group participants) was entered to perform the contrasts, along with the overall IIP-32 scores and the eight individual sub-scale scores. Simple contrasts performed on the IIP-32 data found the following; there were significant differences between the two groups for the overall scale and the majority of sub-scales. No significant differences were found between the two groups on the Openness sub-scale. When comparing the mean scores to normative scores from the general population data of the IIP-32, the clinical group reported significantly higher scores on all scales. Higher scores are more in keeping with means from a patient population (Barkham et al, 1996). The clinical group in this study reported significantly more interpersonal difficulties (higher mean scores) than the normative patient group sample on the IIP-32. The clinical group also endorsed lower scores than the control group on the openness sub-scale. When looking at the IIP-32 norms, the patient population norms indicate that the patient group report less openness than the normative group. This accords with findings from the current study. The overall and sub-scales of the IIP-32 divided by the number of items summed, for the overall scale this is 32, for each sub-scale this is 4. This leaves the overall range for the IIP-32 as 0-4, and 0-4 for the range of each sub-scale.

Table 13. Differences between the clinical and control groups on the Inventory of Interpersonal Problems Questionnaire

Measure IIP-32	Levene's test	Clinical group mean (SD) (range)	Control group mean (SD) (range)	IIP-32 general population mean (SD)	IIP-32 patient population mean (SD)	95% confidence interval	Sig
Overall	p>.888	M=1.93 (.50) (.84-2.72)	M=.98 (.49) (.31-2.16)	M=.98 (.52)	M=1.51 (.68)	.68 – 1.22	F=50.45, p<.000***
Assertiveness	p<.021*	M=2.46 (4.85) (0-19)	M=1.21 (3.54) (0-15)	M=1.12 (.89)	M=1.87 (1.18)	.67- 1.83	F=18.73, p<.000***
Sociable	p>.684	M=2.79 (4.18) (1-16)	M=.96 (3.93) (0-14)	M=1.02 (.83)	M=1.65 (1.29)	1.27 – 2.38	F=43.72, p<.000***
Supportive	p>.113	M=1.19 (3.67) (0-13)	M=.58 (2.84) (0-12)	M=0.65 (.60)	M=0.96 (.95)	.16 – 1.06	F=7.48, p<.009**
Caring	p<.002*	M=2.14 (4.28) (0-16)	M=1.04 (2.46) (0-10)	M=1.25 (.90)	M=1.72 (1.05)	.63 – 1.58	F=21.51, p<.000***
Dependent	p<.019*	M=1.23 (3.35) (0-12)	M=.81 (2.12) (0-8)	M=0.90 (.80)	M=1.60 (.98)	.03 – .80	F=4.77, p<.034*
Aggressive	p<.006*	M=1.74 (4.70) (0-15)	M=.68 (3.21) (0-12)	M=0.84 (.75)	M=1.49 (1.08)	.52 – 1.61	F=15.11, p<.000***
Involved	p>.050	M=2.28 (3.93) (1-16)	M=.62 (2.87) (0-11)	M=0.91 (.89)	M=1.37 (1.13)	1.19 – 2.13	F=50.14, p<.000***
Open	p<.032*	M=1.14 (4.08) (0-12)	M=1.61 (2.87) (1-11)	M=1.74 (.84)	M=1.45 (1.06)	-.95 - .01	F=3.87, p>.055

Levene's test is significant, homogeneity has been violated *p<.05, therefore results based on equal variances not assumed.
F test = p<.05*, p<.01**, p<.001***

The grouping variable (PTSD and clinical group participants) were entered in order to perform the contrasts, along with the overall MSPSS and three sub-scale scores.

No significant differences in the overall scores between the clinical and control groups on the Multi-dimensional scale of Perceived Social Support emerged when simple contrasts were applied. Both groups reported similar levels of perceived social support. A significant difference was found between the two groups on the friend's sub-scale, with the clinical group reporting that they perceived they had less support from friends than the control group. For the MSPSS, questions were scored from 1-7, so participants could obtain scores of 12-84 on the overall scale. For the two sub-scales, scores could range from 6-42.

Table 14. Differences between the clinical and control group on the Multi-dimensional Scale of Perceived Social Support

Measure	Levene's test	Clinical group mean (SD)	Control group mean (SD)	95% confidence interval	Sig
MSPSS					
Overall	p>.675	M=54.22 (16.49)	M=62.67 (16.82)	-.49 - .27	F=3.469, p>.068 ns
Significant other	p>.596	M=21.96 (5.96)	M=22.56 (6.44)	-.39 - .31	F=.123, p>.727 ns
Family	p>.961	M=16.85 (7.63)	M=19.67 (7.66)	-.77 - .10	F=1.830, p>.182 ns
Friends	p>.961	M=15.70 (7.25)	M=20.04 (6.56)	-.77 - -.04	F=5.305, p<.025*

Levene's test is significant, homogeneity has been violated *p<.05, therefore results based on equal variances not assumed.
F test = p<.05*, p<.01**, p<.001***

4.13.1.8. *Hypothesis 2b*

Hypothesis 2b: Participants with PTSD related to childhood trauma will report more difficulties in interpersonal relationships than those who were exposed to trauma in adulthood. A one way between groups MANOVA was performed to test for differences between the childhood and adult trauma groups; no significant

differences were found between the two groups on the overall scores of the relationship questionnaires. Variables entered into the MANOVA were the grouping variable (simple and complex PTSD participants), along with the overall scores from the three interpersonal relationship questionnaires (ECR-S, IIP-31, MSPSS). Pillai's Trace found no significant differences between the childhood and adult trauma groups, V=.040, F (3, 23) = .319, p>.812.

4.13.1.9. *Hypothesis 2c*

Hypothesis 2c: There will be an association between difficulties in interpersonal relationships and accuracy scores on the emotional recognition tasks for the PTSD group (n=27), such that, lower accuracy will be associated with greater levels of interpersonal relationship difficulty. This hypothesis was partially supported; an association was found between the MSPSS and three variables on the facial recognition task, an association was also found between one variable on the auditory task and the ECR-S. When looking at total accuracy scores on the two tasks, an association was found between the total accuracy score on the facial task and the MSPSS.

A Pearson's correlation found a significant correlation between the MSPSS and the overall facial emotional recognition accuracy score (scores for all emotion variables combined). Table 15 shows this correlation was significant at the p<.01 level and by inspecting the confidence interval, this is a positive correlation as the confidence interval remains above zero. No significant correlations were found between the other interpersonal relationship questionnaires (ECR-S and IIP-32) and the facial emotional recognition overall accuracy scores. No significant correlations were found between any of the three interpersonal relationship questionnaires (ECR-S, IIP-32 & MSPSS) and the overall total accuracy on the auditory emotional task.

Table 15. Pearson's correlations between interpersonal relationship questionnaires and overall accuracy scores for the emotional recognition tasks

Interpersonal relationship questionnaires	Facial task overall accuracy score (Correlation, confidence interval)	Auditory task overall accuracy score (Correlation, confidence interval)
ECR-S	.131 (-.683 - .309)	.304 (.069 - .576)
IIP-32	.029 (-.424 - .366)	-.146 (-.681 - .435)
MSPSS	.550** (.045 - .868)	-.203 (-.633 - .435)

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

When Pearson's correlations were performed on the interpersonal relationship questionnaires and the individual emotion variables accuracy scores, it is possible to see which emotions are associated with the relationship questionnaires. As shown in Table 16, the Multi-dimensional Scale of Perceived Social Support (MSPSS) is significantly correlated with two of the facial emotional recognition variables, at the 99% level of significance. The emotion of happiness is significantly correlated with the MSPSS at the p<.05 level of significance; fear was also correlated with the MSPSS at the p<.01 level of significance. When inspecting the confidence intervals, it is apparent that happiness is a positive correlation, as the confidence interval does not go below zero. Therefore, this tells us that the greater the accuracy scores on the auditory task variable of happiness, the more perceived social support (reported on the MSPSS). Due to the confidence interval for fear being both above and below zero, we cannot definitively state the direction of the correlation in this instance.

Table 16. Pearson's correlations between the interpersonal relationship questionnaires and the facial task emotional variables

Facial task emotion variables	ECR-S	IIP-32	MSPSS
Anger	-.131 (-.552 – .359)	-.113 (-.524 - .386)	.341 (-.255 – .745)
Fear	-.209 (-.598 - .310)	-.278 (-.624 - .225)	.514** (-.023 - .832)
Sadness	-.282 (-.626 - .141)	.140 (-.454 - .749)	.288 (-.271 - .764)
Happiness	-.188 (-.560 - .195)	.118 (-.377 - .590)	.452* (.065 - .782)
Disgust	-.025 (-.630 - .484)	.055 (-.407 - .554)	.167 (-.316 - .632)
Surprise	-.050 (-.501 - .441)	.003 (-.299 - .336)	.311 (-.259 - .764)
Neutral	.316 (-.217 - .787)	.037 (-.416 - .547)	.008 (-.438 - .488)

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

The results from the Pearson's correlations found that one emotion variable from the auditory emotional recognition task was also correlated with the Experiences in Close Relationships-Short Form (ECR-S); sadness was significantly correlated with the ECR-S at the p<.05 level of significance; R^2 = .409 (.027 - .696), the confidence intervals indicate that this is a positive correlation. This highlights that higher scores on the auditory variable are associated with higher scores (more reported difficulties) on the ECR-S.

4.13.1.10. *Hypothesis 2d*

Hypothesis 2d: Emotional recognition performance will mediate the relationship between PTSD and difficulties in interpersonal relationships.

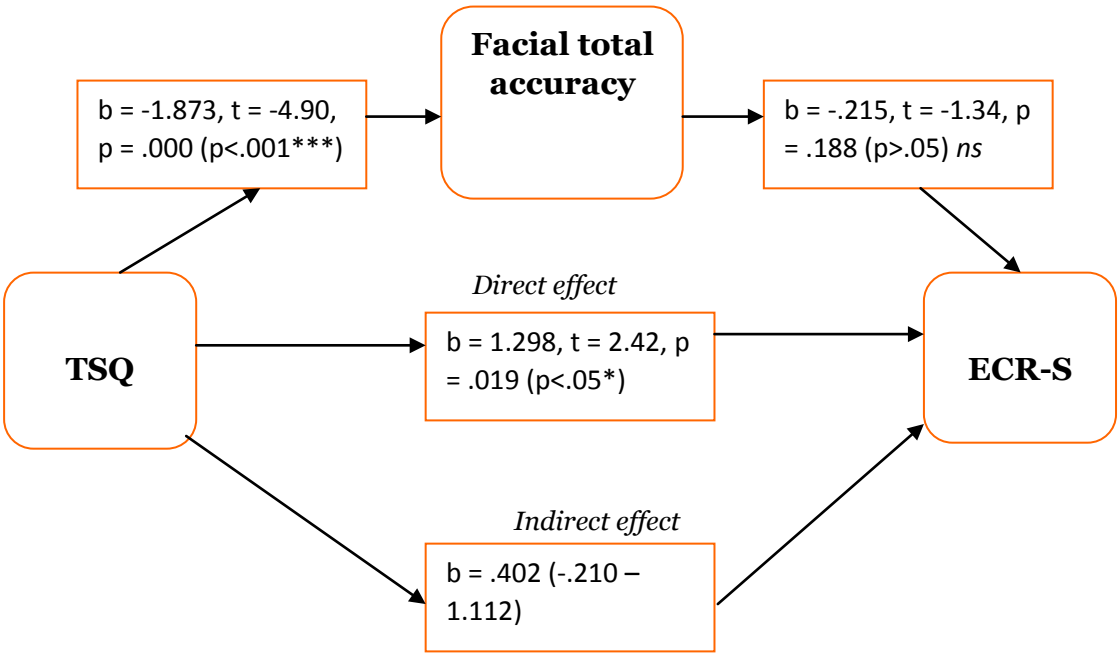
Linear relationships were explored for the three interpersonal relationship questionnaires; no linear relationships existed between the IIP-32 and the measure of trauma symptomology (TSQ), or the two emotional recognition tasks. Therefore as no linear relationships existed, this justified no further exploration of this questionnaire. A linear relationship was found between the ECR-S and the TSQ, R^2 = .467** (.252 - .659) at the 95% level of confidence, this was significant at the $p<.01$ level of significance. A further relationship was found between the MSPSS and the TSQ, R^2 = -.278* (-.517 - -.009) at the 95% level of confidence, this was significant at the $p<.05$ level of significance. Linear relationships were found between the TSQ and the total accuracy scores on both the facial, R^2 = -.562** (-.711 - -.377) and auditory, R^2 = -.516 (-.695 - -.305) tasks.

As discussed in the previous section (hypothesis 2c), linear relationships were found between the MSPSS and the total accuracy scores on the facial task. When looking at individual emotion variables, associations were found between the MSPSS and the facial variables of happiness and fear; an association was found between the ECR-S and the variable sadness on the auditory task. These associations were found at the 99% level of confidence.

Mediation was performed to determine if the relationship between trauma (as measured by scores on the TSQ) and difficulties in interpersonal relationships (as measured by scores on the interpersonal relationship questionnaire – ECR-S) was mediated by emotional recognition difficulties (as measured by the emotional recognition tasks). As this study aimed to look at the relationship between trauma and interpersonal relationships, using mediation was more suitable than running multiple analyses due to the smaller number. Using bootstrapping is applicable as it imposes no distributional assumptions (Preacher & Hayes, 2004).

Mediation was performed to determine if the relationship between trauma (TSQ) and interpersonal relationship difficulties (ECR-S) was mediated by emotional recognition difficulties (facial recognition total accuracy score).

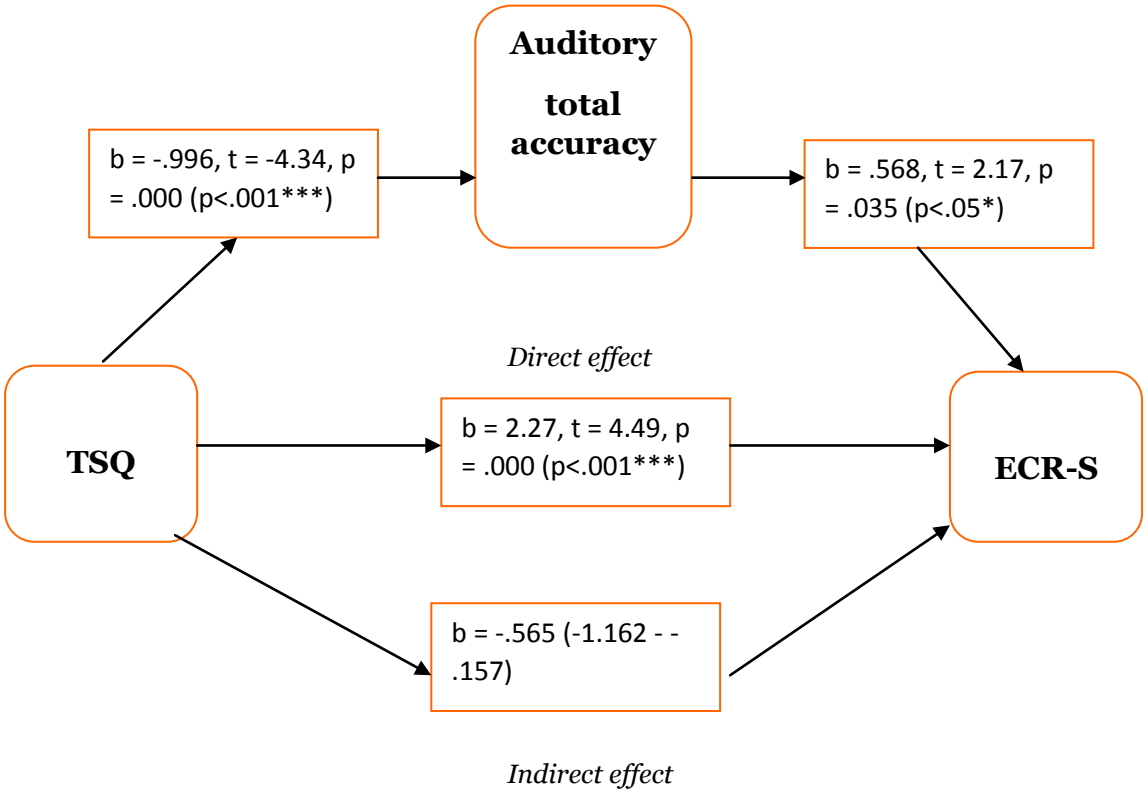
Figure 8. Is the relationship between trauma and interpersonal difficulties mediated by total recognition accuracy on the facial emotional recognition task



As you can see there is a significant effect of the TSQ on facial total recognition accuracy, the negative b demonstrates that as TSQ scores increase, facial total recognition decreases; R^2 = .3155 tells us that facial total recognition accuracy explains 32% of the variance. There was no significant indirect effect of trauma on interpersonal relationships through total emotional accuracy on the facial emotional recognition task, b = .402 BCa (-.210, 1.112).

A further mediation was performed to determine if the relationship between trauma (TSQ) and interpersonal relationship difficulties (ECR-S) was mediated by emotional recognition difficulties (auditory recognition total accuracy score).

Figure 9. Is the relationship between trauma and interpersonal difficulties mediated by total recognition accuracy on the auditory emotional recognition task

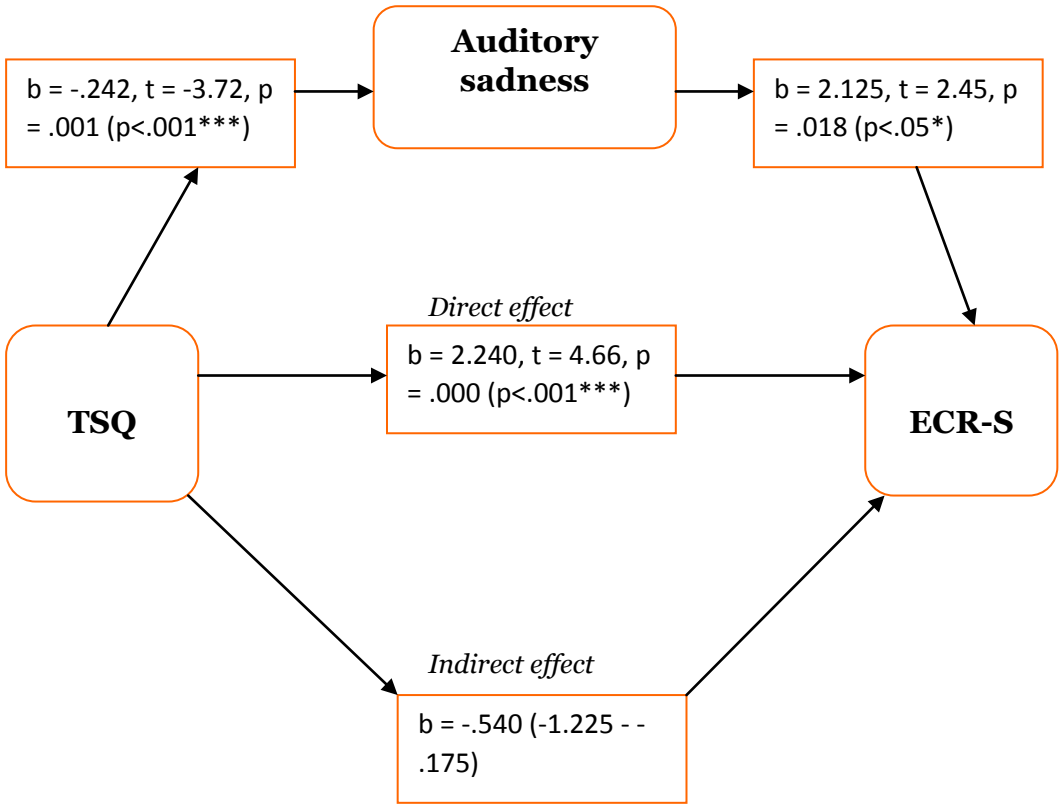


As you can see there is a significant effect of the TSQ on auditory total recognition accuracy, the negative b demonstrates that as TSQ scores increase, auditory total recognition decreases; R^2 = .2663 tells us that the variable auditory sadness explains 28% of the variance. There is a significant effect of auditory total recognition accuracy on the ECR-S, the positive b demonstrates that the auditory total recognition accuracy significantly predicts higher scores on the ECR-S; R^2 = .2839 tells us that the mediator model explains 28% of the variance.

There was a significant indirect effect of trauma (TSQ) on interpersonal relationships (ECR-S) through auditory total emotional recognition accuracy, b = .565, BCa CI (-1.162 - -.157). This represents a relatively small effect, k^2 = .168, 95% BCa CI (.043, .294). This is statistically significant at the p = .05 level. K^2 is bounded between zero and one, so the indirect effect is about 17% of the maximum value it could have been.

As auditory and not facial recognition accuracy mediated the relationship between trauma and interpersonal relationships, further analysis sought to determine if the emotion variables of sadness was a mediator of this relationship. Previous studies findings (Poljac et al, 2011) suggest that sadness and fear were both variables of interest in PTSD, hence the decision to conduct further analyses. As an association was found between the ECR-S and the auditory emotional variable of sadness, R^2 = .409 (.027 - .696), this variable was investigated as a potential mediator. The decision not to run further analyses on the other emotion variables stems from the lack of associations between the emotions and the measures of interpersonal relationships, but also the lack of evidence that for those emotions in relation to PTSD. Whilst fear was considered for analyses, the absence of association justified no further investigation of this emotion variable.

Figure 10. Is the relationship between trauma and interpersonal difficulties mediated by the auditory emotional variable of sadness



As you can see there is a significant effect of the TSQ on auditory sadness, the negative b demonstrates that as TSQ scores increase, auditory recognition of sadness decreases; R^2 = .2106 tells us that the variable auditory sadness explains 21% of the variance. There is a significant effect of the auditory variable sadness on the ECR-S, the positive b demonstrates that the auditory variable of sadness significantly predicts higher scores on the ECR-S; R^2 = .3000 tells us that the mediator model explains 30% of the variance.

There was a significant indirect effect of trauma (TSQ) on interpersonal relationships (ECR-S) through the auditory emotional variable of sadness, b = .540, BCa CI (-1.225 - -.175). This represents a relatively small effect, k^2 = .172, 95% BCa CI (.058, .329). This is statistically significant at the p = .05 level. K^2 is bounded between zero and one, so the indirect effect is about 17% of the maximum value it could have been.

In summary, the auditory emotion variable sadness was found to mediate the relationship between trauma (as measured by the TSQ) and interpersonal relationship difficulties (as measured by the ECR-S). Sadness explained 30% of the variance in the model, although the effect size was relatively small, with the indirect effect of the mediator being 17%. Further investigation of whether emotional recognition mediates the relationship between trauma and social support could have been conducted in this study, but as this was not a planned hypothesis, further analyses were not conducted, despite associations between variables being evident.

Chapter 5

Discussion

5. Summary of the main study findings

Emotional recognition research in a PTSD population is in its infancy; this is an important area of study, particularly considering these abilities in relation to their impact on interpersonal relationships. Considering factors that may impact on a person's ability to engage with others, therapeutic relationships and social support, which are predictive of recovery, is essential in supporting people with PTSD.

This study used a mixed methods design and sought to establish if individuals with a diagnosis of PTSD exhibited differences in emotional recognition compared to a group of healthy controls. It also sought to examine whether men and women with PTSD differed in their accuracy of emotion recognition and similarly if those with a history of PTSD dating to childhood differed from those acquiring trauma in adulthood on emotion recognition tasks. In addition the extent to which difficulties in recognition of emotion were associated with inter-personal difficulties and low levels of perceived social support was also explored. A discussion of the main findings is presented below.

Summary of the results

In summary of the study's findings, significant differences emerged between the clinical and control groups' accuracy rates for facial and auditory emotional recognition. The clinical group had significantly lower accuracy on the auditory task for the emotions of fear and sadness as hypothesised; in addition they also had lower accuracy for disgust. The clinical group also had significantly lower accuracy on the facial task for all six of the emotions, when compared to the control group. No accuracy differences were found between males and females in the clinical group for either task. When comparing participants who had experienced traumas in childhood

with those who had experienced adult traumas, differences were found in accuracy rates for the auditory task, with the childhood trauma group having lower accuracy. Whilst differences occurred between the groups, these were not found for the variables of fear or sadness; the childhood trauma group had lower accuracy for the emotion of happiness. No differences were found between the groups for accuracy on the facial task.

The study demonstrated that significant differences existed between the clinical and control groups on the interpersonal relationship questionnaires overall scores, with the clinical group reporting significantly more difficulties in relationships. When looking at the individual measures, the clinical group reported significantly more difficulties in terms of greater avoidance in relationships on the ECR-S, with no differences were found between groups on the anxiety sub-scale. For the IIP-32 measure, the clinical group had significantly higher scores on the majority of sub-scales, apart from the Openness scale; scores were similar to the measures normative data for a patient population, with more difficulties being reported in relationships. On the MSPSS measure, significant differences were found on the Friends sub-scale, with the clinical group reporting significantly fewer friends than the controls.

The study aimed to establish if there was an association between lower accuracy on the emotional recognition tasks and greater reported difficulties on the interpersonal relationship questionnaires, this hypothesis was partially supported. For the facial task, there was an association between the auditory task and the overall score on the MSPSS; there were associations at the emotion level, between the MSPSS and the emotions of fear and happiness. No associations were found between the overall scores on the auditory task and the interpersonal relationship questionnaires. An association was found between the ECR-S and the emotion variable of sadness on the auditory task. The study also hypothesised that emotional recognition accuracy would mediate the relationship between trauma and interpersonal relationships. Total auditory emotional recognition accuracy was found to mediate the relationship between trauma (TSQ) and interpersonal relationship difficulties (ECR-S). Further investigation found that the auditory variable of sadness also mediated the relationship between trauma (TSQ) and interpersonal relationship difficulties (ECR-S).

5.1. Differences in emotional recognition

The study found that participants with a diagnosis of PTSD had a lower accuracy rate in emotional recognition tasks than healthy controls; this was both for auditory and facial recognition. For auditory emotional recognition, differences were found for the emotions of fear, sadness and disgust with the clinical group having lower accuracy scores for these emotions. For the facial task the clinical group scored significantly lower in terms of accuracy for six out of the seven emotions, these included fear, sadness, happiness, disgust, surprise and anger. These findings were consistent with the findings of previous research (Freeman et al, 2009; Poljac et al, 2011) and with the current study's hypotheses that the clinical group will have lower accuracy scores for the emotions of fear and sadness; this was found to occur in recognition tasks in both verbal and visual modalities. Poljac et al (2011) previously found that individuals with PTSD had lower accuracy rates than healthy controls for the emotions of fear and sadness on a facial recognition task. Nazarov et al (2014) found that fear was recognised at above chance rate in a PTSD group, but was recognised at a lower accuracy rate than the other emotions investigated in the study. This finding was replicated in the current study and moreover extended it to show that this difference also emerged on auditory recognition tasks. The other emotion that was found across tasks to produce significantly lower accuracy rates was disgust, this finding may be interesting for future research projects, particularly when this sample were predominantly older in age and older adults have been found to have higher accuracy rates for the emotion of disgust when compared to their younger counterparts (Calder et al, 2003; Ruffman et al, 2008). Whilst the literature is somewhat divided, in some studies looking at emotional recognition in OCD, disgust has been found to be recognising at lower accuracy rate than other emotions (Sprengelmeyer et al, 1997; Kornreich et al, 2001). Difficulties recognising disgust and fear have also been found in those diagnosed with Bipolar Disorder, who were in the midst of mania (Lembke & Ketter, 2014).

It may be apparent that this is due to these disorders affecting specific brain regions (Adolphs, 2002) or the difficulty with specific emotions may be disorder specific, for

example in the OCD group, consideration is given to whether the issues with disgust relate to individuals who have specific contamination fears (Berle & Phillips, 2006). Adolphs (2002) reviewed brain imaging studies and found that whilst different brain regions are implicated in the recognition of emotions, that the amygdala, in particular, has been implicated in the recognition of fear; the amygdala being involved principally in the processing of stimuli related to threat and danger. Adolphs (2002) argued that the amygdala is also potentially implicated in the recognition and processing of negative emotions such as anger, disgust and sadness. The processing and recognition of fear has also been associated with the orbito-frontal cortex and it is suggested that the insula and basal ganglia may be involved in the recognition of disgust. Ferrucci et al (2012) found that the cerebellum is involved specifically in processing negative facial emotions, although it was not implicated in positive or neutral expressions. Whilst research has investigated brain regions involved in the recognition of emotion for many years, there continues to be an interest in this area, with new findings being regularly published implicating new regions. It is likely that many regions are involved in emotional processing and pathways between these regions have yet to be discovered.

There are a number of confounding factors that may also explain the deficits found in the PTSD population. Difficulties in cognitive functioning, for instance, might explain the findings. Previous research used the Benton Facial Recognition test to rule out the presence of prosopagnosia (Poljac et al, 2011); this study did not adopt a measure to detect facial recognition deficits. Equally, a more global cognitive impairment may explain the study's findings; as the participants were not given a wider battery of neuropsychological tests to rule out more general cognitive functioning difficulties; this must be considered as a possible explanatory factor for the findings. Attentional difficulties may also explain these findings. Another confounding factor that may explain these findings is that of depression, as depression is a co-morbid condition often found with PTSD, it may be that depression alone could explain these findings. The presence or severity of depression was not assessed in this study, as emotional recognition impairments have been found in those with depression (Gur et al, 1992), this may explain the current findings. Gur et al (1992) found that participants with depression had a higher

negative bias across facial recognition tasks, with the severity of depression being associated with poorer performance across tasks; the current study's finding is consistent with Gur's results, so depression may explain the lower accuracy on recognition tasks.

5.2. Gender differences in emotional recognition

Contrary to the proposed hypothesis that males will have lower accuracy scores than females on the recognition tasks, no gender differences were found between the groups. Kret and De Gelder (2012) in their review of sex differences in processing emotional signals discuss that whilst women recognise emotions more easily, men show greater responses to threatening stimuli, for example aggression. The present study did not support previous findings that there were sex differences in performance on emotional recognition tasks. This may be due to the specific issue under investigation and be a product of trauma exposure. Nazarov et al (2014) found that females with PTSD had performance levels on recognition tasks that were not significantly different to those of healthy controls; although no comparisons were made with male performance. Future research should seek to establish if gendered differences found in the performance of healthy controls extend to the performance of those with PTSD or if the current study's findings of no sex differences is replicated.

5.3. Differences in emotional recognition for the simple and complex PTSD groups

No differences were found between participants who met the ICD-11 diagnostic criteria for complex PTSD and those with simple PTSD on the facial emotional recognition task. As mentioned above, impairments in the recognition of six emotions were found for the PTSD group as a whole; this finding might explain why group differences between simple and complex PTSD were not found, as this may be a more general impairment in facial recognition. This finding runs contrary to the findings of previous studies involving facial tasks, for example Poljac et al (2011) did not find a general impairment in facial emotional recognition in the PTSD participants. Conversely, Freeman et al (2009) found that the PTSD sample were all

impaired on comprehension tasks measuring emotional auditory recognition, specific emotions were not discussed, but rather comprehension errors were referred to as a more general impairment.

A significant difference was found between the two groups on the auditory task, with happiness being recognised at a significantly lower rate by the complex group. This emotion was the only significant difference found between the two groups. The profile of emotion recognition accuracy differed between the groups, although accuracy rates for fear were very similar. Interestingly when inspecting the means of the two groups, it becomes apparent that different groups had lower accuracy rates on certain emotions, for example the simple PTSD group had higher mean scores for the emotions of surprise, anger and disgust indicating lower accuracy scores. The complex group had higher mean scores for sadness, happiness, neutral and very marginally fear, although the groups were almost identical in their recognition of fear. These results should be interpreted with caution due to the small numbers representing each group, leading to reduced power in the analysis. Future research should seek to identify if group differences do exist between those with adulthood and childhood traumas; paying particular attention to auditory recognition.

5.4. Group differences in interpersonal relationships

As hypothesised group differences were found between the clinical and control groups on the interpersonal relationship questionnaires. For the Experiences in Close Relationship-Short Form questionnaire (ECR-S) the clinical group reported significantly higher levels of difficulties in close relationships when compared to controls; they were also found to have significantly higher levels of avoidance in relationships than controls. When considering the Inventory of Interpersonal Problems-32 (IIP-32) significant differences were found between groups with the clinical group indicating scores similar to patient norms reported for the IIP-32; the clinical group in this instance had higher overall scores and higher scores on the majority of sub-scales, when compared to controls. With regards to the Multi-dimensional Scale of Perceived Social Support (MSPSS), significant differences were only found for the Friends sub-scale, with the clinical group reporting significantly

less social support from friends than the controls. For the overall sub-scale, both groups indicated a moderate level of social support, when compared to the normative data, means were within the same range (Zimet et al, 1990). As similar numbers of clinical and controls were found to be married, this may account for why differences were not found on the significant other sub-scale, with both groups indicating quite high levels of support from significant others; again means were in a similar range to those provided in the normative data. The clinical group reported lower levels of support from family than controls, although this was not a significant difference; when the PTSD groups' scores are compared to the normative data for the MSPSS, the PTSD group are more than one standard deviation below the mean in terms of the support they receive from family. The lowest levels of reported support were from friends, the PTSDS group scored significantly lower than controls; again they were also more than one standard deviation below the mean when compared to the normative group.

The hypothesis was only partially supported, due to the PTSD group not differing significantly from the controls on the MSPSS overall scale. The finding that the PTSD group perceived moderate levels of social support is encouraging for this population. Although this finding generally contradicts the social cognitive model of PTSD (Sharp et al, 2012) and the view that early adversity may affect cognitive schemas and lead to difficulties accessing social support; in this present study 19 of the clinical group were found to have suffered early childhood adversity and yet the overall scale indicated moderate levels of social support. When you consider two of the sub-scales and comparisons to the normative data, it becomes apparent that the PTSD groups levels of social support are lower in those areas; with the control group data not highlighting this fact, as their scores were equally as low.

Whilst members of the PTSD group were predominantly married, and perceived themselves to be offered moderate to high levels of social support by their significant others and families, they also reported a significant level of avoidance in close relationships. This may indicate that although they perceive they are offered moderate to high levels of social support, engaging with it may be more difficult for

them. Participants often subjectively reported that family were supportive, but that they tended not to burden them with how they were feeling and would retreat and manage their emotions privately. This may suggest that the Multi-dimensional Scale of Perceived Social Support may not accurately measure how much individuals utilise that social support.

The literature pertaining to social support and PTSD suggests that positive social support is associated with positive adjustment outcomes (Borja et al, 2006) and aids integration of the trauma memory, by providing alternative perspectives, through normalisation and shared conversation (Joseph et al, 2005; Lepore, 2001). We would therefore expect this study's sample to have better outcomes, due to their levels of social support. Although conversely, Roberts et al (1982) have highlighted that individuals with PTSD have more difficulties with intimacy and sociability; this study's sample highlighted that they were more avoidant in close relationships than controls and also scored significantly differently to the controls on the perceived social support Friends sub-scale, indicating that they do suffer with specific problems related to interpersonal functioning in certain domains. The sub-scale comparisons highlight that the PTSD group had more difficulties with family and friends that a normative comparison group.

5.5. Simple and Complex PTSD and interpersonal relationships

No differences were found between the simple and complex PTSD groups on the interpersonal relationship questionnaires (IIP-32 and ECR-S). This would seem to suggest that PTSD affected those in this sample similarly regardless of whether their traumas stemmed from childhood or adulthood. Again this finding should be interpreted with caution, due to the small sample size and participant numbers. Future studies may again wish to further investigate this area with a larger sample.

5.6. Interpersonal relationships and emotional recognition accuracy

A significant association was found between perceived social support (MSPSS) and the total accuracy score (accuracy for seven variables combined) on the facial task. Further analyses found associations between the perceived social support (MSPSS) scale and the emotion variables of happiness, fear and sadness on the facial task, such that lower accuracy scores were associated with greater levels of interpersonal difficulties. A significant association was also found between the auditory variable of sadness and the experiences in close relationships overall score (ECR-S); again lower accuracy scores were associated with greater levels of reported difficulties in close relationships. This finding is as expected and hypothesised; as communication and being able to accurately perceive others' communications is a fundamental aspect of interpersonal relationships, it is felt that impairments in accurately identifying emotional states will impact negatively on interpersonal relationships.

Kornreich et al (2002) found that impairments in emotional facial recognition were associated with interpersonal problems in recovering alcoholics; the authors concluded that interpersonal difficulties serve as a mediator between accuracy problems on the recognition task and alcoholism. Szanto et al (2012) found that older adults with a history of suicide attempts had significantly poorer social emotional recognition than controls with no psychiatric history. Older adults who had self-harmed (suicide attempts) had more restricted social networks, perceived less social support, showed more hostility in relationships and were less engaged with family and activities than controls. Research indicates that emotional recognition and interpersonal difficulties are associated and those with poorer recognition generally report more difficulties in interpersonal relationships. Research by Pinkham and Penn (2006) found that deficits in social cognition were associated with interpersonal functioning; with social cognition implicated more in interpersonal functioning than neuro-cognitive impairments. Hooker and Park (2002) found that facial affect and vocal affect recognition performance were related to social functioning and dysfunction in patients with a diagnosis of schizophrenia. Previous findings seem to indicate that impairments in emotional recognition are associated

with interpersonal relationship difficulties; the current study's findings replicate these previous studies.

5.7. Mediation models

Further analysis aimed to determine if emotional recognition mediated the relationship between trauma, as measured by trauma symptomology, and interpersonal relationships. As the emotion variables of interest were fear and sadness due to previous studies findings, these variables were considered, along with emotional recognition total accuracy scores, which provided a more general mediator for analyses. Whilst all interpersonal relationship measures were initially considered, ultimately it was felt that the MSPSS was not a measure of interpersonal relationships, but a measure of perceived social support, for that reason this was not included in any mediation analyses, despite it correlating with the TSQ and emotional recognition total accuracy for the facial and auditory tasks. No associations were found between the IIP-32 and the TSQ or the IIP-32 and either of the emotional recognition task total accuracy scores or any of the individual emotion variables. For that reason, the IIP-32 was not considered as an outcome variable in the mediation analysis. As the ECR-S is a measure of interpersonal relationships and associations were found between it and the TSQ and total auditory emotional recognition accuracy and the emotion variable sadness, this was used in subsequent analyses.

In summary, total auditory emotional recognition accuracy was found to mediate the relationship between trauma (TSQ) and interpersonal relationship difficulties (ECR-S). Further investigation found that the auditory variable of sadness also mediated the relationship between trauma (TSQ) and interpersonal relationship difficulties (ECR-S). These findings again support previous research by Poljac et al (2011) who found that a sample with a diagnosis of PTSD had specific emotional recognition difficulties in relation to the emotion of sadness. As social cognitive abilities are a growing area of research in mental health conditions, there has yet to be a study that has looked at emotional recognition as a mediator between PTSD and interpersonal

relationships; as such comparisons to other studies are not possible. It is hoped that future research will aim to replicate these findings and build on their contribution.

5.8. Methodological strengths and weaknesses

5.8.1. Strengths

A strength of the sample was that it sampled both genders and a range of participants who had developed PTSD from a variety of traumas in both childhood and adulthood. This allowed for comparisons to be made to both the normal population and between trauma sub-groups (those who had a long history of trauma exposure and were perhaps still developing emotional skills when the trauma occurred and those who were presumed to have developed along a normal trajectory and then were later affected by a trauma). This study aimed to provide results that could be generalised more widely than the previous studies of this kind, by recruiting a more representative PTSD sample. Recruiting fairly equal numbers by gender reduced the likelihood that any differences in gender accuracy rates would impact on this study's findings. Kret and De Gelder (2012) found in their meta-analysis on gender differences in emotional recognition that females appeared to have a marginal advantage in emotional recognition, although this appeared to vary depending on age and across the lifespan. The review also postulates that this may be emotion specific and/or modality specific, or dependent on sensitivity levels, with females performing better at maximal sensitivity. Recruiting equal numbers of genders and measuring accuracy rates across a range of modalities, whilst also ensuring that male and female actors were used on both tasks, aimed to reduce the effect of gender on accuracy.

Another strength of this study was its use of several modalities to assess emotional recognition; as previous research had focused on one modality, either facial (Poljac et al, 2011) or prosodic recognition (Nazarov et al, 2014), this study aimed to go further by measuring recognition within both auditory and visual modalities. Schlegel et al (2012) consider whether emotional recognition ability is a unitary ability or requires skills that are different dependent on modality. They concluded that it appears that several skills are required, but this might be a broad ability across modalities. As

research in this area is still growing, the present study sought to identify if differences existed in the recognition accuracy rates for different emotions across modalities.

The study also sampled those with a diagnosis of PTSD, whereas previous studies (Considine & Paivio, 2013; Marshall et al, 2011) had used trauma exposed individuals who did not meet clinical thresholds and therefore were less likely to exhibit problems resulting from their trauma exposure. This study sought to identify if impairments in emotional recognition existed in a trauma sample, by sampling those who were already reporting sequelae. All PTSD participants had previously been assessed at the point of recruitment to the NCMH PTSD registry, and their PTSD status was further screened at entry to this study to ensure that they still met the clinical criteria set out in the diagnostic texts. The present study also went further than these previous two studies by using a control group for comparison; where possible, reference was also made to previous findings and findings were contexualised by making use of norms for the psychometric measures adopted in this study. Treatment status was also considered, with details obtained of the clinical groups' treatment status via self-report. The author was also mindful of the participants' welfare and made onward referrals, where appropriate.

Inclusion and exclusion criteria were set to minimise confounding factors such as neurological conditions, head injuries and other major mental health problems. The control group were also screened, with the same exclusion criteria being applied. Several potential participants were excluded due to serious head injuries (three potential participants disclosed a history of head injuries and were excluded).

5.9. Limitations

5.9.1. Methodological

Limitations of the study's design include not counterbalancing the order of presentation of the two emotional recognition tasks; whilst there was no evidence that this had been undertaken in any previous studies, bias may have been

minimised had two software programmes been written, so counterbalancing could be undertaken. The failure to counterbalance was due to the adoption of existing software in the facial recognition task and the complexity of writing two separate programmes that ran tasks in different orders. To minimise the impact of not counterbalancing, items were randomised within each task and tasks were not completed consecutively. Questionnaires were also given to participants to complete in any order they wished.

As every effort was made to minimise travelling for the clinical group, this led to different sites being used and different testing environments. Due to this, environmental factors such as noise and distractions could have impacted on participants' performance to a minor extent. Some testing was conducted in private rooms in community team premises and some participants who could not travel were seen in their own homes. Every effort was made to minimise distractions and those seen in environments with which they were familiar may have experienced less performance anxiety, than those who were tested in unfamiliar university premises. All control participants were seen in the same environment throughout testing but the test environments varied for participants with PTSD.

5.9.2. Sample

Sampling procedures aimed to address some of the limitations of the previous research in this area (Nazarov et al, 2014; Poljac et al, 2011; Freeman et al, 2009), by recruiting both genders. As previous studies had recruited individuals who had developed PTSD as a result of specific mechanisms (Nazarov et al, 2014; Poljac et al, 2011), this study chose to recruit participants who had developed PTSD through a range of mechanisms, for example childhood traumas, road traffic accidents, military related traumas, acts of terrorism, assaults etc. Whilst this study recruited from a wide range of trauma mechanisms, sampling participants who suffered traumas in both childhood and adulthood, a limitation of this sample were the small numbers in each sub-group making comparison between sub-groups more difficult. The main interest was sampling participants who represented PTSD, although comparisons between childhood and adulthood traumas were undertaken; these results require

caution when interpreted due to the small group numbers. Although from the outset this was designed to be a pilot study, the sample size is a limitation and claims for the generalisability of the findings should be made with caution. A further limitation of the sample, is that whilst participants all reached the diagnostic criteria for PTSD at the time they entered the NIMH PTSD registry, some now scored below the TSQ threshold and did not report clinical levels of trauma symptomology; although this is positive in terms of the individuals well-being.

There were also difficulties recruiting younger participants; the mean age of participants in this study was approximately 53 years, with only seven percent of participants being in the 18-34 age band, compared to 67% in the 51-65 category. Calder et al (2003) found that increasing age impacted on recognition of fear and to a lesser extent anger. This study saw recognition of fear peak at 31-40 and then start to gradually decline thereafter. In contrast, recognition of disgust improved with increasing age; the authors comment that this may be attributable to the brain regions involved in the recognition of different emotions, with some deteriorating more than others with age. Ruffman et al (2008) in a meta-analysis of emotional recognition and ageing found similar results to Calder with the majority of accuracy of recognition across emotions, bar disgust, reducing with age. The meta-analysis looked at a range of modalities for example, facial, auditory, bodies etc. and results were relatively consistent across modalities; it was argued that this was due to changes in frontal and temporal regions of the brain and the findings were consistent with prevalent theories of ageing. The present sample was predominantly Caucasian and had a mean age of 53 years. When interpreting this study's findings caution and consideration need to be given to the potential age effects on emotional recognition, along with how the lack of ethnic diversity in the sample impacts on the generalizability of the study's findings. Future research in this area may wish adopt recruitment criteria which correct for these potential ethnicity and age-related limitations.

5.9.3. Measures

A new task to measure auditory emotional recognition was purpose designed for this study. Whilst a purpose designed task ensured a culturally valid measure of prosody was used, the task was subject to relatively minimal piloting on a small group (n=10) of participants. With hindsight, piloting on this particular sample may have yielded inflated results in terms of the reliability of items, as trainee clinical psychologists were asked to identify the emotions in voices; this group may well be more attuned to emotional changes in communication and may have produced higher accuracy rates than a non-trained group of individuals. Further piloting on this task is required to fully investigate the reliability of items and the task's potential utility in future research. As a result, there may be a danger that the present sample's performance may appear less accurate, due to items being less recognisable than the piloting assumes. Other limitations of the task were the issues around uniformity of items and their sound quality. Whilst the study's author endeavoured to improve sound quality for each individual item, there is a small amount of disparity in terms of sound quality; this may have impacted on participants' performance.

Whilst the Multi-dimensional Scale of Perceived Social Support (Zimet et al, 1990) was employed in this study as a measure of participants' perceived social support and their perception of their interpersonal relationships with others in terms of supportiveness, it could be argued that this questionnaire is designed to look solely at perceived social support, rather than interpersonal functioning per say. As previously outlined, it is possible that whilst the clinical group indicated that they had moderate levels of overall social support, this may not reflect their engagement with that support. For example, participants commented that they maintained a degree of isolation and did not wish to burden family members with their condition. Possibly future studies may wish to consider if measures of engagement with others could be employed, as this may provide a better indication not just of perceived social support, but also of how much participants utilise that support.

As the findings of this study suggest a more general deficit in facial emotional recognition, it is possible that this study should have employed a measure of face

perception, to screen participants for specific impairments in face perception, prior to the emotional recognition tasks. Future research may wish to employ such a measure, for example the Benton Facial Recognition Test (Benton, 1968).

5.9.4. Analysis

Corrections could have been made for the differences between groups in the statistical analyses; it was felt that this was not appropriate though, as it would change the variance. Miller and Chapman (2001) argue that often correcting for differences between groups is inappropriate and should be avoided; arguing that correcting for the covariate can lead to a considerable amount of variance being removed, thus reducing the likelihood of finding genuine differences that exist between groups. Some may critique the results and argue that violations to the assumptions for the parametric data should have been corrected, as stated in earlier sections, the statistical test employed in this study was deemed robust against violations (Finch, 2005). Due to the number of variables in the MANOVAs, the analyses were underpowered. Larger sample numbers would have been advantageous to improve the power and the robustness of the findings. As this study was a pilot study, with a limited sample to determine if a larger study should be conducted, the limited numbers and their effects on power and the resultant findings are acknowledged.

5.9.5. Confounding variables

It is possible that not matching the sample for education may have confounded the results; statistically significant differences were found between the groups in terms of education, with the control group having significantly higher levels of education than the clinical group. Whilst educational differences were not reported to affect emotional recognition tasks employed in previous studies, for example The Florida Affect Battery (Bowers et al, 1991); and previous research into specific mental health conditions has not found that education affects accuracy, for example in a meta-analysis of 110 studies of emotional recognition and schizophrenia (Kohler et al, 2010). Ideally matching the sample for education or controlling for it in subsequent

analyses would limit any effects it may have had on the results and this particular sample. The current sample was representative of individuals with PTSD, as lower levels of education are one of the known risk factors for the development of PTSD (Iversen et al, 2008).

Due to the prevalence of depression in the population, depression could not entirely be excluded from the present sample. A small number of the control group reported that they suffered with mild depression; this may have confounded the results. Difficulties recruiting controls who had never experienced any mental health concerns led to the decision that mild levels of depression were acceptable, as long as they were deemed to be reactive, rather than a lifelong complaint. Not entirely excluding mental health concerns may have reduced the control group's accuracy rates; therefore it is possible larger differences may have been found between groups, had these individuals not been included. This may also account for why the control group reported lower levels of social support in some sub-categories than the normal population.

5.10. Theoretical implications

The findings from this study compliment the growing social cognitive models of PTSD. Whilst De Prince's (2005) and Maercker and Horn's (2013) models offer alternative understandings to how social cognition can play a part in the development of PTSD or the processing of traumatic material, Sharp et al's (2012) social cognitive model of PTSD provides a framework for understanding the present study's findings. The social cognitive model of PTSD proposes that due to early life experiences, schemas develop that can activate in the face of trauma and work on social cognition, making it more problematic for the individual to gain support from relationships. This view offers an explanation for why some individuals indicate that they have high levels of social support but continue to suffer with chronic PTSD and persistent symptomology, despite having received treatment. The current clinical sample in this study could be described in this way; the majority had undergone treatment, but had residual symptoms that maintained their current diagnosis due to

the frequency and severity of symptoms meaning that they continued to meet diagnostic criteria.

Sharp et al's (2012) model is based on theories of attachment and mentalizing, suggesting that attachment relationships during infancy and childhood serve as templates for later interactions. They discuss how often these maladaptive patterns can become activated in the face of activating events, for example traumas and lead the individual to operate in their relationships in a way that prevents them from gaining the social support required to process and incorporate the traumatic memory. Social cognitive processes are thought to play a part in this process as these abilities stem from our interactions with early care givers; these processes or skills develop through social interactions and often the primary care giver is the provider of such information. If early attachments are insecure, social cognitive processing and skills do not develop as they should, again in the face of activating schemas, the two interact to produce difficulties accessing support and engaging with interpersonal relationships.

Sharp's (2012) model might be seen as a suitable framework for understanding the present findings as emotional recognition and processing are aspects of social cognition. This model can also explain how both childhood and adult traumas can lead to similar problems, by understanding how early attachments lead to schemas that are activated in the face of traumatic events. Whilst social support may be available, individuals who have insecure attachment styles and social cognitive difficulties may be unable to engage with the support that is offered, thus reporting difficulties at the interpersonal level, along with developing PTSD symptomology. The present sample reported high levels of avoidance and anxiety in close relationships, which may be indicative of their attachment style.

The present study's findings found that participants who had experienced both childhood and adulthood traumas, reported high levels of anxiety and avoidance in relationships. One hypothesis is that individuals with insecure attachments are more vulnerable to developing PTSD after experiencing a traumatic event and/or

experience greater symptomology (Dieperink et al, 2001; Woodhouse et al, 2015). A wealth of research has looked at attachment style in relation to PTSD from a range of perspectives; with research suggesting that insecure attachment styles affect the outcomes of treatment and recovery (Forbes et al, 2010). In relation to this study's findings, one explanation for the lack of difference in the results of the clinical group (childhood and adulthood traumas), could be due to attachment style. Whilst the prediction was that those who had experienced childhood traumas were more likely to have insecure attachments, by virtue of their early life adversity, the evidence base seems to suggest that insecure attachment styles may make a person more vulnerable to developing PTSD. This may account for the lack of differences found between the two clinical groups on the emotional recognition tasks whilst providing a framework for why both groups reported high levels of anxiety and avoidance in interpersonal relationships. This would also explain why both groups still had persistent levels of PTSD symptomology, despite many having received treatment and many reporting high levels of social support. Social support and its availability may not be predictive of engagement with others due to attachment styles and associated difficulties in relating to others.

This study also adds to the growing literature on trauma and affective functioning; as research has investigated how stress, particularly early life stress can affect social and affective functioning. Pechtel and Pizzagalli (2011) in their review discuss how early life stress can affect social and affective functioning for years to come; this study's findings support this view and may indicate that exposure to trauma and stress, despite the timing of whether this is in childhood or adulthood, has a resultant effect on social and affective functioning. Pechtel and Pizzagalli also found that maltreated and abused children had recognition problems of negative facial expressions; this corresponds to the findings of the present study. Their review discusses the impact trauma has on the amygdala, as the amygdala has been found to be involved in the processing of threat related stimuli and negative emotions. The findings can be interpreted from a social cognitive perspective that trauma exposure interferes with social cognitive processes such as affect perception. Further work is required to establish whether social cognitive processes are affected in the long term due to trauma exposure or whether these processes are interrupted temporarily. Whilst 70% of the present clinical sample had experienced childhood trauma, impairments were

found similarly in those who had experienced adulthood traumas. Again, this study cannot make causal claims about whether social cognitive processes have been impaired due to trauma exposure, or possibly that they were previously disrupted due to early attachment experiences, which then increased the person's risk of developing PTSD after trauma exposure due to the subsequent difficulties accessing social support.

5.11. Clinical and service implications

This study has implications for future clinical practice and service delivery. As the study has highlighted that certain individuals diagnosed with PTSD exhibit impairments in recognising emotions, specifically sadness and fear, professionals working with this population need to be aware of this finding and how it could affect interactions with this group. As communication is a two way process, these findings provide evidence that one party (the individual with PTSD) may have difficulties comprehending the other party's communication. This could lead to a range of problems within relationships, for example therapeutic rifts, problems with engagement, over reactions; depending on how the person interprets the other person's displays of emotion, will ultimately affect their response, for example misinterpreting fear for anger. Clinical implications arising from these findings could include therapeutic approaches that aim to identify and educate service users in recognising emotions. As these difficulties could have far reaching consequences for service users and their interpersonal relationships.

Considering the literature on social support and PTSD, there is a wealth of evidence suggesting that positive social support is a protective factor in recovery from this condition (Ozer et al, 2003; Guay et al, 2006; Iversen et al, 2008). Lepore (2001) suggested this may be due to positive interactions facilitating the processing of trauma memories and offering alternative perspectives to the individual. Interventions that could therefore target communication difficulties such as those highlighted in this study, would therefore go some way to assisting service users in their engagement with others, therefore providing them with greater support.

This finding has implications for how and what is assessed by mental health teams at the outset of work with individuals. Establishing if service users have difficulties in this area prior to treatments being offered is a consideration; this information could be included in formulations and may add to our understanding of service users and the difficulties they are reporting. Future research may wish to establish if those reporting greater levels of alienation have greater levels of social cognitive problems and difficulties with emotional recognition. Ehlers et al (2000) found that those with chronic PTSD report greater levels of alienation; as this study found that there was an association between lower levels of perceived social support and emotional recognition problems for fear and sadness, it could be argued that individuals with emotional recognition problems also have interpersonal relationship difficulties.

Associations were found between social support (MSPSS) and interpersonal difficulties (ECR-S), associations were also found between emotional recognition total accuracy scores or specific emotion (sadness) accuracy scores, these being associated with either social support or interpersonal difficulties. The mediation model also found that recognition in the auditory modality of the emotion sadness mediated the relationship between trauma and interpersonal difficulties. Assessing for these potential problems may change the types of support that are offered, or for example may form part of the stabilisation work that is conducted prior to the commencement of trauma work.

Maercker and Horn's (2013) Social Facilitation Model of PTSD for example proposes that a person's perceptions about themselves, others, and the world interact to either increase or decrease the symptoms and course of PTSD, this is suggested to occur through engagement with social relationships (Sharp et al, 2012). It is possible that this study's findings compliment this model's view and could account for increases in trauma symptomology potentially through a person's negative view of others, leading to withdrawals from relationships. As this sample indicated high levels of avoidance and more difficulties in interpersonal relationships, this provides evidence that this group does withdraw or avoid engagement in certain circumstances. The cognitive model of depression views depressed individual's as having a similarly negative view

of themselves, others and the world (Beck, 1987); this leads to withdrawal from life and the person becoming alienated. Maercker and Horn's model expands from this fundamental basis and suggests that different responses lead to either withdrawal or engagement, which in turn affects the reactions to trauma. They suggest that positive views about others lead to engagement, which helps the person make sense of the trauma and their reaction to the trauma, by providing information that other people would have responded similarly, thereby normalising it and contributing to the processing of the trauma memory. Services may wish to consider systemic ways of working, which aims to support both the individual and their family, aiming to strengthen the connections between them, which may in turn have a positive impact on the individual's mental health.

With regards to service delivery; clinicians may wish to consider modifications to both the assessment and treatments provided to service users diagnosed with PTSD. Services may wish to consider further training for staff working in this area, to raise their awareness of emotion recognition difficulties and their significance, so that staff can best support individuals presenting with these issues. Service providers may wish to configure services to best support service users' social needs, and a move towards further systemic working, incorporating families, carers and other supportive networks into therapeutic interventions may be beneficial. Providing psycho-education in this area may assist those in support of service users to improve engagement and interpersonal relationships. Whilst this poses a range of problems, as adult services need to consider issues such as confidentiality, consent and other factors that can be barriers to greater systemic working; this study's findings do lend to a more systemic approach, involving the wider network of the service user. They also suggest more interdisciplinary and inter-agency working (eg with OTs and nurses) to extend application and testing of skills into the community, home and workplace.

5.12. Future developments

In collaboration with the University's developmental and health psychology department *there are* plans to use the affective prosody measure in future research;

plans will aim to measure the tasks reliability and validity using a large undergraduate student sample. This will seek to establish if the six universal emotions and neutral voice statements are recognisable at a reliability of r= .80, replicating the findings of the test development phase outlined above. Plans to use the measure with other clinical populations, such as children with anti-social behaviour and individuals with brain injuries, are also being considered.

5.13. Recommendations for future research

As this study was originally a pilot to establish if emotional recognition differences could be found when comparing a PTSD sample with a group of healthy controls, future research projects could seek to replicate and extend the current study. The aim would be to establish whether differences exist between PTSD sub-groups, for example simple versus complex PTSD requires further study. Whilst no differences were found in the present study, it could be argued that this was due to the small sample sizes affecting power. This area could be further researched along with determining if differences do exist between other sub-groups, for example whether differences exist between individuals who have developed PTSD from a range of mechanisms. Expanding the present study by recruiting greater numbers would establish if findings are replicable.

Future research projects could also investigate other aspects of social cognition for example individuals diagnosed with PTSD's social memory, theory of mind abilities, reflexive abilities and self-referential processing abilities. Whilst research has already looked at some of these abilities in the PTSD population, for example self-referential processing (Frewen et al, 2011); future projects could expand on this present study and that of Frewen by investigating other social cognitive abilities. Future research could employ neuro-imaging techniques to identify which regions of the brain are activated or show little activation in the identification of specific emotions; this would be an interesting adjunct to the present study. This work could add to the work of Adolphs (2002) and Kennedy and Adolphs (2012).

Future research may also wish to look further at social support and whether this acts as a mediator to emotional recognition difficulties or perhaps whether emotional recognition acts as a mediator between trauma and social support. This could have been investigated in the present study, but as this was not a planned hypothesis, it was felt that this may have extended the reach of the planned piece of work. As associations were found between trauma, social support and emotional recognition, future research may wish to investigate this further.

It would be interesting to investigate why auditory and not facial recognition accuracy mediates the relationship between trauma (TSQ) and interpersonal relationship difficulties (ECR-S). Researchers may want to first establish if these findings are replicable, before proceeding with further investigations. Future studies may also wish to consider other emotion variables as potential mediators; as this study had planned hypotheses around the clinical sample being less accurate for the emotions of fear and sadness, other studies may also wish to consider the other negative emotions, anger and disgust.

5.14. Conclusions

PTSD can have a devastating impact on the individual, their life, work and interpersonal networks, for many PTSD can become a chronic issue with which they suffer for many years, despite having received professional support. Whilst evidence-based interventions are on offer, with many responding well to these interventions, many report that symptoms and feelings persist despite having completed therapeutic treatments. This study sought to identify if social cognitive abilities, such as emotional recognition were impaired in this population, it also wished to investigate whether relationships existed between emotional recognition and interpersonal relationships. The rationale behind investigating social cognitive abilities and their links to interpersonal functioning were to provide further evidence that might support the development of future interventions that considered people in the context of their wider social networks.

This study provides evidence that the present PTSD sample when compared with healthy controls has significantly poorer facial emotional recognition accuracy. The clinical sample was also significantly poorer in terms of auditory emotional recognition accuracy for the emotions of fear, sadness and happiness. When compared to controls, the clinical group reported significantly higher levels of interpersonal relationship difficulties, higher levels of avoidance in close relationships and less social support from friends. Both total auditory emotional recognition accuracy and recognition accuracy for the emotion of sadness were found to mediate the relationship between trauma (as measured by the TSQ) and difficulties in interpersonal relationships (as measured by the ECR-S).

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Appendix 1
Glossary

Glossary

Prosody

Within linguistics prosody refers to the rhythm, intonation, and stress of speech. These features of speech can give the listener information that is not contained in vocabulary or grammar; for example, prosody can provide cues as to whether an utterance is a question or statement, or information about a speaker's emotive intent, such as whether they are conveying sarcasm or emphasis.

Affective Prosody

Affective (emotional) prosody concerns non-verbal cues as to the emotional content of a message; for example, conveying a specific meaning or emotion via any one, or more, of the prosodic elements of speech: pitch, loudness, intonation, or rhythm (Leon & Rodriguez, 2008; Wymer, Lindman, & Booksh, 2002).

Aprosodia

In speech, aprosodia reflects impairments in the comprehension (perception and judgement) and expression of the prosodic elements that make up prosody (see above).

Facial Affect Recognition

Facial affect recognition is an individual's ability to recognise another person's affect (emotion) from their facial expressions.

Prosodic Recognition

Prosodic recognition is an individual's ability to recognise another's emotion from the prosodic elements of speech (see above).

Social Cognition

Social cognition is the encoding, storage, retrieval, and processing of information about other people. Social cognition refers to the processes involved in the perception, judgment, and memory of social stimuli; the effects of social and affective factors on information processing; and the behavioural and interpersonal consequences of cognitive processes. The term social cognition has come to be widely used across a number of areas in psychology and cognitive neuroscience. In these areas, the term social cognition is most often used to refer to various social abilities disrupted in autism and other disorders, for example, difficulties in perceiving, comprehending, and/or expressing social material (Adolphs, 1999).

Universal Emotions

Researchers in the field of emotion research have discussed the universality of emotions in humans as a race. They have found that six universal emotions are produced and recognised by all cultures. These six emotions are happiness, sadness, fear, anger, disgust, and surprise. Cross culturally, individuals both recognise and label these emotions similarly (Ekman, 2014).

Alexithymia

"The construct of alexithymia encompasses the characteristics of difficulty identifying feelings, difficulty describing feelings, externally oriented thinking, and a limited imaginal capacity. These characteristics are thought to reflect deficits in the cognitive processing and regulation of emotions and to contribute to the onset or maintenance of several medical and psychiatric disorders" (Lumley, Neeley, & Burger, 2007).

Post-traumatic Stress Disorder (PTSD)

Post-traumatic stress disorder is a mental-health problem classified as anxiety based, although features of depression are common with the condition. *"Post-traumatic stress disorder (PTSD) develops following a stressful event or situation of an exceptionally threatening or catastrophic nature, which is likely to cause pervasive distress in almost anyone"* (NICE, 2005). Typical symptoms are re-experiencing events, whereby individuals involuntarily re-experience an event; avoidance symptoms, whereby situations, people, and reminders are avoided making the event

difficult to process; and hyperarousal symptoms, which include agitation, restlessness, hypervigilance, and sleep problems. Individuals may also experience problems related to detachment such as dissociation and problems feeling connected to others and emotional numbing (NICE, 2005).

Interpersonal Relationships

Interpersonal relationships refer to the social connections between two people; the relationship itself could be brief or enduring. Interpersonal relationship is used here to encompass relationships of any kind, for example familial, partners or intimate relationships, friendships, acquaintances, work colleagues, or any other social connection (Collins, 2002).

Euthymic

Normal mood which is neither elevated nor depressed (Mosby's Medical Dictionary, 2009).

Face Processing

Face processing refers to the ability to perceive and process the features of a face, in order to recognise the face's owner (Rivolta, 2014).

Mindfulness

"Mindfulness is awareness that arises through paying attention, on purpose, in the present moment, non-judgementally. It's about knowing what is on your mind" (Kabat-Zinn, 1982).

Prosodic Realizations

"*The way in which a particular linguistic feature (prosody) is used in speech or writing on a particular occasion*" (Oxford Advanced Learner's Dictionary, 2015).

Psychopathology*"The study of psychological and behavioural dysfunction occurring in mental disorder"* (Merriam-Webster, 2015).

Appendix 2

Systematic review search terms

Systematic Review – Search Terms

Affective prosody	1415; peer 83; Google 29,100
Facial prosod*	1,659; peer 67; Google 20,500
Prosodic recognition	1,564; peer 85; Google 48,800
Emotional recognition	888,959,290; peer 96; Google 2,310,000
Facial recognition	888,916,159; peer 104, Google 1,290,000
Emotional facial recognition	888,898,720; peer 79, Google 492,000
Social cognition	888,983,518; peer 132; Google 1,990,000
Emotion understanding	888,945,559; peer 94; Google 1,930,000
Emotional dysregulation	888,898,703; peer 86; Google 58,700
Emotional intelligence	888,922,910; peer 40, Google 1,920,000
Interpersonal relationships	888,976,652; peer 110, Google 1,680,000
Bonding	888,975,370; peer 112, Google 2,970,000
Relationship instability	71,210; peer 92, Google 2,450,000
Relationship*	891,746,520; peer 87, Google 4,330,000
PTSD	888,927,361; peer 102, Google 256,000
Trauma	889,422,863; peer 103, Google 2,780,000
Simple PTSD	3,389; peer 73, Google 48,300
Complex PTSD	6,909; peer 90, Google 69,000
Simple post-traumatic stress disorder	3,040; peer 73, Google 106,000
Complex post-traumatic stress disorder	5,813; peer 99, Google 119,000
Complex trauma	888,987,879, peer 104, Google 2,390,000
Multiple traumas	888,895,902, peer 95, Google 78,300
Single trauma	889,019,092; peer 101, Google 2,630,000

Trauma or PTSD 888,917,081; peer 83, Google 69,000

"Prosod*" AND "emotion*" AND "recognition" AND "affective" AND "Mental Health" 10,568; peer reviewed 126; Google 5690

Prosod* and emotion* and PTSD and recognition and fac* and affect* and relationship and trauma 121; peer 12; Google 1520

Prosod* and emotion* and PTSD or recognition or face* or affect* or relationship or trauma 300,757; peer 55; Google 1580

PTSD AND prosodic recognition 838 results, peer 85; Google 1450

Appendix 3

Systematic review inclusion and exclusion criteria

Systematic Review – Inclusion Criteria

Studies must be published in a peer reviewed journal
Studies must have been published between 1980-2015
Studies must be published in English or International English
Studies must include human participants only
Studies must use adult participants only (18 years of age and above)
Studies must include a facial or vocal emotional recognition task
Studies must use some or all of the "universal emotions", e.g., Happy, sad, anger, fear, disgust and surprise in the emotional recognition tasks
Studies must provide the results of the emotional recognition tasks, in addition to any other data they collect, e.g., fMRI scans
Studies must include participants who have suffered trauma or who are diagnosed with PTSD

Systematic Review –Exclusion Criteria

Studies that were not yet published in peer removed journals will be excluded (e.g., conference papers, dissertations and theses, pre-publications, book chapters etc)
Duplicates will be excluded

Appendix 4

CASP case control checklist

CASP case control checklist

11 questions to help you make sense of case control study

How to use this appraisal tool

Three broad issues need to be considered when appraising a case control study:

- **Are the results of the trial valid?** **(Section A)**
- **What are the results?** **(Section B)**
- **Will the results help locally?** **(Section C)**

The 11 questions on the following pages are designed to help you think about these issues systematically.

The first two questions are screening questions and can be answered quickly. If the answer to both is "yes", it is worth proceeding with the remaining questions.

There is some degree of overlap between the questions, you are asked to record a "yes", "no" or "can't tell" to most of the questions. A number of italicised prompts are given after each question. These are designed to remind you why the question is important. Record your reasons for your answers in the spaces provided.

These checklists were designed to be used as educational tools as part of a workshop setting

There will not be time in the small groups to answer them all in detail!

(A) Are the results of the study valid?

Screening Questions

Did the study address a clearly focused issue? ❑ **Yes** ❑ **Can't tell**

❑ **No**

HINT: A question can be focused in terms of

The population studied

The risk factors studied

Whether the study tried to detect a beneficial or harmful effect?

(A) Are the results of the study valid?

Did the authors use an appropriate method ❑ **Yes** ❑ **Can't tell**

❑ **No to answer their question?**

HINT: ConsiderIs a case control study an appropriate way of Answering the question under the circumstances? (Is the outcome rare or harmful)

Did it address the study question?

(A) Are the results of the study valid?

Is it worth continuing?

Detailed questions

Were the cases recruited in an acceptable ❒ **Yes**

❒ **Can't tell** ❒ **No way?**

HINT: We are looking for selection bias which might compromise validity of the findings

Are the cases defined precisely?

Were the cases representative of a defined population? (geographically and/or temporally?)

Was there an established reliable system for selecting all the cases

Are they incident or prevalent?

Is there something special about the cases?

Is the time frame of the study relevant to disease/exposure?

Was there a sufficient number of cases selected?

Was there a power calculation?

Were the controls selected in an ❒ **Yes** ❒ **Can't tell**

❒ **No acceptable way?**

HINT: We are looking for selection bias which might compromise The generalisibilty of the findings

Were the controls representative of defined population (geographically and/or temporally)

Was there something special about the controls?

Was the non-response high? Could non-respondents be different in any way?

Are they matched, population based or randomly selected?

Was there a sufficient number of controls selected?

Was the exposure accurately measured to tell ❒No minimise bias? ❒Yes ❒Can't

HINT: We are looking for measurement, recall or classification bias

Was the exposure clearly defined and accurately measured?

Did the authors use subjective or objective measurements?

Do the measures truly reflect what they are supposed to measure? (Have they been validated?)

Were the measurement methods similar in the cases and controls?

Did the study incorporate blinding where feasible?

Is the temporal relation correct? (Does the exposure of interest precede the outcome?)

(a) What confounding factors have the accounted for? **List: authors**

HINT: List the ones you think might be important, that The author missed.

Genetic

Environmental

Socio-economic

(b) Have the authors taken account of the potential confounding factors in the design and/or in their analysis? ❒Yes ❒Can't tell ❒No

HINT: Look for Restriction in design, and techniques e.g. modelling stratified-, regression-, or sensitivity analysis to correct, control or adjust for confounding factors

What are the results of this study?

HINT: Consider

What are the bottom line results?

Is the analysis appropriate to the design?

How strong is the association between exposure and outcome (look at the odds ratio)?

Are the results adjusted for confounding, and might confounding still explain the association?

Has adjustment made a big difference to the OR?

(B) What are the results?

How precise are the results?

How precise is the estimate of risk?

HINT: Consider

Size of the P-value

Size of the confidence intervals

Have the authors considered all the important variables?

How was the effect of subjects refusing to participate evaluated?

(B) What are the results?

Do you believe the results? ❒ **Yes** ❒ **No**

HINT: Consider

Big effect is hard to ignore!

Can it be due to chance, bias or confounding?

Are the design and methods of this study sufficiently flawed to make the results unreliable?

Consider Bradford Hills criteria (e.g. time sequence, dose-response gradient, strength, biological plausibility)

(B) What are the results?

C) Will the results help locally?

10. Can the results be applied to the local ☐Yes ☐

HINT: Consider whether

The subjects covered in the study could be sufficiently different from your population to cause concern

Your local setting is likely to differ much from that of the study

Can you quantify the local benefits and harms?

---

11. Do the results of this study fit with evidence? ☐**Yes** ☐**Can't tell** ☐**No other available**

HINT: Consider all the available evidence from RCT's, systematic reviews, cohort studies and case-control studies as well for consistency.

Remember

One observational study rarely provides sufficiently robust evidence to recommend changes to clinical practice or within health policy decision making.

However, for certain questions observational studies provide the only evidence.

Recommendations from observational studies are always stronger when supported by other evidence.

Appendix 5

Cardiff University community panel approval

Cardiff University community panel approval

RE: Community panel

From: **Community Panel** (communitypanel@cardiff.ac.uk)
Sent: 10 December 2014 10:35:15
To: Holly Davies (hadavies80@hotmail.co.uk)
1 attachment
List 1.xlsx (32.4 KB)

Hi Holly,

I'm pleased to inform you that Richard has approved your application to use the community panel. Attached is a list of members. The response rate can vary between projects so I've given you 120 members just to be safe. Please let me know if you require another list.

Please could you send me a list of eventual participants so I can note their participation on the database.

Best,

Chris

Appendix 6

Participant recruitment telephone script

Telephone script – Control Group

Introduction

1. May I speak with (insert name) please?

2. Hello (insert name), my name is Holly Davies and I am contacting you as I believe you are a member of Cardiff University's community panel? Is that correct?

3. I am wondering if this is a convenient time to talk?

4. As a member of the community panel, I believe you are happy to be approached about participating in research. Would you be interested in hearing about my research project?

5. No – That's ok, thanks for taking the time to talk to me today. Good day.

Yes –

I am undertaking research into Post-Traumatic Stress Disorder, more commonly referred to as PTSD. I am looking to recruit people for a control group. The control group for this study will not have a diagnosis of PTSD.

(Control groups are made up of individuals who do not have the specific factor(s) that are under investigation. In other words, control groups allow researchers to make comparisons between groups of individuals, where one group differs from the other group on one key factor (in this instance PTSD)).

Study aims

To investigate factors that may impact on a person's management and ability to recover from PTSD.

It is hoped that the results of this study will inform future treatments/interventions and improve patient outcomes.

The study looks at factors that may affect people with PTSD, where my primary aim is to inform future interventions/treatme

Payment

We will be offering a payment of £6 per person.

Travel expenses will be paid at the rate of 24 pence per mile for car users, or we will cover public transport costs such as bus or train fares. Unfortunately, we will be unable to cover taxi fares.

What will be required of you as a member of the control group?

The study will ask you to view a series of faces on a computer screen along with listening to some statements on headphones; you will then be asked to answer some questions about what you have seen and heard.

You will also be asked to complete five short questionnaires asking you for general information about yourself, your relationships, health, and well-being.

The consent process and tasks should take no more than 1 hour and fifteen minutes of your time.

Where will the study be taking place?

In an effort to reduce the amount of travelling volunteers will have to do, we have set up a number of sites across South and West Wales. Ideally, we will endeavour to find a location nearest to your home. If you are interested in taking part, we could organise for you to visit one of the following locations:

Cardiff University
Ebbw Vale – Ysbyty Aneurin Bevan
Gorseinon, Swansea – Ty Einon Centre
Newport – Park Square
Barry – Holton Road
Pontypridd – The Avenue
Abergavenny – Ross Road

6. Do you have any questions you would like to ask?

(If the individual states that they would like to participate; check for mobility issues/access to sites and run through the inclusion/exclusion criteria)

Who can take part?

I need to quickly run through some of the inclusion and exclusion criteria for this study, as they could affect the factors that we are investigating. You do not have to tell me whether any of the following medical conditions may or may not affect you. All you need to say is whether you are eligible to take part. Please do not share anything that you are not comfortable sharing.

Exclusion criterion

If you are currently suffering from any mental health problem(s), or have a mental health diagnosis for which you receive ongoing support and/or medication;
If you are currently suffering with a substance misuse problem, or have previously suffered with a substance misuse problem (drugs, alcohol or prescription medications);
If you have suffered a head injury, or been diagnosed with a neurological condition such as dementia, Parkinson's, epilepsy, etc.
If you have a learning disability;
If you have problems with your sight that cannot be corrected by wearing glasses or contact lenses;
If you have a hearing problem that would prevent you from hearing audio statements on headphones.

If any one (or more) of these statements applies to you then please state that you are unable to take part.

7. Are you able to take part?

(If the individual has not indicated that they would like to take part)

8. Would you like me to send out some information, so that you can look over it before making a decision?

9. Do you have an e-mail address?

10. Alternatively, I can send it via post if you are happy to give me your address?

If you have any questions you would like to ask once you have looked over the information, there are contact details on the information sheet. Please feel free to contact me if you wish me to clarify anything.

11. Would it be ok if I called you in a week to see if you are interested in participating?

(If the individual has indicated they would like to proceed, continue).

<u>Testing session</u>

12. To ensure everyone's safety and to choose the most appropriate site for you to visit, may I ask whether you require any adjustments or have any issues with mobility that require lifts etc?

13. Which would be the most convenient site to attend a testing session?

14. Are there any days and/or times where it would be more convenient for you to attend a testing session? (Note these)

15. I have to book a room at this centre; would it be ok for me to ring you back later with some days and times?

Thank you for your time

Appendix 7

Participant recruitment email

Clinical Psychology Training,
School of Psychology (11th Floor),
Tower Building,
Cardiff University,
Park Place,
Cardiff,
CF10 3AT

Dear Sir/Madam

Researchers at the School of Psychology, Cardiff University are looking for volunteers for research into Post-Traumatic Stress Disorder (PTSD). I have contacted you as you are registered on the community panel and have indicated that you are happy to be contacted about forthcoming research projects. For the purpose of this research you are being contacted to be a participant in the control group, which means that you will not have a diagnosis of PTSD. We initially spoke on the phone, and you agreed that you were happy to receive further information about this study via email.

If this is not the case, or if this email has reached you in error, then please either discard it or contact the sender and state that you are not a member of the panel.

Payment: £6 (plus travel expenses of 24 pence per mile or payment on receipt of public transport expenses (bus fares or train fares only)

Time required: Approximately 60 minutes
When: ASAP

Who can take part?

Men or women aged eighteen years or above.

There are some criteria that we need to exclude for this study, these are as follows;

If you are currently suffering from any mental health problem(s), or have a mental health diagnosis for which you receive ongoing support and/or medication;
If you are currently suffering with a substance misuse problem, or have previously suffered with a substance misuse problem (drugs, alcohol or prescription medications);
If you have suffered a head injury, or been diagnosed with a neurological condition such as dementia, Parkinson's, epilepsy, etc.
If you have a learning disability;
If you have problems with your sight that cannot be corrected by wearing glasses or contact lenses;
If you have a hearing problem that would prevent you from hearing audio statements on headphones.

If any of these statements applies to you then please state that you are unable to take part.

Study outline

You have been asked to participate in this research as a member of the control group, which means that you do not have PTSD. Control groups are made up of individuals who do not have the specific factor(s) that are under investigation. In other words, control groups allow researchers to make comparisons between groups of individuals, where one group differs from the other group on one key factor (in this instance PTSD).

Firstly, you will also be asked to complete a questionnaire, which will ask you questions about your age, gender, occupation, and general well-being. Then you will be asked to view a series of faces on a computer screen; following which you will be asked some questions about what you have seen. Then you will be asked to listen to a series of statements through a set of headphones; following which you will be asked some questions about what you have heard.

After you have completed the tasks you will be asked to complete four short questionnaires. A research assistant will be on hand to assist you, should you require any help. We would encourage you not to think too hard about your responses, but indicate your first response.

The tasks and consent process will take approximately 60 minutes of your time.

It is hoped that this study's findings will inform future interventions/treatments and that this might be a means of improving patient outcomes.

What happens to all the information?

The results from the tasks will be coded with a number; all information will therefore be anonymous once it has been coded. To protect your anonymity, personal information will be destroyed at the point of coding. The anonymized data will only be viewed by the research team, academic staff, and external markers involved in the study; data will be kept for a period of fifteen years, in line with NHS/University requirements and then destroyed.

I have attached an information sheet that should be able to answer any questions you may have. This information sheet provides full details of anonymity and consent. If you have any further questions that you would like to ask about participation, then please do not hesitate to contact me at this email address. I am happy to answer any queries.

How can you take part?

If you would like to participate in this research, and to arrange a suitable time for testing, then please respond via email to: holly.davies@wales.nhs.uk or via telephone: 07583 708 878.

Thank you for your time.

Kind regards,

Holly Davies
Trainee Clinical Psychologist

Appendix 8

Participant information sheet – Control group

Clinical Psychology Training,
School of Psychology (11th Floor),
Tower Building,
Cardiff University,
Park Place,
Cardiff,
CF10 3AT

Information Sheet

My name is Holly Davies, and I am conducting research into individuals with Post-traumatic Stress Disorder (PTSD).

Background

This research will form part of the requirements toward becoming a qualified Clinical Psychologist. I am currently enrolled on the Doctoral Programme in Clinical Psychology at Cardiff University, and therefore will be conducting this study as an academic and not a clinician. Should you require further information or assistance, research staff will aim to signpost you to support services.

Outline of study

You have been asked to participate in this research as a member of the control group. This means that you do not have PTSD.

This study investigates whether individuals with a current diagnosis of Post-Traumatic Stress Disorder (PTSD group) are as able as non-PTSD individuals (control group) to identify emotional expressions when viewing faces on a screen. This study also looks at whether the PTSD group are less able to recognise the emotional content of speech in comparison to the control group. For example, the expression “I’m fine” could be said in a number of different ways, conveying a number of different emotions. Therefore, this study looks at an individual’s ability to recognise the emotional content of a message by exploring how they react to a number of sentences being read aloud.

You will be asked to view a series of faces on a computer screen, along with listening to some statements on headphones; you will then be asked to answer some questions about what you have seen and heard.

You will also be asked to complete five short questionnaires asking you for general information about yourself, your relationships, your health, and your well-being.

The study looks at factors that may affect people with PTSD. My primary aim is to inform future interventions/treatments.

Study aims

To investigate factors that may impact on a person's management and ability to recover from PTSD. Hopefully, the results from this study will inform future treatments/interventions and improve patient outcomes.

"Why am I being asked to take part?"

You are being asked to take part as a member of the control group. Control groups are made up of individuals who do not have the specific factor(s) that are under investigation. In other words, control groups allow researchers to make comparisons between groups of individuals, where one group differs from the other group on one key factor (in this instance PTSD).

Requirements for participants

You are being asked to participate in this research as a member of the control group; the control group participants do not have a PTSD diagnosis.

For the purpose of this study, we need to exclude the following individuals, as people with these conditions may affect the results of this study;

If you are currently suffering from any mental health problem(s), or have a mental health diagnosis for which you receive ongoing support and/or medication;
If you are currently suffering with a substance misuse problem, or have previously suffered with a substance misuse problem (drugs, alcohol or prescription medications);
If you have suffered a head injury, or been diagnosed with a neurological condition such as dementia, Parkinson's, epilepsy, etc.
If you have a learning disability;
If you have problems with your sight that cannot be corrected by wearing glasses or contact lenses;
If you have a hearing problem that would prevent you from hearing audio statements on headphones.

If any of the above applies to you, then please inform the researcher, you do not need to explain which of the above applies to you if you prefer not to, but just state that you are unable to participate.

Payment

Payment: £7 only

Travel expenses: 24 pence per mile, or payment of public transport expenses (bus fares or train fares only – receipts required on the day).

Consent

Before starting the tasks, the researcher will take you through a series of questions to ensure that you understand:

The study's aims.
What is requested of you as a participant.
That you are free to withdraw at any point during the data collection stage.
Data will be anonymised, which means that any and all reference to personal identifiers will be removed.
The potential risks and benefits for participants.
How the results will be used.

You will have the opportunity to ask further questions. If you are happy to continue, then you will be asked to complete a written consent form, agreeing to participate in the study.

Participation in this study is voluntary; you do not have to participate and your rights (medical, employment, or otherwise) will not be affected if you choose not to participate.

Should you choose to participate, you have the right to withdraw at any point during the data collection stage; you do not need to provide an explanation for withdrawal. A researcher may ask you your reasons for withdrawing, but it is your decision whether you wish to answer.

Confidentiality

The results from the tasks will be coded with a number; all information will therefore be anonymous once it has been coded. To protect your anonymity personal information will be destroyed at the point of coding. The anonymised data will only be viewed by the research team, academic staff, and external markers involved in the study; data will be kept for a period of fifteen years in line with NHS/University requirements and then destroyed.

The researcher aims to publish this study at a later date; no identifying (personal) information will be included in any published works. This research may also be presented at future conferences or meetings. Again, no identifying information will be contained in any presentations.

What will be expected of you on the day?

If you agree to participate in this study, we will arrange a convenient time for you to come in and complete the tasks. In an effort to reduce the amount of travelling for volunteers, we have set up a number of sites across South and West Wales. The following locations are available:

Cardiff University
Ebbw Vale – Ysbyty Aneurin Bevan
Gorseinon, Swansea – Ty Einon Centre
Newport – Park Square
Barry – Holton Road
Pontypridd – The Avenue
Abergavenny – Ross Road

Ideally, we will endeavour to find a location nearest to your home to complete the tasks. When you arrive on the day you will be asked several questions to ensure you are participating in the research freely and you will have an opportunity to ask questions. You will then be asked to complete a consent form and a short screening questionnaire, before being taken into the room to complete the tasks.

In this room there will be a computer on which the task will take place. The study will ask you to view a series of faces on a computer screen; you will then be asked to answer some questions about what you have seen.

You will then be asked to complete a questionnaire which will ask you questions about your age, gender and occupation, along with some questions about your general well-being. You will be asked to listen to a series of statements on headphones and again answer some questions about the statements you have heard.

After you have completed the tasks you will be asked to complete four short questionnaires. A research assistant will be on hand to assist you, should you need any help. We would encourage you not to think too hard about your responses, but instead indicate your initial reaction to the statement.

The tasks and consent process will take approximately 60 minutes of your time.

After you have completed the tasks the researcher will debrief you, giving you a full explanation of the study and a debrief sheet for you to take away. Again you will be able to ask any questions that you may have. To ensure that you are ok to leave, the researcher will ask you about how you are feeling. If you need further support, information will be provided on how to contact support agencies.

Ethical approval

Approval has to be granted by Cardiff and Vale University Health Board's ethics committee, Research and Development office, and Cardiff University prior to studies such as this taking place. This study has been granted approval by the appropriate bodies, and they have reviewed the measures put in place to ensure participants safety.

If you wish to make a complaint about any aspect of this study then you are able to do so by contacting:

Secretary of the Ethics Committee
School of Psychology
Cardiff University,
Tower Building,
Park Place,
Cardiff,
CF10 3AT.

Tel: 02920870360
E mail: psychethics@cardiff.ac.uk

Research team contact details

If you need any further information then please do not hesitate to contact me. I am happy to answer any questions you may have.

You can contact me at holly.davies@wales.nhs.uk or DaviesH58@cardiff.ac.uk. Alternatively, you may contact me via post, at the following address;

Holly Davies,
Trainee Clinical Psychologist,
Clinical Psychology Training, 11th Floor Tower Building,
School of Psychology,
Cardiff University,
Park Place,
Cardiff,
CF10 3AT.

Dr Jenny Moses will supervise this project; she can also be contacted at the above address.

If you wish to participate in this research then please contact me as soon as possible to arrange a suitable time for us to meet and complete the testing.

Thank you for taking the time to read this information.

Appendix 9

Participant information sheet – Clinical group

Clinical Psychology Training,
School of Psychology (11th Floor),
Tower Building,
Cardiff University,
Park Place,
Cardiff,
CF10 3AT

Information Sheet

My name is Holly Davies, and I am conducting research into individuals with Post-traumatic Stress Disorder (PTSD).

Background

This research will form part of the requirements toward becoming a qualified Clinical Psychologist. I am currently enrolled on the Doctoral Programme in Clinical Psychology at Cardiff University, and therefore will be conducting this study as an academic and not a clinician. Should you require further information or assistance, research staff will aim to signpost you to support services.

Outline of study

You have been asked to participate in this research as you have been diagnosed with post traumatic stress disorder (PTSD).

This study investigates whether individuals with a current diagnosis of Post-Traumatic Stress Disorder (PTSD group) are as able as non-PTSD individuals (control group) to identify emotional expressions when viewing faces on a screen. This study also looks at whether the PTSD group are less able to recognise the emotional content of speech in comparison to the control group. For example, the expression “I’m fine” could be said in a number of different ways, conveying a number of different emotions. Therefore, this study looks at an individual’s ability to recognise the emotional content of a message by exploring how they react to a number of sentences being read aloud.

You will be asked to view a series of faces on a computer screen, along with listening to some statements on headphones; you will then be asked to answer some questions about what you have seen and heard.

You will also be asked to complete five short questionnaires asking you for general information about yourself, your relationships, your health, and your well-being.

The study looks at factors that may affect people with PTSD. My primary aim is to inform future interventions/treatments.

Study aims

To investigate factors that may impact on a person's management and ability to recover from PTSD. Hopefully, the results from this study will inform future treatments/interventions and improve patient outcomes.

"Why am I being asked to take part?"

You are being asked to participate in this research as you have a diagnosis of PTSD and you are listed on the NCMH PTSD registry.

Requirements for participants

You are being asked to participate in this research as you have a diagnosis of PTSD and you are listed on the NCMH PTSD registry.

For the purpose of this study, we need to exclude the following individuals, as people with these conditions may affect the results of this study;

If you have a mental health diagnoses which is not PTSD or connected to your PTSD, which you receive ongoing support or medication for. For example, Bipolar Disorder, Schizophrenia, Autistic Spectrum Disorders;
If you are currently suffering with a substance misuse problem, or have previously suffered with a substance misuse problem (drugs, alcohol or prescription medications);
If you have suffered a head injury, or been diagnosed with a neurological condition such as dementia, Parkinson's, epilepsy, etc.
If you have a learning disability;
If you have problems with your sight that cannot be corrected by wearing glasses or contact lenses;
If you have a hearing problem that would prevent you from hearing audio statements on headphones.

If any of the above applies to you, then please inform the researcher, you do not need to explain which of the above applies to you if you prefer not to, but just state that you are unable to participate.

Payment**Travel expenses: 24 pence per mile, or payment of public transport expenses (bus fares or train fares only – receipts required on the day).**

Consent

Before starting the tasks, the researcher will take you through a series of questions to ensure that you understand:

The study's aims.
What is requested of you as a participant.
That you are free to withdraw at any point during the data collection stage.
Data will be anonymised, which means that any and all reference to personal identifiers will be removed.
The potential risks and benefits for participants.

How the results will be used.

You will have the opportunity to ask further questions. If you are happy to continue, then you will be asked to complete a written consent form, agreeing to participate in the study.

Participation in this study is voluntary; you do not have to participate and your rights (medical, employment, or otherwise) will not be affected if you choose not to participate.

Should you choose to participate, you have the right to withdraw at any point during the data collection stage; you do not need to provide an explanation for withdrawal. A researcher may ask you your reasons for withdrawing, but it is your decision whether you wish to answer.

Confidentiality

The results from the tasks will be coded with a number; all information will therefore be anonymous once it has been coded. To protect your anonymity personal information will be destroyed at the point of coding. The anonymised data will only be viewed by the research team, academic staff, and external markers involved in the study; data will be kept for a period of fifteen years in line with NHS/University requirements and then destroyed.

The researcher aims to publish this study at a later date; no identifying (personal) information will be included in any published works. This research may also be presented at future conferences or meetings. Again, no identifying information will be contained in any presentations.

What will be expected of you on the day?

If you agree to participate in this study, we will arrange a convenient time for you to come in and complete the tasks. In an effort to reduce the amount of travelling for volunteers, we have set up a number of sites across South and West Wales. The following locations are available:

Cardiff University
Ebbw Vale – Ysbyty Aneurin Bevan
Gorseinon, Swansea – Ty Einon Centre
Newport – Park Square
Barry – Holton Road
Pontypridd – The Avenue
Abergavenny – Ross Road

Ideally, we will endeavour to find a location nearest to your home to complete the tasks. When you arrive on the day you will be asked several questions to ensure you are participating in the research freely and you will have an opportunity to ask questions. You will then be asked to complete a consent form and a short screening questionnaire, before being taken into the room to complete the tasks.

In this room there will be a computer on which the task will take place. The study will ask you to view a series of faces on a computer screen; you will then be asked to answer some questions about what you have seen.

You will then be asked to complete a questionnaire which will ask you questions about your age, gender and occupation, along with some questions about your general well-being. You will be asked to listen to

a series of statements on headphones and again answer some questions about the statements you have heard.

After you have completed the tasks you will be asked to complete four short questionnaires. A research assistant will be on hand to assist you, should you need any help. We would encourage you not to think too hard about your responses, but instead indicate your initial reaction to the statement.

The tasks and consent process will take approximately 75 minutes of your time.

After you have completed the tasks the researcher will debrief you, giving you a full explanation of the study and a debrief sheet for you to take away. Again you will be able to ask any questions that you may have. To ensure that you are ok to leave, the researcher will ask you about how you are feeling. If you need further support, information will be provided on how to contact support agencies.

Ethical approval

Approval has to be granted by Cardiff and Vale University Health Board's ethics committee, Research and Development office, and Cardiff University prior to studies such as this taking place. This study has been granted approval by the appropriate bodies, and they have reviewed the measures put in place to ensure participants safety.

If you wish to make a complaint about any aspect of this study then you are able to do so by contacting:

Secretary of the Ethics Committee
School of Psychology
Cardiff University,
Tower Building,
Park Place,
Cardiff,
CF10 3AT.

Tel: 02920870360
E mail: psychethics@cardiff.ac.uk

Research team contact details

If you need any further information then please do not hesitate to contact me. I am happy to answer any questions you may have.

You can contact me at holly.davies@wales.nhs.uk or DaviesH58@cardiff.ac.uk. Alternatively, you may contact me via post, at the following address;

Holly Davies,
Trainee Clinical Psychologist,
Clinical Psychology Training, 11th Floor Tower Building,
School of Psychology,
Cardiff University,
Park Place,
Cardiff,
CF10 3AT.

Dr Jenny Moses will supervise this project; she can also be contacted at the above address.

If you wish to participate in this research then please contact me as soon as possible to arrange a suitable time for us to meet and complete the testing.

Thank you for taking the time to read this information.

Appendix 10
Debrief Information

Clinical Psychology Training,
School of Psychology (11th Floor),
Tower Building,
Cardiff University,
Park Place,
Cardiff,
CF10 3AT

Debrief Information

Title of research

An investigation of social-cognition in Post-Traumatic Stress Disorder (PTSD)

I would like to firstly thank you for taking the time to participate in this research. Without your help, studies of this kind would not be possible.

Aims of the study

This study investigates whether individuals with a current diagnosis of Post-Traumatic Stress Disorder (PTSD group) are as able as non-PTSD individuals (control group) to identify emotional expressions when viewing faces on a screen. Specifically, the study looks at whether the PTSD group are less able to recognise the emotional content of speech in comparison to the control group. For example, the expression "I'm fine" could be said in a number of different ways, conveying a number of different emotions. Therefore, this study looks at an individual's ability to recognise the emotional content of a message by exploring how they react to a number of sentences being read aloud.

Moreover, we have also gathered information about people's relationships. This is because we wish to investigate whether people who had more difficulties recognising emotional cues would report greater difficulties in their personal relationships. Fundamentally, we believe that relationships are a two way process, and if one person is less able to understand the other person's emotions, then difficulties are more likely to occur.

Your part in the study

You have completed questionnaires about your relationships with others, and how you viewed the support you gained from these relationships. This enables us to get a view of how supported you felt in your relationships.

You also completed computer based tasks, where you viewed faces on a screen and listened to a speaker read sentences. You were then asked to indicate what emotion you felt the person was conveying. This allowed us to obtain a measure of emotional recognition.

Anonymity

The results from the tasks will be given a unique reference number when they are inputted onto our system. This ensures that when people view the results of the tests they do not know who completed them. Consequently, your personal information will be destroyed at the point of coding.

Previous studies

Emotional recognition has been investigated in a number of other groups. For example, previous research has looked at people with diagnoses of schizophrenia and Bipolar Disorder.

If you would like to read more about these previous findings please contact us via the details provided below.

Contact details

If you have any further questions the researcher and her supervisor can be contacted at the following addresses:

Researcher:

Holly Davies
Clinical Psychology Training
School of Psychology
Cardiff University,
11th Floor Tower Building,
Park Place,
Cardiff,
CF10 3AT.

Supervised by:

Dr Jenny Moses
Clinical Psychology Training
School of Psychology
Cardiff University,
11th Floor Tower Building,
Park Place,
Cardiff,
CF10 3AT

Thank you for your time and assistance

Appendix 11

GP letter

Clinical Psychology Training,
School of Psychology (11th Floor),
Tower Building,
Cardiff University,
Park Place,
Cardiff,
CF10 3AT

Name of GP
Address of practice
Town
Postcode

Date:

Dear Dr (Insert name),

RE: (Participant's name)
D.O.B: (Participants DOB)

I am writing to inform you that the above named individual has participated in a research study on (Insert day and date they participated).

Aims of the study

This study investigates whether individuals with a current diagnosis of Post-Traumatic Stress Disorder (PTSD group) are as able as non-PTSD individuals (control group) to identify emotional expressions when viewing faces on a screen. Specifically, the study looks at whether the PTSD group are less able to recognise the emotional content of speech in comparison to the control group. For example, the expression "I'm fine" could be said in a number of different ways, conveying a number of different emotions. Therefore, this study looks at an individual's ability to recognise the emotional content of a message by exploring how they react to a number of sentences being read aloud.
Moreover, we have also gathered information about people's relationships. This is because we wish to investigate whether people who had more difficulties recognising emotional cues would report greater difficulties in their personal relationships. Fundamentally, we believe that relationships are a two way process, and if one person is less able to understand the other person's emotions, then difficulties are more likely to occur.

Why did this patient participate?

The above named individual participated voluntarily in this research and was asked to participate as they have a diagnosis of PTSD and are listed on the NCMH PTSD registry. Informed consent was obtained from the participant, mindful of the Mental Capacity Act (2005) and consistent with the procedure which was approved by Cardiff University, Cardiff and Vale University Health Board and the South East Wales Local Research Ethics Committee.

Debriefing and further support

The participant was fully debriefed at the end of the session and provided with a debrief information sheet to take away with them. This explained what the study was investigating, the procedure and why they had been asked to undertake each task. The participant was not judged to require any further support at this time, although they were provided with contact details for supportive organisations, should they feel they require support at a later stage. Should this participant present to you as their general practitioner requiring additional support then you are welcome to contact the research team, using the details provided below.

Contact details

You can contact me at holly.davies@wales.nhs.uk or DaviesH58@cardiff.ac.uk. Alternatively, you may contact me via post, at the following address;

Holly Davies,
Trainee Clinical Psychologist,
Clinical Psychology Training, 11th Floor Tower Building,
School of Psychology,
Cardiff University,
Park Place,
Cardiff,
CF10 3AT.

Dr Jenny Moses, Consultant Clinical Psychologist, is supervising this project; she can also be contacted at the above address.

Yours sincerely,

Holly Davies
Trainee Clinical Psychologist

Supervised by

Dr Jenny Moses
Consultant Clinical Psychologist

Appendix 12

Participant consent form – Control group

Clinical Psychology Training,
School of Psychology (11th Floor),
Tower Building,
Cardiff University,
Park Place,
Cardiff,
CF10 3AT

Patient Identification Number for this study: _____

Consent Form

Title of study: **An investigation into social-cognition in PTSD.**

Names of Researcher: **Holly Davies**

	Please initial box
1. I confirm that I have read and understood the information sheet dated 25th May 2014 (Version 1) for the above study. I have had the opportunity to consider the information, ask questions, and have had any questions answered satisfactorily.	☐
2. I understand that my participation is voluntary, that I am free to withdraw at any time without giving any reason, and that my medical care or legal rights will not be affected.	☐
3. I consent to receiving information inviting me to take part in future Cardiff University and/or NHS research, and I understand that my participation in any such research would be voluntary.	☐
4. I consent to the data collected in this study being used in future linked NHS and Cardiff University research.	☐
5. I agree to accept a one off payment of £6 for participation in this study research. I agree to be paid travel expenses at the rate of 24 pence per mile, or payment of bus or train fares (with a valid receipt).	☐
6. I agree to take part in the above study.	☐

_____ _____ _____

Name of patient	Date	Signature

Appendix 13

Participant consent form – Clinical group

Clinical Psychology Training,
School of Psychology (11th Floor),
Tower Building,
Cardiff University,
Park Place,
Cardiff,
CF10 3AT

Patient Identification Number for this study: _____

Consent Form

Title of study: **An investigation into social-cognition in PTSD.**

Names of Researcher: **Holly Davies**

	Please initial box
1. I confirm that I have read and understood the information sheet dated 25th May 2014 (Version 1) for the above study. I have had the opportunity to consider the information, ask questions, and have had any questions answered satisfactorily.	☐
2. I understand that my participation is voluntary, that I am free to withdraw at any time without giving any reason, and that my medical care or legal rights will not be affected.	☐
3. I consent to receiving information inviting me to take part in future Cardiff University and/or NHS research, and I understand that my participation in any such research would be voluntary.	☐
4. I consent to the data collected in this study being used in future linked NHS and Cardiff University research.	☐
5. I consent to my GP being informed that I have participated in this study.	☐

6. I agree to be paid travel expenses at the rate of 24 pence per mile, or payment of bus or train fares (with a valid receipt). ☐

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

Name of patient	Date	Signature
Name of person taking consent	Date	Signature

Appendix 14

NRES ethical approval

Health Research Authority

NRES Committee London - Camberwell St Giles

Level 3, Block B

Whitefriars Lewins Mead

Bristol BS1 2NT

Telephone: 0117 3421391

08 September 2014

Dr Jenny Moses

Clinical Psychology Training

11th Floor, Tower Building, Cardiff Univeristy

Park Place, Cardiff

CF10 3AT

Dear Dr Moses

Study title:	**An investigation of social-cognition in PTSD.**
REC reference:	**14/LO/1423**
Protocol number:	**SPON 1328-14**
IRAS project ID:	**149617**

Thank you for your letter of 8th September, responding to the Proportionate Review Sub-Committee's request for changes to the documentation for the above study.

The revised documentation has been reviewed and approved by the sub-committee.

We plan to publish your research summary wording for the above study on the NRES website, together with your contact details, unless you expressly withhold permission to do so.

Publication will be no earlier than three months from the date of this favourable opinion letter. Should you wish to provide a substitute contact point, require further information, or wish to withhold permission to publish, please contact the REC Manager Miss Elizabeth Hearn, nrescommittee.london-camberwellstgiles@nhs.net.

Confirmation of ethical opinion

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

Conditions of the favourable opinion

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

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

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

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

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

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

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

Registration of Clinical Trials

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

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

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

If a sponsor wishes to contest the need for registration they should contact Catherine Blewett (catherineblewett@nhs.net), the HRA does not, however, expect exceptions to be made.

Guidance on where to register is provided within IRAS.

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

Ethical review of research sites

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

Approved documents

The documents reviewed and approved by the Committee are:

Document	*Version*	*Date*
Covering letter on headed paper [Response to REC & R&D]		08 September 2014
Evidence of Sponsor insurance or indemnity (non NHS Sponsors	1	19 July 2014
only) [CU Public Liability Insurance (2013-2014)]		
Evidence of Sponsor insurance or indemnity (non NHS Sponsors only)		
GP/consultant information sheets or letters [GP letter]	1	28 August 2014
IRAS Checklist XML [Checklist_22072014]		22 July 2014
Letter from sponsor [Sponsorship Letter (149617)]	1	19 July 2014
Letters of invitation to participant [Telephone script (149617) - Control group]	1	21 July 2014
Letters of invitation to participant [Draft e mail to control group participants]	1	21 July 2014
Non-validated questionnaire [Demographic questionnaire]	1	19 July 2014
Other [Debrief form (149617) - control and clinical groups]	1	21 July 2014
Other [R&D Response]	14-MEH-5989	08 September 2014
Other [GCP Certificate (Holly Davies)]	1	15 July 2014
Other [information for researchers]		
Participant consent form [Consent Form (version 1 - 149617) - Control group]	1	19 July 2014
Participant consent form [Consent Form (version 1 - 149617) - Clinical group]	1	19 July 2014
Participant consent form [Consent Form (version 2 - 149617) - Clinical group]	2	25 August 2014
Participant information sheet (PIS) [Participant Information Sheet (149617) - Clinical group]	2	31 August 2014
Participant information sheet (PIS) [Participant Information Sheet - Control group]	2	26 August 2014

Participant information sheet (PIS) [Participant Information Sheet (149617) - Clinical group]	1	21 July 2014
Participant information sheet (PIS) [Participant Information Sheet - Control group]	1	19 July 2014
REC Application Form [REC_Form_22072014]		22 July 2014
Research protocol or project proposal [Rsearch proposal (LRSP - 149617)]	1	21 July 2014
Research protocol or project proposal [Rsearch proposal (LRSP - 149617)]	2	02 September 2014
Summary CV for Chief Investigator (CI) [CV Jenny Moses (CI)]	1	15 July 2014
Summary CV for student [CV Holly Davies (PI)]	1	15 July 2014
Summary CV for supervisor (student research) [CV Jenny Moses (CI)]	1	15 July 2014
Summary CV for supervisor (student research) [CV Jenny Moses (CI)]	1	31 May 2014
Validated questionnaire [Questionnaires (Sections B - IIP-32, G - MDSPSS, H - ECR-S)]	1	28 October 2013
Validated questionnaire [TSQ]	1	19 July 2014

Statement of compliance

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

Ethics Committees in the UK.

After ethical review

Reporting requirements

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

Notifying substantial amendments
Adding new sites and investigators
Notification of serious breaches of the protocol

Progress and safety reports
Notifying the end of the study

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

Feedback

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

http://www.hra.nhs.uk/about-the-hra/governance/quality-assurance

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

/LO/1423	**Please quote this number on all correspondence**

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

Yours sincerely

pp KAHearn

Mr John Rihcardson Chair

Email: nrescommittee.london-camberwellstgiles@nhs.net

Enclosures: *"After ethical review – guidance for researchers"*

Copy to: *Ms Helen Falconer*

Ms Helen Paine, Cardiff and Vale UHB

Appendix 15

R&D governance review and approval

Bwrdd Iechyd Prifysgol
Caerdydd a'r Fro
Cardiff and Vale
University Heafth Board

Consultant Clinical Psychologist
1 1 th Floor, Tower Building
Cardiff University
Park Place
Cardiff
CFIO 3AT

Tel 029 20746986
Fax: 029 2074531 1
CAV_Research.Development@wales.nhs.uk

Ysbyty Athrofaol Cymru
University Hospital of Wales
Heath Park, Cardiff, CF14 4XVV
Phone 029 2074 7747
Fax 029 2074 3838
Minicom 2074 3632

Parc Y Mynydci Rychars, Caerdydd, CF144 X W
Ffòn 029 2074 7747
Ffacs 029 20743838
Minicom 2074 3632

From Professor C Fegan
R&D Director
R&D Office, 2 nd Floor TB2
University Hospital of Wales
Cardiff
CF144XW

09 October 2014

Dr Jenny Moses

Dear Dr Moses

Cardiff and Vale UHB Ref and Study Title • 14/MEH/5989 : An Investigation Of Social Cognitian in PTSD

IRAS Project ID: 149617

The above project was forwarded to Cardiff and Vale University Health Board R&D Office by the NISCHR Permissions Coordinating Unit. A Governance Review has now been completed on the project.

Documents approved for use in this study are:

Document	Version	Date of document
NHS R&D Form	3.5	
sst Form	3.5	
Debrief Information: Telephone Scri t - Control	1	20/07/2014
GP Information Sheet/Letter	1	28/08/2014
Information Sheet for Researchers	4	05/04/2012
Letter of Invitation to Participant: Draft email	1	20/07/2014
Participant Consent Form: Clinical Group	2	31/08/2014

Partici ant Information Sheet: Clinical Grou	2	31/08/2014
Participant Information Sheet: Control	2	26/08/2014
Protocol	2	02/09/2014
Questionnaire: Demographic Information Clinical and	1	06/05/2014
Questionnaire: PTSDRe ist - Self complete	6	09/08/2013
Questionnaire: Trauma Screenin		
Pa rticiant Consent Form: Control Group	2	25/08/2014

I am pleased to inform you that the UHB has no objection to your proposal You have informed us that Cardiff University is willing to act as Sponsor under the Research Governance Framework for Health and Social Care.

Please accept this letter as confirmation of permission for the project to begin within this UHB.

Because NISCHR has determined that this study is ineligible for adoption onto the Clinical Research Portfolio and your Directorate R&D Lead has determined that it does not meet the criteria for Pathway-to-Portfolio, the study will incur a £200 R&D set-up fee. The Directorate R&D Lead has confirmed that he is satisfied with the arrangements for meeting this and any other costs. The UHB Finance Department will invoice the Directorate / request transfer of funds from the Directorate accordingly.

May I take this opportunity to wish you success with the project and remind you that as Principal Investigator you are required to:

Inform the R&D Office if this project has not opened within 12 months of the date of this letter. Failure to do so may invalidate R&D approval

Inform NISCHR PCU and the UHB R&D Office if any external or additional funding is awarded for this project in the future

Submit any substantial amendments relating to the study to NISCHR PCU in order that they can be reviewed and approved prior to implementation Ensure NISCHR PCU is notified of the study's closure

Ensure that the study is conducted in accordance with all relevant policies, procedures and legislation

Provide information on the project to the UHB R&D Office as requested from time to time, to include participant recruitment figures

Yours sincerely,

Professor

Christopher Fegan

R&D Director I Chair of the Cardiff and Vale Research Review Service (CaRRS) CC R&D Lead Professor Ian Jones

Holly Davies

Sponsor: Helen Falconer, Cardiff University

Appendix 16

Cardiff University risk assessment

1.General Information

Risk Assessment Form

IMPORTANT: Before carrying out the assessment, please read the Guidance Notes

Department	Clinical Psychology Training	**Building**	Tower Building	**Room No**	Floor 11
Name of Assessor	Holly Davies	**Date of Original Assessment**	12.06.14	**Assessment No**	443_c1269058

Status of Assessor: Supervisor , Postgraduate ✗ , Undergraduate , Technician , Other: (Specify)

☐ ☐ ☐ ☐

2. Brief Description of Procedure/Activity including its Location and Duration

The control group will be recruited via Cardiff University's community panel. The University registry will provide the details of individuals on the panel who are interested in this type of study. The current researcher will screen volunteers to ensure they meet the inclusion/exclusion criteria. Participants will be matched to the clinical sample by gender and age (using the following age ranges - 17-25, 26-40, 41-60, 61 and above). Individuals on the control panel will be contacted, if they match a member of the clinical sample for gender and age, to ascertain if they wish to participate in the study.

The researcher will contact panel members by telephone inviting them to participate and providing details of the inclusion/exclusion criteria, outlining the research and providing them with a participant information sheet (via e mail) should they require further information. Individuals that volunteer will later be contacted via e mail to arrange a suitable time and location to complete the tests and to answer any further questions that they may have about the study.

Alternatively the clinical sample will be asked at the point they are recruited whether they have a friend who would like to participate in the research. If the clinical sample is aware of someone who would like to participate they will be given the researcher's details to pass onto any interested parties, so that potential control volunteers can contact the researcher for further details of the research and a testing appointment.

Testing will commence shortly thereafter; participants will be invited to attend the University to complete the test(s) or one of the satellite NHS locations (clinical space provided in clinics across South and West Wales); participants will be asked about their mobility to ensure sites are appropriate to their needs and to reduce the likelihood of falls. Satellite sites are being used to minimise the travelling for potential participants and to reduce travel expenses (overall research expenses). By minimising travelling for potential participants, it is felt this minimises their risk, as they will be accessing a site nearest to their home location. The researcher will do the bulk of the travelling, but will aim to book several appointments at each site, in order to minimise

the risk to herself. The researcher travels daily as part of her NHS role, visiting patients within the community and will continue to adhere to the health and safety policies and procedures in place; she also has the necessary business insurances for this purpose.

The benefit of using additional sites means there is an added safety element for the researcher, as NHS sites will have staff on hand, providing an additional presence and therefore reducing the likelihood of the researcher being personally attacked. Equally mental health professionals will be available in all these sites, to provide additional support and assistance for any emotional or mental health concerns that could arise. The researcher is currently a Trainee Clinical Psychologist and has therefore had specific training in risk issues, management of violence and aggression and communicating with distressed or hostile individuals. An additional presence will also reduce the risk to the researcher in

handling monies for travelling expenses, payment etc. Only petty cash required for each day will be kept on the researchers person; in the event of a participant becoming hostile, personal safety would be paramount and cash would be handed over, with the police being called in the event of such an incident. Testing will only take place during working hours. The researcher will have additional support at the University; with clinical staff on hand each day at Clinical Psychology Training (11th Floor) should assistance be required. An additional safeguard could be implemented whereby the researcher send an e mail at the end of each testing session, or calls in at designated points to Clinical Psychology Training; so that an alarm can be raised in the event of contact not being made.

On the testing day, the researcher will reiterate the purpose of the study and the role of the participant, answering any further questions the participant may have at this time. Written consent will be obtained, along with addressing issues of confidentiality and consent. Participants will be informed that testing data will be kept for a period of fifteen years, in line with NHS requirements and then destroyed. Participant identifying information will be destroyed immediately after the testing data is coded with a unique identifier, no personal data will be stored. The consent process will take approximately 10 minutes of participant's time.

Participants will be asked to complete the tests on a computer which will take approximately thirty minutes, their responses being recorded for later analysis. Testing will take place in either one of Cardiff' University's labs in the School of Psychology or in a clinic room at a satellite site, which will be NHS premises based across South and West Wales. The labs will be checked to look for potential hazards; these will be highlighted to participants upon entry and details of fire exits will also be provided for each location. The researcher will accompany all participants to and from the building, to provide support and to minimise the risks to participants. All hazards, such as electrical cords etc will be covered where possible to minimise risks. The researcher will make herself aware of the fire procedures and also where the nearest (appropriate) fire extinguisher is, in the event of a fire breaking out. In between the FER and the emotional prosody test (computer based tasks), participants will be asked to complete the demographic questionnaire. In addition participants will also complete the Experiences in Close Relationships Scale – Short Form (ECS-S), Multi-Dimensional Scale of Perceived Social Support and Inventory of Interpersonal Problems (IIP-32); which should take approximately 45 minutes to complete. These measures will be completed at the end of the tests, in line with an experimental design and to ensure that participant's responses to the tests are not influenced by

knowledge of the research question, thus minimising demand characteristics. The control group will be asked to complete the PTSD Checklist for DSM-IV (PCL-5) to ensure they do not meet the criteria for PTSD.

Participants who would like feedback from the study can request a research summary from the researcher on completion of the study. Individuals can withdraw from the study at any time without it affecting their rights to treatment or inclusion in further research.

3. Persons at Risk	Are they...	Notes
Staff Students ✗ Visitor ✗ Contractor	Trained ✗ Competent ✗ Inexperienced Disabled	The researcher is currentlyundertaking DClinPsyand so has had the appropriate training in health and safety, fire safety, management of violence and aggression, lone working, personal safetyetc.

4. Level of	Not
None Constant Periodic ✗	Satellite sites will have other members of staff on hand in the event of an emergency or assistance being required. Cardiff University will be used during working hours; the researcher can also add additional safety measures by checking in after each appointment has finished. Clinical Psychology Training staff will be on the premises daily, if

5. Will Protective Equipment Be Used? Please give ***specific*** details of PPE	
Head Eye Ear	N/A

6. Is the	Not
Yes No ✗	Electrical equipment will be used; this should have been safety checked by each site and the sites safety procedures

7. Will Waste be	If 'yes' please give details of
Yes No ✗	N/A

8. Hazards involved

Work Activity / Item of Equipment / Procedure / Physical Location	**Hazard**	**Control Measures and Consequence of Failure**	**Likelihood (0 to 5)** × **Severity (0 to 5)** = **Level of Risk**
Electrical equipment (computer)	Electrical fire	Ensure safety checks have been performed; be aware of fire extinguishers, fire procedures. Risk of serious injury.	1 4 4

Physical environment	Slips, trips and falls	Ensure room is free from hazards, site maintenance has been maintained. Risk of injury.	2	2	4
Travelling	Car crash	Sites have been chosen to minimise participant travelling. Researcher will follow the health & safety policies in place for travelling.	1	4	4
Lone working	Attack	Sites have been chosen so that other staff will be on the premises to minimise the risks to the researcher. Additional safety measures (regular check ins) can be implemented.	1	2	2
Handling monies	Attack	Sites have been chosen so that other staff will be on the premises to minimise the risks to the researcher. Additional safety measures (regular check ins) can be implemented.	1	2	2

9. Chemical Safety (COSHH Assessment)

Hazard	Control Measures	Likelihood (0 to 5)	× Severity (0 to 5)	= Level of Risk
N/A				

Scoring Criteria for Likelihood (chance of the hazard causing a problem)

10. Source(s) of information used to complete the above

11. Further Action

Highest Level of Risk Score	Action to be taken
0 to 5 ✗	No further action needed
6 to 11	Appropriate additional control measures should be implemented

12 to 25	Additional control measures **MUST** be implemented. Work **MUST NOT** commence until such measures are in place. If work has already started it must **STOP** until adequate control

12. Additional Control Measures – Likelihood and Severity are the values with the additional controls in place

Work Activity / Item of Equipment / Procedure / Physical Location	Hazard and Existing Control Measures	Additional Controls needed to Reduce Risk	Likelihood (0 to 5)	×	Severity (0 to 5)	=	Level of Risk

After the implementation of new control measures the procedure/activity should be re-assessed to ensure that the level of risk has been reduced as required.

13. Action in the Event of an Accident or Emergency

In the event of an accident or emergency, site specific procedures will be followed. This would entail raising an alarm, evacuating the building in the event of a fire (not using

14. Arrangements for Monitoring the Effectiveness of Control

In the event of an accident or emergency, site specific procedures will be followed. This would entail raising an alarm, evacuating the building in the event of a fire (not using

Ad-hoc visual checks and ...each site will be responsible for maintaining its ongoing safety checks of equipment, buildings etc. Any significant problems will be discussed with the supervisor and no further testing will be carried out until the problem has been resolved

15. Review: This assessment must be reviewed by (date):

In the event of an accident or emergency, site specific procedures will be followed. This would entail raising an alarm, evacuating the building in the event of a fire (not using

Ad-hoc visual checks and ...each site will be responsible for maintaining its ongoing safety checks of equipment, buildings etc. Any significant problems will be discussed with the supervisor and no further testing will be carried out until the problem has been resolved

Name of Reviewer:	Holly Davies	Date of Review:	May 2015
Have the Control measures been effective in controlling			
Have there been any changes in the procedure or in information available which affect the estimated level of			
What changes to the Control Measures are required?			

16. Signatures for printed copies:

Form completed by: Holly Davies	Date:13.06.14
Approved by:	Date:
Assessor:	Date:
Reviewed by:	Date:
This copy issued to: (print name and sign)	Date:

Appendix 17

Cardiff University letter of sponsorship

Research, Innovation and Enterprise Services
Director Geraint W Jones
Gwasanaethau Ymchwil, Arloesi a Menter
Cyfarwyddwr Geraint W Jones

Cardiff University
7th Floor
30 - 36 Newport Road
Cardiff CF24 0DE
Wales UK
Tel *Ffôn* +44(0)29 2087 5834
Fax *Ffacs* +44(0)29 2087 4189
Prifysgol Caerdydd
Llawr 7
30 - 36 Heol Casnewydd
Caerdydd CF24 0DE
Cymru Y Deyrnas Unedig

29 May 2014

Dr Jenny Moses
Clinical Psychology Training
School of Psychology
Cardiff University
11th Floor
Tower Building
Park Place
Cardiff
CF10 3AT

Dear Dr Moses,

Title: What do I see when I look at thee: An investigation of social-cognition in PTSD.

I understand that you are acting as Chief Investigator for the above DClinPsy project to be conducted by Holly Davies.

I confirm that Cardiff University agrees in principle to act as Sponsor for the above project, as required by the Research Governance Framework for Health and Social Care.

Scientific Review
I can also confirm that Scientific Review has been obtained from the DClinPsy supervisory team (within the School of Psychology).

Insurance
The necessary insurance provisions will be in place prior to the project commencement. Cardiff University is insured with UMAL. Copies of the insurance certificate are attached to this letter.

Approvals

On completion of your IRAS form (for NHS REC and NHS R&D approvals), you will be required to obtain signature from the Sponsor ('Declaration by the Sponsor Representative').

Please then submit the project to the following organisations for approvals:

- the appropriate Research Ethics Committee(s);
- National Institute for Social Care Health Research Permissions Coordinating Unit (NISCHR PCU- to arrange host organisation R&D approval).

Once Research, Innovation & Enterprise Services has received evidence of the above approvals, the University is considered to have accepted Sponsorship and your project may commence.

Roles and Responsibilities
As Chief Investigator you have signed a Declaration with the Sponsor to confirm that you will adhere to the standard responsibilities as set out by the Research Governance Framework for Health and Social Care. In accordance with the University's Research Governance Framework, the Chief Investigator is also responsible for ensuring that each research team member is qualified and experienced to fulfill her delegated roles including ensuring adequate supervision, support and training.

Roles and responsibilities are adequately detailed in the research protocol – no contract required.

May I take this opportunity to remind you that, as Chief Investigator, you are required to:

- ensure you are familiar with your responsibilities under the Research Governance Framework for Health and Social Care;
- undertake the study in accordance with Cardiff University's Research Governance Framework and the principles of Good Clinical Practice;
- ensure the Research complies with the Data Protection Act 1998;
- inform Research, Innovation & Enterprise Services of any amendments to the protocol or study design, including changes to start /end dates;
- co-operate with any audit inspection of the project files or any requests from Research, Innovation & Enterprise Services for further information.

You should quote the following unique reference number in any correspondence relating to sponsorship for the above project:

SPON 1328-14

This reference number should be quoted on all documentation associated with this project.

Yours sincerely

Dr K J Pittard Davies
Head of Research Governance and Contracts
Direct line: +44 (0) 29208 79274
Email: resgov@cardiff.ac.uk

Cc Holly Davies

Appendix 18

Cardiff University insurance certificate

silwood House
60 Bishopsgate
London EC2N
4AW Tel: 020
7847 8670

TO WHOM IT MAY CONCERN

1 August 2014

Dear Sir/Mada

CARDIFF UNIVERSITY

AND ALL ITS SUBSIDIARY COMPANIES

We confirm that the above Institution is a Member of U.M. Association Limited, and that the following covers are currently in place:-

EMPLOYERS' LIABILITY

Certificate No.	Y016458QBE0114/165
Period of Cover	1 August 2014 to 31 July 2015
Limit of Indemnity	£50,000,000 any one event unlimited in the aggregate.
Includes	Indemnity to Principals
Cover provided by	QBE Insurance (Europe) Limited and Excess Insurers.

PUBLIC AND PRODUCTS LIABILITY

Certificate of Entry No.	UM165/13
Period of Cover	1 August 2014 to 31 July 2015

Includes	Indemnity to Principals
Limit Of Indemnity	£50,000,000 any one event and in the aggregate in respect of Products Liability and unlimited in the aggregate in respect of Public Liability.
Cover provided by	U.M. Association Limited and Excess Cover Providers led by QBE Insurance (Europe) Limited

If you have any queries in respect of the above details, please do not hesitate to contact us.

Yours faithfully

Susan Wilkinson

For U.M. Association Limited

ISO 9001
REGISTERED FIRM

Registered Office: Hasilwood House, 60 Bishopsgate, London, EC2N 4AW

U.M. Association Limited

Registered in England and Wales No. 2731799

Appendix 20

Demographic questionnaire

Clinical Psychology Training,
School of Psychology (11th Floor),
Tower Building,

Cardiff University,
Park Place,
Cardiff,
CF10 3AT

Background

To start I would like to ask you some questions about your background and present circumstances.

Gender: **Male** ☐ **Female** ☐

Year of birth: ☐☐☐☐

1. What is your postcode (first four letters/numbers only)? ☐☐☐☐

2. What is your ethnicity?

☐ **White British or any other white background**

☐ **Mixed white and black Caribbean, white and black African, white and Asian, or other mixed background**

☐ **Asian, Asian British, Indian, Pakistani, Bangladeshi, or any other Asian background**

☐ **Black or black British Caribbean, African, or any other black background**

☐ **Chinese**

☐ **Other (please state)**

_____

3. What is your highest level of education?

☐ **Left school before aged 16 (no formal qualifications)**

☐ **Left school with GCSE/CSE/O-level equivalent**

☐ **Left school with A-level or equivalent**

☐ **College certificate or diploma**

☐ **University degree**

☐ **Higher university degree (MSc, PhD)**

☐ **Other (please state)**

---

4. What is your current marital status?

☐ **Married**

☐ **Cohabiting**

☐ **Single**

☐ **Widowed**

☐ **Divorced**

☐ **Separated**

5. Are you currently employed?

☐ **Yes (Go to Q5a)**

☐ **No (Go to Q6)**

5a. What is your current occupation?

_____

_____

5b. How long have you been employed in your current job?

☐☐ **Years** ☐☐ **Months**

Please continue to the next page

Tower Building,
Cardiff University,
Park Place,
Cardiff,
CF10 3AT

Health and well-being

The next few questions are about your health and well-being and any problems that may have been bothering you recently (last twelve months).

6. Have you suffered with any physical health problems recently?

☐ **Yes (Go to 6a)**

☐ **No (Go to 7)**

6a. What physical health problems have you experienced recently?

_____

_____

_____

7. Do you have any long term illness, health problems, or disabilities which limit your daily activities or the work which you can do?

☐ **Yes**

☐ **No**

Thank you for taking the time to complete this questionnaire