Examining the role of nature-based activities in the lives of military veterans with post-traumatic stress disorder

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Abstract

Nature-based activities have been shown in previous research to be beneficial to veterans with post-traumatic stress disorder (PTSD) through attendance at group nature-based interventions. Benefits have included improved PTSD symptoms. improved self-esteem and increased social connections. Interventions are diverse in duration, activities and organisation, and more research is needed to understand the mechanisms that lead to benefits. Additionally, little is known about how veterans with PTSD use nature-based activities in their daily lives, outside of organised interventions. Theoretically, attention restoration theory (ART) provides the most prominent theory of how nature is restorative to mental health, suggesting that being around nature improves fatigued attention, which improves wellbeing. Using mixed methods, four research studies investigated how nature-based activities help veterans with PTSD, the role that organised interventions play, and evidence of restoration as proposed by ART. The first study was a mixed method case series design that showed psychosocial improvements mainly occurred in the latter part of a 7-night fishing intervention for a group of eight veterans with PTSD, and showed mixed results in terms of social and attentional benefits. The second, qualitative study showed veterans with PTSD used nature-based activities to counteract their PTSD, allowing them to gain control through the environment and strength through accessing their military identities. This was further evidenced through an online survey in Chapter 4 that showed veterans found nature-based activities more helpful than non-veterans in their recovery from mental health issues, and in helping to manage symptoms of current mental health problems. Finally, a correlational study in Chapter 5 showed veterans were faster at a cognitive task when they had done more recent nature-based activities, but non-veterans were not. Overall, this thesis

enhances understanding of how veterans with PTSD benefit from nature and suggests veterans may have a different relationship with nature than non-veterans.

Chapter 1 Introduction

This chapter details a framework of literature that underpins this thesis and explains the rationale for the study. The first section is an introduction to military veterans in the United Kingdom (UK) and their mental health, before focusing on post-traumatic stress disorder (PTSD), its definition, associated literature and issues around mental health support. The second section explores the role that nature-based activities have been shown to play in supporting veterans' mental health and provides a theoretical background for the restorative influence of nature. The chapter concludes with the rationale and aims of the research.

1.1 UK veterans and their mental health

1.1.1 Veterans in the UK

The Ministry of Defence (MOD) estimates there are 1.99 million military veterans living in Great Britain (England, Scotland and Wales) in 2022, based on a projection from a 2019 report (Ministry of Defence, 2019) . The definition of a veteran used by the MOD is someone over 16 who has served at least one day in the Armed Forces as full time or reservist personnel. However, this official veteran figure does not include those who were homeless or living in communal accommodation, such as care homes and prisons at the time of data collection. Up to 290,000 additional veterans are thought to be excluded from the official figure for this reason (Royal British Legion, 2014), which would bring a more realistic figure to 2.29 million. Although the number of leavers of the Armed Forces is expected to remain stable at approximately 20,000 full time and reservist personnel per annum (Ministry of Defence, 2021a), the number of veterans is falling due to the high number over 70 years old. The overall number of veterans is projected to decrease to 1.6 million by 2028, when 44% are expected to be of working age (16-64) (Ministry of Defence, 2019). Research has suggested that the vast majority of ex-military personnel seem to have benefitted from serving in the military and have integrated well into post-military life (Iversen et al., 2005; Royal British Legion, 2014). However, for some, particularly those with mental health issues, civilian life can be problematic. For example, compared to the general population, some research suggests veterans can have greater difficulties with social integration (Hatch et al., 2013), problem gambling (Dighton et al., 2018) and alcohol abuse (Rhead et al., 2020).

1.1.2 Veterans and mental health

It has been widely reported that veterans suffer no more mental health issues than the general population (Royal British Legion, 2014) although there are surprisingly few studies comparing the mental health of veterans in the UK to the general population (Rhead et al., 2020), with little before 1995 (Hunt et al., 2014). One study investigated 257 post-national service personnel who served after 1960 found those who had served in the British military suffered no more mental health issues than those who had not (Woodhead et al., 2011). The British Legion reported only 12% of veterans in their national survey said they had experienced psychological difficulties in the preceding year (Royal British Legion, 2014), and a recent study using medical records in England found a prevalence in veterans of 18% for depression, 15% for anxiety and 3% for PTSD (Finnegan & Randles, 2022). In comparison, 17% of people in England were found to meet the criteria for common mental health conditions such as anxiety and depression in a 2014 Adult Psychiatric Morbidity Survey (McManus et al., 2016).

Such figures are reflected in studies of serving personnel. Two cohort studies of British personnel, funded by the Ministry of Defence published in 2006 and 2010,

found those deployed to conflicts in Iraq and Afghanistan had almost identical prevalence of mental health issues than in those not deployed there (Fear et al., 2010; Hotopf et al., 2006). In both studies the prevalence of probable PTSD was 4% for those deployed and those not deployed. In 2006, common mental health difficulties were 21% in the deployed group compared to 19% in the not deployed group (Hotopf et al., 2006) and the 2010 study showed 19.9% of common mental health health problems in those not deployed and 19.6% in the deployed group (2010).

Other research suggests mental health problems are more prevalent in both serving personnel and the veteran community than in the general public. A study comparing serving military personnel with the general population in the UK found those in the military were twice as likely to report factors indicating common mental health disorders (Goodwin et al., 2015). A more recent report compared veterans with the general population and found significant differences between groups: Common mental health disorders such as depression and anxiety were reported at 23% in veterans compared to 16% in the general public, and PTSD at 8% compared with 5% in the non-military population (Rhead et al., 2020). Interestingly, of 1562 veteran respondents to this study, 1432 (87.56%) had been officers or non-commissioned officers, with only 130 (12.44%) from lower ranks. A higher prevalence of PTSD has been shown in lower ranks in other research (Iversen et al., 2008), so it is possible that PTSD in Rhead and colleagues' 2020 sample was not entirely representative of the veteran population as a whole, and prevalence of mental health issues may be even higher. Additionally, veterans of lower rank have been found to be less likely to fill in guestionnaires than officer ranks (Fear et al., 2010) and thus lower ranks may be under-represented in the literature more widely.

There are indications that more recent conflicts have produced increased mental health issues over time, with a 6.2% incidence of probable PTSD in British personnel deployed to Iraq or Afghanistan (Stevelink et al., 2018), increased from 4% in prior studies (Fear et al., 2010; Hotopf et al., 2006). However, this later study includes personnel who had left the military following their deployment, and this group of veterans had twice the prevalence of PTSD (9%) than in those still serving, where prevalence remained 4%. The Ministry of Defence reported a statistically significant uptick in specialist mental health care requirements between 2013 and 2016 for serving military personnel previously deployed to Iraq or Afghanistan, in comparison to those not deployed there (Ministry of Defence, 2021c). Furthermore, data for a 2011 study mentioned above that showed no differences in veterans and nonveterans mental health illness originated in 2006/7 and thus were unlikely to include many veterans of Iraq and Afghanistan conflicts, ongoing at that time (Woodhead et al., 2011). This increase in mental health issues in more recent conflicts is substantiated by the higher prevalence of PTSD found in younger veterans seeking help for psychological problems (Murphy et al., 2019; Prigerson et al., 2001). Despite this, Murphy et al., (2019) found that help-seeking veterans were more likely to have been in older conflicts such as Northern Ireland, and proposed this may be due to a delay in veterans seeking help. Thus, the picture remains unclear.

In summary, although mental health problems have previously been shown to be no more prevalent in veterans than the general public, recent research suggests a more complex picture, with indications that some issues may be on the increase, particularly in relation to Afghanistan and Iraq conflicts in the early 21st century.

1.1.2.1 PTSD in veterans

Although it has been shown that depression and anxiety are the most prevalent mental health problems in veterans (Finnegan & Randles, 2022), post-traumatic stress disorder (PTSD) is the mental health condition most associated with military service (Royal British Legion, 2014). PTSD is a complex and significant psychological condition that develops in some people after they have been through a traumatic experience. It is characterised by four clusters of symptoms: reexperiencing, hyperarousal, avoidance and negative alterations in thoughts and mood (American Psychiatric Association, 2013). PTSD and associated theories are discussed in detail in section 1.1.3.

In veterans seeking mental health treatment from a leading British veteran charity, research has shown PTSD to be the most commonly presented problem. A 2019 study surveyed 600 veterans who had received, although not necessarily completed treatment, from Combat Stress over the period of a year (Murphy et al., 2019). The most common mental health problem was PTSD, with 82.4% meeting the criteria for potential PTSD, 72.3% for common mental health difficulties such as depression and/or anxiety, 74.4% had anger difficulties and 42.7% reported alcohol misuse. Comorbidities were common, for example, 95.2% of those meeting PTSD criteria also met criteria for at least one of the other primary health outcomes.

The number of veterans in the UK that have PTSD is hard to determine accurately, although recent UK study found a probable PTSD prevalence of 7.4% in veterans of all conflicts (Stevelink et al., 2018). Given the current estimate of around 2.29 million veterans in the UK it can be estimated that nearly 170,000 veterans in the UK could meet the criteria for PTSD.

1.1.3 Post-traumatic stress disorder

1.1.3.1 DSM-Classification

PTSD was first recognised as a diagnosable condition by the American Psychiatric Association in the third edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-III) in 1980. Subsequent versions have updated the criteria, with DSM-V being published in 2013 (American Psychiatric Association, 2013). This current version now specifies the types of traumatic experience that must have occurred for a diagnosis to be made in 'Criterion A'. Traumatic events are those that involve actual or threatened death, serious injury, or sexual violence, and include bereavement when death was 'violent or accidental', as well as secondary trauma from repeated or extreme exposure to other people's experiences through, for example, someone repeatedly having to view images of child abuse as part of their job. Any or all PTSD symptoms can be typically experienced by someone after a traumatic event, but to be diagnosed with PTSD, the symptoms must have lasted at least a month and cause significant disruption to daily life. The DSM-V details four clusters of symptoms, with at least one symptom from each needing to be experienced for PTSD to be diagnosed:

Criteria B: Re-experiencing the event, for example through intrusive thoughts, nightmares, or flashbacks,

Criteria C: Avoidance of factors that act as reminders of the event, for example trying not to think about the event, avoiding people or places that remind you of it.

Criteria D: Persistent negative cognitions and mood in relation to the event, for example, believing you are bad, the world is dangerous, difficulty remembering parts of the event, and blaming yourself or others for the event.

Criteria E: Feeling on edge, for example being hypervigilant, prone to angry outbursts, having an exaggerated startle response and problems concentrating.

1.1.3.2 Psychological theories of PTSD

Several theories of the mechanisms involved in development and maintenance of PTSD have been proposed. As well as helping to understand the condition, these models also serve to direct the treatment processes and form hypotheses for research. PTSD has been described by some as a memory disorder because symptoms are linked to memory function and the way the traumatic experience is processed (Nijdam & Wittmann, 2015). The dominant theories that drive current recommended treatment in PTSD are fear conditioning theory (Keane et al., 1985), cognitive theory (Ehlers & Clark, 2000) and dual representation theory (Brewin, 2003). These propose mechanisms and individual differences that account for PTSD symptoms. There are also social theories that consider external and social factors that influence development and recovery of PTSD that are relevant.

1.1.3.2.1 Conditioning theory

A simple way of explaining how PTSD develops is through classical conditioning (Keane et al., 1985; Mowrer, 1960). Development of PTSD occurs through the unconditioned stimulus, the traumatic event, for example a car crash, being associated with the circumstances in which it occurred, for example a motorway slip road (the conditioned stimulus). Subsequently, coming across a motorway again

becomes fear laden due to the association with the fear experienced and this evokes potent memories of the accident and its sights, sounds and feelings. Keane et al. (1985) proposed that subsequently, a wide range of associated stimuli elicits the same fear response, and that PTSD is further maintained through avoidance of thinking of the experience or reminders of it. Avoidance behaviours are reinforced through short term reduction of fear but increase overall anxiety through proactively attempting to avoid thinking about it. It is thought that in most people, such a conditioned fear response originating from a traumatic experience is diminished over time in the absence of the fearful trigger (extinction learning). However, it is thought that in PTSD there is a failure of this extinction process, therefore the fear response continues (Phelps et al., 2004)

However, this learning approach does not explain all the elements of PTSD and does little to explain differences between the causes of PTSD and other anxieties (Brewin & Holmes, 2003). Later, PTSD theories draw on classical conditioning but have incorporated more cognitive aspects to the explanations of PTSD that call on models of memory.

1.1.3.2.2 Cognitive model of PTSD

The cognitive theory of PTSD proposes that a persistent sense of current threat is central to the condition, created by the presence of reminders of the event, for example intrusive thoughts, nightmares and feeling as though the trauma is still happening (Ehlers & Clark, 2000). This leads to two categories of negative cognitions: Negative appraisals of the threat, and personal connection with the threat are constant and include external appraisals such as 'Nowhere is safe' and internal appraisal such as 'I'm going mad'. Additionally, negative social appraisals develop such as 'No-one is there for me'. Coping strategies intended to deal with the current

threat result in behaviours that maintain or exacerbate PTSD symptoms. For example, avoiding going out can consolidate feelings that the world is dangerous and active attempts to suppress intrusive thoughts can increase them (Bomyea & Lang, 2016). Socially, friends and family not talking about the trauma to be kind, can be interpreted as not caring. Further cognitive processes involved in PTSD maintenance include ruminating about the event and how it could have been prevented, and avoidance of reminders of the event.

Ehlers and Clark (2000) propose that PTSD cognitive and behavioural patterns are influenced by prior values and beliefs. They also suggest a relevant component of PTSD that prevents either help being sought or commitment to treatment, is often due to a patient's belief that there is no point to talking because they have tried talking before and it has not helped. Treatment focuses on retelling the traumatic event so that it becomes part of the patient's life narrative, addressing problematic appraisals of the trauma, and changing behaviour patterns that exacerbate symptoms.

1.1.3.2.3 Emotional processing theory of PTSD

Another prominent theory is a single representation theory proffered by Foa and Rothbaum (2001). Foa and Rothbaum (1998) suggested that before the traumatic event, a person may see the world as safe and themselves as competent. When a trauma happens, it can be so intense and in contrast to these beliefs that the person cannot assimilate the event into their view of themselves This leads to the former beliefs being replaced by new dysfunctional ones. Similar to Ehlers and Clark (2000), two categories of negative cognitions are prominent in individuals with PTSD: the belief that the world is a dangerous place, and the belief that one is incompetent or helpless in the face of trauma and posttraumatic symptoms. The suggestion is that people with particularly rigid thinking are susceptible to PTSD.

Central to the theory is the idea that people have a fear network, based on the principles of a network model of memory. Such memory models propose that memory acts as an associative network of nodes that interconnect where each node is an object, person, or concept, and that these nodes interlink and connect to form associations. This can be applied to the fear network (Lang, 1979). Foa and Rothbaum (1998) propose that a fear network develops, which is made up of stimulus information, such as details of the incident; the feelings and emotions attached to the event; and any meanings attached to the event. They suggest that if any part of this network is activated, the whole network is, and a large number of cues (or 'triggers') can cause this activation. Further, they suggest that because the memory of the incident is fragmented, it cannot be assimilated into the normal memory system, and therefore cannot be experienced as truly in the past.

The main treatment associated with emotional processing theory is prolonged exposure therapy (Foa, 2011). Fear extinction is the aim of the therapy, which is largely accomplished through repeated activation of the traumatic memory. In this way, the traumatic memory is assimilated into a persons' normal memory through new information that is associated with reminders of the event but that does not illicit the fear response. For example, driving on a motorway and not crashing the car. Such assimilation leads to new beliefs being formed that incorporate the traumatic event, such as 'the world is largely not dangerous', and 'I am competent'.

1.1.3.2.4 Dual representation theory

Where Foa and Rothbaum's (1998) emotional processing theory proposes a single representation of the event, it has been criticized for not explaining why the memory of the traumatic incident can appear highly detailed, emotional and fixed, such as in the case of flashbacks, whilst at the same time can be fragmented and vague. Brewin's dual representation model (Brewin et al., 1996; Brewin et al., 2010) proposes two distinct different types of memory. Verbally accessible memory (VAM) is normal memory that can be accessed voluntarily. It originates from what was consciously experienced at the time, but the memory consists of secondary emotions not experienced at the time of the event that are directed at the past, such as shame, guilt, and regret. Situational accessible memory (SAM) is traumatic memory. This is fixed and consists of experiences from the time of the trauma such as feelings, bodily sensations and heart rate that were *not* consciously experienced at the time. It is more emotionally charged than VAM. There is no verbal code attached to the memory, which accounts for why most flashbacks do not have a verbal narrative. Emotions attached to SAM are fixed, difficult to control and do not get updated by new information. The memory is unconscious until triggered by a cue. This explains why someone with PTSD can still be terrified of an attacker as though they were present, even though the attacker is in prison or another country. In people without PTSD, when the memory becomes conscious through triggers, the choice is made to consciously attend to the memory, which is then processed through the VAM system into the autobiographical memory, thus the traumatic stress response to the event reduces over time. However, in PTSD, conscious attention to the memory is suppressed, so it fails to become assimilated into normal memory.

Brewin et al (1996; 2010) suggest the process of exposure therapy allows for the previously unconscious experience to be re-experienced consciously, which can then be processed by the VAM system and reassimilated as normal memory.

1.1.3.3 Social Theories

There are undeniably social elements to PTSD. Risk factors associated with the development of PTSD such as childhood adversity, low education, being younger, in a lower military rank and not in a relationship (Iversen et al., 2008) have social elements to them. Similarly, later social experiences also contribute. Some research has shown the way in which other people discuss the traumatic event, post-event social support and other negative social interactions contribute to the development and maintenance of PTSD. For example, it has been suggested that the vilification of Vietnam veterans and lack of social support may have contributed to the development of their PTSD (Nijdam & Wittmann, 2015; Oei et al., 1990). In a metaanalysis, lack of social support following a traumatic experience was found to have the greatest effect of any factor associated with developing PTSD in adults exposed to various types of trauma (Brewin et al., 2000). In UK military research, lack of interest in problems by superiors and low morale has been linked to the development of PTSD after combat (Iversen et al., 2008). In other research, in patients under treatment for severe PTSD, nightmares were associated with daytime social difficulties rather than happening randomly (Lansky & Bley, 1995). Further, the traumatic nature of the incident can be drawn out to include, for example, medical treatment, worries about losing income and difficulty in maintaining a social life (Brewin, 2003, p. 29; Brewin et al., 2000).

In essence, PTSD is not merely a response to a single traumatic event but is a process, influenced by factors before and after the event that moderate

development, maintenance and recovery (Nijdam & Wittmann, 2015). Although the cognitive models of PTSD detailed above recognise and incorporate social elements to PTSD, the socio-interpersonal perspective to PTSD proposed by Maercker and Horn (2013) adds further social emphasis. In their model, three levels of interpersonal processes are proposed: Individual, close relationships and broader societal level, all of which are at play after the trauma and contribute to the development of PTSD.

Where Maercker and Horn (2013) incorporate mainstream models of PTSD and PTSD treatment, some critics of common theories of PTSD reject the idea of a distinct, objective, psychopathologic condition entirely. For example, from a social construction perspective, it has been suggested that symptom clusters detailed in DSM classification are too subjective and do not depict an objective disease (Summerfield, 2001). Such critics draw on the political zeitgeist within which PTSD was initially defined; that of the Vietnam War. Summerfield suggested PTSD was part of the anti-war movement and more to do with the development of a compensation culture in America. From that perspective, a diagnosis of PTSD enabled veterans to not only become the victim rather than a perpetrator of unnecessary violence in a controversial war, but also to claim compensation for their war wounds. This is thought to reflect a societal move towards individualism, and, ultimately, to victimhood, compared to the more antiquated 'stiff upper lip' approach to adversity in the West (Summerfield, 2001). Indeed, it has been suggested that PTSD is a rare psychiatric condition, in that people are pleased to receive a diagnosis (Andreasen, 1995).

The Sociologist Lembcke also suggested PTSD was socially constructed through the cultural and political arena, but put further emphasis on the role of the media (1998). Lembcke argues the concept of a flashback relates to the portrayal of memories of the Vietnam war depicted in films. There is indeed evidence to suggest symptoms resembling flashbacks were hardly apparent in British veterans before the Gulf War in a study that applied modern PTSD criteria to medical notes of veteran psychiatric patients from the Boer War, World War I and II and Gulf War (Jones et al., 2003). Lembcke (1998) argues that to fully understand PTSD, it should not be considered as a condition that was awaiting discovery and formal description but should be considered in the context of its emergence during political events and media involvement. Such approaches do not, however, propose PTSD does not exist but are warning against a purely bio-medical viewpoint (McNally, 2012).

One issue with such positions is the obvious emphasis on military experiences, as the origins of PTSD are related to veterans. PTSD is now widely accepted as being possible following all manner of trauma as defined by the DSM-V and Criterion A. For example there has for some time been much in the literature about PTSD following sexual assault (Foa & Rothbaum, 1998) as well as after road traffic accidents (Holeva et al., 2001) and natural disasters (Beaglehole et al., 2018).

However, there are factors linked in particular to the military population, for example, features of PTSD such as hypervigilance are inherent to the military because soldiers are trained to be hypervigilant when in combat, and struggle to shake the behaviour off when they leave the military, thus settling into non-military life can be a cause of the PTSD development (Hoge, 2010). Furthermore, the risk of PTSD has been shown to increase when there is previous trauma (Brewin et al., 2000) and

combat military personnel are often repeatedly exposed to traumatic experiences including risk of own death, witnessing the death of others and other associated war related horrors (Hoge et al., 2004).

1.1.3.4 Neuropsychological aetiology of PTSD

Three main areas of the brain have been implicated in PTSD: the amygdala, the hippocampus and the medial prefrontal cortex (mPFC; Bremner, 2006; Shin et al., 2006). The amygdala is a small area embedded within the temporal lobe of the brain that is a key area involved in affective processing, particularly emotions like fear and anxiety are responsible for hard-wired biological responses to threat, such as releasing stress hormones, activating the sympathetic nervous system and the fight/flight/freeze behavioural response (Brewin, 2003). A review of neuroimaging research into PTSD found a heightened responsivity in the amygdala to trauma related stimuli. The level of responsivity was found to be positively correlated with PTSD symptom severity (Shin et al., 2006). Secondly, the mPFC, an area at the front of the brain involved in executive control (also referred to as cognitive control and executive functioning) which controls and regulates cognitive functions in order to attain goals such as problem solving and reasoning (Miller et al., 2002). A particularly relevant function of the mPFC to PTSD is thought to be extinguishing activity in the amygdala, and thus the threat response. Several studies have found reduced responsivity in the mPFC in people with PTSD, the level of which has been shown to be negatively correlated with PTSD symptom severity (Shin et al., 2006; Woon et al., 2017). Furthermore, some studies have revealed a reduced connectivity between the mPFC and the amygdala. The third area established as being associated with PTSD is the hippocampus, also embedded within the temporal lobe, which is known to be involved with memory and learning. In Shin's (2006)

review paper, the majority of, although not all studies investigating hippocampus volume in PTSD found reduced volume in people with PTSD compared to controls, either with or without trauma exposure. In addition, there is evidence for decreased hippocampal functionality in some PTSD research (Shin et al., 2006). Multiple studies show decreased verbal declarative memory in those with PTSD, a memory function closely associated with the hippocampus (Bremner, 2006), supporting the idea that PTSD is a memory disorder. Neuroimaging research therefore indicates PTSD may reduce functionality in certain key cortical structures leading to a heightened threat or fear response, a reduced ability to extinguish this response and a potential dysfunction of the memory system. In this way, neuroimaging supports the idea that PTSD is related to a failure of fear extinction. It is worth noting, however, that not all studies have consistent findings, other brain regions have also been implicated, and neuro-imaging research can frequently be complicated by comorbidities (Shin et al., 2006).

1.1.3.5 Cognitive function in PTSD

The DSM-V (American Psychological Association, 2013) and ICD-10 (World Health Organization, 1992) refer to cognitive impairment as a core symptom in PTSD but only in terms of difficulty in concentration (NICE, 2019). Although it is theoretically possible to be diagnosed with PTSD without having this single symptom, other direct trauma-specific associations between core symptoms of PTSD and cognitive control have been reported. For example, lack of memory control is evident through intrusive memories and vivid nightmares containing memories of traumatic events. This is often accompanied by difficulties with voluntary recall of parts of the traumatic memory (Brewin et al., 2007). Similarly, hypervigilance reflects attentional control issues, whereby over-attentiveness to extraneous environmental cues and potential presence of threat occurs, which, may be adaptive in combat situations and other dangerous events, but are not effective in everyday life (Hoge, 2010). Attentional issues are also apparent through an inability to suppress or move attention away from intrusive memories (Scott et al., 2015).

Reviews of literature have shown a prevalence of cognitive impairments including attention, memory, learning and executive functions (Block & Liberzon, 2016; Kocak & Kilic, 2017; Polak et al., 2012; Scott et al., 2015; Woon et al., 2017). One theoretical explanation for such impairments is from attentional control theory, which proposes that arousal dysregulation in anxiety disorders, such as hyperarousal in PTSD, diverts cognitive resources away from such goal-directed processes (Eysenck et al., 2007; Scott et al., 2015; Vasterling et al., 2002).

1.1.3.5.1 Relationship between cognitive impairment and PTSD

The cognitive impairments in people with PTSD found in the literature could have developed because of PTSD or could have pre-dated the traumatic events and been a risk factor PTSD development. However, a lack of pre-trauma data means only minimal studies are available and in fact it may not be one or the other. It has been proposed that pre-existing cognitive impairments are risk factors in the development of PTSD, may be significant in the maintenance of symptoms and appear to be linked to symptom severity (Aupperle et al., 2012). They may also be linked to social and occupational functioning (Geuze et al., 2009). Several papers have suggested that memory and concentration problems may contribute towards non-responsiveness to therapeutic treatment (Falconer et al., 2013; van Rooij et al., 2015; Wild & Gur, 2008). Understanding of the mechanisms of PTSD could reveal how such factors could impede treatment and assist in profiling of patients in clinical settings (Scott et al., 2015).

One study used neurocognitive data collected before military deployment and 2 years later and found PTSD and depression post-deployment was associated with a decline in processing speed, learning and recall, even after accounting for the influence of traumatic brain injury (Vasterling et al., 2012), suggesting cognitive decline as a consequence of PTSD. In contrast, cognitive performance of co-twins with PTSD after service in Vietnam were not found to be significantly different to their non trauma-exposed twins, suggesting that PTSD may not have affected cognition (Gilbertson et al., 2006). However, the study was conducted many years after the Vietnam war, with no data for the intervening years, where cognition may have fluctuated. More research is required to understand how developing PTSD may change cognitive function.

There is some evidence to suggest that pre-existing impairment in cognition may be a risk factor in the development of PTSD following traumatic events. For example, in a monozygotic twin study (Gilbertson et al., 2006), 43 twin pairs were compared in which one co-twin was a Vietnam veteran (trauma exposed) and one was not (nontrauma exposed). In twin pairs where the trauma exposed co-twin developed PTSD both twins performed significantly worse in tests of executive function, attention and verbal memory compared to twin pairs where the trauma-exposed co-twin did not acquire PTSD. Co-twins showed no significant cognitive differences between them. This suggests an association with development of PTSD and pre-existing lower cognitive function (Gilbertson et al., 2006), although this study used only chronic long-term PTSD sufferers and did not account for co-morbidity effects.

Another possibility is that poor cognition found in PTSD patients may reflect the effects of the trauma rather than the PTSD per se. An American cohort study

examining the effects of deployment in Iraq using pre and post neurocognitive measures over a mean period of 73 days, found deployment compared to nondeployment was associated with a decline in sustained attention, visual spatial memory and verbal learning, although not executive attention (Vasterling et al., 2006). In this study, potentially traumatic experiences of deployed participants included coming under small arms fire (98%), going on combat control/missions (91%), and witnessing allies being seriously wounded or killed (55%). Analysis revealed cognitive decline occurred independent of changes in PTSD symptoms, suggesting that deployment rather than PTSD development, was related to cognitive changes. Findings could, however, have reflected short term cognitive responses in non-PTSD participants which may have extinguished over time. Although response to trauma is an important issue, research into PTSD manifestations most often accounts for such effects by using a trauma exposed control group.

However, it should be noted that cognitive dysfunction is also not always present in PTSD. For example, a recent study of veterans with PTSD, who had served Iraq and Afghanistan, were found to be in the average range of cognitive ability (Samuelson et al., 2017).

1.1.3.6 Factors influencing the development of PTSD in veterans

1.1.3.6.1 Combat experience

In a review paper in 2010 in the USA, combat exposure was consistently associated with 'probable' PTSD (Ramchand et al., 2010). In one study featured in the review, the prevalence of probable PTSD in US personnel returning from deployment in Iraq was found to increase in a linear fashion with the number of firefights experienced during combat, with 4.5% prevalence in those with no firefights rising to 19.3% in

those with five or more (Hoge et al., 2004). In the UK, an association has also been reported between increased likelihood of probable PTSD and having a combat role (Fear et al., 2010). In a study of UK veterans having support for their mental health, where PTSD was the most common condition, more than 60% had been in combat roles. One explanation for the difference in PTSD prevalence found between the UK and USA has been the level of combat exposure (Hunt et al., 2014) with 86-92% of US respondents reporting coming under artillery fire compared to 55% in Hotopf et al.,'s UK study (2006).

The influence of deployment overall, is less clear. In the UK, a study of serving personnel showed deployment to Iraq during the 2003 conflict was no more associated with PTSD than those not deployed during the same period (Hotopf et al., 2006), when deployment did not necessarily include being under direct line of artillery. In contrast, later UK research has found significantly more probable PTSD in male veterans who had been deployed than in male non-veterans, irrespective of whether they were in combat roles (Rhead et al., 2020). This difference was not evident when comparing non-deployed veterans with non-veterans, suggesting that deployment could be a factor in PTSD development. In sum, there appears to be a link between combat facing experiences and risk of PTSD, and potentially a risk of PTSD in deployment, irrespective of direct combat experience.

1.1.3.6.2 Other factors

Even personnel who do experience multiple firefights are more likely *not* to develop PTSD than to develop it, thus there must be other factors involved. Research has shown other pre-trauma factors that have been found to influence the development of PTSD in military personnel/veterans include rank, education, childhood adversity and socio-domestic background (lversen et al., 2008).

1.1.3.7 Recommended treatment for PTSD

Treatment for PTSD is usually a combination of psychotropic medication and therapy (Watts et al., 2013). The National Institute for Health and Care excellence (NICE, 2018) recommends individual trauma focused cognitive behaviour therapy (CBT) to treat PTSD, with an option for this to be computer delivered, plus eye movement desensitization reprogramming (EMDR) for non-combat related trauma. Medication recommended by NICE includes selective serotonin reuptake inhibitors (SSRI) such as Sertraline, and anti-psychotics for presentations of severe hyperarousal or psychosis. The assessment of treatment efficacy is largely through self-reported symptoms from questionnaires such as the PCL-5 PTSD Checklist (Blevins et al., 2015), together with individual assessments with a mental health professional. A change in the NICE 2018 recommendations compared to previous guidelines was the specification that EMDR is only suitable for non-combat trauma. This appears to be due to a lack of random controlled trials in EMDR research in people with combat trauma, and this recommendation has been criticised as short-sighted by some (Matthijssen et al., 2020).

1.1.3.8 Mental health support for veterans

Following discharge from the military, health care for UK veterans is provided by the NHS, although many veterans have been shown to rely on veteran charities to provide specialist support (van Hoorn et al., 2013). Prior research has indicated that veterans were more likely to report experiences as positive when they felt the care they received was sensitive to the military, and were more likely to engage with veteran specific support (Fraser, 2017). Other research has shown that veterans with PTSD have a tendency to feel disconnected from civilian society and feel

unappreciated which can affect their inclination to engage with support (Brewin et al., 2011).

In the UK, a measure designed to combat these issues has been the implementation of the Armed Forces Covenant (Taylor, 2011), in existence since 2000, but recently cemented in law in the Armed Forces Act 2021. The Armed Forces Covenant pledges that veterans, as well as those still serving in the military and their families, should be fairly treated in terms of public services including health, and should be given priority treatment if an injury is a consequence of military service. The NHS have made pledges to adhere to the Covenant and ensure staff are trained in veterans' needs and are aware of promises made in the Covenant. NHS England state that seventy-five out of two hundred and twenty three NHS trusts have signed up to the Veterans Covenant Healthcare Alliance (VCHA) as 'veteran aware', with the aim of all trusts signing up eventually (NHS England, n.d.). This accreditation ensures staff are trained and aware of the Covenant and veterans' needs and can offer specialist support and advice when required.

However, a 2019 study found that only 35% of health and public services staff who took part in the study said they had a good understanding of the Armed Forces Covenant (Fulton et al., 2019), although this figure does not represent a disinterest in learning more. Nevertheless, now the Covenant is embedded in law, awareness of the Armed Forces Covenant within health and other public services staff may improve.

Healthcare for military veterans appears to face unique challenges. A 2013 metaanalysis of research into the efficacy of PTSD treatment, both psychological and pharmacological, found that studies with veterans showed smaller effects than in other populations (Watts et al., 2013). A study of UK veterans found those symptomatic of mental health problems remained symptomatic over time (Iversen et al., 2005b). Several reasons for this can be posited. For example, the deprived backgrounds of many military recruits can mean they may have prior issues such as substance abuse and other comorbidities, making them more prone to complex mental health problems that are more difficult to overcome (Murphy et al., 2015). A particular issue, however, seems to centre around difficulty engaging in treatment and high dropout rates from treatment programmes, especially for veterans with PTSD (Murphy et al., 2014; Brown et al., 2016).

1.1.3.9 Help seeking behaviour

Some qualitative research suggests veterans often only seek help once a crisis point has reached (Murphy et al., 2014; Pearson et al., 2019), although other research has shown veterans in England to be no slower to seek help than non-veterans (Woodhead et al., 2011). Nevertheless, research findings indicate there could be a significant number of veterans in the UK who are suffering with PTSD and other mental health issues, but have yet to receive or complete treatment. The consequences of late access to treatment can be pronounced and significantly affect treatment success. A longer wait for clinical intervention has been found to be associated with worse long term outcomes (Boulos & Zamorski, 2015) and more severe PTSD symptoms were found in veterans who had waited longer before asking for help (Murphy et al., 2019).

What lies behind help seeking and engagement issues has been investigated in a body of research and is likely to be due to a combination of factors (Murphy et al, 2015). The reluctance to seek help has been attributed to the unique culture of the military which exacerbates the inherent stigma attached to mental health (Murphy &

Busuttil, 2015; Weiss & Coll, 2011). Indeed, it has been suggested that historically, during the second World War, stigma was encouraged as a way of reducing disobedience (Wells, 2014). Military culture instils a sense of stoicism, emotional control and prioritises the requirements of the regimental unit and the mission before individual needs, even when not actively deployed (Weiss, Coll & Metal, 2011). These characteristics of military training and time spent in such a culture are internalized, thus they remain after leaving the military and affect the likelihood of seeking help (Greene-Shortridge et al., 2007).

The average number of years after leaving the military for veterans to access help does appear to be improving. It has reduced from 24 years reported in 1994 to 11.8 years in 2014 (Murphy et al., 2015). In a more recent report, 54% of veterans seeking help had taken less than 5 years to seek help (Murphy et al., 2019). Improvements could be due to the UK Armed forces making efforts in the military to raise awareness and increase peer support through new measures. These include 'decompression', where military are given time between deployment and going home in a third location, to provide a period of adjustment and education about mental health. Evaluation has been mixed, with some reports showing no discernible benefits (Hacker Hughes et al., 2008; Iversen et al., 2008) and others indicating a reduction in PTSD risk (Jones et al., 2013). Another initiative is Trauma Risk Management (TRiM), which uses peer support to highlight potential risk of trauma in individuals, and promotes earlier intervention, and has been shown to increase help-seeking behaviour in some reports (Iversen et al., 2010; Jones et al., 2017).

1.1.3.10 Charity stabilization programmes

Several prominent UK veteran charities including Combat Stress and Walnut Tree Health and Wellbeing offer stabilization programmes for veterans with PTSD and
other mental health issues. Walnut Tree's programme is based on group-based cognitive behavioural therapy, psychoeducation, and mindfulness. Combat Stress's programme is based on NICE treatment recommendations and includes traumafocused cognitive behavioural therapy (TF-CBT) as well as group psychoeducational programmes to improve understanding of PTSD symptoms. In addition, the programmes include art therapy and mindfulness. Such programmes have been found to be effective: Murphy, et al. (2015), found that after a 6 week residential treatment programme at Combat Stress, 231 veterans showed statistically significant improvements in PTSD symptoms, depression, anxiety and anger. This was largely maintained at a 6 month follow up, indicating longer term benefits. However, the authors of the paper acknowledge the mean PTSD symptom scores, measured using the PCL-5 PTSD Checklist, did not take the participants below the suggested threshold for probable PTSD at any data point. In another study, which followed up 12 months after the treatment programme, similar findings were evident, with 63.8% still meeting the threshold for probable PTSD, although symptom severity was still significantly reduced since pre-treatment (Murphy et al., 2016). This indicates that although the stabilization programme is a valuable tool, PTSD symptoms can endure following attendance. Thus, there is potentially a sub-population of veterans in the UK who continue to live with PTSD but are not necessarily accessing further treatment, and this sub-population appears under-researched.

In the case of PTSD, there may be other factors linked to non-response to treatment, including guilt regarding the traumatic event, comorbid depression, substance abuse and combat exposure (Currier et al., 2014; Murphy & Busuttil, 2019; Phelps et al., 2018). In addition, drop-out rates in therapy tend to be high for PTSD treatment generally (Najavits, 2015), perhaps due to its intensity and necessitating painful re-

experiencing of the trauma (Bisson et al., 2007). In veterans, drop-out rates of more than 65% have regularly been found in treatment of PTSD (Garcia et al., 2011; Watts et al., 2014). It has been suggested that nature-based group interventions for veterans with PTSD may be a viable alternative treatment for veterans with PTSD who have dropped out of treatment or who are not ready to engage (Wheeler et al., 2020) and this is explored in detail in section 2.

1.1.3.11 Summary

In sum, the picture of mental health of veterans in the UK is complex. The prevalence of mental health issues appears to be similar to the general population, but there are particular issues in the treatment of and help-seeking behaviour of veterans that may mean mental health problems are undocumented and not fully treated. Findings from Murphy et al. (2015) and Murphy et al. (2016) show that even after charity treatment programmes, veterans can still meet the threshold for PTSD, which indicates many veterans may continue living with PTSD, even after treatment. This sub-population of veterans who continue to live with PTSD in the community whilst not accessing treatment is little understood and under-researched. It has been suggested that initiatives such as nature-based interventions may engage veterans with PTSD who have not engaged in more traditional therapy.

1.2 Section 2. The influence of Nature-based activities

There is growing evidence that nature-based activities can improve veterans' mental health. Horticultural therapy was used for veterans following combat as far back as after the First World War (Davis, 1998), and long standing farming based programmes and therapeutic horseback riding for veterans with PTSD in the USA are still proving beneficial (Fleming, 2015; Johnson et al., 2018). In the last twenty-five years, an increasing body of research has evaluated nature-based interventions

for veterans with mental health issues, and found evidence for psychosocial benefits, for example improvements in PTSD symptoms, stress, and depression (Greer 2019). This research with military veterans is part of broader literature investigating the health and social benefits of spending time in natural environments. Before detailing research with veterans relevant to the research in this thesis, an exploration of wider literature on the benefits of nature and theoretical background will be discussed.

1.2.1 Terminology in nature-based activities for health

In research and other literature discussing benefits of spending time in nature to promote wellbeing and health, the lack of consistent terminology has been noted by several papers, but it appears no general consensus has as yet been agreed in the field (Bragg & Atkins, 2016; Garside et al., 2020). In this thesis, the terms 'nature-based activity' and 'green activity' are used interchangeably to refer to activities that are carried out within natural environments. These activities can form part of someone's daily life or be a part of an organised intervention. 'Nature-based intervention' is the term used for an intervention organised by a person, group, or organisation for the specific purpose of providing activities for a group or individuals.

1.2.2 Research into the benefits of nature

Figures published by the United Nations show that 55% of the World's population lived in urban areas in 2018, a figure that is increasing year on year (United Nations, 2019), and some research suggests people are becoming increasingly less likely to take part in nature-human interactions (Soga & Gaston, 2016). There is a perception that urban living is detrimental to wellbeing (Markevych et al., 2017; Ulrich et al., 1991) and people living urban lives often view rural environments in an idyllic and romantic way (Valtchanov, 2013; van den Berg et al., 2007). Natural environments provide health benefits from less pollution, noise, traffic and danger (Markevych et al., 2017). There is broad evidence that access to nature can be beneficial to health and behaviour. Research findings include workers with views from windows have less work stress and improved general wellbeing (Leather et al., 1998) and prisoners with views of nature from their cells have been found to visit prison medical teams less often (Moore, 1981). Indoor plants in offices have been found to decrease sick leave and improve productivity (Bringslimark et al., 2007) and posters of nature on office walls can lead to less anger and stress in men (Kweon et al., 2008). Research measuring cognitive functionality found students who had a natural window view from their dormitories did better on cognitive tasks such as digit span forward and backward tasks (Tennessen & Cimprich, 1995). In Chicago, crime rates were lower in areas with more vegetation than in those with less (Kuo & Sullivan, 2001). In Japan, studies investigating the effects of forest bathing (time spent in forest environments) compared to urban environments have found benefits including reduced blood pressure (Park et al., 2010), improved cardiovascular health (Lee et al., 2014; Li et al., 2011), and increased anti cancer proteins (Li et al., 2008). Research has shown that as little as five minutes of activity in a natural environment can be beneficial to mood and self-esteem (Barton & Pretty, 2010).

There have been several reviews of research into the benefits of activities in natural environments, sometimes known as 'green exercise' (e.g., Barton & Pretty, 2010; Pretty et al., 2005; Rogerson, 2016). One centred on studies that compared activities such as walks or runs in 'green' environments (such as parkland) compared to 'synthetic' environments (such as indoor gyms) over twenty five studies (Bowler et al., 2010). They found evidence for green environments showing significant positive benefits compared to synthetic environments, with the strongest effect for reducing negative emotions such as anger and sadness, and smaller effects for decreasing

anxiety and increasing energy and tranquillity. Thompson Coon et al. (2011) also reviewed studies that compared exercise in outdoor natural environments with indoors. Six out of seven studies comparing walking found a greater positive effect on mood including self-esteem, pleasure, and frustration after walking outdoors compared to indoors, as well as showing greater enjoyment and intent to repeat the activity when it was outdoors. However, studies were criticized for poor methodology and diverse outcome measures which prevented a meta-analysis. In a systematic review of green exercise research, Lahart et al. (2019) included twenty eight studies that compared exercise whilst viewing nature either in real life or virtually with indoor exercise. Overall, they found effects of green exercise over non-green indoor exercise for enjoyment and affective valence, but inconclusive results for outcomes such as energy, calmness, tension, anger, fatigue, and depressed mood. In a review that compared activities outdoors in green environments compared to outdoors in non-green environments, a meta-analysis of nine studies showed greatest effects for green environments over non-green for improvements in anxiety, fatigue, positive affect and vigour, with a small effect for depression (Wicks et al., 2022).

1.2.2.1 Green Care and Nature research in clinical populations

The most common population in studies in such reviews are students and active adults with only a small number from clinical populations. However, research into the health benefits of nature has included studies of several clinical populations. For example, research in hospital settings has suggested that views of a natural scene from a hospital bed could improve recovery time after surgery (Ulrich, 1984), and access to a hospital garden during labour was beneficial to expectant mothers and their partners (Ulrich & Perkins, 2017). In terms of mental health, a multi-study review of ten studies found that participants who self-reported mental health issues had stronger effect sizes for self-esteem improvements after green exercise compared to healthy participants (Barton & Pretty, 2010). In a more recent paper, Rogerson et al. (2020) found participants who reported 'low' wellbeing showed greater positive effects after green exercise than those who started with 'average to high', indicating that green exercise could be particularly helpful for those with low mood. The idea that nature-based interventions can be beneficial for clinical populations has produced an increasing amount of nature-based initiatives in the UK targeted at supporting specific vulnerable groups (Bragg & Atkins, 2016).

In the last few years in the United Kingdom, 'social prescribing', which links patients in primary care to community based support for improving health and wellbeing, has increasingly been promoted through the NHS (Bickerdike et al., 2017). A recent government report investigated nature-based social prescribing for mental health and concluded there was currently evidence for positive impact on depression, anxiety, mood and feelings of hope in quantitative studies to date. (Garside et al., 2020). However, such evidence was limited due to lack of random controlled trials and the plurality of activities and models of nature-based interventions. The report highlighted the need for further research and increased understanding of the active elements of effective nature-based support for mental health. A major recommendations of the report was to increase understanding of what and how nature-based social prescribing works, and for whom (Garside et al., 2020, p. 156).

1.2.3 Theories relating to the benefits of nature

Several theories propose mechanisms through which spending time in nature can be beneficial, with the most prominent theories coming from an evolutionary perspective.

1.2.3.1 Psycho-evolutionary theories

1.2.3.1.1 Biophillia hypothesis

The biophilia hypothesis proposes that humans have an innate affinity with nature (Kellert & Wilson, 1995), and we are drawn to spend time with natural, living things. Kellert and Wilson suggest that humans are not only concerned with physical survival but also realising our own potential and fulfilment, and that this may be attained through our relationship with the natural world. Thereby, nature is important to us for our psychological, intellectual and spiritual health (Kellert & Wilson, 1995).

1.2.3.1.2 Attention Restoration Theory

Probably the theory at the forefront of research into the psychological benefits of spending time in nature is Attention Restoration Theory (ART; Kaplan, 1995). This proposes that nature is psychologically beneficial because it is a restorative environment for cognitive fatigue. Based on the evolutionary perspective that humans are most suited to natural environments, the theory posits that urban environments are cognitively challenging because human cognition developed before urbanisation, and thus mechanisms for maintaining and restoring focus are most effective in natural environments (Hartig & Evans, 1991; Kaplan, 1995). Although literature around ART references urban and modern living as the main origin of depleted attention, attention restoration may also be relevant to depleted attention brought about by, for example, PTSD, where attention and other cognitive deficits are well documented (section 1.1.3.5.1).

ART posits that urban life makes it challenging to direct attention to tasks for which people have low interest because they have to supress distractions in order to

concentrate on them (James, 1892; Kaplan, 1993). The theory surmises that because 'directed attention', a top-down cognitive process, is cognitively demanding, it can become fatigued due to the depletion of cognitive resources. Directed attention fatigue can be restored with exposure to environments which are 'softly fascinating', in that they promote interest in engaging, yet unobtrusive ways, and engages the brain using involuntary attention. This allows the directed attention mechanisms to rest and restore. More details of the restorative process proposed by ART is discussed in section 1.2.2.1.2.3 below. A wide body of research purports to have found support for ART, showing that directed attention capacity can be affectively restored after walking in a rural environment (Berman et al., 2008; Hartig & Evans, 1991), or viewing images or videos of nature compared to urban scenes (Berto, 2005; Chen et al., 2011; Hartig et al., 1997). However, a meta-analysis of thirty one ART studies found results were mixed with only some attentional measures showing significant results (Ohly et al., 2016). Although the basic theory may appear simple, the components of ART need unpacking to fully understand the theoretical mechanisms which Kaplan has suggested.

1.2.3.1.2.1 Directed attention

Directed attention is a top-down cognitive process which involves suppressing, or inhibiting distractions in order to focus on the task at hand (Kaplan, 1993; Kaplan et al., 1988). ART proposes that these distractions are more pronounced in urban environments, making achieving tasks in modern and urban living more difficult. Following ideas by 19th century landscape architect Olmsted (1865), Kaplan (1993) proposes that directed attention has a finite capacity and can become fatigued. Directed attention is seen as required for any task which is for our own aim and volition, and as the effort to remain on task increases with time, fatigue also

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increases. Fatigue becomes more pronounced and quicker to occur when motivation to complete the task is low and the distractions are more intrusive (Kaplan, 1995). Models of attentional networks exist which suggest several components are involved, for example Mirsk et al. (1991) proposes four elements to attention: focus-execute, sustain, shift, and encoding. Another, widely used model separates attention into alerting, orientating and executive control (Petersen & Posner, 2012; Posner & Petersen, 1990). However, Kapan (1995) does not draw on such models for any clarity, and ART literature tends to be less detailed about what constitutes directed attention. Some papers, such as Valtchanov (2013), appear to use the term 'executive function' 'cognitive resources' and 'directed attention' interchangeably, and another paper refers to directed attention as inhibitory control (Hartig & Evans, 1991). Although sounding like a single process, directed attention appears to cover a complex set of cognitive functionalities, which research to date does not appear to have adequately defined within ART literature. This failure to be clear about what directed attention is, is perhaps reflected in the broad set of measures used to investigate its restoration found in a meta-analysis (Ohly et al., 2016). Of the 31 studies in the paper, a total of 21 different measures of attention are mentioned, with 10 studies using measures not used in any of the other papers.

1.2.3.1.2.2 Directed attention fatigue

There is little research examining how cognitive fatigue develops in urban life because ART research has focused on the restorative effects of nature, hence this aspect of ART remains largely theoretical as this point. Nevertheless, ART claims attentional fatigue encompasses a vast range of cognitive functions. Kaplan's (1995) paper suggests that directed attention fatigue can have detrimental effects on selecting information, problem solving, inhibiting behaviour, as well as perception and planning. This can lead to distraction, irritability, self-absorption, and stress. More recently, Kaplan and Berman (2010) have linked direct attention fatigue with problems of self-regulating behaviour such as gambling and over-eating. Although such literature highlights the importance of directed attention fatigue, it does not help to define it. Additionally, earlier papers make no reference to directed attention fatigue but only use the term 'mental fatigue' as a consequence of sustained directed attention (Kaplan, 1993), while other Kaplan papers posit that 'mental effort' leads to directed attention fatigue (Berto, 2005, p.170). Directed attention and its fatigue, therefore, is largely referred to in general terms.

1.2.3.1.2.3The restorative process

In ART, several conceptual properties of nature are hypothesized to play roles in the restorative process (Kaplan, 1993; Kaplan, 1995). Firstly, a restorative environment must give the impression of separation from directed attention tasks, so that a conceptual shift occurs to a state of '*being away*'; secondly, a sense of '*fascination*' in the natural environment so that it interests you and draws your attention to it; a feeling the environment has '*extent*' so you feel as though you are in another world and your mind is largely taken up by the environment; and a sense of '*compatibility*' with activities carried out in the environment, for example any activity you do should be one that suits your tastes and the environment should not be detrimental to you, for example if you suffer from hay fever (Kaplan, 1995).

Out of the restorative criteria in ART, it is the concept of fascination that is the most complex and most often discussed in literature. ART asserts that our directed attention fatigue can be overcome by spending time in an environment which makes no demands on directed attention and allows 'fascination' to come to the fore (Hartig

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et al., 1997). Fascination can be obtained through many sources such as animals, water, nature, and people and through processes such as storytelling (Berto et al., 2008). It has been suggested that natural environments, however, have a particular aesthetic advantage (Herzog et al., 2003) which provides positive '*soft fascination*', creating interest but not so intensely that it prevents contemplation (Berto et al., 2008; Herzog et al., 2010; Kaplan, 1995). '*Hard fascination*' is, on the other hand, intense and distracting to the point of preventing contemplation (Kaplan, 1995) examples being watching television (Berto et al., 2010), gambling (Berto et al., 2008), watching violence and being involved in intense competition (Kaplan & Berman, 2010). Kaplan and Berman (2010) suggest that a short-term sense of restoration can be achieved through such hard fascination activities, but due to the inability to reflect on unresolved issues, longer term effects are detrimental to wellbeing.

The concept of fascination has been criticised for lack of clarity and failing to provide an adequate explanation for its varying soft, hard, low and high qualities (Valtchanov, 2013). It is also an abstract idea and thus difficult to measure objectively (Neilson et al., 2019).

1.2.3.1.2.4 ART research in clinical populations

To date, most research investigating the concepts outlined in ART has focused on healthy participants. Out of thirty one studies in a meta-analysis of attention restoration theory research (Ohly et al., 2016), only two included participants with mental health issues (Berman et al., 2012; Wu et al., 2008). In one of the two studies, Berman et al. (2012) found working memory, measured in a digit backward task, and positive affect in participants with major depression was significantly more improved after a nature walk than after an urban walk. In the other study, patients with schizophrenia showed no significant improvement in attention after series of horticultural classes (Wu et al., 2008).

Although there is little prior research investigating the benefits of nature through ART in clinical populations, given that cognitive deficits, including attention, have been found in people with PTSD, it is viable that the same attention restoration mechanisms evidenced in healthy populations could also be active in PTSD. If attention can be improved, it may assist those with PTSD in controlling their internal focus away from intrusive thoughts (Duvall and Kaplan, 2014; Scott et al., 2015). External attentional control issues characterised by an over-attentiveness to environmental cues in PTSD (Hoge, 2010) could be improved by increasing the ability to focus and concentrate on a task through restored directed attention. Additionally, if cognitive impairments are detrimental to therapy (Falconer et al., 2013; van Rooij et al., 2015; Wild & Gur, 2008), improved attention could help maintain focus in the therapeutic process. Although such improvements may not directly alleviate the traumatic memories at the core of someone's PTSD, such effects could reduce some symptoms and improve quality of life.

1.2.3.1.3 Stress Reduction Theory

In common with ART, Ulrich's psycho-evolutionary restoration theory originates from the evolutionary perspective that people evolved in natural environments and as such are most equipped to restore psychologically in natural surroundings (Ulrich, 1983; Ulrich et al., 1991). Unlike ART, however, Ulrich views people's response to nature as primarily emotional rather than cognitive and sees the restorative process as predominantly stress-reducing with a subsequent cognitive effect. Because of this, Ulrich's theory is most often referred to as stress reduction theory (SRT).

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1.2.3.1.3.1 Background to SRT

SRT surmises that urban life is stressful for many different reasons, including noise, traffic, crowds and pollution, plus personal stressors including bereavement and illness (Ulrich et al., 1991). Natural environments, which suggest plentiful resources and suitability for psychological restoration, elicit positive emotions which reduce the stress and subsequently restore cognitive deficits. It is proposed that such responses to nature involve an automatic, unconscious and rapid process (Ulrich et al., 1991) referred to in some literature as the 'automatic affective response' (Valtchanov, 2013). Ulrich proposes that the ability to recover quickly from stressful situations by seeking restorative environments was an essential adaptive skill in early humans, and modern humans remain biologically inclined to seek naturally restorative environments (Ulrich & Perkins, 2017; Ulrich et al., 2008). In relation to PTSD and other anxiety related mental health issues, it is perhaps then also an adaptive response to seek nature-based restoration. Numerous studies have shown that access to nature can improve affect and reduce stress. For example, sitting by a view of nature decreased blood pressure quicker than a viewless window, and walking in nature was found to reduce anxiety and anger (Hartig et al., 2003). Work stress has been shown to be lower in offices with posters of nature (Kweon et al., 2008) and participants watching videos of nature after a stressful film had reduced blood pressure, skin conductance and muscle tension more quickly than a group watching non-nature videos (Ulrich et al., 1991). Reduced stress has also been found in veterans with PTSD following nature-based interventions (Bennett et al., 2017; Townsend et al., 2018; Vella et al., 2013; Wheeler et al., 2020).

1.2.3.1.3.2 SRT and the Stress response

Ulrich's stress reduction theory argues that cognitive fatigue is a manifestation of a state of stress, rather than stress being a consequence of depleted cognitive resources, as suggested by ART (Ulrich et al., 1991) Stress occurs when people are faced with challenges or threats to their wellbeing, and responses are psychological, physiological and behavioural (Baum et al., 1985). Psychologically, people react with emotions including anger, fear, and sadness, cognitively appraise a situation and access appropriate coping strategies. Physiological responses include activation of the cardiovascular, skeletomuscular, and neuroendocrine systems to prepare for action, with the main physiological after-effects of encountering a stressor being general fatigue. As well as the direct behavioural reactions to an immediate stressor, longer term behavioural stress indicators can include drug and alcohol use, irritation, and avoidance behaviours, together with cognitive decline (Marshall et al., 2016; Ulrich et al., 1991). In PTSD, the stress response is exaggerated and persistent in the absence of threat (Hoge, 2010), and such long-term stress behaviours are thus also characteristics of PTSD. Reduced stress through time spent in nature could be beneficial to people with PTSD by reducing the stress response.

1.2.3.1.3.3SRT and Processing

Stress reduction theory argues our response to nature is an instant and unconscious emotional reaction (Ulrich, 1981; Ulrich et al., 1991). Drawing on Zajonc's principle that affect precedes cognition (Zajonc, 1980), Ulrich describes our adaptive biological preparedness to respond initially to a scene preconsciously with an emotional reaction, for example, interest or dislike which elicits an approach-avoidant response with minimal cognitive activity (1991). Whereas the response could be to threat, such as to a cliff edge, resulting in stress and avoidance, an unthreatening response results in approach behaviour and receptiveness to psychological and physical restoration. SRT proposes this biological preparedness causes us to react to and seek out restorative natural surroundings, which firstly provide respite following a stressful experience, and secondly show potential for survival due to resources such as food and water. There is evidence for rapid physiological responses to natural stimuli, such as Dimberg's facial electromyography study (1990) which showed responses to negative and positive stimuli within 400ms, and phobia research showing skin conductance changes when stimuli featuring snakes and spiders were shown implicitly (Öhman et al., 1989).

1.2.3.1.4 Considering ART and SRT together

Both ART and SRT start with the premise that because we evolved in natural surroundings, this is where we are most efficient. Although there are differences in their understanding of the processes of fatigue, they both agree that ultimately, modern urban life can lead to increased stress, negative mood states and depletion of cognitive function. Much research into the benefits of nature measures affect, cognition and stress and often finds evidence for recuperation in all areas (Chang et al., 2008; Hartig et al., 2003; Ulrich et al., 1991), suggesting common resources are involved. Evidence for separate pathways of stress and attention mechanisms comes from papers which show improvement in either attentional measures or mood states but not both. For example, students with natural dormitory views performed working memory tasks more consistently than those with no natural views, although there was no difference in affect (Tennessen & Cimprich, 1995). Similarly, Berman, Jonides and Kaplan (2008) found improved Digit Span Backwards after a walk in nature, but there was no change in mood from PANAS. Also, Berman et al. (2012)

found participants with depression improved affect and working memory, but data were not correlated. There is therefore scope for future research to continue to examine the relationship between stress and attention restoration through exposure to nature, underpinned by both attention restoration theory and stress reduction theory.

1.2.3.1.5 Potential effects on PTSD

As previously discussed, if spending time in natural environments can improve attention, this could reduce intrusive thoughts, and improved concentration could reduce hypervigilance and have a positive effect on the therapeutic process. Reducing stress could overall reduce the stress response involved in hypervigilance. These are all elements of PTSD as detailed in Criteria E of the DSM-V classification (American Psychiatric Association, 2013). Thus both ART and SRT propose mechanisms potentially involved in improving elements of PTSD through naturebased activities. However, nature-based activities do not address the traumatic events themselves in the way that trauma focused therapy does, where clients repeatedly revisit memories of the events through a carefully controlled therapeutic process. Thus it should be noted that nature-based activities may provide a complementary treatment, rather than an alternative to treatments that offer a mechanism for reassimilating traumatic memories into the normal memory system.

1.2.3.2 Social influences in nature restoration

Where both ART and SRT draw on evolutionary theory, there are limitations with this approach. For example, suggested mechanisms of restoration in ART and SRT do not take account of more recent associations which may have developed, such as certain environments may be pleasing to us because they remind us of holidays and

recreation (van den Berg et al., 2007). Not only could these be personal memories but there are socially constructed ideas of beauty and representations of serenity and peace which are prevalent in media and social norms. Equally, both personal experiences and wider social constructs could provide negative associations with urban environments, which is relevant in studies which compare rural and urban environments. For example, fear of crime and gang culture in cities perpetuated by media coverage (Gibson et al., 2002; Liska et al., 1982). Additionally, traffic pollution has been shown to be detrimental to health including adverse lung function (Sinharay et al., 2018) and depression (Kioumourtzoglou et al., 2017) and awareness of this could have an effect. More recently, during the lockdown for COVID-19 in 2020, in the UK, one hour's exercise was permitted and no travel, thus living near pleasant environments was seen as desirable (McCunn, 2020). Greider and Garkovich (1994) propose that we view nature through the lens of our values and beliefs, which can fluctuate over time as we change.

Mayer et al. lists four additional beneficial mediators of spending time in nature that are not featured in ART (Mayer et al., 2009), namely encouraging exercise, promoting social interaction, and optimizing child development and personal achievements. Consequently, when someone is seeking restoration, it makes more logical sense that they seek benefit from an environment with more perceived benefits than an urban environment.

1.2.3.3 Conditioned restoration theory

Recently, classical conditioning has been applied to the restorative properties of nature through conditioned restoration theory (CRT; Egner et al., 2020). Egner and colleagues suggest that unconditioned restoration occurs through leisure time, which results in relaxation and wellbeing. Because this frequently occurs in natural

environments, the environments become associated with restoration (restorative conditioning). Subsequent time spent in the environment results in the same positive, restorative response, and the effect is generalized to other similar environments so that natural environments evoke relaxation and positive responses.

1.2.3.4 Restorative properties of nature

Recent research may provide insight into the visual properties of natural views that may make them restorative. Ulrich (1991) suggested restorative natural environments may be characterised by low complexity, movement and intensity, which arousal theory posits is calming to feelings of stress or emotional arousal (Berlyne et al., 1963). Valtchanov and Ellard (2015) suggest this may be due to activation of the visual reward system when viewing scenes of low-level visual properties, which can be manipulated by changing spatial frequencies. In their research, they found removal of mid to high spatial frequencies, which have previously been linked to the visual reward system, resulted in natural and urban images being viewed as equally pleasant. There has also been research into the fractal properties of nature, with a recent EEG study showing that images using statistical fractal properties, which have the high level of randomisation found in nature, produced a higher alpha response (associated with a relaxed wakeful state), compared to computer generated, less randomised fractal designs. (Hägerhäll et al., 2015). Through the lens of ART, it could be argued that these attributes may provide an explanation of the soft fascination element of natural environments described in ART literature.

There is also evidence that natural environments have non-visual properties that are beneficial. For example, forest bathing research has found a link between phytoncides emitted by trees in a forest and improvements in mood and increased

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production of natural killer (NK) cells in the human immune system (Li et al., 2006; Seong et al., 2014). Negative air ions, which are charged air particles, are particularly common in natural environments such as waterfalls and forests and have been found to have numerous health benefits including increasing alertness and decreasing headaches, dizziness and stress (Franco et al., 2017).

1.2.4 Nature-based interventions for military veterans

Nature-based interventions for veterans are well established. It has been proposed that they can foster a sense of purpose, improve self-esteem, provide respite from PTSD symptoms and daily worries, and provide social connection to other veterans that may have lapsed after service (Caddick, Smith, et al., 2015b; Hyer et al., 1996; Wheeler et al., 2020). Although there is growing research interest in the area, to date, there are relatively few studies that have evaluated interventions, the majority of which have stemmed from the USA, with only two published in the UK to date (Caddick, Smith, et al., 2015b; Wheeler et al., 2020). These studies show Interventions follow different models involving a variety of activities, formats, and durations. Activities included fly fishing (Bennett et al., 2017; Craig et al., 2020; Mowatt & Bennett, 2011; Vella et al., 2013), wilderness treks (Bird, 2015; Dietrich et al., 2015) and surfing (Caddick, Smith, et al., 2015b; Crawford, 2016; Rogers et al., 2014). Durations ranged from one day (Wheeler et al., 2020) to six months (Dietrich et al., 2015), with one involving meeting once a week for a year (Gelkopf et al., 2013). Some interventions included a specific therapeutic element (e.g. Bettman et al. 2021; Bird, 2015; Poulsen et al., 2016) but most did not. The common elements to all the interventions, however, are a natural environment, the company of other veterans and an activity of some type that engages with the environment. Thereby, they have experiential, social and physical components (Besterman-Dahan et al.,

2021). It is the combination of these three elements that are thought to bring about therapeutic change (Greer & Vin-Raviv, 2019; Wheeler et al., 2020).

1.2.4.1 Evidence of therapeutic change

1.2.4.1.1 Effects on PTSD and psychological wellbeing

Quantitative research has produced consistent evidence of improvements in PTSD symptoms following attendance at nature-based interventions, using self-report questionnaires. In nine studies that measured PTSD symptoms, only one failed to find significant improvement between pre and post intervention (Hyer et al., 1996) with seven studies finding significant pre to post reductions in PTSD symptoms severity. The remaining study, in contrast to the prevailing pre to post study design, measured PTSD symptoms daily over a two-week period whilst participants took part in a recreational intervention (Bettmann et al., 2021). Analysis found that on an individual, within-person basis, the amount of time individuals spent doing outdoor activities predicted their following day's reduction of PTSD symptoms, with more time spent outdoors leading to greater symptom improvements.

Similarly, improvements in depression between pre and post intervention has been found in numerous studies (Bennett et al., 2017; Bird, 2015; Crawford, 2016; Gelkopf et al., 2013; Rogers et al., 2014; Townsend et al., 2018; Vella et al., 2013; Wheeler et al., 2020). Stress has been measured less frequently, but has been found to reduce from pre to post intervention in four studies (Bennett et al., 2017; Townsend et al., 2018; Vella et al., 2017; Townsend et al., 2018; Vella et al., 2013; Wheeler et al., 2020), although two others found no changes in stress (Duvall & Kaplan, 2014). Reduced anxiety has been found following two fishing interventions (Vella et al., 2013; Wheeler et al., 2020).

1.2.4.1.1.1 Evidence for pre-intervention to follow up improvements

Where quantitative studies have invariably found pre to post improvements in at least one psychological measure, improvements between pre-intervention measures and follow-up are less consistent. One study found negative mood states, depression, anxiety and PTSD symptoms were significantly reduced six weeks after a fly-fishing intervention compared to baseline (Vella et al., 2013). Likewise, Wheeler et al. found pre- to post- and pre-intervention to follow up improvements in PTSD, depression, anxiety and stress four months after a brief angling intervention (2020). However, in a four-day fly fishing intervention, PTSD symptoms, depression and stress all improved pre to post, but none at a three-month follow-up showed any changes since baseline (Bennett et al., 2017). In a review, Greer et al (2019), found five of nine quantitative studies collected follow-up data between three weeks and six months after the intervention, with three finding improvements to psychological measures that were still statistically significant at follow up compared to baseline. One study took follow-up data at three and six months after a week-long retreat for veteran couples, consisting of a programme of therapy, education, and nature activities such as rafting, fishing and hiking (Townsend et al., 2018). PTSD symptoms reduced at the end of the retreat and were largely sustained at 3 and 6 months. However, the authors acknowledge that 60% of the participants were undergoing other treatments at the same time as attending the retreat and these may have contributed to the longer-term results. Potentially, however, involvement with the project may have given the veterans more confidence to engage with other treatment. Or indeed, participants may have continued nature-based activities outside of the intervention. At present, current research has not investigated the longer-term effects of attending nature-based interventions in any such detail.

1.2.4.1.2 Qualitative studies

Some, but not all qualitative studies assessing nature-based interventions for veterans have produced themes relating to changes in their PTSD symptoms and psychological wellbeing. The most direct of these was found in a study where veteran members of a surfing charity were interviewed and analysis produced the theme 'experiencing respite from PTSD', which related to how participants, while surfing, were able to focus on and experience surfing, so they were unaware of their PTSD, which provided a boost to their wellbeing (Caddick, Smith, et al., 2015b). Themes in another study, derived from journal entries kept by the participants, were organised around symptom clusters of PTSD (Dustin et al., 2011). They found anecdotal evidence of reductions in re-experiencing, avoidance, and hyper-arousal, although some effects were more evident later in the trip.

Qualitative themes reflected psychological effects in other studies less overtly, for example, in comments from participants about not needing their medication whilst on the intervention (Craig et al., 2020; Dietrich et al., 2015; Mowatt & Bennett, 2011). In one of the papers, a participant referred to the wilderness experience as 'natural medicine' (Dietrich et al., 2015).

Overall, there appears to be robust evidence for psychological benefits following nature-based interventions, although longer term benefits are not as well understood.

1.2.4.2 Social benefits

Although social factors are thought to be a key ingredient in nature-based interventions, only two quantitative studies to date have assessed changes in social functioning in veterans following attendance (Gelkopf et al., 2013; Wheeler et al.,

2020). Wheeler and colleagues found significant improvements in social adjustment at two weeks and four month after an angling intervention compared to baseline (2020). Gelkopf and colleagues found quality of life, which included social elements in the scale, improved significantly after a year-long sailing intervention (2013).

In qualitative studies, however, the most common themes reflect social connections with other veterans during the interventions. Themes include 'collective identity' (Caddick, Smith, et al., 2015b), 'social reconnection' (Dietrich et al., 2015), 'development of a social community' (Rogers et al., 2016), 'reconnection' (Bennett et al., 2014), 'necessity of camaraderie' (Mowatt & Bennett, 2011) a sub-theme of 'fostering connections' (Craig et al., 2020), and 'connection with others on the trek' (Bird, 2015). These findings reflect the importance of interventions providing other veterans to connect with, creating a sense of belonging (Rogers et al., 2016), which may contrast with participants' normal lives that are often characterised by feelings of social isolation (Royal British Legion, 2014). Interestingly, one of the studies also noted the participants chose to spend a significant time on their own during a wilderness trek, and this was thought of as positive for their psychological wellbeing (Dietrich et al., 2015). In another intervention conducted over ten weeks in a therapeutic garden, it was found that participants were more likely to seek out other veterans as the intervention progressed, with veterans more inclined to spend time on their own at the beginning (Poulsen et al., 2016). However, in this study it is not clear how separate the participants were from each other, for example whether they took part in mindfulness and nature-based activities on their own or in a group.

Thus, the positive role of the social element of nature-based interventions for veterans is evident from qualitative studies but remains minimally measured quantitatively. Some qualitative studies suggest solitary time can also be important.

1.2.4.3 Benefits of nature-focused activities

A major element of nature-based interventions for veterans with PTSD is the activities participants take part in. These are hugely varied and range from hiking, wilderness experiences and kayaking, although the most common are fishing (either fly-fishing or carp) and water sports. Several qualitative studies detailed themes that relate to the sense of achievement and challenge from taking part in activities. In a study using focus groups of prior participants in a fly-fishing intervention, the importance of learning new skills in the theme 'successful experience' was revealed, which facilitated increased confidence and ability to relax (Bennett et al., 2014). In another fly-fishing intervention, the 'outdoor activity participation' theme reflected the enjoyment in taking part in the activities, as well as intention to continue fishing in the future (Mowatt & Bennett, 2011). A similar theme was found in Rogers et al. (2016), where being able to do activities facilitated 'Regained confidence and rejuvenation' Some studies referred to the almost meditative state of becoming so absorbed in an activity to the exclusion of everything else, which has been described as 'flow' (Caddick, Smith, et al., 2015b; Dietrich, 2003).

Interestingly, research suggests that the type of nature-based activity may not be important for benefits to be experienced (Hartig & Evans, 1991). In the first study reported in Wheeler et al., (2020) participants were in one of three groups doing oneday experiences of either horse husbandry, angling, or falconry. Significant pre-to post-intervention to follow-up improvements were found for PTSD symptoms, stress, depression and anxiety in all groups, although effects were greatest for angling (Wheeler et al., 2020).

1.2.4.4 Effects on attention

Two studies to date have drawn on attention restoration theory (ART; Berto, 2005) and have measured attentional function as a potential effect of nature-based interventions. Duvall and Kaplan (2014) analysed effects of several group-based, nature recreation experiences for veterans. They found participants who reported their daily lives were frequently affected by mental or physical health issues, showed significant improvements in attentional function using a modified version of the Attentional Function Index. Vella, Milligan & Bennett, (2013), found several benefits to veterans with PTSD after a fishing-based nature intervention, including a statistically significant improvement in attentiveness and serenity, two subscales of the positive and negative affect schedule (PANAS-X; Watson & Clark, 1999). Duvall and Kaplan proposed that this suggests an increased attentional focus on the flyfishing activities that may have distracted the veterans away from intrusive thoughts from their PTSD. Other than these two studies, attention changes, as proposed by attention restoration theory have not been measured in studies with veterans with PTSD to date, and there was no attention task included in either study, highlighting a gap in research to date.

1.2.4.5 Autonomy

A common element most of the above studies have is that they evaluated an intervention. One issue with this is that it does not evaluate nature-based activities that veterans do proactively in their own lives, which may or may not reflect behaviour change following attendance at a formally run nature-based intervention. One study addressed this, when they examined the use of a garden by veterans at a

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hospital where their treatment for substance abuse had included a horticultural intervention (Lehmann et al., 2018). Some veterans were found to have continued visiting and working in the garden after the intervention ended for up to two growing seasons. Those who were found to be taking part in the self-initiated gardening reported feeling 'calm', 'serene' and 'refreshed' after their visits. This highlights behaviour outside of formal interventions and shows the value of autonomy.

One suggested reason behind the success of nature-based interventions is that they naturally harness a 'strengths approach' to PTSD treatment (Hawkins et al., 2016). This perspective is linked to positive psychology and puts a focus on existing strengths and promotes the idea the veterans themselves have many of the answers to improving their health. Its importance here is that attendance on these programmes based on one-off interventions may well have lasting effects on participants in terms of encouraging self-belief and autonomy, which could be used to help with their mental health in their lives going forward. However, qualitative studies to date have not included follow-up data, so long-term effects are not known in this respect. The Hawkins et al., (2016) study highlights an opportunity for further research to investigate behaviour change following interventions.

Another aspect that the literature has not yet considered is the long-term relationship that veterans with PTSD may have with nature. Missing from the studies is whether the participants already regularly did similar activities. The exception was in one study that reported all participants were new to group outdoor experiences (Duvall & Kaplan, 2014). However, it was not reported whether this referred to the organised group aspect of the intervention, or the activities themselves. It is possible that veterans who volunteer for such interventions do so because they are already inclined to do nature-based activities (Greer & Vin-Raviv, 2019). It is thus unknown whether, for example, there would be a greater effect in people who have already adopted such a 'nature mindset' or in those for whom spending time doing naturebased activities would be a novel occurrence. Although activities detailed in studies to date mention coaches and experts overseeing veteran participants' activities, it is implied that teaching new skills is part of the intervention, but it could also be the skills are already held by at least some of the participants.

One significant feature of results to date is the clear advantage of being with other veterans who have PTSD, evident largely from qualitative findings. It is not known currently whether the social aspect has a greater influence than the natural environment or the outdoor activities interventions, and this is a gap in the literature to date.

1.2.4.6 Summary

Overall, nature-based interventions for veterans with mental health issues including PTSD can produce improved PTSD symptoms, depression, stress and quality of life, although pre-2018 studies in literature have been criticised for having largely weak methodology (Greer & Vin-Raviv, 2019). Three clear elements of the interventions; physical activities, social interaction and engaging in a natural environment are thought to combine to provide a forum for benefits to occur. However, the interventions are very different in terms of activities, duration and therapeutic input and the restorative mechanisms are not currently understood, nor is it known whether the three elements equally contribute to the results. Research at present has not adequately captured the relationship that veteran participants already have with nature or develop following interventions, and it is not known at present how

veterans may use nature-based activities in their lives outside of organised group activities.

1.3 Rationale for study in the current thesis

The previous sections have demonstrated several important areas that underpin the rationale for this thesis. Firstly, it was established there is a sub-population in the UK of veterans with PTSD who may have had difficulty engaging with available mental health support services or may have been through treatment but remain symptomatic. PTSD has been shown to be more than a maladaptive response to a single traumatic event; it is a complex condition influenced by internal, external, and social factors before and after the traumatic event that combine to develop and maintain PTSD.

Secondly, nature-based interventions have been shown to provide at least shortterm improvements to PTSD symptoms, depression, and stress, and foster improved self-esteem, personal growth, and social identity. However, understanding of the mechanisms for this change requires more research, in particular to understand the optimum elements that make interventions beneficial, as currently interventions in the literature are diverse in several ways. Prominent theories, especially attention restoration theory (ART) have provided a theoretical underpinning for research investigating changes in attentional function after exposure to natural environments. However, to date, objective changes in attention in veterans with PTSD have not been measured in studies of nature-based interventions, nor have any restorative affects beyond those described by ART been explored .

Thirdly, a final gap in the literature revolves around nature-based behaviour in veterans with PTSD outside of organised interventions. This is both in terms of long-

term behaviour changes following such interventions, and in terms of any preexisting 'nature mindset'. In essence, it is not currently known how veterans with PTSD may use nature-based activities to facilitate positive influence on their daily lives, living with their mental health condition.

1.3.1 Research aims

The purpose of this PhD thesis was to increase understanding of how green activities help veterans with PTSD to manage their lives. This was attained by expanding on prior research studies and exploring how veterans with PTSD proactively use nature, as well as to further examine the effect of nature-based outdoor group recreational experiences on the wellbeing of veterans with PTSD. The main research questions are as follows:

- How do veterans with PTSD use nature-based (green) activities to help them with their daily lives?
- What mechanisms are involved in nature-based activities shown to be beneficial to veterans with PTSD?
- How do group nature-based interventions contribute to the wellbeing of veterans with PTSD?
- Can attention restoration theory be applied to veterans with PTSD?

Chapter 2 Evaluation of a 7-night fishing intervention

2.1 Chapter summary

This chapter details a mixed methods case series study examining the effects of a 7night fishing intervention in southwestern France for eight military veterans with PTSD. The purpose of the study was to examine psychological, attentional, and social responses to the intervention, and the trajectory of any effects were monitored over five time points from 2 week prior to the intervention to follow up one month afterwards. PTSD symptomology, cognitive function, stress, mood, and social connectedness were measured. Qualitative data, obtained through interviews with participants, were analysed using thematic analysis to provide additional data. Quantitative and qualitative results were combined in the discussion section to provide an in-depth picture of how participants responded to the intervention. In line with prior studies, psychosocial benefits were evident pre- to post-intervention for PTSD symptomology, stress, anxiety, depression, and negative affect, with the most notable changes between day 4 and day 7. Largely, these were not maintained at follow up. Social benefits were not evident from the Social Connectedness Scale, although gualitative data showed the participants experienced positive peer support. Subjectively measured attention was shown to improve, but there were minimal changes in objectively measured attention using computer tasks. The in-depth mixed method data gave a detailed picture that revealed useful insights for future research and organisation of similar interventions for veterans with PTSD.

2.2 Background

2.2.1 Optimum dose

Previous nature-based interventions for veterans with PTSD are varied in several ways including their duration, as discussed in Chapter 1. The idea of an optimum dose of nature for mental health benefits has been examined in non-clinical populations in a 2010 meta-analysis (Barton & Pretty, 2010). Six studies were included that measured the effects of activities in nature-based environments (green exercise) on mood and self-esteem. Activities included walking, gardening, fishing, and sailing, with durations varying between 5 minutes and a whole day. Results showed the greatest effects on self-esteem and mood was found in activities that lasted just 5 minutes and involved the lightest physical intensity. These results suggest that initial exposure to natural environments could have the greatest impact on mental health, and in fact benefits may even decrease over time. On the other hand, an Australian study found that regular time spent in nature of durations of 30 minutes or more were more associated with lower depression and blood pressure than shorter durations (Shanahan et al., 2016). Furthermore, another study that found military veterans with PTSD showed their PTSD symptoms reduced more, the more time they spent outdoors on the previous day (Bettmann et al., 2021).

An alternative way of exploring the idea of an optimum dose of nature-based activities is to consider the trajectory of effects over the course of a longer intervention. This would show, for example, whether the greatest effects are seen early on (indicating a shorter duration could have been as beneficial) or whether changes continue to increase over time (suggesting longer durations could be more valuable). Although prior quantitative studies of nature-based interventions have focused on a pre-post follow-up protocol, one qualitative study of veterans with PTSD taking part in a 4 day river rafting and camping intervention analysed journals the veterans kept over their time on the trip (Dustin et al., 2011). This analysis indicated that veterans acclimatised to the river environment over the first day or two of the trip, before experiencing an increased sense of 'peace and relaxation'. Thus, in this instance, a shorter trip may have been less beneficial if it had ended before participants had acclimatised. It is likely that some interventions require a longer settling in period than others, possibly linked to how familiar participants are with the environment, the level of social anxiety involved in meeting new people, and the availability of participants' usual support networks. More research is hence needed to increase understanding of how veterans with PTSD respond to nature-based interventions over time, to provide insight into the optimum amount of time required to produce mental health benefits along with which other elements may be beneficial.

2.2.2 Peer support

As discussed in Chapter 1, peer support is an integral part of previous nature-based interventions for veterans with PTSD and is thought to be pivotal in the therapeutic process. However, although highlighted in qualitative research as a prominent theme (Bennett et al., 2014; Bird, 2015; Caddick, Smith, et al., 2015b; Craig et al., 2020; Dietrich et al., 2015; Mowatt & Bennett, 2011; Rogers et al., 2016), changes in social functioning after nature-based-interventions for veterans with PTSD have only been measured in two quantitative studies to date (Gelkopf et al., 2013; Wheeler et al., 2020). Wheeler and colleagues used the five item Work and Social Adjustment scale (WSAS; Mundt et al., 2002) and found significant improvements in the scale at two weeks and four month post an angling intervention compared to two weeks prior, although only two of the items related to social functioning (2020). Similarly, Gelkopf

and colleagues found pre to post Quality of Life measure with a social subscale had improved significantly after a year long sailing intervention, as well as finding a significant increase on a 'functioning' scale that included social elements (2013). The social elements involved in the interventions, therefore, remain underresearched in quantitative research.

2.2.3 Theoretical background suggesting mechanism for change

Theoretical explanations for the mechanisms involved in the benefits found in naturebased interventions most commonly draw on attentional restoration theory (ART; Kaplan, 1995) and/or stress reduction theory (SRT; Ulrich et al., 1991). These are detailed in chapter 1 section 1.2.2.1. Both theories posit that time spent around nature can improve attentional function and reduce stress, although they differ in how this occurs. ART suggests restoration occurs initially through cognitive recovery, specifically, directed attention, which leads to reduced stress. SRT proposes our response to nature is primarily emotional, reducing stress, with subsequent cognitive recovery. Studies evaluating nature-based interventions for veterans with PTSD have produced evidence for reduction in stress (Bennett et al., 2017; Townsend et al., 2018; Vella et al., 2013; Wheeler et al., 2020). However, evidence for naturebased interventions affecting attention in veterans with PTSD is sparse. This is despite ART having been regularly cited as a relevant theory in studies evaluating such interventions (Dustin et al., 2011; Duvall & Kaplan, 2014; Poulsen et al., 2016; Vella et al., 2013; Wheeler et al., 2020).

Two studies to date have measured attention using subjective measurements through self-report questionnaires. Duvall and Kaplan (2013) found significant improvements in self-reported attentional functioning after nature-based interventions lasting between 4 and 7 days, compared to baseline measures using a modified version of the Attentional Function Index: a questionnaire designed to measure perceived functioning in common tasks requiring attention and working memory (AFI; Cimprich et al., 2011). A second study measured self-reported attentiveness in a group of veterans with PTSD following a 3-day fly-fishing intervention (Vella et al., 2013). They found increased attentiveness after the intervention, measured using an extended, 60 item version of the positive and negative affect schedule (Watson & Clark, 1999), which includes an attentiveness subscale consisting of the words 'alert, attentive, concentrating, determined'.

There appears to be only one study to date that has measured cognitive function using an objectively measured task after a nature-based intervention in participants with PTSD (Zabag et al., 2020), although they did not measure attention, but focused on cognitive flexibility, the ability to change responses according to context. The between groups study investigated individuals with PTSD who went sailing for four hours a week for a year. They measured PTSD symptoms, state and trait anxiety and cognitive flexibility using a computerised task. Cognitive flexibility has been found to be impaired in PTSD in a prior study (Levy-Gigi et al., 2015). In Zabag's study, the group with PTSD who had gone sailing was compared with a PTSD group who had not gone sailing, and two healthy control groups, one of whom had taken part in the sailing intervention and the other had not. They found significantly less severe PTSD symptoms, and trait anxiety in the PTSD group who had sailed compared to the PTSD group who had not and the control group. They also found both groups with PTSD had impairment in cognitive flexibility compared to the control group (Levy-Gigi et al., 2015). Zabag et al., propose this may explain why people with PTSD find it hard to adjust their responses according to context, for example responding the same to loud bangs from fireworks as in combat. The authors do not

specifically state PTSD participants in this study were veterans or military personnel, although their PTSD diagnoses had been acknowledged by the Israeli Department of Defence, it can be surmised they had military connections. Due to the lack of preintervention data, the study was unable to report pre-post data. Therefore, there remains a lack of studies investigating cognitive function in veterans attending nature-based interventions and it appears that to date, objective measurement of attentional function before and after such interventions in veterans with PTSD has yet to be measured.

2.2.4 Attention restoration studies using cognitive tasks

Cognitive tasks have been used to measure changes in attention in research investigating ART and the restorative effect of nature in several populations including elderly residents of a care home (Ottosson & Grahn, 2005), students (Tennessen & Cimprich, 1995), and city dwelling children (Taylor et al., 2002). Methods are not standard, and various tasks, arguably testing various aspects of attention, other cognitive skills, and executive function have been used to explore attention restoration theory (Ohly et al., 2016). For example, the Digit Span Backwards task (DSB), although strictly speaking a test of working memory rather than attention, has been used in several nature studies testing ART (Berman et al., 2008; Berman et al., 2012; Faber Taylor & Kuo, 2009; Ohly et al., 2016). The task, which requires participants to repeat sequences of digits of increasing length in reverse order, was found to be the cognitive task yielding the most consistent improvement in task performance after exposure to nature, according to a meta-analysis (Ohly et al., 2016).

Another common task in such ART studies is the Trail Making Test (Reitan, 1955), which measures visual attention (trail A and B) and task switching (trail B). Trail A

involves locating and joining up dots in a numerical sequence (1,2,3 etc) and in trail B, a sequence alternating letters and numbers (A,1, B, 2 and so on). In a random controlled trial, Cimprich and Ronis (2003) found significant differences in performance on test A and B between experimental and control groups after the experimental group had taken part in weekly nature-based activities during pregnancy. In another study, Shin et al., (2011) found walks in the forest significantly improved task performance on trail B compared to walks in urban settings in a group of students.

Another useful measure of attention, the sustained attention to response test (SART), measures attentional vigilance (the ability to sustain attention on a task) and the inhibition response (the ability to supress an instinctive response). It has been used in several ART studies (Berto, 2005; Berto et al., 2010; Lee et al., 2015). In the task, participants are presented with a succession of single digits on a screen and instructed to press the space bar each time a digit appears, unless it is an assigned target digit (usually 3), when they should inhibit their prepotent response. Berto, (2005) found that after participants were shown images of natural environments, SART performance for response time and accuracy were significantly improved, compared to a control group shown urban pictures, who showed statistically nonsignificant changes in SART performance. Another study found that even a 40 second micro-break viewing a green roof was enough to show improved performance in the SART task, compared to viewing a concrete roof (Lee et al., 2015), This task is used in vigilance research, and relates to the tonic alerting mechanism in Posner's model, as it measures the ability to remain on a task. Vigilance is at the core of Kaplan's description of directed attention
2.2.5 Evidence attentional function might change.

One question for consideration is whether veterans with PTSD are *likely* to find attention improved by spending time in nature. Whereas there is established evidence of cognitive deficits in PTSD including attention, memory, and executive function (Qureshi et al., 2011; Vasterling et al., 2002; Woon et al., 2017), it is not yet fully understood whether such deficits are a result of PTSD or a precursor to development of PTSD (Block & Liberzon, 2016). Furthermore, as discussed in chapter one, there is little research into whether cognitive function in PTSD patients improves as their PTSD symptoms improve. A small amount of evidence has been found that cognitive function, including attention, can improve following therapy (Nijdam et al., 2018; Walter et al., 2010). Whether other influences, such as time in nature, can also have any effect on objectively measured cognition appears yet to have been researched.

2.2.6 Cognitive function in PTSD

There is strong evidence of reduced cognitive function in sufferers of PTSD and researchers investigating this in veterans have used some of the same tasks as researchers investigating ART. In one of several studies examining executive function in PTSD, Tian et al. (2014) found reduced accuracy in the digit span task (backwards and forwards) in the PTSD group compared to the control group. The Trail Making Test has been used in numerous studies to indicate executive function impairment in participants with PTSD (LaGarde et al., 2010; Reinhard et al., 2017; Walter et al., 2010) including Vietnam veterans (Beckham et al., 1998). Therefore, it seems reasonable to investigate whether such deficits could be improved given the right circumstances. Due to the lack of research to date, however, the likelihood of changes in cognitive performance for veterans with PTSD after time spent on a

nature-based intervention is unknown, even if past research suggests psychological benefits are likely to be found.

2.2.7 Mixed methods

The majority of research into nature-based interventions for veterans with PTSD are quantitative. In thirteen studies in a recent review (Greer, 2019), nine were guantitative and four gualitative. There are two mixed methods papers in relation to nature-based interventions for veterans. In Bird, (2015), a 6 day outdoor therapy intervention for injured veterans, not all of whom had PTSD, was assessed using questionnaires and journals kept by participants during the programme. They found significant improvements in depression, anxiety and stress, self-efficacy and life satisfaction between baseline, post-programme and at two months follow-up. They also observed social gains, improvements in self-determination and enhanced personal competence. An earlier study, (Hyer et al., 1996) also used mixed methods, finding that a 5 day outward bound experience for veterans with PTSD resulted in no significant changes in PTSD symptoms, however comments by the participants revealed positive experiences including increased self-esteem and selfconfidence. The advantage of mixed methods is that insight can be gained from a combination of qualitative and quantitative data that could not have been gained from either on their own (Creswell & Clark, 2017). Nature-based interventions for veterans with PTSD are complex, both in terms of their constituents, and accordingly, in participant experience. Mixed methods allow for a more complete picture of the participants' response to the intervention. Mixed method studies have also been identified as a useful tool for researching trauma per se (Creswell & Zhang, 2009) and so are employed in the current study.

2.2.8 The current study

The purpose of this study was to evaluate a new, 7-night angling intervention created to support veterans with PTSD, using a mixed method, case series design. The intervention was based on a protocol established in prior two day interventions that had shown significant pre to post-intervention improvements in PTSD symptoms, stress, anxiety and depression (Wheeler et al., 2020). The objective was to use both quantitative and qualitative data to explore the research aims.

The first specific aim was to assess the psychological effects of the intervention, in terms of PTSD symptoms, stress, anxiety, depression and mood, and in particular, the trajectory of effects from before the intervention, during the week of the intervention and one month afterwards. The purpose of examining the trajectory of changes through quantitative data was to increase understanding of how participants responded to being on the intervention, and to examine points during the intervention where psychosocial effects were most evident. It was anticipated that qualitative data would provide additional insight into the psychological effects through participants' subjective experiences.

A second aim of the study was to examine the social effects of the intervention, and the influence of peer support. Social benefits have been detailed in several qualitative studies, but quantitative social data is sparse. The aim was to use a quantitative measure of social connection before, during and after the intervention endeavoured to capture social elements of the intervention that prior qualitative studies found to be a pivotal part of participants' experiences. It was anticipated that qualitative data would provide additional insight into the social effects through participants' subjective experiences. A third aim was to evaluate potential processes of change through application of attention restoration theory (Kaplan, 1995). The theory suggests changes in attention occur following time spent in natural surroundings, and thus the study used cognitive tasks to measure objective attention, and a questionnaire to measure subjective attention. ART proposes a process through which restoration occurs that requires the environment to provide conceptual properties of *fascination, being away, extent* and *compatibility*. A mixed method approach suits this aim because where quantitative measurements through questionnaires and cognitive tasks assess whether changes have occurred, qualitative data can be used to examine how participants subjectively experienced the conceptual properties of nature suggested by the theory.

2.3 Method

2.3.1 Participants

Inclusion criteria was a diagnosis of PTSD from a secondary care clinician such as a psychiatrist, and prior military service in the British Armed Forces. There were no exclusion criteria. There were ten attendees at the fishing intervention. One had not officially left the military, and another did not have a PTSD diagnosis from a secondary clinician so did not meet inclusion criteria for the research. The remaining eight took part in the study All were male between the ages of 25 and 60, who had left the British armed forces between 1983 and 2018. Seven were British Army veterans, and one served in the British Air Force. All had fishing experience. Four participants agreed to provide follow-up data 4 to 6 weeks after the intervention.

Of the eight participants, two were diagnosed with PTSD before they left military service, with the remainder being diagnosed after discharge. Two participants

reported no co-morbidities, and none were in therapy at the time. All were on psychotropic medication to help with PTSD symptoms. Six were married or in long term relationships, and three were in employment. A summary of demographics by participant is shown in table 1.

Pseudonym	Age	Service	Left military	Years in service	Baseline PCL-5	Year diagnosed	Years diagnosed after discharge	Co-morbidities	Married/ partner?	Lives on own?	In employ- ment?
Bob	46	British Army Infantry	1995	7	60	1995	0	Renal cancer, anxiety, depression	Y	Ν	N
Callum	60	Royal Air Force, Transport	1999	22	62	2015	16	Hypertension, prostate cancer (in remission)	Y	Y	Ν
Richard	59	Brtish Army, Royal Signals and others	1983	6	69	2006	23	HIV	Y	Ν	Ν
Мо	44	British Army, Royal Signals	1994	5	51	2009	15	IBS	Ν	Y	Y
Simon	49	British Army Infantry, Royal Regiment of Fusilliers	1997	12	67	2016	19	Type 2 diabetic	Y	Ν	Y
Jake	25	British Army infantry	2013	4	57	2014	1	None	Ν	Ν	Y
Zach	33	British Army, Royal Signals Infantry support team	2018	10	70	2013	-5	Back, hip injury, hearing loss, psychogenic non- epileptic seizures (PNES)	Y	Ν	Ν
Taylor	27	British Army Infantry	2013	4	65	2017	4	None	Y	Ν	Ν
Mean	42.88			8.75	62.63		9.13				
SD	13.47			6.07	6.48		10.33				
Median	45.00			6.50	63.50		9.50				
IQR	20.00			5.75	8.25		16.00				

Table 1 Participant demographics

2.3.2 Ethical considerations

Ethical approval was obtained from the University of Essex prior to collecting data (appendix A). The main ethical considerations were in respect of the mental health of the participants, all of whom had clinical level of PTSD symptoms. Although the fishing lakes were serene and peaceful, there was a potential for re-experiencing of traumatic events, or increased anxiety. An experienced trauma psychotherapist was always on site to provide mental health support if required. There was also a very small risk the activities involved in participating in the study (filling out questionnaires and doing computer tasks) may have caused anxiety. Participant information sheets and consent forms were provided to each participant when they were first contacted and prior to obtaining consent to take part in the study (appendix B). The document made it clear that any participant could withdraw from the study at any time, whilst continuing with the fishing, should they wish. Participants were reminded of this right to withdraw prior to data collection on days they were asked to carry out research activities, so they had plenty of opportunities to withdraw if they chose to do so. To reduce the risk of anxiety during the qualitative interview, participants were not asked to reveal any information about their trauma. A risk assessment was carried out which considered both the physical and mental health risks of taking part in the study in context (appendix C). A final ethical consideration was in relation to a documentary crew who were filming the trip. The ethical impact was in relation to ensuring confidentiality of data whilst the participants took part in the study. In this regard, measures were taken to ensure confidentiality was maintained for example the participants' data was not filmed and no filming was allowed in the testing room.

2.3.3 Design

The study used a concurrent mixed-method case series design. Case series is a descriptive research design that observes a group of individuals with common characteristics who share a disease, treatment or procedure (Carey & Boden, 2003). They are a useful and appropriate design for evaluating new interventions (Carey & Boden, 2003; El-Gilany, 2018), understanding individual responses (El-Gilany, 2018) highlighting potential complications, and to help formulate new hypotheses for further more rigorous investigation (Kooistra et al., 2009). No causal inferences can be made about the effectiveness of an intervention in case series (El-Gilany, 2018; Kooistra et al., 2009) and they differ from single case design studies in that there is no manipulation of the independent variable. This makes case series useful for evaluating interventions in which the investigator does not control any aspect. This also gives case series designs high external validity through a participant group that is representative of more usual clinical service groups. This is because there is no reliance on minimizing differences between participants, for example, to reduce the effects of co-morbidities, which are common in PTSD.

The concurrent aspect of the design study relates to both qualitative and quantitative data being collected during the same period. Results were analysed independently, and findings brought together after analysis. In this study, the main emphasis was on quantitative measures, with supportive qualitative data being analysed separately and then compared with quantitative findings in the discussion section. In keeping with the method's protocol, there was no manipulation of the intervention, except indirectly through necessitating the veterans to stop fishing while they carried out tasks involved in the study.

2.3.4 Materials

For collecting pre-intervention and follow-up data, the participants were contacted by telephone and email. Participants used their own telephone and computer device to administer the tasks. Apart from personal computers and mobile phones, materials included hard copies of the questionnaires to fill out by the researcher while on the phone. The cognitive tasks were accessed through a link that was emailed to each participant. At the intervention site, the researcher used a laptop onto which the cognitive tasks were loaded, and on which the participants carried out the tasks whilst sitting at a table in a 'study room' created in one of the lake's secluded lodges. Questionnaire packs were provided to the participants in hard copies. Interviews were recorded on a Sony IC digital voice recorder.

2.3.5 Intervention

The premise of the intervention was to allow participants to experience the environment, fishing, and peer support with no additional, specialist therapeutic intervention. It took place at a dedicated carp fishing lake in central France at the end of October 2018. The participants met at the University of Essex on Friday evening, travelling through the night in two minibuses, and arrived on the afternoon of the Saturday (day 1). Participants had been allocated a fishing coach per two participants, forming five groups of three. Coaches provided fishing advice and peer support, with four out of five coaches having military backgrounds. Although the participants all had at least some fishing experience, an important aspect of the interventions for veterans with PTSD that have tended to feature acquisition of new skills as an important aspect of the intervention (Greer & Vin-Raviv, 2019).

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The intervention was arranged and managed by a community interest company (iCARP CIC) who specialise in running such outdoor experiences and include in their staff an experienced trauma therapist and a cognitive neuroscientist, who work in collaboration with other charitable organisations supporting veterans. Permission to carry out this proposed research alongside this intervention was granted by the organisers.

2.3.5.1 The Site

The fishing compound consisted of two fishing lakes, two lodges and the owners' farmhouse where the lake owner and family lived. The larger lodge was set aside for catering, a social area, and accommodation. The smaller lodge became the testing room for the research project. Participants and coaches fished and slept by the lake. The research and support team used accommodation in the lodges. There was also a documentary film crew on site who always had access to the lakes and the participants (see section 2.5.6.5 for a discussion of the possible impact of the film crew).

2.3.5.2 Arrival

Upon arrival, participants were allocated an area of the shore and lake from which they would fish and camp (referred to as their 'swims'). Individual bivouacs with bedding were provided for the participants in which they slept at night and could retire to at any time. The participants were free to move around to see other participants should they wish. There were no structured activities other than fishing.

2.3.5.3 Food

All participants were provided with a substantial hot breakfast and evening meal each day. These were delivered to the participants at their swims unless they requested to be fed centrally at the large lodge, where the caterers cooked the meals. This decision was made due to the adverse weather conditions and the large site. Tea and coffee were supplied at the lodges. Otherwise, participants provided their own refreshments including any lunch, snacks, and drinks. They also brought their own camping stoves and kettles to make hot drinks at their swims.

2.3.5.4 Socialising

This was largely unstructured except on two occasions when the food was served to everyone at the large lodge. Due to inclement weather, there was minimal intermingling between the two lakes and between coaching groups.

2.3.5.5 Fishing

All fishing equipment was provided including rods and bait, although some participants chose to bring some or all their own equipment.

2.3.5.6 Mental health support

An experienced trauma psychotherapist was always on site, who checked the welfare of the participants at least once a day and provided emotional support if required.

2.3.5.7 Outcome measures

Given the lack of research examining executive function in PTSD participants before and after a nature-based intervention, it was proposed to combine methodology from nature studies and PTSD studies. Therefore, the participants were tested using cognitive tasks which both reflect the executive control impairment shown in PTSD sufferers and have also been used in nature studies, where executive function has shown some improvement after exposure to nature.

2.3.5.7.1 Post-traumatic Stress Disorder Checklist (PCL-5).

PTSD Symptom severity was assessed using the self-report questionnaire PCL-5 (Appendix D; Weathers et al., 2013), used frequently as a clinical tool, which asks 'In the last month, how much have you been bothered by....' followed by 20 scenarios relating to the DSM-5 criteria for post-traumatic stress disorder. Examples include 'Repeated, disturbing dreams of the stressful experience', 'Feeling distant or cut off from people' and 'Being "superalert" or watchful or on guard'. Participants are asked to rate these scenarios on a 5-point scale ranging from 0 for 'not at all' to 4 for 'extremely'. The checklist has been shown to have strong psychometric properties including internal consistency (α = .94), test re-test reliability (r = .82) and convergent validity relative to other PTSD measures including the post-traumatic diagnostics scale (rs = .74 to .85) (Blevins et al. 2015).

2.3.5.7.2 Positive and negative affect scale (PANAS)

A second questionnaire was used to assess the participants' changes in mood. The positive and negative affect schedule (Appendix E; Watson et al., 1988) is a 20 item scale measuring general positive and general negative affect. In research evaluating changes in veterans with PTSD after a nature-based group intervention (which included fly fishing) positive affect was found to have significantly increased whilst negative affect significantly decreased, when using a revised version of the PANAS (Vella et al., 2013). Participants respond on a Likert-type scale to various adjectives such as 'strong', 'alert' and 'enthusiastic' from the positive scale and 'nervous', 'upset' and 'guilty' from the negative scale. Participants are asked to rate the extent to which each adjective describes how they feel on a 5-point scale ranging from 1 (very slightly or not at all) to 5 (extremely). This scale is widely used and has been demonstrated to have convergent validity relative to other mood inventories (rs = .76

to .92), good test-retest reliability (r = .68 for PA and r = .71 for NA) and good internal consistencies ($\alpha = .88$ for PA and $\alpha = .87$ for NA) (Watson & Clark, 1999).

2.3.5.7.3 Depression, Anxiety and Stress scale (DASS-21)

A third self- report measure monitored psychological distress levels using the depression anxiety stress scale (DASS-21;Lovibond & Lovibond, 1995). This consists of three subscales of seven items each, measuring depression, anxiety, and stress on a 4-point Likert scale. In this scale, Lovibond and Lovibond define depression as characterised by a reduced self-esteem, lack of incentive and low expectation of achieving goals. Anxiety is classified as feelings of nervousness accompanied by fear, and stress is viewed as a state of tense arousal and being easily distressed or aggravated. An example item for depression is 'I felt downhearted and blue', for anxiety 'I felt I was close to panic' and for stress 'I found it difficult to relax'. Responses range from 0 (did not apply to me at all) to 3 (applied to me very much, or most of the time). Severity cut off scores are shown in table 2. The DASS-21 has shown good internal consistencies ($\alpha = .94$ depression, .87 anxiety and .91 for stress) and concurrent validity compared to several measures including the trait version of the State-Trait Anxiety Inventory (STAI-T; (Spielberger, 2010) which found correlations of .71 for depression, r = .55 for anxiety and r = .68for stress (Antony et al., 1998). A copy of the DASS-21 is shown in Appendix F.

Range	Depression	Anxiety	Stress
Normal	0 - 9	0 - 7	0 - 14
Mild	10 -13	8 - 9	15 - 18
Moderate	14-20	10 - 14	19 - 25
Severe	21-27	15 - 19	26 - 33
Extremely severe	28 +	20 +	34 +

Table 2 DASS-21 – Interpretation of scores

Note: All scores for the DASS-21 are doubled to allow comparison to the 42-question version of the scale. Details obtained from DASS website (http://www2.psy.unsw.edu.au/groups/dass)

2.3.5.7.4 Social Connectedness Scale (SCS)

This scale consists of twenty statements such as 'I feel close to people', 'I am able to relate to my peers' and 'I don't feel related to most people'. Participants are asked to rate the statements between 1 and 6, where 1 is strongly disagree and 6 is strongly agree. Internal item reliability analysis has shown a Cronbach's alpha co-efficient of .92 (Lee et al., 2001). The full scale is detailed in appendix G.

2.3.5.7.5 Attentional function Index (AFI)

The questionnaire consists of thirteen statements with three subscales of *effective action, attentional lapses*, and *interpersonal effectiveness*. In the original measure, respondents were asked to rate how well they felt they were functioning in various areas of attentional function on a scale of 1 – 100 (Cimprich et al., 2011). The measure was modified to be scored using a Likert scale in a subsequent study (Duvall & Kaplan, 2014). Participants in the current study used the Likert scale scoring method from the modified version used by Duvall and Kaplan (2014). This asked them to rate their functioning according to the statements on a scale of 1 to 5, where 1 was not very well or not at all and 5 was extremely well or a great deal. Statements include 'Keeping your mind on what you are doing', 'Doing things that take time and effort' and 'Forgetting to do important things'. Internal consistency

coefficient for the modified version of the scale used by Duvall and Kaplan showed a Cronbach's alpha co-efficient of .93. See appendix H for a copy of the scale.

2.3.5.7.6 Digit Span Backwards (DSB)

The Digit Span Backwards and forwards test are subtests of the Wechsler Adult Intelligence test (Wechsler & De Lemos, 1981), in which participants repeat increasingly long sequences of numbers in reverse order. The computerised version used in this study was based on Woods et al. (2011), which had a test-retest reliability correlation of .67.

The visual Digit Span Backwards task involved the participants viewing a sequence of single digits appearing one at a time in black in the centre of a white screen. Following the protocol established by Woods et al. (2011), experiment one, each digit remained on the screen for one second, before being followed by next digit. A red circle appeared in the centre of the screen for 1 second at the start and end of the sequence. After each sequence, following the red circle, a circle of digits was shown on the screen, which the participant used to repeat the sequence in reverse order, selecting each digit using the mouse. Each correct response subsequently resulted in a longer sequence; incorrect responses led to a level being repeated. Consecutive errors resulted in the level reducing. The task started with a sequence of two digits, rising to a maximum of ten. In the version of the task used, there were 14 trials, preceded by a practise session of two trials.

2.3.5.7.7 Trail Making Test (TMT)

A further measure that has found significant improvements following nature-based activities is the Trail Making Test (Reitan & Wolfson, 1985), which involves drawing a line, on paper or screen, connecting either a simple numerical sequence (1-2-3-4-5

etc.; test A) or a more difficult task alternating between numbers and letters (1-A-2-B-3-C etc.; test B). The computerised version of the task has been shown to have a strong test-retest reliability: Intraclass correlation coefficient (ICC) for total time to complete z scores .87 for trail A and .85 for trail B (Woods et al., 2015).

The Trail Making Test took approximately five minutes, and consisted of four trails, two practise and two main tests. In trail type A, the practise test was a short trail involving joining dots in numerical order that were numbered 1 to 4. This was followed by the main test comprising of joining dots numbered 1 to 25. The participant used the laptop mouse to move between the dots in numerical order. The trail B also had a short practise run, followed by a trail of 1 to 12 and A to J, which the participant must alternate between (1A 2B etc).

2.3.5.7.8 Sustained Attention to Response Task (SART)

When used in one study, both accuracy and response time in the SART task were found to be significantly improved in participants after they were shown images of nature (Berto, 2005). The task involves pressing a keyboard key when single digits appear on screen (4,1,2,5,7 etc.), except when the digit is an assigned target (usually 3), when the participant is asked to refrain from responding (Robertson et al., 1997). The task has a good test-retest Pearson's correlation of .76 (Robertson et al., 1997).

The version of the SART used consisted of 225 trials made of nine digits that appeared one at a time in a predetermined order, so the order was the same each time the task was done. Participants were instructed to press the space bar when a digit other than a 3 appeared. Each digit appeared in the centre of the screen for 250 milliseconds, randomly in one of five font sizes, in white on a black screen. After 250ms, the digit was replaced by a mask of a circle containing an X which remained on the screen for 900ms. The task took approximately six minutes to carry out. A practise session of 18 trials preceded the main task, during which the participants received feedback showing the word 'incorrect' if the spacebar was pressed when a 3 appeared. The main task did not include feedback, and there was no break in the task.

2.3.6 Procedure

2.3.6.1 Recruitment

The intervention organisers, iCARP CIC recruited attendees to the interventions. Once attendees were confirmed, contact details were sent to the researcher via the intervention organisers, after having obtained permission for contact details to be passed to the researcher and telephone calls to be made. The researcher called each participant to introduce herself and the study and to invite them to take part. Upon verbal agreement, the participant information sheet and consent form were sent via email. The participant was invited to call the researcher if they had any questions before signing the consent form. Upon receipt of the signed consent form, a time for a second phone call was set, approximately two weeks before the intervention, to collect pre-intervention data.

2.3.6.2 Pre-intervention

Approximately two weeks before the intervention, a telephone assessment was conducted by the researcher for each participant. Details taken included gender, date of birth, military role and date of leaving, details of PTSD diagnosis, treatment to date, other medical conditions, and medication. In the same phone call, they were taken through three questionnaires, which they verbally responded to: PCL-5 PTSD Checklist, DASS-21 and PANAS-20. While on the phone, each participant was sent a link via email to allow them to download the executive function tasks of Digit Span Backwards, SART and TMT (A and B) using Inquisit software (Millisecond Software, Seattle WA). Once the email was received and the participant was ready to continue, the researcher left each participant to download the software and complete all tasks, before advising the researcher of their completion and confirming a convenient time for a second phone call as soon as possible. In this second call, verbal responses to the Social connectedness scale (SCS) and Attentional function Index (AFI) were obtained. Participants all completed pre-data collection within approximately two hours of their initial telephone assessment. Data for the online cognitive tasks were securely stored online by participant ID, accessible only by the researcher.

2.3.6.3 Day 1

Day 1 measures were taken within 24 hours of arrival at the lake. Once participants had set up camp and had their evening meal, the researcher visited each participant and gave them hard copies of the questionnaires (PCL-5, DASS-21, PANAS 20, AFI and SCS) and explained procedures involved in continuing to take part in the study. They were also given an approximate time the following morning to go to the testing room, to hand in the questionnaires and carry out the cognitive tasks.

The participants were instructed to fill out the questionnaires while sitting quietly by the lake, and to answer the questions according to how they felt at the time they completed them, thereby treating all questionnaires as measures of their current state.

The participants attended the testing room one at a time the morning after arrival. The testing room was set up in the smaller of the two lodges, where the testing area could be kept quiet with no interruptions, approximately a five-minute walk from each lake. The order the participants were seen was broadly in the order they were camped around each lake. Once at the testing room they handed in their completed questionnaires and were invited to sit down and relax. The researcher first gave a verbal reminder of what each participant was expected to do, and the participants were then reminded of their right to withdraw from the study. They were also reminded they would still be allowed to continue with the fishing if they chose to withdraw. The tasks were carried out on a laptop on which had been preloaded with Inquisit software. The tasks were done in the same order for each participant: TMT, DSB and then SART. Data for each task carried out during intervention was held securely on the laptop.

2.3.6.4 Day 4 and day 7

Hard copies of the questionnaires were given to participants to fill out while they were by the lake. They were also given a time to return to the testing room to complete the tasks again. The procedure was the same as on day 1. A full schedule of when all measures were taken is included in appendix I.

2.3.6.5 Interview

Interviews with the participants took place on day 6 of the intervention and added the qualitative element to the study. The purpose of the interviews was not to provide in depth information but to provide an adjunct to quantitative data. The interviews focused on asking open questions to encourage the participants to reflect on their week. Questions included asking about the participants' experiences of the intervention, perceived benefits, and any negative aspects. Short semi-structured interviews took place by the side of the lakes on day six of fishing. They lasted

between 21 and 33 minutes, except for one that lasted 10 minutes because the participant did not feel like talking. An interview schedule is included in appendix I.

2.3.6.6 Follow up

A follow-up telephone call was made 4 to 6 weeks after the intervention to repeat the self-report measures and the executive function tasks were repeated remotely as per pre-intervention.

2.3.7 Planned analysis

In keeping with the concurrent design of the study, quantitative and qualitative data were analysed and presented separately.

2.3.7.1 Inferential and descriptive statistics planned analysis

Descriptive statistics presented focus on medians, but means are also shown in tables for all quantitative outcome measures. Recording the means allows for comparisons with other studies and are used to calculate reliable and clinically significant changes. Although there is no need to duplicate data, medians are presented in both tables and graphs. This is to provide an additional visual representation of the trajectories of effects for all outcome measures.

To investigate the psychological effects of the intervention in terms of PTSD symptoms (PCL-5), stress, anxiety, depression (DASS-21) and mood (PANAS), non-parametric Friedman's tests were conducted to compare data from the first four time points (pre-intervention, day 1, day 4 and day 7). Where main effects were found, Dunn-Bonferroni post hoc tests were carried out to investigate relationships between each time point.

Pre-intervention to follow up data was analysed separately using a Wilcoxon signed rank test. The reason for this separate test was that the Friedman's test only takes complete sets of data into account, thus when run across all five time points only participants who took part in follow up would be counted in the analysis.

The same pattern of inferential tests was conducted for data from the Social Connectedness Scale (SCS) to measure social effects, the Attentional Function Index (AFI) to measure self-reported attentional function, and each cognitive task to objectively measure attention.

2.3.7.2 Reliable and clinically significant change (RCSC) planned analysis

Data from the questionnaires and tasks were analysed to ascertain whether participants showed reliable and clinically significant change (RCSC) using what is often termed the Jacobson-Truax method proposed by Jacobson and Truax (1991). The analysis was run using Microsoft Excel. This method is a way of assessing each participant's changes in scores against the context of observed changes in the whole sample (Evans et al., 1998). The two aspects of the analysis are the reliability of the change, whether a change is sufficient to not be due to error of measurements, and clinical significance, which is whether change is significant in relation to clinical and normative groups.

The reliable change index (RCI) is the amount of change that can be viewed as reliable, in that it is more than the unreliability of the measure would suggest might happen for 95% of participants. It is thus a product of the reliability of the measure and initial standard deviation of the sample. Following terminology in prior literature (Evans et al., 1998) 'reliable improvement' refers to scores in either direction which depict an improvement in the measure (for example a reduction in symptoms, or

increase in functionality). 'Reliable deterioration' was used to denote decline in the measure of the same, reliable magnitude (for example an increase in symptoms or decrease in functionality). Reliable changes calculations were carried out for all measures.

Clinical significance relies on calculating a post-treatment cut-off score for the measure, based on clinical and normative data. The cut-off represents a point at which change is calculated as having enough magnitude to be clinically meaningful. Jacobson-Truax suggest three possible criteria for calculating clinical significance based on the type of normative data available. Criterion A measures whether a participant has moved more than 2 standard deviations (SDs) in the direction of the mean of the clinical group. The clinical group can be from a large sample as close to yours as possible, or the research sample if none is available. Criterion B calculates whether a person has moved to within 2 SDs of the mean of a normative group. Criterion C measures whether a person has moved to a point halfway between A and B. In this study, normative values were available for the PCL-5, PANAS, DASS-21 and SCS but not for the AFI. Clinical values were available for PCL-5 and DASS-21. As no clinical or normative values were available for the AFI, and the sample size in this study was too small to calculate meaningful means, clinical significance was not calculated for the AFI, although reliable changes could still be calculated. Criteria used for this study are summarised in table 3.

Measure	Clinical norms source	Normative values source	RCSC criterion used
PCL-5	Wortmann et al, 2016	Bovin et al, 2016	С
	Treatment-seeking military veterans and non-veterans	Veterans generally	
Depression anxiety and stress scale (DASS-21)	Antony et al, 1998	Antony et al, 1998	С
Sucss scale (DAGC-21)	Means of those with panic disorder, obsessive compulsive disorder, social phobia, major depressive disorder	Non clinical volunteers	
Positive and negative affect scale (PANAS)	None available	Crawford and Henry, 2004	В
		Male adults, general population	
Social Connectedness	None available	Capanna et al, 2013	в
		Adults, general population	
Attentional function Index (AFI)	None available	None available	N/A
Digit Span backwards	None available	Woods et al, 2011	в
		General population, aged 18 -65	
Trail making test (TMT) A and B online version	None available	Woods et al, 2015	В
		Adults, general population	
Sustained attentional response test (SART)	None available	Carriere et al., 2010	В
		Adults, general population	

Table 3 Criteria used to calculate clinically significant change

2.3.7.3 Planned Qualitative analysis

The thematic analysis applied a deductive approach and thus sought data reflecting the study aims: The first aim of the study was to examine the veterans' psychological response to the intervention, paying particular attention to the trajectory of effects. Coding involved looking for data that related to how their psychological wellbeing had been affected. The second aim was to consider the influence of social connection, so coding focused on finding data that related to how the veterans interacted with their peers at the intervention, as well as any indication of a broader social effect regarding wider groups or networks such as friends and family. The third aim was to apply attention restoration theory to investigate potential processes of change (Kaplan, 1995). In this respect, coding involved looking for data relating to the restorative actions of nature, of perceived changes in attentional focus and references to the elements of nature restoration as suggested by ART. These are a sense of 'being away' from daily routine and environments responsible for attentional fatigue, a sense of 'fascination' in the natural environment, a feeling the environment has 'extent' to the point where one's mind is largely taken up by the environment, and a sense of 'compatibility' with activities carried out in the environment.

The coding process started with familiarisation of the data by listening and transcribing the interviews and making notes. The coding was conducted by marking up hard copies of the text, highlighting relevant sections and making notes. An example of this coding can be found in appendix K. This was followed by generating initial codes, searching for themes that related to the study aims. These were broadly categorised into psychological effects, social effects, and explanations of *how* the participants felt the environment and fishing activities impacted on them. The third stage of the process involved reducing initial, multiple codes to initial themes. The analysis focused on semantic meanings, so that the level of interpretation was kept low. In this phase it became clear that some themes were relevant to more than one aim of the study, as references to restorative aspect of nature was regularly referred to alongside the psychological benefits such as feeling more relaxed and calmer. The fourth stage was reviewing the themes, creating a codebook that detailed quotes in each theme, and the final stage before writing the report was to define themes and ensure they had focus, and represented aims of the study.

2.4 Results

Data from the tasks completed online were uploaded into Excel, as were task data held on the laptop collected during the intervention. The questionnaire results were entered into an Excel spreadsheet and the hard copies kept securely. Interview recordings were transferred from the voice recorder, and all data was held securely on University of Essex shared Box drive. Digital consent forms were stored in a separate folder. Excel data was formatted and transferred to SPSS for statistical analysis and kept in Excel for the purpose of running reliable and clinically significant change analysis.

Results are presented in the order described in the planned analysis section, beginning with quantitative results (descriptive and statistical analysis and reliable and clinically significant change analysis), followed by qualitative results. The results of both are brought together in the discussion section.

2.4.1 Descriptive and statistical analysis

Data were checked using a Shapiro-Wilk test and found to be normally distributed (W (8) = .84 to .95, ps > .05). However, due to the power of tests of normality being low for small sample sizes (Razali & Wah, 2011), the data was treated as though it was not normally distributed and group level statistical analysis was obtained using non-parametric Friedman's tests. There were eight participants and four took part in the follow up. One participant submitted blank sheets for questionnaires for post-intervention due to an oversight but did carry out the tasks .

2.4.1.1 PTSD Symptoms

Median (IQR) PCL-5 score reduced from 63.5 (8.25) pre-intervention to 38 (19.50) post-intervention. Compared to a study of treatment seeking veterans that showed a mean pre-treatment value on the PCL-5 of 42.41, (SD = 15.06; Wortmann et al

2016). this indicates participants were overall highly symptomatic pre-intervention, and experienced a notable reduction in reported symptoms post-intervention, although still over the suggested cut-off score of 31 -33 for probable PTSD, as suggested by the US. Department of Veteran Affairs, National Center for PTSD website (Weathers et al., 2013). Descriptive statistics are shown in figure 1 and table 4.

A non-parametric Friedman's test found a significant main effect of the intervention $\chi^2(3) = 14.83$, p = 0.002. Dunn-Bonferroni post hoc tests were carried out and revealed a significant difference between pre- and post-intervention (p = .011) and between day 1 and post-intervention (p = .003) after Bonferroni adjustments. There were no significant differences between other time points.

Wilcoxon signed rank test was conducted to compare pre-intervention to follow-up data and found no significant difference between pre-intervention and follow-up PCL-5 scores (p = .141)



Figure 1 Median PCL-5 scores across time points

			<u>PC</u>	L-5 scores			
	n	Min	Max	Median	IQR	Mean	SD
Pre	8	51	70	63.50	8.25	62.63	6.48
Day 1	8	51	74	62.00	12.75	62.75	8.92
Day 4	8	23	75	54.00	17.75	53.88	16.91
Post	7	11	67	38.00	19.50	37.57	19.01
Follow up	4	56	65	57.00	4.00	58.5	4.51

Table 4 PCL-5 scores for each time point

Note: IQR is the interquartile range calculated from the range for the third quartile minus the range of the first quartile

2.4.1.2 Depression, Anxiety and Stress.

Median (IQR) DASS-21 scores all reduced from pre- to post-intervention, after having slightly increased on day 1. The highest score for each subscale is 42, and pre-intervention median scores of depression 31.00 (5), anxiety 23.00 (7) and stress 38 (13) were all in the 'extremely severe' range (see table 2) with some participants scoring the maximum of 42 in some subscales post-intervention median scores for depression. Twenty (16) were in the 'moderate' range, anxiety 18 (13), and stress 18 (13). These scores remained notably higher than normative mean (SD) values from a non-clinical sample for depression of 2.12 (3.64), anxiety of 1.22 (1.77) and stress of 3.51 (3.78; Antony et al, 1998). Mean and median scores and standard deviation on the DASS-21 are summarised in table 5 and medians shown in figure 2.

Analysis of the first four time points using a non-parametric Friedman's test revealed a significant main effect of the intervention for stress, χ^2 (3) = 9.57, p = 0.023 but not for depression or anxiety (ps > .05). Dunn-Bonferroni post hoc tests were carried out for stress scores and found no significant difference between time points after Bonferroni adjustments. A Wilcoxon signed rank test comparing pre-intervention to follow-up data and found no significant changes for depression, anxiety, or stress (ps > .05).



Figure 2 Median DASS-21 scores by across time points.

Subscale		n	Min	Max	Median	IQR	Mean	SD
Depression	Pre	8	18	36	31.00	5.00	29.50	6.39
	Day 1	8	26	38	34.00	7.50	32.75	4.89
	Day 4	8	10	42	26.00	14.50	24.25	10.50
	Post	7	0	42	20.00	16.00	20.29	14.04
	Follow up	4	10	30	19.00	6.50	22.00	8.23
Anxiety	Pre	8	18	38	23.00	7.00	24.75	6.58
	Day 1	8	18	40	31.00	10.00	29.00	7.86
	Day 4	8	10	42	18.00	15.00	21.00	11.21
	Post	7	0	32	18.00	13.00	17.71	11.10
	Follow up	4	9	38	23.00	8.75	25.50	11.87
Stress	Pre	8	29	42	38.00	13.00	34.75	8.48
	Day 1	8	22	42	35.00	9.00	33.75	6.71
	Day 4	8	8	42	27.00	16.50	26.75	11.95
	Post	7	0	42	18.00	13.00	18.29	13.34
	Follow up	4	11	38	34.00	6.75	29.25	12.31

 Table 5
 DASS-21 scores for each time point

Note: IQR is the interquartile range calculated from the range for the third quartile minus the range of the first quartile

2.4.1.3 Mood

Median (IQR) positive affect pre-intervention was 31.00 (11.25) out of a total possible of 40, decreasing slightly on day 1 to 27.00 (3.75), before increasing at the end of the intervention to 32.00 (9.5). Post-intervention scores were comparative to normative data for men of 32.06 in a study evaluating the measure in a nonclinical sample (Crawford & Henry, 2004). At follow-up, the four participants who responded had a median positive affect score of 32.00 (2.5). Mean and median scores are listed in table 6 and medians in figure 3.

Median (IQR) negative affect pre-intervention was 35.5 (9.75) out of a total possible of 40, showed no change on day 1, at 35.00 (12.5) before decreasing at the end of the intervention to 26.00 (13). Post-intervention scores were notably higher than normative data for men of 15.20 in a study evaluating the measure in a nonclinical sample (Crawford & Henry, 2004). At follow-up, the four participants who responded had a median negative affect score of 36.50 (13.25). Mean and median scores are listed in figure 3 and table 6.

Analysis of the first four time points using a non-parametric Friedman's test revealed a significant main effect of the intervention for a decrease in negative affect, χ^2 (3) = 9.69, p = .021, but this was not significant for positive affect. Dunn-Bonferroni post hoc tests were carried out for negative affect scores and found a significant difference between day 1 and post-intervention after Bonferroni adjustments. There were no other significant differences between time points.

Wilcoxon signed rank test was conducted to compare pre-intervention to follow-up data and found no significant differences (ps > .05).



Figure 3 Median PANAS scores across time points

Subscale		n	Min	Max	Median	IQR	Mean	SD
Positive	Pre	8	13	35	31.00	11.25	27.63	8.57
	Day 1	8	19	30	27.00	3.75	26.00	3.63
	Day 4	8	19	41	27.00	13.25	29.38	8.30
	Post	7	25	40	32.00	9.5	32.29	6.02
	Follow up	4	29	33	32.00	2.5	31.50	1.91
Negative	Pre	8	28	48	35.50	9.75	36.00	7.25
	Day 1	8	29	50	35.00	12.5	38.38	8.12
	Day 4	8	20	49	32.00	12.5	32.13	9.31
	Post	7	15	48	26.00	13	29.00	11.66
	Follow up	4	21	47	36.50	13.25	35.25	11.32

 Table 6
 PANAS scores for each time point

2.4.1.4 Social Connectedness

Median (IQR) social connectedness scores increased from a pre-intervention of 58.00 (13) to post-intervention 67.00 (35.50) and then reduced at follow-up to 55.50 (35.50). Median scores remained notably lower than reported normative values in a study of adults from the general population of 91 (SD13.83; Capanna et al, 2013). Results can be seen in table 7 and figure 4.

Non-parametric Friedman test showed no significant changes between the first four timepoints (χ^2 (3) = 3.514, p = .319) and a Wilcoxon test showed no change from pre-intervention to follow-up (Z = 1.461, p = .250).



Figure 4 Median SCS scores across time points

 Table 7
 Social Connectedness Scale mean and median scores

	п	Min	Max	Median	IQR	Mean	SD
Pre	8	20	83	58.00	13.00	56.38	19.13
Day 1	8	25	77	54.50	17.50	51.88	17.89
Day 4	8	30	93	60.00	11.00	60.63	17.71
Post	7	26	92	67.00	35.50	56.29	25.10
Follow up	4	35	78	55.50	35.50	56.00	22.14

2.4.1.5 Attentional Function

Pre-intervention median (IQR) scores increased from 24.00 (3.75) to 35.00 (8.50) post-intervention before reducing again at follow-up. No normative values were available for comparison. Means and medians are shown in table 8 and figure 5.

A non-parametric Friedman's test was conducted and found a significant main effect of the intervention for the first four time points, χ^2 (3) = 11.78, p = 0.008. Dunn-Bonferroni post hoc tests were carried out that showed no significant differences between time points after Bonferroni adjustments (ps >.05), although pre- to postintervention was approaching significance (p=.058). Analysis by subscale for the first four time points using a non-parametric Friedman's test revealed a significant main effect of the intervention for subscale *effective action*, χ^2 (3) = 10.57, p = 0.014 but not for *interpersonal effectiveness*, χ^2 (3) = 7.246, p = 0.064 or *attentional lapses*, χ^2 (3) = 6.82, p = 0.078. Dunn-Bonferroni post hoc tests for *effective action* showed no significant differences between time points after Bonferroni adjustments (ps > .05), although like overall AFI scores, the pre- to post-invention difference was approaching significance (p = .058).

A Wilcoxon test showed no change from pre-intervention to follow-up (Z = 1.095, p = .273) for AFI total scores or between any other time point.



Figure 5a & 5b Median AFI across time points (a) total and (b) by subscale

	n	Min	Max	Median	IQR	Mean	SD
Pre	8	21	36	24.00	3.75	25.25	4.83
Day 1	8	16	30	24.50	4.50	24.38	4.31
Day 4	8	23	49	32.50	11.00	33.38	8.50
Post	7	23	47	35.00	8.50	35.29	7.89
Follow up	4	24	31	29.00	3.25	26.75	5.91

Table 8 AFI scores for each time point

2.4.1.6 Digit Span Backwards

Results showed the mean maximum length recalled before making two subsequent errors increased pre- to post-intervention from 4.50 (SD= 1.77, Mdn 4,50) to 5.13 (SD = 1.46, Mdn = 5.00). This was slightly higher than reported normative scores in a nonclinical adult population of 4.61 (SD = 1.22; Woods et al., 2011). Results are shown in figure 6 and table 9.

A Friedman's nonparametric test showed there were no statistically significant changes in scores within the first four time points (χ^2 (3) = 3.532, p = .317). In comparing pre to follow-up scores, a Wilcoxon test showed no significant change (Z = 1.134, p = .317).



Figure 6 Median Digit Span Backwards scores across time points.

		Max length attained							
	n	Min	Max	Median	IQR	Mean	SD		
Pre	8	2.00	7.00	4.50	3.00	4.50	1.77		
Day 1	8	3.00	6.00	4.00	1.25	4.25	1.04		
Day 4	8	1.00	6.00	4.50	2.00	4.50	1.69		
Post	8	3.00	7.00	5.00	2.25	5.13	1.46		
Follow up	4	3.00	6.00	4.50	1.50	4.50	1.29		

 Table 9
 Digit Span backwards scores across all time points

Note: 'Maximum length attained' is the length of digit sequence recalled correctly before making 2 subsequent errors

2.4.1.7 Trail Making Test (trail A and B)

Descriptive statistics are shown in figure 7 and table 10. The median time (IQR) to complete the task reduced throughout the intervention from 51,907ms (19,712) pre to 48,688ms (8,862) post for trail A and from 86,504ms (46,511) to 50,211ms (32,794) for trail B. Median pre-interventions response times were slower than normative values when compared to a study with typical adults (Woods et al., 2015). Post-intervention scores remained slower than normative response times for trail A (37,490ms), and quicker for Trail B (60,820ms)

Non-parametric Friedman tests showed no significant changes between the first four timepoints for trail A (χ^2 (3) = 5.850, p = .119) or trail B (χ^2 (3) = 7.050, p = .070) and a Wilcoxon test showed no change from pre to follow up (Trail A, Z = -.730, p = .625; trail B, Z = -.730, p = .625.



Figure 7 Median Time taken to complete trail making tasks A and B

Table 10	Mean and median times taken to com	plete Trail Making Tests A & B
		p

			Time taken to complete (ms)						
		n	Min	IQR	Mean	SD			
Trail									
А	Pre	8	38,674	80,730	51,907	19,712	56,135	14,681	
	Day 1	8	34,819	70,204	54,039	22,448	52,929	13,367	
	Day 4	8	30,578	86,868	39,629	12,345	44,210	18,247	
	Post	8	25,808	55,559	48,688	8,862	44,677	9,383	
	Follow up	4	27,861	51,634	49,587	6,855	44,667	11,256	
Trail									
В	Pre	8	46,360	134,781	86,504	46,571	84,380	32,500	
	Day 1	8	41,122	140,037	62,717	36,012	77,992	37,494	
	Day 4	8	42,605	100,032	58,808	12,760	61,749	18,074	
	Post	8	26,774	91,733	50,211	32,794	59,978	23,485	
	Follow up	4	49,013	82,751	71,230	23,500	68,880	15,905	

2.4.1.8 Sustained Attention to Response Task

Participants were required to press the space bar when a number appeared unless it was a number 3. Performance is usually gauged by looking at omission and commission errors. Means and medians of both across time points are shown in table 11. Commission errors occur where the participant fails to suppress pressing the space bar when a 3 appears on the screen, that is, they press the space bar when they should not do so. A commission error marks a failure of inhibitory control and reflects a lapse in attending to the task. Median (IQR) number of commission errors pre-intervention was 16 (7.25) compared to normative data of 10.41 (Carriere et al., 2010), indicating a potential reduced functionality in sustained attention and inhibitory control.

Non-parametric Friedman tests showed a significant main effect of time between the first four timepoints for commission errors (χ^2 (3) = 10.692, p = .014). Dunn-Bonferroni post hoc tests were carried out and revealed a significant reduction in commission errors between pre and day 4 (p = .012) after Bonferroni adjustments, but not between other times points. This suggests the participants reduced the number of commission errors between pre-intervention and day 4.

In contrast, omission errors are instances where the participant fails to press the space bar when a number other than 3 appears, or in other words they fail to press the space bar when they should. Instructions clearly explain the task involves pressing the space bar when a number other than 3 appears. Omission errors reflect how much the participant is engaged in or keeping up with the task. The median number of omission errors pre-intervention was 6.5 compared to normative data of 2.88 (Carriere et al., 2010) showing the participants were less accurate than norms.
Friedman's test revealed there was a significant change in omission errors depending on the time point, (χ^2 (3) = 10.719, p = .013). Dunn-Bonferroni post hoc tests revealed this was due to a significant increase in omission errors between pre and day 4 (p = .016) after Bonferroni adjustments, but not between other times points. Wilcoxon tests showed there was no significant differences between pre and follow up for commission errors (Z = -.921, p = .50) or omission errors (Z = -1.604, p = .25).



Figure 8 Median SART commission and omission errors across time points

			N	lo. of cor	nmissio	No. of omission errors										
	n	Min	Max	Median	IQR	Mean	SD	Min	Max	Median	IQR	Mean	SD			
Pre	8	4	24	16.00	7.25	16.13	6.49	0	36	6.50	10.75	11.00	13.17			
Day 1	8	3	24	13.50	14.75	13.13	8.17	0	118	14.50	34.75	30.25	38.83			
Day 4	8	0	22	8.00	10.00	9.50	7.35	0	109	75.50	37.25	61.13	38.53			
Post	8	0	23	17.00	2.25	15.25	7.03	0	70	19.50	18.00	25.88	23.52			
Follow up	4	0	15	14.00	3.75	10.75	7.18	0	26	1.50	7.25	7.25	12.53			

2.4.2 Reliable and clinically significant change analysis

2.4.2.1 Summary of reliable and clinically significant change results

A summary of RCSC findings is shown in Table 12 showing the numbers and percentages of participants showing reliable and clinically significant changes at each time point compared to pre-intervention scores.

Table 12 Numbers and percentages of participants showing reliable and clinically significant changes

at each time point compared to pre-intervention scores

n	Pre to day 1 8 Reliable change							Pre to day 4 8 Il Reliable change change								Pre to post 7 (8 for cognitive tasks) Reliable change								<u>Pre to follow up</u> 4 Reliable change							Clinical			
	Improve		orove	No change		Deteriorate		change		Improve		No change		Deteriorate		ate		Improve		No change		Deteriorate		change		Improve		No change		Deteriorate		change		
Sub scale	Criteria	RCI	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
PCL-5	С	6.19	2	25.0%	4	50.0%	2	25.0%	0	0%	4	50.0%	3	37.5%	1	12.5%	1	12.5%	6	85.7%	1	14.3%	0	0.0%	2	28.6%	2	50.0%	2	50.0%	0	0.0%	0	0.0%
DASS Depression	С	4.34	0	0.0%	5	62.5%	3	37.5%	0	0%	2	25.0%	5	62.5%	1	12.5%	0	0.0%	5	71.4%	1	14.3%	1	14.3%	1	14.3%	2	50.0%	2	50.0%	0	0.0%	0	0.0%
DASS Anxiety	С	6.58	0	0.0%	5	62.5%	3	37.5%	0	0%	3	37.5%	5	62.5%	0	0.0%	0	0.0%	4	57.1%	2	28.6%	1	14.3%	0	0.0%	1	25.0%	3	75.0%	0	0.0%	0	0.0%
DASS Stress	С	7.05	0	0.0%	8	100.0%	0	0.0%	0	0%	3	37.5%	5	62.5%	0	0.0%	0	0.0%	6	85.7%	1	14.3%	0	0.0%	1	14.3%	2	50.0%	2	50.0%	0	0.0%	0	0.0%
PANAS Positive	В	7.88	1	12.5%	6	75.0%	1	12.5%	0	0%	0	0.0%	7	87.5%	1	12.5%	0	0.0%	3	42.9%	4	57.1%	0	0.0%	0	0.0%	0	0.0%	4	100.0%	0	0.0%	0	0.0%
PANAS Negative	В	6.67	0	0.0%	7	87.5%	1	12.5%	0	0%	4	50.0%	2	25.0%	2	25.0%	3	37.5%	5	71.4%	1	14.3%	1	14.3%	3	42.9%	2	50.0%	1	25.0%	1	25.0%	1	25.0%
Social connectednes	в	15	0	0.0%	7	87.5%	1	12.5%	0	0%	2	25.0%	5	62.5%	1	12 5%	1	12.5%	0	0.0%	6	85.7%	1	14.3%	0	0.0%	2	50.0%	2	50.0%	0	0.0%	1	25.0%
s Attentional Function	N/A	3.79	1	12.5%	5	62.5%	2	25.0%	n/a	n/a	6	75.0%	1	12.5%	1	12.5%	n/a	n/a	6	85.7%	1	14.3%	0	0.0%	5	n/a	2	50.0%	2	50.0%	0	0.0%	n/a	n/a
DSB	В	2.82	1	12.5%	7	87.5%	0	0.0%	0	0%	0	0.0%	8	100.0%	0	0.0%	0	0.0%	0	0.0%	8	100.0%	0	0.0%	0	0.0%	0	0.0%	4	100.0%	0	0.0%	0	0.0%
TMT A	В	14,673	2	25.0%	5	62.5%	1	12.5%	2	0%	4	50.0%	3	37.5%	1	12.5%	4	50.0%	4	50.0%	4	50.0%	0	0.0%	4	50.0%	2	50.0%	2	50.0%	0	0.0%	2	50.0%
TMT B SART	В	34,303	2	25.0%	5	62.5%	1	12.5%	2	0%	3	37.5%	4	50.0%	1	12.5%	3	37.5%	3	37.5%	5	62.5%	0	0.0%	3	37.5%	1	25.0%	3	75.0%	0	0.0%	1	25.0%
commission error SART	В	8.81	1	12.5%	7	87.5%	0	0.0%	0	0%	2	25.0%	6	75.0%	0	0.0%	2	25.0%	0	0.0%	8	100.0%	0	0.0%	0	0.0%	0	0.0%	4	100.0%	0	0.0%	0	0.0%
omission error	В	17.88	1	12.5%	5	62.5%	2	25.0%	1	0%	0	0.0%	2	25.0%	6	75.0%	0	0.0%	1	12.5%	5	62.5%	2	25.0%	0	0.0%	0	0.0%	4	100.0%	0	0.0%	0	0.0%

2.4.2.2 PTSD Symptoms

Clinical data for the PCL-5 was taken from a study of treatment-seeking military veterans (Wortmann et al 2016). Psychometric and normative data was from study of trauma exposed individuals with no reported PTSD (Ashbaugh et al, 2016). Criterion C was used. The calculated RCI was 6.19, so was the minimum score change needed for changes to be reliable.

Analysis revealed on day 4, four participants (50%) showed reliable improvements in their PCL-5 scores compared to pre-intervention, with one showing reliable and clinically significant improvement and one who had reliably deteriorated.

Post-intervention, six out of the seven participants (85.7%) who filled out the questionnaire showed reliable improvements compared to baseline. Two showed clinically significant changes, meaning post-intervention scores were below the cut off figure of 32.52.

At the follow up, two out of the four (50%) participants showed reliable improvements on the PCL-5 compared to baseline. None had made a clinically significant change.

2.4.2.3 Depression, Anxiety and Stress.

Clinical comparisons and normative data were provided by a study listing norms for a variety of psychological problems and a non-clinical sample (Antony et al., 1998). The study consisted of clinical groups of participants with obsessive compulsive disorder (OCD), panic disorder, major depressive disorder, social phobia, and specific phobias. The clinical comparison figure used was the mean of these clinical groups. RCI was calculated as 4.34 for depression, 6.58 for anxiety and 7.05 for stress.

At the midweek point, two out of eight participants (25%) showed a reliable improvement in depression, three (37.5%) for anxiety and three (37.5%) for stress. The other participants showed no change except for one whose depression score showed reliable deterioration. None showed clinically significant changes.

Post-intervention scores revealed six out of seven participants (85.7%) who completed the questionnaire showed reliable improvement for stress, and four (57.1%) for depression and anxiety. One participant showed a clinically significant improvement to below the calculated cut off score of 9.25 for depression and 10.92 for stress. No other participants showed clinically significant changes.

All four participants at follow up had made a reliable improvement in anxiety since pre-intervention (100%) and two (50%) in depression and stress. There were no clinically significant changes.

2.4.2.4 Mood

Normative data for the PANAS was taken from Crawford and Henry (2004) from a sample of non-clinical adult men. Criterion B was used as no clinical comparisons were available. The reliability of the measure was .89 (Crawford & Henry, 2004). The RCI was calculated as 7.88 for positive affect and 6.67 for negative affect.

On day 4 none of the participants showed any reliable or clinically significant improvement in positive affect; seven (87.5%) showed no change, with one (12.5%) showing reliable deterioration. However, four participants (50%) showed reliable improvement in negative affect, two (25%) showed no change and two (25%) had reliably deteriorated. Of the 50% showing reliable improvement, three (37.5% of all participants) had scores below the calculated cut off of 27.56, showing clinically significant improvement.

Post-intervention scores showed three participants (42.8%) with reliable improvement in positive affect, although none were clinically significant. The remaining four (52.2%) showed no change. For negative affect, five participants (71.4%) showed reliable improvements, of which three (37.5% of participants) had maintained clinically significant improvement. Of the remainder, one (14.3%) showed no change and one (14.3%) had reliably deteriorated.

At follow-up, all four participants (100%) showed no change in positive affect. Two (50%) showed reliable improvement in negative affect, one (14.3%) showed no change and one (14.3%) had reliably deteriorated. One participant showed a clinically significant improvement in negative affect compared to pre-intervention.

2.4.2.5 Social Connectedness

Normative data for the SCS questionnaire was taken from a study using adults from the general population (Capanna et al., 2013). Criterion B was used to calculate RCSC as no clinical comparisons were available. The reliability of the measure was .92 (Lee et al., 2001). The RCI was calculated as 15.00.

On day 4 two participants (25%) showed reliable improvement compared to preintervention, with one (12.5%) being clinically significant. Five (71.4%) showed no change and one (12.5%) reliably deteriorated.

Analyses revealed no reliable or clinically significant changes for any participants between pre- and post-intervention scores. Six (85.7%) showed no change and one (14.3%) had reliably deteriorated. At the follow-up, two participants (50%) out of four showed a reliable improvement in social connectedness, with one of these being clinically significant. The remainder showed no change.

2.4.2.6 Attentional Function

As a little used measure, there were no clinical data or normative values available, thus no clinical significance was calculated for the AFI. A For changes to be reliable, it was calculated that a change of 3.79 was required.

On day 4, our analysis revealed six out of eight (75%) reported reliable improvement, with one unchanged, and one who had reliably deteriorated.

Post-intervention scores showed six out of seven participants (85.7%) who filled out the questionnaire showed reliable improvement in their AFI score compared to preintervention scores, with the remaining participant showing no change.

2.4.2.7 Digit Span Backwards

Normative values were obtained from a study using non-clinical adult participants (Woods et al., 2011). There were no equivalent clinical norms available, therefore criterion B was used. Reliability for the measure was .67 and the pre-intervention mean in this study was 4.50. The RCI was calculated as 2.82, so that participants' scores needed to improve by at least this amount to be reliable.

Analysis revealed no reliable or clinical changes between pre-intervention scores and day 4, post-intervention or follow-up.

2.4.2.8 Trail Making Test (Trail A and B)

Normative data for the TMT was obtained from a study using adults from the general population (Woods et al., 2015). There were no equivalent clinical norms available, therefore criterion B was used. Reliability of the task was .87 (Woods et al., 2015). The pre-intervention mean for trail A was 55,723ms and for trail B 84,180ms. The RCI was calculated as 14,673ms for trail A and 34,303ms for trail B. The clinical

change cut off using criterion B was calculated as 67,839 ms for trail A and 116,640 ms for trail B.

On day 4, four participants (50%) showed a reliable improvement in trail A, all of which were also clinically significant. Three (37.5%) showed no change and one had reliably deteriorated. For trail B, three participants (37.5%) showed reliable and clinically significant improvement, four (50%) showed no change and one reliably deteriorated.

Post scores showed four participants (50%) showed reliable and clinically significant improvements for trail A, and three participants (37.5%) for trail B between pre- and post-intervention. The rest showed no changes. At follow up, two of the four participants (50%) had maintained the reliable and clinically significant improvement on trail A and one (25%) for trail B, with the rest showing no change.

2.4.2.9 Sustained Attention to Response Task

Normative data for the SART was obtained from a study using a sample from the general population aged 14 - 77 with a mean age of 37.36 (Carriere et al., 2010). There were no equivalent clinical norms available, therefore criterion B was used. Reliability of the task was .76. The reliable change index for commission errors was calculated as 8.81, and for omission errors it was 17.88.

On day 4, two participants (25%) showed reliable and clinically significant improvement in commission errors, that is, they were making fewer errors. The remaining participants showed no change. On day 4, six of the participants (75%) showed a reliable increase in the number of omission errors (a reliable deterioration in task performance), and two (25%) showed no change. No reliable changes were found for commission errors post-intervention. Omission errors were reliably improved for one of the participants (12.5%) compared to pre-scores, five (62.5%) showed no change and two had (25%) reliably deteriorated, in that they had increased number of errors. At follow up, all four participants (100%) showed no change in commission or omission errors compared to pre-intervention scores.

2.4.3 Qualitative analysis

Four main themes were identified: One theme related to the trajectory of the effects, namely 'Effects of the journey and settling in', one in relation to social effects: 'Peer support' with a subtheme 'Talking about trauma'. The remaining two themes of 'Engaging with the environment' and 'Focusing the mind' related to attention restoration theory but also provided insight into influences of the intervention on PTSD symptoms and psychological wellbeing. An example of coding is shown in appendix K.

2.4.3.1.1 Theme 1: Effects of the journey and settling in

Several of the veterans alluded to an initial settling in period. Some of this was

related to the tiring nature of the journey, for example Callum said

Well, the journey over was stressful and tiring. And obviously I suffer from the old hypervigilance, so I'm looking around; strange place, strange environment and all that. And it's the little things, like whilst there were no issues, I'm not driving, so I'm not in control. It's a subconscious thing. Then you go to a strange place, you have a good look around, as you do. It took about 48 hours and then I settled. (Callum)

This settling into a new environment was another factor and having to get used to a

new routine

I would say the initial anxiety issue which probably lasted about a day, a day and a half, yeah. And I think what it is, you settle into a routine then. Get a new routine going you know, when the food comes down and everybody gets to know that. And then you know what you know, what to expect then. (Simon)

An element for some was being away from home, which several of them rarely did,

some not really ever leaving the house

I think the first 2 days were a bit tense. I had a bit of a wobbly moment on the second night. But [coach] sort of took me away for a bit and helped me out. I don't know if that was because I haven't stayed away from home for a long time. And I haven't stayed outside for even longer. So, I don't know whether it was a sort of shock to the system. But after that, the third night was the best night's sleep I've had in years. (Taylor)

However, not all the veterans had difficulty with the journey. Some felt prepared for it

and although it was not enjoyable, did not feel adversely affected.

It's a tough journey, I know the journey, I know it takes a long time, very uncomfortable, but that's par for the course. That's something I can't complain about. (Richard)

The theme of 'Effects of the journey and settling in' showed most of the veterans

spent the first couple of days recovering from the journey and getting used to being

in a new place with a new routine.

2.4.3.1.2 Theme 2: Peer support

All the veterans expressed the benefits of being with other veterans with PTSD.

Some felt it was because they felt understood by them:

It makes so much of a difference. You don't have to tell each other here, war stories and stuff all that, you just know, everyone just subconsciously knows we've all done the same stuff, all been through the same shit. So subconsciously you can relate to every single person here. Whereas when you're talking to your mates at home they don't quite understand. It's a little bit different. It's weird. (Jake)

Another view was the importance of not feeling judged by other veterans. Mo

explained

Cos everyone's got horrific stories here. It won't be judged. The amount of people who say, 'Ex forces, he's probably got PTSD, he's just mental.' I've heard it a million times. If people know I've got PTSD, it's 'Oh he's a nutter' They wouldn't know me from Adam. But that's the difference here, no one is judging. It gives you a chance to get it out of your system. Which I think is important. (Mo)

Also 'banter' was regularly referred to as a benefit of being with other veterans. Bob,

for example explained that

Other fishing trips with civilian friends, it's not the same banter, it's not the same sort of experience. With these guys you'll all take the mickey out of each other, have a laugh at dinner times, and it's, you sort of feel a hell of a lot safer on a lake with squaddies than you do with civvy mates. (Bob)

However, two of the participants, who were in the same coach group, felt there was

not enough socialising. One of them, Richard, explained

Well, yeah, I felt isolated. I didn't feel there was any opportunity, or not much opportunity to intermix with people. To socialise, at all. (Richard)

The theme of 'Peer support' revealed the importance of being around other veterans

with PTSD which appeared to promote feelings of being understood, accepted rather

than being judged, and provided opportunities to engage in good humoured 'banter'.

A couple of the veterans would have liked more opportunities to socialise outside of

their coaching groups, which was partly due to inclement weather making

participants less likely to leave their fishing areas.

2.4.3.1.2.1 Subtheme: Talking about trauma

Whilst there were benefits felt by most of the veterans in terms of being with other veterans, there was a more mixed response to whether peer support included opening up about their trauma experiences relating to their PTSD. Some had talked more freely but found it challenging. Simon said

I've spoken about a lot of trauma since I've been here (...) Some of it has made me, it's put me on a downer and there's been certain situations where I've had to walk away. About three or four times when I've heard people talking about stuff. I've walked away because I thought I don't want to listen to this because it's making me mad and it's making me, you know, it's putting me in a place where I don't want to be. (Simon)

Others had also talked more than they would do normally, but had done so

cautiously, concerned there would be repercussions they would struggle with. For

example, Zach said he had spoken more about his trauma, saying of his coach,

He's heard things that I've not even told my wife. (Zach)

Nevertheless, he went on to say that he had been careful about how much he had

shared, saying

Not all of it, no, just the easiest one I can think of without going into too much depth. Because then I don't have to worry. Because I've not got the care when I get home (...) Yeah, the avoidance has got to be there, otherwise I'm not going to be able to handle it when I get back. (Zach)

Some participants also said they were concerned about triggering anxiety in other

people if they had shared unpleasant stories that resonated with others. In Jake's

case, he said he had not told stories of his trauma, saying

My war stories, no, not really. I have spoken little bit about the funny stuff that happened in the army. That stuff. And I feel like if you start explaining to everyone else, then everyone else is just going to start remembering their bad stuff. I don't want to be dealing with that. (...) I don't want to trigger other

blokes off. I'd rather not, everyone knows what people have done, everyone knows what you go out there to do. (Jake)

A couple of the participants explained that awareness of people's sensitivities to some conversations, and assertiveness in speaking up, ensured conversations were adjusted when necessary. For example, Bob said

You don't want to talk too much and excite their triggers as such. So, you sort of know when the conversations going a bit too raw. Someone will say 'Look, I don't want to talk about Bosnia anymore, or Northern Ireland.' (...) We're very good with each other by going 'Nah, stop the conversation' 'Oh, sorry, I've said too much, alright' And then talking about something else. (Bob)

The subtheme 'Talking about trauma' showed the veterans had different responses to opening up to other veterans and the coaches about trauma relating to their PTSD. Some did seem to be confident opening up more than they would normally, some were concerned about triggering anxiety in other people, and others found talking caused themselves anxiety, and were cautious in managing how much they talked. However, a confidence was expressed by a couple of the veterans that they were able to manage conversations and move away from difficult subjects when required, to protect and support each other.

The following two themes relate to application of attention restoration theory. The first, 'Engaging with the environment' relates to the veterans' connection with the environment, and the second, 'Focusing the mind' relates more to the activity of fishing.

2.4.3.1.3 Theme 3: Engaging with the environment.

A central component to ART is the concept that natural environments are 'softly fascinating' (Kaplan, 1995). The theory states nature is inherently, gently

fascinating, and tends to draw our attention into it, enlisting what Kaplan refers to as 'involuntary attention'. Activities that involve the landscape, including fishing, utilise involuntary attention, which, crucially, unlike directed attention, does not become fatigued or use up resources. Thus, the theory posits we can engage effectively in activities around nature, even when fatigued in other ways.

This theme shows how the veterans felt drawn into their environment. For example,

Zach, who had a minor traumatic brain injury diagnosis in addition to PTSD had

significant memory issues but explained how the environment captured his attention:

Especially when it's lovely weather, like today. You've got all these picturesque sights wherever you look, and it's just lovely. It's really warming, you're just taking it all in. I don't remember shit, and I forget things straight way. But you can appreciate what's in front of you. Do you know what I mean? (Zach)

Similarly, Simon showed how absorbing he found the environment, saying

Because I think, as well as breathing in clean air, you know, a nice environment and, although I was saying your brain slows down, I still think you take a lot in. I think the beauty, the wildlife all of that, (...) I think it is it you know, it's taking in sights and taking things in that you don't normally take in which works your brain a little bit more but in different ways. (Simon)

The theme 'Engaging with the environment' shows that, as suggested by ART, the

veterans found the environment fascinating and absorbing.

2.4.3.1.4 Theme: Focusing the mind

According to ART, capacity to remain attentive to everyday demands requires

effortful attention that becomes fatigued, making the tasks increasingly difficult.

Natural environments provide restoration from this fatigue. Some of the veterans

expressed frustration with high levels of such mental exhaustion, and they felt that

fishing helped this element of living with PTSD. Kaplan (1995) suggested that many people find it easier to function in natural settings and activities such as fishing that involve relating to the natural environment can be particularly restorative due to this high '*compatibility*'. Additionally, Kaplan said that natural environments that have enough '*extent*' provide such an engaging experience that one's mind is mainly occupied by them.

The theme 'Focusing the mind' relates to how the veterans expressed that unlike many activities they usually found frustrating and difficult, they were able to focus on fishing, and this then gave them respite from the everyday frustration they felt when they were being less effective in their daily functioning. This, consequently, gave them respite from their PTSD symptoms.

This difficulty with coping with daily life's stressors was expressed by several of the veterans. For example, Mo explained how he felt being by the lake was '*being away*' from normal stressors in his life, which reduced his frustration

But obviously I think the biggest thing about the PTSD is your inability to deal with stress. And emotions. And frustrations. Even when you're in the house, you've got your email, you've got general noises, you've got everything about your life, haven't you, you've got to deal with, and that becomes all accumulating. But when you're outside, all of that stops, doesn't it? (Mo)

Similarly, and fitting in with the ART concept that activities involving the natural environment are not tiring, Simon expressed that fishing allowed his mind to relax. This appeared to be due to the absence of activities and responsibilities he found challenging in his normal life.

> Most PTSD sufferers will sympathise with this, your mind goes at a million miles an hour and you can't concentrate and that's when you forget stuff and you think why didn't i remember to do that. Your mind is going round at

a million miles an hour like a washing machine almost. When you go fishing, outdoors, you're not driving so you haven't got to concentrate on the road, you're not going to a shop so you don't have to remember a list, you're not doing stuff that you've got to remember to do so, your mind can actually chill out almost it can almost take a back seat and go 'Oh, yeah, thank God for that!'. (Simon)

Others explained that they were drawn into the environment through the activity of

fishing. Jake, for example seemingly expressed the 'fascination' he enjoyed with the

setting, becoming absorbed in his surroundings as he sought to locate fish

Whereas here, you're just sitting here, like right now, you got them ripples going on, and you sit there trying to work out where the fish are. So you're concentrating constantly on the lake. (Jake)

For Jake, he felt this had a direct effect on his PTSD, saying

Because you're concentrating so much on fishing and where the fish are, you just don't think about it really. (Jake)

This resonates with the idea of 'extent' where Kaplan (1995) suggested that when

the environment is of restorative quality, it has a sense of cohesion that allows the

mind to be taken up with connecting with it, so you feel like you are in another world.

Similarly, other veterans said that being busy with fishing helped to provide respite

from symptoms. Callum, for example explained how it blocked out the usual intrusive

thoughts of his trauma

I'm watching, I'm busy. I haven't got time to be thinking about what happened when I was in Sarajevo, what happened here what happened there, you know. Which is why fishing is such good therapy. "I forget everything. I concentrate on my fishing. I talk away to myself, putting the world to rights. (Callum)

The theme of 'Focusing the mind' gave insight into reasons why the fishing intervention helped the veterans manage their PTSD symptoms through the application of attention restoration theory. It showed that fishing provided a sense of 'being away' from the usual stressors of daily life which helped reduce anxiety and promote relaxation. Fishing engaged them with the environment and allowed them to focus their minds on the activity which in turn deflected their thoughts away from their PTSD, even supressing intrusive thoughts.

2.5 Discussion

2.5.1 Summary of findings

The study aimed to explore psychological, social and cognitive effects of a weeklong fishing intervention. In line with previous literature on nature-based interventions for veterans with PTSD, the intervention was beneficial to most participants in terms of reducing pre- to post-intervention PTSD symptomology, stress, anxiety, depression, and negative affect. Data across time points revealed the most notable benefits occurred between mid-week and post-intervention. In support of this, qualitative data showed there was a settling in period at the beginning of the week that may have delayed benefits. Social benefits were not evident from the Social Connectedness Scale, although qualitative data showed participants felt important gains from peer support. In relation to changes in attentional function, self-reported data from the AFI showed an improvement in subjective attentional function in most participants. Objective measurement of attentional function showed mixed results across three tasks used. Interview data indicated the participants were drawn into the environment and felt able to focus their minds on the task of fishing, which reduced the impact of their PTSD. Pre-intervention to follow up, reliable improvements were seen in two of the four veterans who provided follow up data in most guestionnaire measures, except anxiety and positive affect, indicating some longer-term improvements.

2.5.2 Psychological benefits

The first aim of the study was to examine psychological effects, with a particular focus on their trajectory over the five time points. Although the small group case series design did not allow for testing overall effectiveness of the intervention, results showed this study followed trends established in previous, similar studies that have shown psychological improvements after nature-based interventions for veterans with PTSD. Most participants showed reliable pre-post improvements in all psychological measures except positive affect. Overall, the greatest improvements pre- to post-intervention were in PTSD symptomology and stress. Median improvements in PTSD symptoms were statistically significant, and six out of seven participants (85.7%) showed reliable pre to post improvements for both PTSD symptoms and stress. There was a main effect of the intervention on stress, although no significant changes between time points. However, median stress reduced from the 'extremely severe' range pre-intervention to 'mild' post-intervention. Previous, similar veteran studies have also found significant pre-post reductions in PTSD symptoms and stress following nature-based interventions (Bennett et al., 2017; Townsend et al., 2018; Vella et al., 2013; Wheeler et al., 2020). Of these studies, significant improvements pre to follow up were also found for PTSD symptoms (Townsend et al., 2018; Wheeler et al., 2020) and for stress (Wheeler et al., 2020). In common with this study, however, Bennett et al., and Vella et al., found pre to post improvements for neither PTSD nor stress were maintained at follow up, although this study did maintain some reliable changes.

2.5.2.1 Trajectory of psychological effects

Unlike other studies to date, this study was able to track psychological effects over the course of the intervention. Results showed that in the first 24 hours, most of the participants showed either no change or a deterioration across all data collected, and this was reflected in the qualitative theme 'Effects of the journey and settling in'. At the midweek point, more improvements were experienced, but it was not until postintervention that most participants showed reliable improvements, or statistically significant group improvements were seen.

For example, for depression, on day 1, three participants showed a reliable deterioration with the rest showing no change compared to pre-tests. Midweek, two (25%) showed reliable improvements, one deteriorated and the rest did not change. By the end of the week (post-intervention), five out of the seven who completed the questionnaires (71.4%) showed reliable improvements, one deteriorated and one had no change in their depression score. A similar pattern of effects across the week was seen for PTSD symptoms, anxiety, stress, and negative affect.

These initial difficulties mirror those found in two studies that analysed journals of veterans attending nature-based interventions. In Bird (2015), qualitative analysis of journals written during a 6-day programme, showed that general nervousness at the start of the programme was one of the most common stressors in veterans attending (although not all of them had PTSD). Dustin et al., (2011) also found their participants took a day or two before settling and experiencing the relaxing benefits of a 4 day river trip for veterans with PTSD, although there is no discussion of this in the paper.

The present study can be compared with a recent study that also found significant psychosocial improvements in veterans with PTSD (Experiment 1; Wheeler et al., 2020). Differently to the present study, the interventions in Wheeler et al. which involved falconry, horse-husbandry, and fishing events, lasted a single day or overnight in the case of fishing. Interventions were local to the participants, who were picked up and dropped off at their homes, thereby the intervention had a low impact on their usual routines. In contrast, in the present study, in the first 24 hours potential stressors included travelling to the pick-up site, which for some took several hours, a long overnight journey spent with strangers, little sleep, and arrival at a venue in a foreign country a substantial distance from usual support networks. In effect, this produced a confounding variable in the early stages of the intervention which may have stalled the beneficial effects of the fishing. The implication on the optimum doses of time in nature to produce positive effects from Wheeler et al. is that longer interventions are not *required* to produce positive effects. However, longer interventions may be needed when they are initially more disruptive to participants' routines and produce initial confounding variables. On the other hand, interventions of longer durations can provide additional benefits such as more exciting challenges, which may additionally appeal to veterans who are often drawn towards a sense of adventure and challenge (Crawford, 2016; Hoge, 2010; Rogers et al., 2014). An example would be the opportunity to catch extremely large fish, which one participant in this study described as 'the opportunity of a lifetime' (Jake).

Interestingly, in the present study, the participants reported the first two days were the most difficult. However, questionnaire results suggest that for up to half of the participants, reliable changes compared to pre-intervention tests were not experienced until after day 4. This suggests that the settling in effects may have delayed psychosocial benefits for longer than participants were aware of. Such information is potentially valuable for people organising nature-based interventions, who should consider potential implications of stressors at the initial stages of interventions.

2.5.3 Social benefits

A second aim of the study was to evaluate the social effects of the intervention, measured using the Social Connectedness Scale (SCS) and through analysis of the interview data.

2.5.3.1 Pre- to post-intervention social connection

The results appeared somewhat conflicting: On the SCS, no participant showed reliable improvements pre- to post-intervention, and there was no statistically significant change in the group. However, it was clear from the interviews, described in the theme 'peer support', that *all* participants felt some social benefit from being with other veterans with PTSD, and this was often contrasted with social difficulties with 'civilians' in their lives at home. Bird (2015) also found a disparity between quantitative and qualitative data after a 6-day outdoor peer support therapy programme for injured veterans. Using the positive and negative interactions scale, no significant changes over time were found between baseline, the final day of the programme and two months afterwards. Qualitative data, however, drawn from journals written during the intervention, found evidence of positive connections with other participants, accompanied with increased sense of closeness, and belonging within the group. However, other previous quantitative research has found social benefits to group based outdoor interventions with other veterans (Duvall & Kaplan, 2014; Wheeler et al., 2020).

One possibility in this study is that the SCS did not accurately capture social connectedness in the veterans. The SCS consists of statements such as 'I am able to connect with other people' and 'I feel close to people'. Such general statements do not specify who 'people' are, and it is unclear whether the veterans would have responded in relation to veterans and others present at the intervention or social connectedness at home. If it was the latter, positive relationships between participants may not have made a difference to their responses. However, two statements on the scale did relate specifically to peers. Although responses to these would not result in any substantial change to overall SCS scores, if there was increased social connectedness between participants, it would be expected that these two statements would show social connection scores moving positively across the six-point Likert scale across time points. Nevertheless, the statement 'I have little sense of togetherness with my peers' showed four participants (50%) stayed within one scale point or the same at each time point from pre- to post-intervention, and only one participant scored the statement post intervention more than two scale points than pre-intervention. The other peer statement 'I am able to relate to my peers' showed little consistency between participants in the group. If these peer statements reflect the connections they felt with other participants, the indication is that social connectedness was not evident in most participants during the intervention. It seems unlikely, then, that the lack of changes in SCS scores echoed a problem with using the scale.

Thus, if the SCS results did indeed reflect no improvement in social connection despite anecdotal peer support positivity, it is worth considering contributing factors. Firstly, there was less social interaction than planned between the veterans due to bad weather, and some participants reported in their interviews that they would have

liked more opportunities for socialising with participants outside of their coaching groups. Persistent rain meant the veterans were more likely to stay in their bivouacs and less likely to socialise around the lakes, or go to the lodges, which were a few minutes' walk away. There was little that could be done to increase such social contact at the time, although future interventions could arrange for more social areas nearer to where the participants fish.

Another factor could have been social issues between participants, such as social conflicts during the week and rivalry between coaching groups. Interestingly, across time points there were two participants mid-week who showed reliable changes in SCS from pre-scores, which was not maintained post intervention. Although research into peer support is almost always positive, drawbacks have been found in other studies, such as problems relating to individual personalities (Hundt et al., 2015), and this could have been a factor in the fluctuation.

It could also have reflected the mental health of the participants in the group, who may have been unable to subjectively feel more socially connected, despite positive social connections during the intervention. SCS mean pre-intervention scores were considerably lower than the normative comparisons (Capanna et al., 2013), revealing the extent of social issues experienced by the veterans, also found in previous veteran studies (Leslie et al., 2020; Wilson et al., 2018). With such substantial issues of social disconnection in the veterans in this study, it may simply be that although positive, the social interactions they had on the intervention were insufficient to alter their feelings of social connectedness overall. It has been shown in other research that people with anxiety and depression often view social interactions more negatively (Geyer et al., 2018) and given that post-intervention

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means and median scores for anxiety and depression were in the 'severe' and 'moderate' range respectively, this may have meant participants were less likely to increase their social connectedness scores.

2.5.3.2 Social benefits after the intervention

Two of the four participants taking part in the follow-up showed a reliable improvement in SCS scores since pre-intervention who had not shown pre- to postintervention improvement, suggesting a possible increase in connectedness with other veterans for some of the participants after the intervention. This could be related to participants voluntarily joining a Facebook page where they could communicate with each other and participants from previous interventions. Social connectedness through social media, especially Facebook has been found to be linked to lower depression, anxiety and increased life satisfaction in adult Facebook users (Grieve et al., 2013). Such online social connectedness has, however, been found to be a separate construct to offline social connectedness (Grieve et al., 2013; Sinclair & Grieve, 2017), so may not be a substitute for meeting other veterans in person. Another study showed that veterans with more social media contact also had more in-person contact, and more in-person contact was associated with a lower risk of probable PTSD and depression (Teo et al., 2019). This could indicate the value of using Facebook contact to encourage repeat attendance at nature-based activities, thereby increasing in-person contact. This has been found elsewhere in veterans with PTSD who regularly attended a surfing club (Caddick, Smith, et al., 2015b). They found the development of relationships with other veterans, as well as the surfing activity, were an integral part of providing increased wellbeing.

2.5.3.2.1 Peer support

In contrast to SCS scores, the qualitative theme 'peer support' strongly indicated benefits of spending time with other veterans with PTSD during the intervention, in line with prior qualitative studies (Bennett et al., 2014; Hyer et al., 1996; Rogers et al., 2016). Areas highlighted by 'peer support' included elements found in other studies, such as feelings of being naturally understood by other veterans (Caddick, Phoenix, et al., 2015), not feeling judged and engaging in good-humoured military banter (Caddick, Smith, et al., 2015a; Parry et al., 2021).

2.5.3.2.2 Talking about trauma

The subtheme 'talking about trauma' revealed the complexities of how the veterans negotiated implications of opening up about their trauma. Narrative exposure therapy, where PTSD patients are encouraged to repeatedly explain experiences of traumatic events in detail until it no longer causes extreme anxiety, has been shown as an effective treatment (Adenauer et al., 2011), but it is not known whether discussing traumatic experiences through peer support can similarly be helpful. A 2015 study investigated benefits and drawbacks to peer support for veterans with PTSD and found numerous benefits including normalization of PTSD symptoms, feelings of hope, and providing purpose and meaning (Hundt et al., 2015). The paper also found the majority of the twenty-three participants in the study were keen to talk about their trauma, however, a minority preferred not to, though the number of veterans who had this preference was not reported. In the current study, there appeared to be several viewpoints towards talking about trauma, with several showing reluctance for fear of 'triggering' others' trauma. It is well established that in PTSD, re-experiencing of traumatic events can often be triggered easily by matching cues (Ehlers, 2015), which the veterans appeared acutely aware of. In the current

study, there is minimal evidence that talking about trauma was a significant part of the peer support, but instead touches on prior research into peer support in veterans with PTSD that has found advantages such as being understood without having to explain (Caddick, Phoenix, et al., 2015), focusing on the here and now, acceptance and normalization of PTSD experiences (Kumar et al., 2019)

2.5.4 Attention restoration theory.

A third aim of the study was to consider mechanisms for change as offered by attention restoration theory (ART), which proposes time spent in nature facilitates improvements in directed attention that in turn lead to psychosocial benefits. For restoration to occur, ART proposes the environment needs to connect with someone through four conceptual properties: *fascination*, *being away*, *extent* and *compatibility* (Kaplan, 1995; Kaplan, 2001). Fascination relates to patterns in nature that attract and hold attention in an effortless way, shown in the theme 'Engaging with the environment', which illustrated how the veterans were drawn into the environment, paying attention to details and 'taking it all in' (Zach). Being away requires either a physical or conceptual distance from the maladaptive environment that requires, and fatigues directed attention. In this instance, the participants were physically removed from their daily stressors, and the theme 'Focusing the mind' showed how important this was for the veterans, who constantly battled with daily tasks at home. Thus, the component being away was satisfied. For the restorative environment to have extent it must be of a quality that you can become lost in, so you experience enough scope to give a sense of being in another world. with your mind largely taken up by it. The lakes provided such an environment, expressed in the theme 'Focusing the mind' in which the veterans became so absorbed by the lake and locating fish that their minds were taken away from their PTSD. The final component is *compatibility*, which

states the environment and nature-based activities are restorative when they are well matched and reflect one's preferences. The veterans, except for one, were keen anglers, and as such, were highly suited to the intervention. Angling was an example of a 'predator role' suggested by Kaplan (1995), as a way of interacting with the environment that increases *compatibility* through a sense of purpose.

2.5.4.1 Attention restoration

With the participants experiencing the conceptual properties of a restorative environment, as suggested by ART, elements were in place for attentional restoration to occur. This was measured in two ways: objective measurement using computerised cognitive tasks, and subjectively through a self-report measure using the Attentional Function Index (AFI).

2.5.4.1.1 Objective measurement of attention

When compared to normative values for the tasks used to objectively measure attention, results indicated that participants had reduced attentional function in terms of visual attention and task switching (measured through the TMT A and B), sustained attention and inhibitive control (measured through the SART), but not working memory (measured by the DSB).

Reliable changes in attentional function between time points was found in one of the three cognitive tasks: In the TMT, four of the eight participants (50%) for trail A and 37.5% for trail B showed pre- to post-intervention reliable improvements and 50% retained improvements on trail A and 25% on trail B at follow-up. This indicates improved attentional function for some of the participants in visual attention and task switching, maintained for some at follow up. The TMT task has been shown to be susceptible to practise effects (Woods et al., 2015), so improvements could have

been related to the repeated measure design of the study. However, if this was the case, we might have expected to see improvements in the other tasks as well, where in fact the other tasks yielded no changes over time points. This is in contrast to previous studies where improvements in task performance have been found following exposure to natural environments for both the DSB (Berman et al., 2008; Berman et al., 2012; Faber Taylor & Kuo, 2009) and SART (Berto, 2005) although in those studies, none of the participants were veterans or had PTSD.

In the Digit Span Backwards task, none of the participants showed any reliable improvements, and mean participant pre-intervention scores were equivalent to normative data. This suggests working memory was not deficient in the participants, found to be the case in at least one other study of veterans with PTSD (O'Neil et al., 2019) Consequently, improvements would not be expected, and could explain why there were no changes in task performance across time points. This is not to say that for improvements to be seen there had to be initial deficits, as improvements in the task have been found after spending time walking in nature in other ART studies where deficits were not present (Berman et al., 2008), although again, participants were not veterans. However, improvements are less likely when no initial sign of dysfunction is present.

SART results were more variable, and on the whole, the participants appeared to struggle with the task. Pre-intervention mean errors showed participants made more errors than in normative data, indicating a potential deficit in sustained attention (vigilance) and inhibitory control. On first look, it appeared the participants were improving over time, because mean commission errors on day 4 had reduced compared to pre-intervention tests. However, this was offset by a significant increase in omission errors from pre-intervention to day 4. The phenomenon was widespread amongst the veterans, with 75% showing increases in this type of error midweek. This is in contrast to other studies, which have found omission errors to be rare in the SART (Manly et al., 2000). Post-intervention, omission errors had subsequently reduced. It is unclear what could have caused this pattern of response in this group, which could suggest some level of disengagement from the task, or possibly attempts at different strategies to improve performance. Ultimately, however, the veterans showed no improvements in performance over time. A possibility is that they could have found it too fast, and a slower version might have produced a different pattern of results. Alternatively, the erratic responses could have been due to difficulties with inhibitory control, which has been found in other studies to be diminished in people with PTSD (DeGutis et al., 2015). It has also been suggested that such deficits in inhibitory response could be a factor in failure to suppress intrusive thoughts (Catarino et al., 2015), as well as unsuccessful treatment using cognitive behavioural therapy (Falconer et al., 2013). Generally, the erratic results suggest that the SART may not have been a suitable measure for the veterans in the study.

2.5.4.1.2 Subjective measurement of attention

With the AFI, a statistically significant effect of the intervention for overall AFI scores was found, and post hoc tests showed pre to post changes approaching significance. That all but one participant who filled out post-intervention questionnaires showed reliable pre to post self-report improvements, demonstrates nearly all participants perceived their attentional function to have improved. These findings are in line with Duvall and Kaplan (2014) who used a modified version of the same scale. Their study surveyed 54 veterans with PTSD who attended an intervention in a

programme of twelve different nature-based experiences of between 4 and 7 days, covering several different activities and levels of therapeutic support. They found a statistically significant improvement in self-reported attentional function between baseline (taken a week before interventions) and post-intervention tests (one week afterwards). Improvements between pre-intervention and follow-up (4 weeks after the intervention) were not sustained. Likewise, in the current study there were no statistically significant pre-intervention to follow-up improvements, although two participants (50%) did retain reliable improvements from pre-intervention. Thus in both studies, many of the veterans perceived their attentional function to have improved pre- to post-intervention, regardless, in terms of the present study, of a lack of changes in objectively measured attention.

The role of perceived cognitive function in PTSD has been explored in several recent studies, although the area is still under-researched (O'Neil et al., 2019). One recent study found no link between perceived cognitive impairment and objectively measured cognitive function in veterans with PTSD (O'Neil et al., 2019). They used an extensive battery of cognitive tests including the Digit Span Backwards and TMT trails A and B. Perceived function was measured using the Neurobehavioral Symptom Inventory (NSI; Cicerone & Kalmar, 1995) and items regarding concentration from the PCL-5 and Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001). Results showed a disparity between perception and objective measurement, with 80% declaring perceived cognitive problems, and only 46.7% showing deficits in at least one cognitive domain. The O'Neil study was a pre-post design examining the effects of evidence-based psychotherapy on veterans with PTSD, however the published paper only presented baseline data due to the research being ongoing at time of publication. Currently there is very little research

comparing cognitive skills before and after therapy in PTSD, thus further publication of results in O'Neil et al.'s study will add significantly to existing literature.

Another study investigated the relationship between PTSD symptoms, cognitive functionality, and functional outcome such as social integration, finding employment and quality of life in veterans with PTSD. They found functional outcome was mediated by the perception of cognitive deficits, measured using a subscale of the Cognitive Self-Report Questionnaire (CSRQ; Spina, Ruff, & Mahncke, 2006) that asked questions relating to concentration, forgetfulness and decision making (Samuelson et al., 2017). However, performance of objectively tested cognitive performance using a battery of cognitive tasks including the TMT and digit span tests, did not mediate the relationship between PTSD and functional outcome, thus providing more evidence to suggest objective and subjective measures of cognitive functionality appear to be differently related to PTSD.

One factor to consider is how closely subjective measures of cognitive function that ask, for example, if participants have difficulty concentrating in their daily lives, are related to performance on a targeted task designed to measure a specific element of cognition. In the present study, the AFI clearly measures a wider scope of 'attention' than the cognitive tasks: The AFI consists of three subscales which reveal a more detailed picture of the participants' perceived attentional function. The first is *effective action*: seven items that relate to the perceived ability to carry out everyday tasks and includes the statement 'Following through on your plans'. The second is *attentional lapses*: three items that relate to the ability to direct attention to everyday tasks and includes the statement 'How hard you find it to concentrate on details'. The third subscale is *interpersonal effectiveness*: three items that measure perceived

ability to interact with others in ways that demand attention, including the statement 'Being patient with others'. The subscale *attentional lapses* is closest to reflecting directed attention, with the other subscales covering more broad aspects of attentional function. Despite overall AFI scores showing pre post changes approaching significance, further examination of our data showed that only pre/post changes on the subscale *effective action* was significant and not the other two subscales. This suggests that as a group, participants were experiencing an increased ability to carry out day to day tasks (*effective action*) but did not perceive improvements in attention-based interaction with others (*interpersonal effectiveness*) or directed attention, required for the tasks (*attentional lapses*). This, arguably, suggests their perceived directed attention may have been more in line with their cognitive task performances than overall AFI scores would suggest.

Where the *attentional lapses* subscale is closely linked to directed attention, *effective action*, which showed statistically significant pre- to post-intervention improvement, is related to everyday tasks. For the veterans, whilst on the intervention, these were camping and fishing by the lake. At home, where there were more distractions and more expected of them, everyday tasks were very different. The qualitative theme 'focusing the mind' revealed many of the participants usually struggled to cope, with their minds racing and dealing with intrusive thoughts and anxieties, which would get in the way of carrying out their daily functioning. The veterans described how, when fishing, they felt very different, and the activities involved in fishing were able to take up their thoughts, so they thought less about their PTSD symptoms. Hence, fishing gave them a rest from struggling with everyday tasks and relaxed their minds. A similar effect was found in veterans with PTSD when they engaged in surfing, which provided respite from their suffering through a similar process of focusing on another

activity that engaged them with the natural environment (Caddick, Smith, et al., 2015b).

This effect can be explained through the mechanisms of attention restoration theory. In ART terms, difficulty in focusing on tasks due to distractions illustrated fatigued directed attention, although the veterans' PTSD would have intensely magnified these difficulties. According to the theory, nature is inherently fascinating, and tends to draw our attention into it, enlisting what Kaplan refers to as 'involuntary attention'. Activities that involve the landscape, including fishing, utilise involuntary attention, which, crucially, unlike directed attention, does not become fatigued or use up resources. Thus, we are able to engage effectively in activities around nature, even when fatigued in other ways.

The theme 'engaging with the environment' showed how the veterans did indeed find the environment fascinating and absorbing. Accordingly, in ART terms, engaging in such activities provides the mechanism for our fatigued directed attention to restore. The cognitive tasks, as intended by the researcher, measured elements of directed attention, known to be fatigued, so that any changes in task performance would indicate possible directed attention restoration. The AFI was also intended to detect changes in directed attention, but subjectively. However, the AFI, like the other questionnaires, was filled out at each timepoint before the veterans completed the tasks, therefore the veterans were most likely considering their attentional function during fishing, especially in the subscale *effective action*. Because they were reflecting on attentional function doing tasks they were able to do, they were much more likely to report improvement in function. Equally, because these fishing-based tasks were using involuntary attention, the AFI *effective action* subscale was not,

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arguably, at this point measuring directed attention, but merely measuring how well the veterans felt they were achieving their current activities. In this way, it could be said that *effective action* is closely related to self-efficacy. Improvement in selfefficacy has been found to be a factor in the success of nature-based interventions for veterans in a qualitative study of a 4 day kayaking intervention (Dustin et al., 2011). Additionally, in a study using the general perceived self-efficacy scale, selfefficacy was found to be significantly improved on day 6 of a peer outdoor support therapy intervention compared to day one on a camping and outdoor initiative for veterans (Bird, 2015; Schwarzer, 1999). In terms of the Attentional Function Index measure, if *effective action* relates to ability to function when carrying out recent or current activities, the way to measure changes in direct attention would be attained by looking at pre-intervention to follow-up scores, using the same subscale. This would measure changes experienced by the veterans when they returned to their usual lives, compared to before the intervention. Two out of the four in the follow-up did show reliable improvements in total AFI scores, compared to pre-intervention tests. However, as a case series study with only four follow up participants, results cannot be generalised.

2.5.4.1.3 Attention restoration summary

In relation to investigating attention restoration theory as a mechanism for change in the intervention, qualitative data showed the veterans were experiencing nature in a way that resonated with the theory. Evidence for restoration in objective measures was limited, and issues with perceived attention as measured through the AFI have been discussed above. That psychosocial effects were evident without objective changes in attention provides some evidence for the mechanisms of change suggested by ART. Ultimate interpretation of results in relation to the theory depends on the prominence given to subjective versus objective attentional improvement, which, as discussed, measure different interpretations of attention and have been found to be different constructs in some research (O'Neil et al., 2019). However, irrespective of the relationship between subjective and objectively measured attention, there are indications from the literature that the veterans perceived improvements in attentional function could have a significant influence on functional outcomes, and thus, arguably, is more important from the veterans' perspective than objectively measured cognitive function using computerised tests (Samuelson et al., 2017). Future research could potentially explore functional outcomes in larger studies with a control group and more participants.

2.5.4.2 Stress Reduction Theory

An alternative lens through which to view results is through stress reduction theory (SRT; Ulrich et al., 1991) rather than ART. SRT suggests our response to nature is predominantly emotional, reducing stress, which can have a subsequent effect of improving cognitive function. In this study there was subjectively measured stress reduction evidenced through the DASS-21 questionnaire. As with AFI scores, there was a statistically significant main effect of the intervention on stress reduction, although post hoc tests did not reveal a significant difference between any specific times points. Six out of seven participants showed reliable improvements in stress pre to post intervention. This strongly suggests that for most of the participants, a reduction in stress in veterans with PTSD after nature-based interventions (Bennett et al., 2017; Townsend et al., 2018; Vella et al., 2013; Wheeler et al., 2020). Interestingly, median stress did not increase between pre intervention and day 1, unlike depression and anxiety. Additionally, median stress levels for the four

participants at follow up showed an increase in stress approaching day 1 levels. These two findings suggest that subjectively measured stress may be more sensitive to natural environments than anxiety and depression, reducing more quickly but also increasing again once no longer around nature. Both Kaplan (1985) and Ulrich (1983) propose both attentional improvements and stress reduction are experienced through time in natural environments, although they disagree which influences which. As subjectively measured through the AFI and DASS-21 in this study, it could be said evidence for both theories were present in the results of this study.

2.5.5 Strengths

2.5.5.1 Design

The mixed method case series design allowed for extensive data collection and indepth analysis. Qualitative data were able to support and widen discussion around the quantitative data, and although the results cannot offer evidence of the efficacy of the intervention, insight obtained from the in-depth analysis paves the way for further research and informs future practise.

2.5.5.2 Analysis

The RCSC calculation highlighted reliable changes at an individual level, presenting a different view of the data than group based statistical analysis. Thus, whereas in other studies where non significance through analysis of means or medians is equated to a lack of efficacy, this analysis could show more details on the individual impact the intervention had on participants, and its subsequent effect on their daily lives (Jacobson & Truax, 1991). For example, in the PCL-5, two out of the four participants in the follow-up showed reliable improvements in symptom severity since pre-tests. Furthermore, both participants' PCL-5 scores reduced by more than
10 points, which has been taken to be a clinically meaningful change by the US. Department of Veteran Affairs, National Center for PTSD website (Weathers et al., 2013). Thus, it can be surmised that at least 25% of the eight participants taking part in the study showed longer term improvements in PTSD symptoms. Although not a majority, the reality is that for those individuals, the intervention made a reliable difference to their condition, although other influences cannot be ruled out. Thus, this analysis allows for prominence to be given to individual experiences, which are lost in studies that focus entirely on means and inferential statistics.

2.5.5.3 Attention restoration theory.

As previously discussed, this study included self-reported attentional function, alongside cognitive tasks that measured aspects of attention, and subjective experiences of the veterans through interview data. It appears to be the first study to do this for a population of veterans with PTSD and to explore attention restoration theory in this detailed way. In exploring the mechanisms of change proffered by ART, all the elements of ART were present, including qualitative evidence that resonated with concepts in the theory. Although little evidence for attention restoration through objectively measured attention was found, the subjective attentional improvements present a discussion point about the relative importance of objective and subjective cognitive function, especially regarding functional outcomes in veterans living with PTSD.

2.5.6 Limitations

2.5.6.1 Design.

Aspects of the design that presented limitations included the repeated measures, where participants may have grown tired of completing the questionnaires and tasks. Although there was no indication of this whilst at the intervention, this may have influenced the number of participants who took part in the follow up. To reduce such fatigue, future studies could reduce the number of times the cognitive tasks and Attentional Function Index were used, perhaps to pre-intervention, post and follow up. The downside of this, however, would be to lose data that tracks the trajectory of effects over the duration of the intervention. Alternatives to this include using different tasks that are thought to measure the same cognitive, more engaging or shorter tasks, or to provide incentives for taking part in follow up data collection.

2.5.6.2 Potential bias, e.g. loyalty to the project.

Participants expressed their personal gratitude and support of the project and expressed a strong desire for the project to raise awareness of veterans with PTSD and for it to help other veterans. Whilst the support was positive, the presence of a personal commitment to 'the cause' may also have resulted in research bias that may have caused participants to inadvertently elevate positive effects through being eager to show the intervention in a positive light. This also may have affected followup numbers: Three participants declined to take part in the follow-up measures because they did not feel up to it, indicating they may not have been experiencing longer term benefits of the intervention. This may have meant they did not wish to take part because they did not want to let the project down by giving negative responses. Another potential issue was the timing of this study: there was a high chance of detrimental impacts on wellbeing after the intervention because the time of year (mid-autumn) presents challenges such as fireworks on bonfire night (November 5th), followed by Remembrance Day (November 11th), followed by the lead up to Christmas. All these factors could have been negative influences on the veterans' mental health and may have resulted in them wanting to avoid taking part

in the follow-up so they did not submit responses that they felt would put the project in a negative light. Future research could time the intervention and follow up to avoid such influences.

2.5.6.3 Self-selection bias.

A similar issue was the self-selecting nature of the participants in the study. Seven out of the nine were keen anglers, with one participant stating it was an unmissable 'opportunity to catch a fish of a lifetime'. This means they were predisposed to benefitting from the trip. However, this is always going to be the case with evaluating voluntary activities chosen by participants due to their personal appeal.

The role that fishing played in the lives of the participants was not explored in this study, as focus was on the effects of the intervention. However, during the interviews, the veterans were asked about their fishing experience (see appendix J for interview schedule) and some alluded to fishing being used as a coping strategy for living with PTSD. None of the participants were in therapy at the time of the study, although all of them had at some point had some therapeutic support, highlighting that some military veterans with PTSD are living with no real support. A progression for future research would be to examine how veterans with PTSD use fishing and other nature-based activities in their lives, and this is explored in Chapter 3.

2.5.6.4 Analysis.

The calculation of clinically significant change was problematic in some instances. Firstly, obtaining equivalent clinical means was challenging, with only two of the measures (PCL-5 and DASS-21) having clinical comparison groups. Therefore criterion C, the most middle ground of the three criteria (in that it is least prone to scores that are too lenient or difficult to acquire), was only used on these two measures. Furthermore, of these two measures with clinical means, only one of these were from studies using veterans with PTSD (PCL-5), with the other based on a range of mental health diagnoses. A second issue is that the calculation proposed by Jacobson and Truax (1991) is based on the principle that clinical significance means a person is functioning within the normative range for the measure. As such, the calculation at times produced a cut off score that was very stringent, for example for stress, the cut off was 7.22, well within the 'normal' range for the measure (0-14). This meant that although pre-post stress scores were statistically significant, and 85.7% of participants showed reliable improvements, only one (14.3%) of the participants achieved clinically significant change. In contrast, on some measures, where scores decrease with improvement and there is a high standard deviation, clinical significance occurred in every case of reliable improvement. This was the case with TMT A, where the cut off calculated was higher than any of the participants post-intervention scores. Due to such scenarios, calculated cut-offs can leave clinically significant changes too difficult to attain or too easy. Thus, it is arguable that reliable change is the more meaningful measure of change, with clinical significance being less informative in many instances.

2.5.6.5 Effect of filming

An element to the intervention that may have affected the participants was the filming of the documentary. Measures were taken to ensure confidentiality was maintained, and the participants were not filmed while carrying out any measures. As part of their interview, each participant was asked how the filming had affected their week. The majority said it had little or no effect on their week, and another reported it had only affected him for a short while when filmed when he caught a fish.

One said the documentary maker had been positive company, although he said he was nervous to begin with. One participant reported the filming had made the intervention more exciting and for him, it appeared to have been an integral part of the intervention and associated positive effect. Other than for this one participant, it appeared the veterans were not overtly affected by the documentary makers, although more subtle effects cannot be ruled out.

2.5.7 Informing future practise

Investigating the trajectory of psychosocial changes highlighted the effects of the journey, which quantitative results showed may have delayed psychological benefits for longer than qualitative data suggested. There is therefore a possible trade-off between more exciting or further away interventions, and the longer time required to recover from the journey, with a longer settling in period required . Organisers of such events could add additional support to counteract these initial effects, or perhaps introducing veterans to each other online before meeting at the intervention. Future research could investigate whether such changes to future interventions would improve the overall effects.

Qualitative data also showed the complexities involved in the social aspects of the intervention, providing valuable insight for future practise. For example, such data highlighted participant concerns about triggering other participants or having insufficient support and could therefore be useful for future interventions to consider where organisers may wish to encourage participants to talk about their trauma. Additionally, the value of ensuring participants have ample opportunities to socialise was raised and could be useful in improving social connectedness in future interventions.

2.5.8 Reflexive statement

My role as researcher in this study was complex because we spent a week away together, so I naturally got to know the participants quite well. In our first phone call I introduced myself as a PhD student who had also worked in the police as a welfare adviser and had significant experience of working with trauma and PTSD. This was because I then asked them the questions from the questionnaires, which were personal and intrusive, and I wanted to make sure they felt comfortable answering and viewed me as an experienced professional.

As a woman, a non-veteran, and a non-angler I was always going to feel separate to the veterans. While in France, they were very polite and respectful, always helpful and on hand to help or offer to carry things for me. They were open about behaving differently around me, not wanting to offend me. This was always very good natured though and we all laughed about it, and I did my best to reassure them I was not easily shocked or offended. An important part of the intervention was socialising between the veterans and it was important that I helped to facilitate that happening, so this was another reason to keep my distance when I wasn't collecting data.

The documentary crew could have been intrusive and changed the nature of the trip as well as present confidentiality issues in relation to research data. However, there were no issues, and I was surprised how quickly we all adjusted. I think this was largely to do with the easy-going nature of the documentary makers.

As the researcher, I kept as separate from the participants as possible, whilst being friendly and approachable. We travelled to the lakes as a separate group – the two event organisers and I were in a separate car to the veterans, who travelled in

minibuses. I stayed in a lodge on site with the documentary makers and this created a separation from the veterans on the trip who were all in their tents by the lakes. Due to the weather, the veterans were got wet and cold and at times I felt a bit guilty I was dry and warm, which implied privilege. At times it felt a little like we were in the officers' mess, and my guess is the veterans may have felt that too. In reality I'm not sure this was negative as long as they felt fairly treated, and it may even have helped reconnect them with military life and facilitated camaraderie between them. All the participants were very welcome in the lodge, although not to sleep, and the available bathrooms were in the lodges too. Thus it was separate, but friendly.

It was difficult sometimes to ask the veterans to come and do the tests because I felt like I was interrupting, however, it was also an opportunity for them to be in the warm and dry and have a cup of tea. I gave them as much flexibility as I could about when they stopped fishing to come to the testing room, and as much notice as possible so they had time to make sure someone else could watch their rods. I did worry a little about how much the veterans were expected to do as part of the research. In reality, it was about 45 minutes three times during the week for each participant, plus the interview, and the rest of the time they were left to enjoy the trip. On balance then, I did not feel data collection was overly intrusive or interrupted the restorative nature of the intervention. I believe as much was done as possible to ensure data collected reflected effects of the intervention rather than effects of taking part in the research. As it was, I feel the participants and I had a respectful and friendly relationship. By the end of the week when I conducted the interviews, I think we all felt comfortably familiar with each other. I didn't feel they resented the research, in fact they all reported feeling positive about their involvement in it.

2.5.9 Conclusion

Taken as a whole, the results are in line with prior studies that have found psychosocial benefits of nature-based interventions for military veterans with PTSD. Through the mixed methods case series design, insight was gained into the influences that may affect the trajectory of effects, the social implications, and evidence was found for the mechanisms of change being consistent with attention restoration theory. The design of the study allowed for in-depth analyses, which have provided potential directions for future research and informing future practise. Interestingly, the fact that almost all participants were already keen anglers raises the question of whether some of the veterans were able to use fishing as a coping mechanism in their lives at home, and this is explored in greater depth in Chapter 3.

Chapter 3 Qualitative study: How veterans with PTSD use nature

3.1 Chapter summary

Most participants in the Chapter 2 study were already keen anglers and alluded to fishing and time in nature helping them manage their symptoms in their lives at home. Whereas prior research has focused on the evaluating nature-based interventions, this chapter explored the role that nature plays in the daily lives in veterans with PTSD, through an in-depth qualitative study. Thirteen veterans with PTSD who used spending time in nature to help them in their daily lives, described in the study as having a 'nature mindset', were interviewed. Data was analysed using thematic analysis, using a social constructionist framework. Themes of 'Nature connectedness' and 'Reconnection through the environment and green activities' showed the veterans' relationship with nature was heavily influenced by experiences during and after their time in the military, shown in the themes 'Disconnect from the military', 'Disconnect from society' and 'Negative identity constructs'. The study revealed how spending time in nature helped the veterans reconnect to their military identities and regain a sense of control, providing respite from their PTSD and prevailing sense of disconnection.

3.2 Introduction

As discussed in Chapter 1, there are potentially a significant number of veterans in the UK with mental health issues such as PTSD, who may not have sought treatment, have been partially treated or have been through a treatment programme but remain symptomatic. Nature-based interventions for veterans with PTSD are thought to provide an alternative therapeutic medium and have been shown to have positive psychological effects (Greer & Vin-Raviv, 2019). Such interventions, however, only illustrate one way that spending time in nature may be implicated in improving the wellbeing of veterans with PTSD. It is likely that at least some of those drawn to such interventions are already engaging in similar nature-based activities, and this may reduce the direct effects of the intervention or enhance them if participants are particularly responsive to nature. In the study in chapter 2, seven out of eight participants who attended a fishing intervention were already regularly going fishing, and spending time doing other activities outdoors and this was an existing coping strategy in living with their PTSD (reference section). The study showed the intervention had psychological benefits, although the follow up data showed these may not have been long term. Other research evaluating naturebased programmes for veterans with PTSD, follow up measures have been taken between three weeks and six months after the intervention, with some studies showing pre to post benefits being maintained (E.g. Crawford, 2016; Wheeler et al., 2020) and others showing them dropping off (Bennett et al., 2017; Duvall & Kaplan, 2014). However, it is not known what other influences may be affecting such longterm results. One possibility, for example, is that participants showing longer term benefits may have been taking part in other green activities. To date there does not appear to be research investigating the effects of an ongoing and active connection with nature, and how this may influence people's mental health. Furthermore, this population of veterans with PTSD who are symptomatic and use nature-based activities to help them cope, appears under-researched. Little is known about their

lives and how they manage their PTSD outside of primary care and charity mental health support programmes.

To address this gap, the aim of the present study was to examine the role of nature in the lives of veterans with PTSD who regularly take part in nature-based activities, using a social constructionist approach. As well as considering how nature is of help and how a 'nature mindset' is constructed, the study also aimed to explore how experiences of nature-based interventions contribute or relate to the veterans' existing relationship with nature, or their 'nature construct'. Research questions are 'How does spending time around nature contribute to the lives of veterans with PTSD?', 'How and why are particular nature-based activities (e.g. fishing) beneficial?' and 'How are experiences of nature-based interventions with other veterans with PTSD related to the participants' personal nature construct?'

3.3 Method

3.3.1 Participants

Participants were recruited from veterans attending therapeutic fishing interventions organised by the community interest company iCARP, who specialise in therapeutic fishing trips for military veterans with PTSD. Attendees at an initial intervention in May 2019 were asked to take part in the study through email prior to attending. An information sheet and consent form were included in the email and can be found in Appendix L. Further participants were recruited through snowballing sampling, using a flyer given to initial participants, and through word of mouth at subsequent iCARP interventions. The simple inclusion criteria were that participants should be military veterans with PTSD who regularly take part in 'nature-based activities'. All participants were fully briefed on the study, including their right to withdraw, through

a participant information sheet and given opportunity to ask questions before signing a consent form prior to the interview.

Thirteen male military veterans were interviewed, between the ages of 27 and 62. All had a diagnosis of PTSD, although two had not had a formal diagnosis from a psychiatrist, but self-identified as having PTSD: one had received a diagnosis from a military nurse and general practitioner (GP), and one had refused a psychiatrist assessment due to perceived social stigma but had been diagnosed by their GP and therapist. The participants took part in a range of nature-based activities, although fishing was the primary one. All but one reported that they enjoyed fishing as a hobby with varying frequency. One veteran did not include fishing as a hobby but regularly helped at fishing events organised for veterans with PTSD. All had taken part in organised nature-based activities for groups of veterans with PTSD. Demographic information is shown in the table below (Table 13; Names are pseudonyms).

The participants were at various points in what could be described as their 'PTSD journey'. They varied in terms of when and whether they received a formal diagnosis, the reasons they left the military (only two included PTSD), the amount of therapy and support they had received, and their symptom severity. All these factors had implications for the data produced in the interviews. Some had experienced difficulties with finding suitable support, but were, at the time of the interview, relatively content with the support they had. Others, however, were still struggling to be heard. Thus, their worldviews varied significantly, according to the experiences they had.

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Table 13 Participant demographics

Pseudonym	Age	Length of service	Branch	Service ended	Type of trauma	Green activities	Marital status
Ant	34	10	Army	2014	Frontline combat	Fishing	Married
Bradley	53	29	RAF	2012	Combat related	Fishing	Married
Connor	46	5	Army	1998	Complex, Frontline combat related	Fishing	Divorced
David	62	37	Army	1997	Sexual assault in military and frontline combat related	Dog walking, fishing	Married
Eddie	47	17.5	Army	2008	Combat related	Dog walking, fishing, mindful nature walks, nature photography & painting	Has partner
Greg	45	4	Army	1986	Post-military violent attack	Fishing, Geocaching	Married
Harry	37	12	Army	2008	Frontline combat related	Fishing, scuba diving, walking	Engaged
Josh	46	6	Army	2007	Complex, childhood and interpersonal in military	Falconry, fishing	Married
Marcus	45	5	Army	not known	Interpersonal in military and frontline combat related	Dog walking, walking	Married
Peter	32	12	Army	2016	Frontline combat	Fishing	Married
Scott	32	9	Army	2011	Frontline combat	Fishing, walking, farming	Living with partner
Thomas	36	7	Army	2016	Health related/interpersonal in military	Fishing	Single
Will	27	6.5	Army	2014	Combat related	Deer stalking, fishing	Married

3.3.2 Ethical approval

Ethical approval was granted from the University of Essex School of Health and Social Care (Appendix M). The first main ethical consideration was protection of the participants should they become distressed during the interview. In contrast to the interviews in Chapter 2, interviews in this study included inviting participants to tell the story of how they developed PTSD. Participants were informed that they should not share any details they were not comfortable sharing, and an experienced trauma therapist was contactable during the interviews. The second main ethical consideration was safeguarding of the principal researcher; thus all interviews took place in public spaces.

Obtaining informed consent included explaining clearly to the participants they had a right to withdraw from the study at any time until the thesis or other publication had been written. This included being able to request their interview data was removed after the interview had taken place. Additionally, it was explained to the participants that the interviews would be recorded and transcribed, and their data would be anonymised and kept securely on the University of Essex secure drive. The principal researcher checked each participant's understanding before obtaining signed consent.

3.3.3 Data collection

Interviews took place between May and November 2019. Eleven interviews took place during fishing interventions run by community interest company iCARP. These trips lasted between 2 and 7 nights at fishing lakes, and consisted of groups of seven to ten veterans with PTSD and a small team of fishing coaches. Interviews were conducted either by the side of the fishing lake or in a building on site. The two remaining interviews took place in public cafes with views of the countryside. One of these was a prior participant at iCARP fishing interventions, and the remaining interviewe had attended other group nature-based interventions for veterans with other organisations. Interview duration was between 40 minutes and 3 hours, mainly dependant on the amount of detail of their trauma they wished to share. All interviews were conducted by the principal researcher, and all participants had had informal contact prior to the interviews.

The interviews were semi-structured and in depth. An interview schedule included relevant topics to be covered and guide questions were developed and can be found in Appendix N. To understand the participants' individual construction of themselves as a veteran with PTSD, each participant was invited to tell the story of how they developed PTSD, including type of trauma, how it was dealt with by the military, diagnosis and treatment. However, to protect the participants from distress and feeling they should tell details they were not comfortable talking about, the first question was 'Would you feel comfortable telling me the story of how you came to have PTSD?'. One participant said they would rather not, and another only wished to give sparse details, and in these cases, participants were reassured that this was fine. The others were then invited to tell their story and *all* participants were told they should only include details in the interviews they were comfortable sharing. Furthermore, the principal researcher checked the wellbeing of participants and reminded them not to share anything that made them uncomfortable, at relevant times when they appeared to be disclosing sensitive information.

Interviews were transcribed verbatim, and transcripts loaded on to qualitative data analysis software NVivo 12. An example of a transcription is included in appendix O. The software aided the coding process by helping the researcher to organise codes and themes and review them regularly and easily through the analytic procedure.

3.3.4 Analysis

The epistemological underpinning of this study was social constructionism, which sees knowledge as subjectively constructed and proposes people construct their own realities through social interactions and experiences (Burr, 2015). Such realities are relativist, situational and contextual, and the positivist notion that enquiries should return definitive, objective answers to human and social phenomena is rejected (Burr, 2006). Social constructionism thus takes the viewpoint that social factors such as politics, the media, family values, personal attachments and social interactions all act together to construct meaning (Braun & Clarke, 2012; Burr, 2015). For example, Greider and Garkovich (1994) propose that we assign symbolic meanings to natural landscapes by seeing the environment from the perspective of our values and beliefs, thereby we construct and reconstruct our views of nature according to our changing definitions of ourselves. When conducting research from this perspective, it is recognised that the researcher plays an integral and pivotal role in the construction of meaning from the data through the interview process and analysis (Clarke & Braun, 2013).

Thematic analysis was used to analyse the interviews using a social constructionist framework. TA is a flexible method which can be used for various theoretical perspectives. TA is a qualitative method of extracting patterns of meaning in data to select themes which are illustrative of the social phenomena under investigation. The six phase analytical method described by Braun and Clark (2006) has been utilised for this analysis. This study used an inductive approach, drawing themes from the interview content rather than applying theoretical framework to the data. It is, however, acknowledged, as noted by Braun and Clark (2006) that a purely inductive approach is not possible as there are always influences from researchers' existing knowledge and experiences.

The six phases of analysis were:

 Familiarization with the data, obtained through listening to the audio recordings, transcription, then reading and rereading the transcripts, making notes, and relating the data to the research questions. Reflective notes on each interview were made, as well as thoughts reflective of the whole dataset. This revealed from the outset that the veterans' construction of nature was developed through their experiences of the military and subsequent struggles with civilian life. A sense of overall disconnection and reconnection through nature and peers was also observed from the data. Excerpts from these are in appendix P

- 2) Generation of initial codes. This was done by drawing both semantic and latent meanings from the data, so analysis was interpretive, extracting underlying meanings, and not just taking the participants' words at face value. Text from the transcripts were highlighted, and notes made as I went along. A raw list of codes was drawn up and is detailed in appendix Q.
- 3) Generating themes, which involved reviewing initial codes, extracting patterns across the whole dataset which relate to the research question, and identifying overlaps. Initial themes were Military self; Military resentment, loss, disconnection; Nature connection; Negotiating support; Transition to civilian life; Peers (from interventions); Identity and What PTSD means.
- 4) Reviewing potential themes, which included appraising the themes to ensure they represented the whole dataset. This phase led to main themes and subthemes around disconnection from the military, disconnection from civilian society, identity constructs in discord, and this was juxtaposed with connection and reconnection through spending time in nature.
- 5) Defining and naming themes, which ensured each one had focus, scope, and purpose. The final themes were summarized in a diagram (Figure 9), which represented the final themes in a succinct way that captured the relationships between themes and represented the pivotal role of nature.

6) Writing the report. This consisted of choosing insightful quotes that were representative of the themes and across all participants, writing narrative around the themes and presenting them in a cohesive fashion

3.3.4.1 Establishing trustworthiness

In order to produce trustworthy qualitative research, Lincoln and Guba (1986) proposed 4 criteria for consideration by qualitative researchers. These are *credibility, transferability, dependability,* and *confirmability*. These criteria can be applied to this study as follows:

Credibility refers to the degree that analysis of the data produced an accurate representation of the interviews and adhered to the participants' 'truth' of the data. There is no objective 'truth' from a social constructionist position, however, to achieve credibility, several of the suggested approaches were adopted, as follows:

Analyst triangulation was achieved by the research supervisor coding extracts from the transcripts and comparing these with the principal researcher's coding. In line with the constructionist epistemology of the study, the purpose of this was not to ensure coding was 'correct' but to highlight any areas where the principal researcher may not have been representing the semantic or latent meanings of the content. Research supervisors were also involved in reviewing themes and in-depth discussions of the results section.

Transferability relates to measures which ensure the study findings would be relevant to a different population (Lincoln and Guba 1985). For replication of the study, such as with a different population or with participants taking part in different nature-based activities, details of the participants and the context in which the research was conducted is required. In this study, the method was described and

details of the demographics of the participants were obtained in terms of age, length of service, marital status, and green activities that the veterans took part in. Further, the interview topics discussed, and the context in which the interviews took place, which was largely during veterans' fishing interventions, has been described. It is considered that the measures taken will be sufficient for other researchers to assess whether the research would be transferable to a different population or context.

Dependability relates to the consistency and transparency of the research, so that it could be replicated by another researcher. To achieve this, a detailed description of the method has been included, and notes were taken after each interview, as well as diarised notes on decision making throughout the process. The use of NVivo software simplified the process of coding and establishing themes in a structured and transparent manner. It is considered that the measures taken will be sufficient for the method to be used again in a comparable study.

Confirmability ensures the research process and analysis are as impartial as possible, and the resulting analysis reflects the meanings intended by the participants rather than the researcher's own biases. However, from a constructionist perspective, it is not possible to remove the influence of the researcher as the interview is a social (co)construction resulting from the interplay between research and participant. Nevertheless, the principal researcher used subject topics in the interviews to achieve a semi-structured process, which ensured the interviews all covered similar topics. This construction is an integral part of the research and with this epistemology it is seen as a necessary and positive aspect of the research process (Burr, 2006). However, it is essential that the researcher remains aware and is reflective of the input from their own experiences, culture,

gender and worldview (Braun & Clarke, 2006). To be sure of this, the principal researcher took a reflexive stance and kept a reflective journal and made notes after each interview. A corresponding reflexive statement is included in the write up of this study as a summary of this journal.

3.4 Results

3.4.1 Summary of themes

Five main themes were identified through analysis and are shown in Figure 9 representing the thematic map as suggested by Braun and Clarke (2006).

The analysis revealed the construction of the veterans' relationship with nature was heavily influenced by their experiences during and after military service. The trauma they experienced and its subsequent effects, level of support when leaving the military and experiences of transition into civilian life all contributed to their worldview and identities of being ex-servicemen living with PTSD in a civilian world. The first 3 themes of 'Disconnect from the military', 'Disconnect from society' and 'Negative identity constructs' relate to the construction of their worldviews in this respect. It was felt these themes set the background for why and how the veterans use nature-based activities, which is why they are presented first. It was felt a full appreciation of the final two themes of 'Nature connectedness' and 'Reconnection through the environment and green activities' was best achieved through understanding of the first three themes.



Figure 9 Summary of themes and subthemes

3.4.2 Theme: Disconnect from the military

The first theme of 'Disconnect from the military' relates to the participants' experiences which led to the emotional and physical breakdown of their relationship with the military. Three subthemes of 'Military culture', 'Negotiating the consequences of trauma' and 'Rejection, resentment and loss' were identified.

3.4.2.1 Subtheme: Military culture

The basic military training that all UK military personnel undertake instils the idea that the strength of the armed forces is built on the strength of the team. Several of the veterans alluded to a military culture where needing help was seen as weakness and, that admitting such 'weakness' was discouraged because it would be seen as letting the team down. This in turn created a pressure to remain 'strong' and made the veterans less likely to speak up about their problems. Ant, who left the army voluntarily some time before his behavioural problems led to a PTSD diagnosis, believed keeping issues a secret contributed to the onset of PTSD. He said:

There was that mentality of you didn't want to be weak when you were in the army so if you had asked for help, you would have been the weak link in the section or platoon, or whatever. So I think, a lot of people... masked it and got on with life and now it's fallen into place that people have got PTSD. (Ant)

Some of the veterans felt that obvious negative effects of exposure to extreme levels of trauma on the frontline were not acknowledged by officers. The veterans were mainly teenagers when they joined up and this added to feeling overwhelmed and powerless in the face of the enormity of their experiences. In Connor's case, he felt dramatically affected by frontline trauma and his behaviour deteriorated whilst serving in the Gulf War. Although he felt the others in his battalion suffered as well, he maintained officers ignored any distress and expected the soldiers to continue as normal, and this exacerbated feelings of vulnerability and powerlessness. I mean when we saw stuff out there, it was just brushed aside. I mean just carry on. Being new to the battalion I didn't really question it. I was only 17/18, so. And I really didn't come from round there, I was really quiet. I didn't have the confidence. (...) When I came back from leave and that, I found I was the complete opposite. I found I was getting into people's faces, I would argue about stuff. And it all got brushed aside. No-one spoke about it in the battalion. No-one. And you could see there was breaking points for everyone. But they didn't take any notice. (Connor)

Another feared consequence for 'weakness' was being singled out and punished with harsh treatment. David, for example, saw this as normal behaviour in the 1970s, "It was just 'I'm the hard man and you'll do as I tell you' and that was just accepted more" (David). Thus, from the veterans' viewpoint, army culture internalised the belief they were expected to remain strong and able to cope with whatever they experienced. The treatment for 'weakness' was to be either ignored or met with further harsh treatment. When they started to feel distressed, they positioned themselves as 'weak' and no longer fitting this ideal of a strong and capable soldier.

3.4.2.2 Subtheme: Negotiating trauma within the military culture

When the veterans were adversely affected by traumatic events, they were presented with the dilemma of finding a resolution to their distress within this military culture. Their dilemma was resolved in several different ways. Some continued serving and avoided becoming seen as the 'weak link' by keeping the effects of the trauma to themselves and maintaining the appearance of strength. This strategy was short lived for some who later found they were unable to continue. Connor said "I thought if I get out, things will be better. I got out, but things got worse". Others, such as Peter, believed they had overcome their distress and left the military for reasons unrelated to mental health. After leaving, the true consequences of the trauma became apparent. Peter said, "You don't know you're broke till you leave".

For those who chose to speak up whilst still in the military, most found support at the time was either insufficient or non-existent. David was sexually assaulted by an officer aged 19 but when he reported it no action was taken, other than to move the officer to another regiment. This left David feeling ignored and undervalued, feeling it was better to try and cope on his own. He said, "I never mentioned it again, until 2 ½ years ago", after a long army career spanning 38 years. Furthermore, when Eddie asked for help, he said "We were just told to get over it and get on with your life". Consequently, Eddie felt the army was uninterested in his suffering, saying, "They don't look at the individual, they look at the group"

For some of the veterans, physical issues led to the end of their military careers, but there were mental health consequences too. The loss of their careers made them feel they had 'lost everything' and those that felt a lack of social support suffered with lasting consequences. Thomas described it as feeling he had been told "You're not good enough, now bugger off". He had developed a spinal condition and spent 2 years waiting to be discharged. He felt the army were no longer interested in him and was left with feelings of rejection and abandonment. He said

I was not allowed to go to work, wasn't allowed out. I wasn't allowed to come home though. I had to stay on camp until I had a date for my medical discharge hearing (...) It was just like a blur to me. My mates got up, they went for a run, I pulled out a crate of beer. For 2 years I just sat there and drunk, and drunk, played on my Xbox, drunk, popped my pills, got off my face and that was it really

Researcher: You had no support?

No support whatsoever. (Thomas)

These experiences of becoming the 'weak link' led to feelings of powerlessness, and

a construction of the military as unable or unwilling to support them, and which

ultimately rejected them.

3.4.2.3 Subtheme: Rejection, resentment and loss

The majority of the veterans had good memories of their time in the military, and this contributed to their feelings of resentment for having to leave. Several referred to being created a soldier by the military and feeling a particular sense of loss of being subsequently rejected by the organisation that created them. Others apportioned blame to individuals linked to their trauma or subsequent lack of support, but also resentment towards the organisation as a whole for not being able to keep them safe.

It's just a sausage factory. You go in as a civilian, they break you, turn you into a soldier. And then, on your last day, hand your ID card back in and they're happy just to get rid of you. This whole thing about there is support after you leave is just rubbish. (Ant)

Ultimately, this led to resentful and angry disconnection from the military for nine of the participants. These experiences highlighted a feeling of imbalance of power, with the veterans being powerless against an organisation which rejected them.

Peter describes a total disconnection from the military upon leaving, feelings of being abandoned, cut off, with his only link a court case.

I hate them. Yeah. A hell of a lot of resentment. I've not spoken to anyone since the day I walked out of those gates. Not through choice. Just, no-one's ever bothered. No follow up phone call (...) I'm suing them for medical negligence. In my opinion they cut my career short. (Peter)

In summary, the first theme detailed how the veterans experienced a military culture which created a stigma around mental health issues. These are seen as representing 'weakness', which is at odds with the idea of the strong capable soldier constructed through military training. Through their experiences, the veterans constructed a view of the armed forces which values the group over the individual, where individual distress is overlooked and inadequately addressed. The effect of this was to make the veterans view themselves as powerless within this culture. Ultimately, the relationship ended through either being discharged for a variety of reasons (n = 7) or leaving voluntarily (n = 6). The veterans position themselves as having been ignored and rejected by the military, which is seen as contributing to their PTSD, causing resentment alongside feelings of loss.

3.4.3 Theme: Disconnect from society

The veterans left the military with their current mental health problems in varying stages of being evident. Some left with little idea of how their PTSD would develop, some left to try and help themselves. Two were discharged with significant mental health problems. The 'disconnected from society' theme includes 3 subthemes covering different elements of disconnection the veterans felt from civilian society after they left the military. These subthemes were 'culture shock', 'difficulties with accessing support' and 'social disconnection'. The resulting construction of civilian society was unwelcoming and difficult to integrate into.

3.4.3.1 Subtheme: Culture shock - Struggles with transition

Resettlement packages from the armed forces provided some assistance for the veterans when they left the military, but many felt unprepared for civilian life. As soldiers, the veterans were used to the structure of the military, and not used to being responsible for aspects of life such as paying bills, or making appointments, and this added to feeling out of place once they left. For instance, although Thomas was 25 when he joined the army, he said:

They changed me as a person so much that I had no coping mechanisms for outside the army. I was used to having everything done. Water, heating,

food, do you know what I mean? Everything. And having that taken away from me (...) That just threw me into pieces. (Thomas)

Similarly, David said

I came out and I had nothing. I had no backup. I was institutionalised (David)

In addition to dealing with responsibilities and decisions they were not used to, a significant hurdle was dealing with having been a soldier with status, then becoming a civilian with mental health issues. Peter left the army very suddenly after being medically discharged for hearing loss. He described the transition from feeling powerful and proud as a soldier to feeling inadequate as a civilian as making him feel "not human" (Peter). Scott too struggled, although he fought hard to "build myself up" after transition, he said

So before, you used to be this big strong, fit person, running around effing and blinding, closing the enemy down, and getting shot at. (...) Then you lose it all. When I came out I was nothing (Scott)

These feelings of inadequacy contributed to a sense of discord with the civilian world, exacerbating the feeling they did not belong and presenting a barrier to connecting with civilian society.

3.4.3.2 Subtheme: Difficulties accessing adequate support

All the veterans expressed difficulty in accessing the right kind of support in some way and this mirrored some of the issues they had getting support before leaving the military. At the time of the interviews, most of the veterans had received some level of support since leaving, with some feeling well looked after; however, all had experienced difficulties of some sort. Some of the veterans found the NHS were ill equipped to help veterans, again making them feel they were not valued enough to be looked after. The same was experienced by some when they approached charities that were not veteran specific. For example,

I mentioned that I was ex-Forces, and the first thing they said was, no, your needs are too complex. (Eddie).

Others struggled with getting a diagnosis, which for many of the veterans was a pivotal factor in their recovery. Not only did it lead to obtaining the right treatment, diagnosis increased self-esteem and self-understanding, by answering the question 'What is wrong with me?' However, even after diagnosis, the veterans often seemed to suffer setbacks with their attempts to get support and were not always psychologically strong enough to keep persevering. This led to a continuing frustration and disappointment at the lack of support. Here, Bradley attempted to receive the right help through his GP:

I'd gone to the doctor and the doctor basically turned round and said to me I think you've got PTSD, but I'm not qualified to say that you have (...) So they sent me to see someone in [local town] and they talked about listening to whale song and all that crap and they said they couldn't give me a diagnosis either. (Bradley)

A common problem seems to be that support received did not fully treat the problem. Eleven of the participants said they had had treatment that was either insufficient or did not work, leaving them to manage their lives while they still struggled. Connor had relied on regular, support from a veteran charity, but support was withdrawn after changes at the charity. He then struggled to get support, having been turned down by other charities because "they wouldn't do multiple traumas" (Connor). This is an example of how some of the veterans would be given some support but would later be left with periods of no support. Similarly, Josh saw a charity therapist who became ill and left, after which Josh was left unsupported for 3 years. A pattern emerged across the veterans of support either being insufficient, the wrong type or inaccessible. Thus, the veterans felt rejected and were left struggling on their own to manage their symptoms. The feeling of being undervalued by society mirrored their experiences of the military which had already abandoned them, exacerbating feelings of not belonging. Eddie said, regarding his struggle to get support:

I find it annoying because it's a case of I signed a contract saying that I was willing to give up my life for my country but now it seems as though my country's not interested (Eddie)

3.4.3.3 Subtheme: Social disconnection

All participants had difficulties with disconnection and social isolation, avoiding crowds or new people. This subtheme reflects the sometimes extreme nature of how much the veterans see the world as a source of threat. This subtheme illustrates how the veterans' worldview affects their daily lives. For some, not going out of the house was a current and constant situation.

I hardly go out. I hardly open the curtains. At all. (Connor)

Others have conquered extreme isolation but fear it returning. For instance, Josh, who also battled with depression, had coping strategies to prevent him becoming too sedentary. He kept himself busy with multiple hobbies and interests, knowing that he was prone to withdrawing. Not all the participants stayed indoors, but for many, going to a shop or a restaurant was something they felt they had to manage carefully to avoid people as much as possible. Eddie explained:

I do struggle to go to new places. (...) If I haven't been there before, I start stressing, and I sometimes actually travel there myself at night to basically recce it (...) I went to Tesco with my partner 2 weeks ago, and I had to walk out of the shop because I couldn't cope with the amount of people. (Eddie)

Even family celebrations were fraught with difficulties in order to manage hypervigilance and anxiety. Will explained how hypervigilance affected time spent with his wife:

> Well, when I go for meals with my wife, I've got to sit with my back against the wall, or as close to the wall as possible. I'm always watching what people are doing. My wife hates it because she says you're not paying all your attention to me. I'm listening to things which are being said, trying to comprehend it, to see if something's going to kick off. I do a lot of that. (Will)

A major concern seemed to be anxiety about other people acting in a way that made them angry, and the result of this would be the veterans would lose control. David explained "I'm frightened of what I'd do if I lashed out. I mean you've got to keep it under control, or it would just all come out" and this was typical of the veterans' views that they were holding 'it' in. The fear of losing control of their behaviour was key for many of the veterans in influencing how and when they chose to interact with people.

Veterans were at different stages in their treatment and integration, and several were in a better place than they had been. Nevertheless, the veterans' construction of civilian society was one they struggled with in their daily lives, affecting relationships, social integration, and daily functioning such as shopping in supermarkets or visiting restaurants.

3.4.4 Theme: Negative identity constructs

This theme is concerned with the veterans' identity constructs; Their own, 'Isolated military identity' which remained strong, their construction of a 'Negative civilian identity' which magnified differences and exacerbated feelings of not belonging, and their 'Reduced sense of self' in terms of their internal struggle to reconcile their PTSD with a sense of who they are.

3.4.4.1 Subtheme: Isolated military identity - How veterans' military ID remains intact despite their disconnection

Despite physical disconnection from the military, and for some, extreme negative feelings of resentment and blame towards the military for their PTSD, the vast majority of the participants maintained a strong military identity. For some, this manifested itself as a desire to return to service, despite feeling intensely negative toward the organisation. These feelings were complex and Bradley, for example, found the dichotomy difficult to reconcile:

> If someone turned 'round to me today and said I want you to go back to Afghan, I will be like, yep, no worries. (...) Yeah, even though it fucked me up I'd still go back, and that is something I couldn't get my head round and my wife certainly couldn't get her head round. The psychiatrist turned 'round and said that's normal. (Bradley)

Often, discourse in this theme consists of references to soldiers being constructed through their military training, after which their identity had been fundamentally, and permanently altered. This identity was associated with particular behaviours and thought patterns, and these were evident in diverse aspects of post military life. In this excerpt, Marcus explained how tidiness is a key indicator of a military identity:

I spoke to a person recently who served, like, a year. He said "My trauma can't be down to the military, I didn't serve long enough". But actually, his wardrobe was folded, his shirts were the same. Because he spent that time. That's for the rest of your life.... (Marcus)

The conflict between no longer belonging in the military but retaining a core identity that did not belong outside the military, made the veterans feel out of place and vulnerable. Eddie described how this added to the resentment he feels towards the military One of the things I hate about the Forces is the fact that they deconstructed me to make me into a soldier. But when they made me into a soldier, they didn't then take it to pieces afterwards, and put me back together how I was before. (Eddie)

A factor the veterans felt set them aside as military minded was prioritising the team over the individual. This meant the veterans were trained to keep the focus away from their individual needs and although this was seen as key to efficiency whilst in the military, outside of it, the veterans felt it increased their vulnerability:

> You know, you spend so many of your years, being a team, you don't look out for yourself. So things evolve and work themselves out because you're not thinking of yourself. Now, when you get out, it is literally, you're on your own, apart from your immediate family (Peter).

A consequence of wanting to prioritise the team over the individual was that nine of the veterans said helping other people was an important factor in their lives. For example, Will goes fishing regularly at a local lake and helps inexperienced anglers, saying "I'm there to help everyone catch, not just me". Helping others seemed to be a particularly positive influence, perhaps because it brought back feelings associated with being in a team, enabling them to feel valuable, and increasing self-esteem. "Helping others helps me. Like I say, I love teaching". (Peter)

3.4.4.2 Subtheme: Negative civilian identity - How the construction of civilian identity exacerbated feelings of not belonging

The second subtheme of 'Negative civilian identity' details the veterans' feelings that 'civilians' were different, for example individualistic, which made integrating into civilian life seem so difficult. For example, Scott was on a group trip which included a veteran couple where one of them was severely disabled and in a wheelchair. He explained how the veterans would all try to help, and contrasts with what he thought would be more usual. As a soldier, you're thinking is she alright, are you sure she's alright, do you need anything? Oh, ok, great. And then someone else will come along, and he's going is she alright? Yeah. You want anything? No (...) You know, and it's all because we look out for each other. So it's nice to have that. Whereas he's probably used to having to do it all himself. (Scott)

The assumption that normally the veteran couple would be left on their own highlights one of the differences between veterans and civilians that the veterans had constructed. Where veterans were seen as caring and focused on helping others, the identity assigned to civilians was uncaring and focused on the individual. This feeling that civilian society is unhelpful extended the veterans' feeling of not belonging. Eddie talked of how his military identity differed from that of civilians, and why this added to his anxiety.

As a soldier I needed to know that for everything I was going to do, what the effect was for me and for the people around me. But I don't have that control in the real world, because nobody cares what their actions are going to be to somebody else. (Eddie)

The idea that civilians do not think about how their actions affect other people was mentioned by several of the veterans. Peter said, "I think everyone's out for their own agenda, everyone's out for themselves". To some of the veterans, this meant that civilians were more likely to behave in selfish and unpredictable ways, which contributed to the veterans' anxiety that something adverse might happen when in public. Additionally, this exacerbated the sense of not belonging.

3.4.4.3 Subtheme: Reduced sense of self

The third subtheme within identity constructs, relates to an internal sense of self, and considers how the veterans made sense of their PTSD in terms of how they viewed themselves. Many of the veterans said dealing with their PTSD was a battle to find ways to maintain control of their symptoms and daily living. Aggression, violence, excessive drinking, and extreme behaviours were common during periods where

they felt out of control. Important factors in achieving control include receiving a diagnosis of PTSD, access to therapy, medication, and learning how PTSD affected them. Several had attended re-stabilisation programmes run by veteran charities, which included therapy and coping techniques such as grounding and mindfulness which assist in combatting anxiety.

Largely, the veterans appeared to make sense of their PTSD by viewing it as something they had rather than something they were. PTSD was viewed as a permanent presence, for example Josh said, "It's like diabetes, you learn to live with it". This was sometimes expressed as a reason diagnosis was so important. As Marcus said of his diagnosis, "It helps me cos then I realised, well, it's not my fault, you know" because he had previously thought his violent behaviour was due to being "born bad". Therapy helped them understand influences on their anxiety and gave them strategies to combat it, thus providing feelings of being able to control their PTSD. When the strategies worked, the veterans spoke of 'managing it', 'understanding it better', but this was met with frustration and anger when they were unable to stop symptoms overwhelming them. In one case, Thomas, who had recently felt suicidal, voiced his anger about not being able to help himself, saying

But why do I let myself get like that? There's no control over it, once I start going, I can't stop. (Thomas)

An aspect of PTSD for some of the veterans was a lack of emotional response to their surroundings and events in their lives, and this made them feel disconnected from their sense of self. Several reflected on times they were unable to connect with their own emotions and feelings. Peter said he struggled to feel emotion, and this caused him feelings of guilt about not being able to respond emotionally to his son I've got a 3-year-old son. That's another thing that bugs me. I never got emotional when he was born. Nothing. I was there. I know I should feel something, but I don't. Same as his birthday, his first day at school. I should be, I think I'm happy for him. But I know I don't express it. (Peter)

This lack of emotion and of empathy towards others was accompanied by frustration in their inability to do anything about it. For some, this was a reason to seek out violence through fighting, which appeared to reflect anger but also a quest for excitement, for emotional arousal, or as Ant put it, anything to get "that little kick".

The 'Negative identity constructs' theme illustrated how a strong military identity was maintained by nearly all the participants. Their construction of a negative civilian identity contrasted strongly with their military identity, thus providing subjective evidence for why integrating back into civilian society was difficult. Meanwhile, internal struggles with their sense of self were evident, through battling to control their PTSD, and struggling to react emotionally with their surroundings. This intensified feelings of not belonging.

3.4.5 Theme: Nature connectedness

The previous three themes of 'Disconnect from the military', 'Disconnect from society' and 'Identity constructs' established how the veterans' worldview of disconnection was constructed through experiences of feeling devalued and rejected by the military and how they struggled to engage with and feel valued by civilian society. The veterans' identity constructs show a strong military identity after leaving the military: a social identity which reinforces discord with the civilian society and ongoing battles with a sense of self, which is focused on controlling symptoms and connecting with emotions. Although most of the veterans had received mental health treatment, all still battled with PTSD symptoms and sought to find ways to control them. The theme of 'Nature connectedness' illustrates that nature-based

environments and activities are one way which helped the veterans 'live with' their PTSD. Twelve of the thirteen veterans talked of their sense of connectedness to the natural environment. Several discussed their life-long love of being outside. There were various elements of their connection to nature, which were often in stark contrast to their feelings of disconnection elsewhere.

3.4.5.1 Subtheme: Harmony and integration with nature

The first subtheme in nature connectedness relates to how the veterans were able to connect to their surroundings. The veterans reported they found the environment calming and relaxing and promoted a feeling of belonging. Nature seemed to provide escape from stress felt elsewhere, and an escape to somewhere they could connect to. This provided a break from anxious thought patterns:

Nothing's playing on my mind, it's escapism. And everything else can wash away for that period, however long you're doing it for. (Harry)

Ant explains a harmony he feels with nature when he is fishing, and for him, his solitude is an important factor:

There's no worries or nothing when you get down to the lake, you get down there, set your rods up, you lay there, I can lay in my bivvy all night, especially when it's raining, you can hear the rain, you can hear the ducks quacking in the water, you just harmonise with everything around you, and there's nothing like it, you ain't got nothing else to worry about, cos you're on your own, and you can just relax. (Ant)

When outside in nature there is little concern that external factors will trigger anxiety because the surroundings are nonthreatening. This releases the veterans from some of their hypervigilance and reduces stress they experience, for example when in public around other people. Scott explained his connection with nature feels almost primeval. Having discussed how he uses music and meditation to ease his
anxiety, he feels the sounds of nature can help him in the same way. In a nonthreatening environment he feels more connected to his 'normal' self and at ease with his thoughts:

The rain on the tent yesterday was fucking brilliant. That really calms me, being outside. Living like a fucking caveman, in a way innit? You know, really, really. (...) I find it helps, you know, I feel more normal. If that makes sense, it's not so much what's going on in the outside world, then, it's all about what you're doing in there [points to head]. (Scott)

Thomas goes further regarding the connection between evolution and humans' association with nature, highlighting the strength of belonging he felt with nature when he slept outside.

I think it's because, you know we're all from the earth and sleeping outside its where everybody belongs, we come from here, so you're going back to your roots. (Thomas)

For some, being able to connect with the natural environment allowed for relaxation and positivity, acting as respite from daily stressors. For example, David planned his working day around a walk by the lake, helping him to lower stress and keep positive. Others connected with the environment through activities such as photography, drawing and mindfulness. Eddie talked of becoming focused on the environment by the fishing lake and when dog walking, enabling him to focus on his wellbeing and connect with his sense of self.

I'm also looking at how it's changing through the seasons. It's err, I do from time to time do a bit of photography, sometimes I do take the camera with me when I take [the dog] for a walk, so I'll take photographs of how it's changing (...) I see it as 'me-time'. (Eddie)

In regard to fishing, most of the veterans had fished since childhood. Consequently, nature and fishing had long been a part of their lives, providing relaxation and

recreation. In post-military life it provided the same, therefore, whilst much of their lives had changed, fishing had remained a constant source of restoration. Peter, for example, a lifelong angler, had often been drawn to fish when on leave when serving in the army. It provided an unpressured environment where he could destress, and he still used it for this purpose.

It's like a release valve. It's like someone just pops the cap off, and you can just, the pressure's gone (...) no noise, no-one asking you for something, no-one telling you to do something, don't have to think about anything. (Peter)

3.4.5.2 Subtheme: Increased sense of self through sensory experience

Some of the veterans talked of the sensory aspect of their connection with nature;

the extent to which they were able to connect appeared to be linked to their symptom severity.

Marcus described how he was able to connect to nature through his senses now he had received therapy for his PTSD and was on effective medication. Previously, his anxiety was so pronounced that his anxious thoughts stopped him from connecting with his environment. Now he can connect and absorb all sensory aspects of his surroundings when out in nature, which he was unable to do before. In this way, even though he is still symptomatic, nature is constructed as a reminder of how far he has come from when his PTSD was at its worst

It was the anxiety of thinking the worst scenario. But now I can sit there, and I can listen to the birds, and I really concentrate and I can hear things. Par for the course now is that I can hear things that I wouldn't have heard before, wouldn't have seen before. I'm not in a rush to get home, to get anywhere. So being around the environment, the calmness, is lovely. (Marcus)

In a similar way, Scott equated responding to the natural environment through his senses as a reminder he was alive, and as evidence he was breaking through the numbness he had felt before. He linked sensory experiences such as listening to the rain, or feeling wet feet, to the emotional experience of responding to the horror and death he experienced in the army. Where becoming numb to horrors in war could have been a coping strategy, perhaps the nonthreatening environment was facilitating Scott's ability to become responsive again.

Fishing for your food, you know, cooking your food on the side of the lake, having a cup of tea at the side of the lake. It all, for me, brings everything back. You know if you get too close you can get your socks wet, inside the lake. It's all a feeling. Like when I walked up with you earlier on I said, oh, bloody boots, I've got a soggy sock. You know, I laugh about it, you know. As much as I don't like having wet feet, that was a feeling. That soggy foot was a feeling.

Researcher: And those feelings... are important?

I think so, otherwise it makes you feel numb. Um. Before, someone could die in front of me, and I wouldn't blink an eyelid. (Scott)

Harry, whose PTSD related to losing the use of his legs due to a spinal injury from an explosion, had described himself as having struggled to feel any emotions, and being "completely and utterly brain numb, body numb" during the time he spent in a wheelchair. Like Scott, he contrasted the sensory experiences of enjoying nature with this time of being unresponsive. For Harry, being able to experience outside again in this way, represented connection with his sense of self again.

It's very sensory, I like that (...) It's so different from all the time I spent feeling switched off. (Harry)

Whereas in many aspects of life, the veterans were retreating from their environment, around nature they were able to connect with their surroundings and allow themselves to experience it through sensory input. By allowing the outside in, they opened themselves up to responding through emotions as well. This ability to become responsive again restored their sense of self which the veterans felt disconnected from when they felt numb and unresponsive.

3.4.6 Theme: Reconnection through the environment and green activities

Where the 'Nature connectedness' theme illustrates how the veterans connected with the natural environment, the theme of 'Reconnection through nature, green exercise, and fishing' relates to how the veterans use green activities to *actively counteract* the disconnection which is experienced in many aspects of life and enables the veterans to achieve more than a passive connection.

3.4.6.1 Subtheme: Gaining control

Finding solace and comfort in green activities, the veterans were also able to use the environment to counteract facets of their PTSD. The veterans commonly had a lifelong relationship with fishing, and this added to its appeal as an activity they were comfortable with. David constructed fishing as an activity that gave him feelings of strength, achievement and safety, feelings that were difficult to achieve in many other aspects of his life. Even though he had the intention to do other things, he was often unable to see them through due to anxiety. Fishing provided an activity he was able to persevere with.

I'm prepared to do things, and then something happens, I go right up to the line, but I won't cross it, sometimes. But with fishing, I can go right up to the line, and then I cross it. So, I plan it, and I do it, where as other things, I plan, you know. A couple of years ago my friend died, (...) and I wanted to go to his funeral, but I couldn't cope with it. I had everything ready, the car ready, just about to go... No, I'm not going. Fishing? I'd go. I don't feel... I'm in a position where I don't feel threatened. I don't feel, I feel totally comfortable within myself. (David)

The green activities also created feelings of excitement and anticipation. Some of the veterans described a proactive way of counteracting their PTSD when fishing. Instead of their hypervigilant minds being taken up with thoughts of potential dangers, they were able to "use the anxiety as a tool" (Josh) to optimise their chances of catching a fish. Will explained how thought processes that cause him issues socially could be positive when fishing and deer stalking. Consequently, he sought out these activities as often as possible, especially when his anxiety rose.

When you're fishing, you're always watching the water, whereas if I was in a bar, you're watching people's hands, you're watching signals that they are making. But when you're fishing, you're looking at the water, you're looking at the signs, what the birdlife is doing, you're always watching something. Same with deer stalking, you're looking at the grass, you're looking at the birds, birds are communicating where the deer is. (Will)

Similarly, Greg described how his mind was normally "just churning all the time" on negative thoughts and fears about what could happen. But when fishing, these thoughts were "squeezed out" by thoughts of how to catch a fish. He said

It turns apprehension into anticipation. (...) Because what you're actually doing, is that you're hoping that something will happen. (Greg)

Whilst some were using their hypervigilance for tactical fishing, other veterans

actively used the environment for contemplation, problem solving and planning.

Thomas, for example, sought time in nature to help him when things got too much.

He said

I can put things in order. Get my ducks in a row, sort of thing (Thomas).

He went on to discuss a particular time he went camping in the woods near his home when he was feeling stressed. He explained the strong pull he felt towards being around nature was complex, but ultimately reflected what he felt was absent from most of his life outside the army.

I wanted to rough it. And roughing it is, I don't know, it's weird I can't explain it. It is home. It is what I'm used to. It is the way I've been trained, it is comfort, it's solitude, it's everything I want that I don't get in civilian life (Thomas).

Thus, the veterans, in several different ways used green activities and seeking out natural environments to actively take control. And ultimately, the last point that Thomas made contrasts the natural environment and the ability to cope within it to civilian life, and the difficulties of living within it.

3.4.6.2 Subtheme: Reconnection to Military through the environment and activities which connect to the environment

A second subtheme is the active use of nature to reconnect to their military lives, evident in nine participants. Fishing was constructed as a source of connection with their military selves and experiences during service. Unlike some of the negative aspects of their relationship with the military evident in the 'Disconnection with the military' theme, the unthreatening environment facilitated positive connections through similar positive feelings and associations. For Peter, it was the exciting, tactical element of fishing that reminded him of military life.

> I get excited. I think it's cos I'm... For me, I'd say the best way to describe it for me, it's like being tactical. You've got to think one step ahead. And it's the same as when I was commanding men, you're always thinking one step ahead: your tactics, what you're going to do, and how you're going to confront certain problems. (...) It's the same with fishing. You've got to know where you put your rigs, what you're going to use, you have to read the battlefield, the lake. (Peter)

David also described the feelings of excitement in fishing, but for him it was linked to the sense of anticipation he felt on patrol in the army. He said:

The best time I like fishing is when you're snuggled down in your bivvy and it's raining. And you get that warm, toasting the marshmallows on the fire feeling. (...) And so you feel excited, you feel exhilarated when those alarms go off. And in a way, sometimes, it's a bit like patrolling the streets in Ireland. You know, you're on QRF (Quick reaction force), you're ready, and then they go, and you go into action. And that's how I feel. (David)

Such aspects of being in the army; tactical problem solving and the exhilaration of being on the frontline, were examples of elements of military life that were enjoyable but were difficult to connect to without a context that could elicit the same feelings. For some of the veterans, fishing provided that context.

Sometimes, it was the environment itself which provided the connection. Bradley, for example directly associated the fishing environment with the environment in his later years in the RAF, and this promoted a sense of familiarity and safety, with strategies ready in case anything went wrong. This sense of being in control contrasted with the anxiety and lack of control he felt when interacting with society in daily life. Although Bradley felt a pronounced resentment towards the military, he still had positive associations with many of his experiences, and the natural environment thus enabled him to connect to those positive elements.

Because it's so quiet, I can hear anyway, and so, when I'm sitting there, I've got my peripheral, so, you know (...) Because for the last eight years of my military life, I lived in this environment, so you know this isn't hard for me, to do this (...) I think it maybe makes me feel like I'm back in the military again. (Bradley)

3.4.6.3 Subtheme: Reconnection through military peers

Further positive military reconnection was attained through the peer support of other veterans with PTSD. Although all of the participants spent time independently doing green activities on their own or with others, all participants attended organised events for veterans with PTSD (twelve attended fishing interventions, one scuba diving), and most of the interviews took place during these events. Drawing on the data, and previous themes, it can be seen why it is that peer support is so beneficial in these circumstances.

Peer support allowed the veterans to reconnect with positive feelings associated with being in the military. As discussed, the fishing provided a relaxed, nonthreatening environment within which they could connect with their sense of self and military identity. The addition of attending an event with other veterans with PTSD further enhanced the restorative effect of fishing. For example, Peter had had no contact with anyone from the military since his discharge, but by socialising with other veterans he was able to revisit the positive social aspect of being in the military. This reconnected him to positive memories, which had been inaccessible to him since he had left the army.

It's remembering more of the good times, for me. When he says me and the lads we done this, blah blah blah, and I'm like fucking hell, I remember, and then you're just having a laugh. Cos you're remembering the fun times you had not just the bad. The good (...) Even the bad stuff is followed up with a funny story. (Peter)

Further, by being with other veterans, the participants were able to reconnect with team-based thinking. Being a team was a strong aspect of military life that many of the veterans missed and felt was absent in civilian society. When isolated, the veterans avoided thinking about many of their experiences, but being in a group of veterans returned them to feelings of belonging and strength they associated with the team-based thinking of the military. Being with others who were also suffering with PTSD made them feel less alone and allowed them to connect with their PTSD in a different way. Thomas expressed the relief he felt to find other people like him.

I thought I was on my own, I didn't realise there were loads of people like me (...) Everybody up here was exactly the same place as me and it wasn't a single thing, I didn't have to deal with it on my own. (Thomas).

Additionally, Thomas went on to explain the importance of finding other veterans to socialise with, saying

What it is, is army folk, will get on with army folk. Our sense of humour, our wit, our stupidness, and everything else, is like no other. (Thomas)

By being in a military-based social group, the veterans were able to access social coping strategies viewed by the veterans as being particular to the military: Talking very directly, and laughing at adversity through dark humour, often referred to as 'banter' was used as a strategy in difficult circumstances. As Peter described it, "That's what you do as a soldier, make light of a bad situation". Such coping strategies were presumed, by the veterans, to be unacceptable outside of military company. Marcus explained:

I think for military people, you can be who you want to be when you're around them. Sometimes civilian people struggle with how we cope with death, how we cope with traumas, you know. We've had conversations with people, and the shock on people's faces. But that's the way we cope with them traumas, you know. And it's hard for some people to do it but round military people, you can be yourself. (Marcus)

The freedom to be able to say what they wanted was liberating for the veterans, allowing them to discuss their lives with PTSD, and sometimes their traumatic experiences in more detail and with more honesty than they could elsewhere. They felt free to talk whereas normally they would feel they had to hold back.

Hence, the veterans expressed the freedom they felt to 'be themselves' when they were around their peers without fear of being judged. This reinforced the subtheme from 'Negative identity constructs' of 'Isolated military identity' where this identity was so strongly maintained by the veterans. Further, this military identity was constructed as their real self. This was expressed by David

You know, it doesn't matter who we are, what age, or whatever, the fact is, we've all been in the military, and I think, you don't have to justify anything,

or explain to people you do things this way, because you're military, everybody just accepts you for who you are. (David)

The effect of these elements of peer support was for the veterans' to be able to socially reconstruct their PTSD as more acceptable. The veterans felt stronger in the group, and more able to cope. The feeling of belonging and accessing positive military connections not only reduced anxiety but gave the veterans access to social coping strategies. They felt freedom to 'be themselves' and express themselves comfortably, compared to the usual pressure to 'fit in' to the civilian world. In some cases, this led to talking about experiences in a way they had not felt comfortable with before. The feelings of belonging and acceptance contrasted with feelings of not belonging in either civilian society or the military.

3.4.6.4 Subtheme: Improved social connections

The final subtheme relates to longer term social effects of the green activities. The perceived personal benefits of spending time around nature have already been discussed, leaving them "ready to face the world again" (David). However, some of the veterans also appeared to use green activities as a way of helping personal relationships: The majority of the veterans in this study were married or in stable relationships. When their PTSD symptoms worsened, some would opt to spend restorative time around nature, or their partners would suggest they should go. This seemed for some, to be in a recognised pattern, and integrated with their relationship. For example, Will's wife would regularly encourage him to go fishing:

I've got to say my wife is amazing, she knows when I've had enough and I need to go fishing. So I go fishing for a day, come back, and I'm good as gold for 3 days afterwards. (Will)

Will's description of the effects of fishing implies the significant impact on his home life: The benefit was to Will after he had reached a point of having 'had enough', but the effect of being 'as good as gold' suggests his subsequent behaviour was less troublesome to the family, even if only for a few days. For Josh, the benefits were viewed as longer lasting, and the impact on his relationship was clear, providing an alternative focus to Josh's PTSD, and reducing stress within the relationship.

I'm calmer, my missus is calmer. There's something else to talk about, other than problems. It's just all-round relaxation. But as I said, after about 2 weeks, life starts then encroaching back into things. (Josh)

Whereas Will and Josh were examples of participants who had fishing integrated into their lives, Eddie was a less frequent angler, with his main green exercise being daily dog walks. The organised fishing weekends were less frequent, but the influence also felt strongly by his partner

She wanted me to come because she said after I've come back from the other times, I've been a happier person. (Eddie)

Will explained that when fishing he would go home when he felt he had benefitted

enough from fishing. When asked what those benefits feel like, he said:

Relief, like a weight is off my shoulders. I don't get so snappy for one. I can sit there with my children, I can play with my children. (Will)

Thus, this final element of the 'Reconnection' theme illustrates how the benefits of the green activities have lasting social effects for the veterans as well as their families.

3.5 Discussion

The analysis showed how spending time around nature contributed to the worldview of veterans with PTSD, providing a sense of belonging and connection. This is in

contrast to the feelings of disconnection they experienced with the military and transition into civilian life. Further, the veterans accessed their military identity through spending time in nature, reconnecting with their military selves through the environment and through green activities. Additionally, when on organised, outdoor, veterans' events, peer support from other veterans reconnected them with the social norms of military life, facilitating a return to memories, feelings and coping strategies connected with their military experiences. Finally, time spent in nature enabled improved social connections when they returned to their daily lives.

The five themes that were identified can be separated into those related directly to the veterans' interactions with nature, and those that contribute to why those benefits were experienced, and why they are important. The first 3 themes provide the background and will be discussed first.

3.5.1 The role of military culture, masculinity, and identity constructs

The theme of 'Disconnect from the military' detailed the veterans' construction of their fractured relationship with the military. Central to this was the conflict between the veterans' distress from trauma, and the military culture which appeared to disregard it. Military culture is specifically in place to maximise the efficiency of the armed forces during war. It is markedly different to civilian culture with different structure, rules and priorities. (Cooper et al., 2018). Recruits are assimilated into this culture which prioritises stoicism, mental strength, collectivism, and loyalty (Bryan et al., 2012). The culture fosters strong in-group identification, strengthened by shared experiences of living, working and socialising in often adverse conditions (McGurk et al., 2006).

Masculinity models of military identity posit hegemonic masculine attributes are instilled in serving personnel including physical and emotional hardness, aggressiveness, and stoicism (Cooper et al., 2018; Godfrey et al., 2012; Higate, 2001). Suppression of fear, pain, self-doubt, and discomfort is part of military training and forms part of the military identity that is constructed and maintained throughout service (Bryan et al., 2012). Thus, mental health problems can be seen as a failure to adhere to these values, creating a stigma around those who seek psychological support, who are seen as having let the team down. This resonates with the experiences of the veterans in this study, who showed that being seen as the 'weak link' in this way was a significant factor in help seeking behaviour and lack of adequate support.

Stigma of mental health problems in the military are well documented and widely found in research studies (Ashcroft, 2014; Sharp et al., 2015). The most common barriers to seeking mental health support have been shown to relate to stigma in one study, with over a third of serving personnel agreeing that peers would see them as 'weak' if they sought help (Iversen et al., 2011). A US study found that non-commissioned officers (NCOs) shared this view, with over 50% agreeing with statements that personnel reporting mental health problems would be seen as weak and would harm their reputation (Ramchand et al., 2015). Research has shown a strong link with lack of social support and PTSD (Brewin et al., 2000), so the ensuing inadequate support experienced by some of the veterans could have contributed to the development of their PTSD.

As highlighted in the 'Identity constructs' theme, the veterans' military identity, constructed through their basic training and military experiences, remained intact

and continued to drive their behaviour and thought patterns after transition. A central aim in the construction of the military identity is to train recruits to think and behave in collective terms (McGurk et al., 2006). Importance is given to the maintenance of group integrity, resulting in strong in-group identification. However, a consequence of this is that outsiders can be viewed with suspicion, even if they are healthcare workers (Bryan et al., 2012).

The veterans' enduring military identity may have influenced their view of people in civilian society as 'other'. Not only did this influence social reintegration, but also may have influenced the veterans' expectations of being able to access appropriate civilian healthcare. Complex difficulties of transitioning from military to civilian life are fully recognised, with the change from the structure and discipline of military culture to civilian culture having been described as 'reverse culture shock' (Bergman et al., 2014). Problematic personal experiences of transition, including accessing mental health support, and the veterans' personal identity struggles with their PTSD exacerbated the feelings of not belonging in 'Civvie Street'. The increased anxiety towards spending time around civilians likely increased their hypervigilance, which in turn exacerbated social difficulties.

The significant influence of the veterans' military identities is in line with literature on transition problems, which has found problems are more pronounced in those who have internalised their military identity more (Binks & Cambridge, 2018). On the other hand, Ashcroft (2014) stated that the most important factor to determine successful transition was preparedness and attitude. It may be that PTSD experiences exacerbated both factors. For example, their resentment and feelings of abandonment may have interfered with their willingness to let go of their military

identity, and their PTSD symptoms and sense of powerlessness could have made preparation for transition more difficult.

In summary of the first three themes, military culture and identity were central to the veterans' worldview, in which they saw themselves as having been constructed, but also abandoned by the military. Positive associations with their military experience enhanced the feelings of resentment of no longer being part of the armed forces. Their enduring military identity continued to shape their behaviour and view of civilian world, in which their struggle to integrate and form a new civilian identity was complicated by PTSD symptoms. These factors establish the background to how interactions with natural surroundings are so valuable.

3.5.2 Nature connectedness

From a socially constructed viewpoint, natural landscapes have been cited as reflections of sociocultural meanings (Greider & Garkovich, 1994), and spending time in nature resonates with memories of holidays and recreation (van den Berg et al., 2007). That the majority of the veterans had fished since they were children meant that the act of fishing, and the fishing environment had positive connotations bridging across pre and post military life, and thus not connected to their traumatic experiences. Several of the veterans had expressed being naturally 'outdoorsy', revealing a sense of belonging in the natural environments, which were constructed in their worldviews as places of safety, serenity, and freedom. This is an example of 'place attachment', where emotional and social attachments are associated with certain places (Hawkins et al., 2016). Through their experiences as veterans with PTSD, many social environments, such as restaurants and supermarkets had developed as places of potential threat that were risky to engage with and heightened anxiety and hypervigilance. Going to natural environments presented

none of these threats, thus not only had positive associations, but also lacked negative ones, and with no danger. These feelings of safety lessened anxiety reduced the need for fretful preparation for threat, and allowed their self-concept to restore, making them feel "more normal" (Scott). This resonates with findings from Poulsen, Stigsdotter, Djernis, & Sideniu (2016) who found veterans attending therapeutic sessions in a nature garden felt they were taking nature in, viewing the environment as a safe place, and found it reduced their feelings of alertness.

Some of the veterans discussed the pleasure of connecting with the sensory element of nature, for example hearing birds sing, or rain falling on their tents. This enjoyment in connecting with their environment was contrasted with times they had been unable to engage with events around them when they had experienced numbress. One explanation for lack of responsiveness to surroundings in PTSD is that it is a defence mechanism to attempt to shut out further stressors (Brewin & Holmes, 2003). When in a nonthreatening environment, the need for this suppression is reduced, allowing for connection with sensory input. The use of all senses to fully engage with natural surroundings has been linked to health benefits such as spending time in a forest environment, known as forest bathing (Li, 2012; Takayama et al., 2014) This phenomena was also found in a research study where veterans took part in a ten week nature therapy programme (Poulsen & Stigsdottir, 2015). The programme took place in a forest therapy garden three times a week for ten weeks and included mindfulness exercises, individual therapy, unstructured time in the garden, and nature-based activities such as tree planting. Using an interpretative phenomenological approach exploring the participants experiences of the therapy, a prominent theme that could be drawn from interviews regarding the participants'

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experiences was 'Taking nature in' which related to increased sensory awareness of the natural environment throughout the programme.

Being around nature was described by some as feeling like they were connecting to a primeval side of themselves, particularly linked to sleeping outside, fishing and cooking outside. Several psycho-evolutionary theories promote the idea that nature is restorative because our attachment to the natural world is linked to evolutional development having taken place in the natural environments. For example 'Biophilia' is a term used to describe an innate affinity we feel for the natural world (Kellert & Wilson, 1995), and attention restoration theory posits that nature has fascinating qualities that draw us in, aid contemplation and offer an escape from day to day stressors (Kaplan, 1995). In addition, it could be that phrases such as "living like a (...) caveman" were the veterans merely expressing the extent to which they felt able to integrate with the environment, taking part in simple outdoor activities, in pleasant surroundings they felt attuned with. These feelings promoted a strong sense of belonging that was lacking in much of their daily lives, allowing them to relax and benefit from restorative surroundings. In other studies, it has been suggested that nature can act as a buffer, reducing negative effects of life stressors, which can improve resilience (Hawkins et al., 2016).

3.5.3 **Proactive reconnection**

The final theme 'Reconnection through nature, green exercise and fishing' related to how the veterans proactively counteracted negative aspects of their PTSD using nature-based activities. Gaining control, the first subtheme, has been cited in other nature-based intervention research. For example, 'Overcoming negative emotions and being more in control' related to taking part in an outbound course (Hyer et al., 1996) and a theme of 'restoring control' was found in a study evaluating a veteran fly

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fishing programme (Craig et al., 2020). Arguably, this relates to the importance of combatting the 'weakness' of their PTSD in order to attain strength (Caddick, Smith, et al., 2015a). Some of the veterans discussed how their lives were often a proactive battle to control their symptoms, often through using methods attained through therapy. This resonates with Caddick et al., (2015a) who found similar discourse in veterans who were surfing with other veterans with PTSD. As previously discussed, the masculinity of the military culture encouraged a 'getting on with it', stoic coping strategy of ignoring distress, which had been detrimental to the veterans' mental health whilst serving. Caddick suggested proactively gaining control over PTSD is a reconstruction of this 'getting on with it' strategy, reframed to become actively pursuing activities to cultivate wellbeing, thereby fighting their PTSD head-on. Thereby, masculinity was maintained through a different type of stoicism - finding ways to control it and stop it taking over (Caddick, Smith, et al., 2015a).

One aspect of such a strategy was to proactively find ways to use some aspects of their PTSD for wellbeing. Several of the veterans said they 'used' their hypervigilance in activities as a way to help them catch fish or track deer because it helped them keep alert to their environment. This was a way of changing a negative to a positive, or as one veteran put it, "apprehension into anticipation" and was an example of reframing their PTSD as a strength. This approach was only available to them, however, because the natural environment was unthreatening. Although not a feature in previous qualitative nature-based veteran studies, prior research has found hypervigilance to be correlated with deployment to war zones, irrespective of the presence of PTSD. (Kimble et al., 2013). Kimble suggests this may be partly due to the vigilance required in military training transforming to hypervigilance in the presence of real threat. Therefore, it may be that reconstructing hypervigilance as

positive was enabling them to revisit feelings they had during military service where heightened vigilance was seen as advantageous.

3.5.4 Military reconnection

The veterans proffered various ways in which they reconnected to their military identity through the natural environment and through green activities. These included using tactical methods to catch fish (or in one case to stalk deer) and being reminded of the excitement of being on patrol through a sense of anticipation of catching a fish. Further, simply being in similar environments to much of their military career, and using skills and resourcefulness reminded them of positive aspects of military service. The important factor, however appeared to be the freedom to remember in a nonthreatening environment. Not only was the environment providing respite from stressors and demands, it was seen as an opportunity to reconnect to positive associations of their military career.

Although this study was primarily concerned with how veterans benefitted from the effects of nature, all participants had taken part in nature-based interventions with other veterans, so the effects of peer support were also explored. In line with other evaluations of similar interventions, (Bennett et al., 2017; Hyer et al., 1996; Mowatt & Bennett, 2011; Poulsen & Stigsdottir, 2015; Rogers et al., 2016), peer support was cited as an important factor in producing the positive outcomes of the fishing trips in which the participants had taken part. Veterans have been found to perceive relationships with peers to be better quality than those of non-military friends and relatives (Laffaye et al., 2008). However, in line with prior research, most of the veterans in this study had not maintained contact with military peers (Hatch, et al., 2013) meaning that a social outlet for their military identities had been absent. This illustrates the importance of accessing such nature-based interventions as a way of veterans getting together.

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Military identities are collectivist social constructions (Weiss & Coll, 2011), so have most meaning when socially experienced. By reconnecting the military identities of the veterans in a peer group, they were no longer isolated, and a new group was established. As previously discussed, helping others was identified as central to their military identities; therefore, the idea of being able to support and be supported within the group was immediately comforting to the veterans. However, the manner in which the veterans helped each other needed to be done within the rules of an adapted version of the military culture to which their military identities belonged.

According to the veterans, seen in the subtheme 'reconnection through military peers', one of the most available coping mechanisms in the armed forces appear to be centred around using humour as a coping strategy. This appears to have two aspects. Firstly, light hearted military 'banter' amongst military personnel involves using humour to tell stories and make fun of each other as a way of increasing camaraderie and forming social bonds (Caddick, Smith, et al., 2015a). Secondly, for the veterans in this study, humour was also used as a way of making light of challenging situations. Using humour as a coping strategy has been associated with emotional support in veterans with traumatic stress in other studies (Caddick, Smith, et al., 2015a; Green et al., 2010). In the military generally, the use of humour as a coping mechanism has been linked to lower reported psychological problems (Riolli & Savicki, 2010) and better resilience (Rice & Liu, 2016). An important property of the military humour construct in the veterans was that civilians do not understand it and cannot take part in it. Therefore, this type of coping was considered only available through being with others with military experience. Arguably, it is not unique to the military, as similar masculine banter has been found in other

emergency services including firefighters (Baigent, 2001) and the police (Silvestri, 2017).

As previously discussed, the military culture and masculinity of military identity can provide barriers to talk about mental health problems. Some research, however, has discussed such military masculine identities as being fluid, and situational, so that in some circumstances, the right group of people can facilitate group discussions without a loss of masculine kudos (Connell & Messerschmidt, 2005; Green et al., 2010) This was explored in a study of veterans with PTSD taking part in surfing (Caddick, Smith, et al., 2015a). What was found was that banter could provide a means to promote wellbeing. By taking part in positive masculine banter, a type of masculine capital was attained, which meant that discussing more difficult subjects such as PTSD was then allowed as a type of 'trade off'. Additionally, by telling stories of facing their PTSD and measures to take control of it, they were able to reframe their PTSD struggles in masculine terms of stoicism (Caddick, Smith, et al., 2015a).

Importantly, the veterans referred to being able to be their real selves while in the company of other veterans, strongly alluding to their enduring military identities being the real them, irrespective of how long ago they had left the military. Self-censorship was common in many aspects of their lives but being amongst veterans provided opportunities to lower their guard. Time spent with peers has been associated with being more honest and open about experiences due to a sense of shared understanding, which means less need to use self-censorship (Bird, 2015; Sherman, Blevins, Kirchner, & Ridener, 2008). In this way, peer support led to a renewed sense of belonging. Through social interaction, the veterans were able to socially

reconstruct their military identity to one in which expressions of 'weakness' had been reframed as strength.

3.5.5 Longer social effects

The benefits of spending times around nature included positive knock-on effects for social and family relationships and for some, factoring in green activities was an integral part of family life, from daily dog walking to weekly fishing. There is growing research into military families and the effects of mental health issues in veterans' lives (Turgoose & Murphy, 2019), and many veterans with PTSD struggle with maintaining relationships (Galovski & Lyons, 2004; Monson et al., 2009). That the veterans in this study were almost all in stable partnerships may reflect how regular green activities may provide a stabilizing influence, with benefits for all the family. There would be value in future research including interviews with family members, to explore this interplay between nature and family relationships in greater depth.

3.5.6 Strengths

A particular strength of this study is that focusing on the constructed worldviews of individuals rather than effects of specific interventions, it has been able to broaden the understanding of the role nature plays in the lives of veterans with PTSD, rather than being specific to the effects of a targeted intervention. As previously discussed, understanding how veterans living with PTSD manage their symptoms is an area that is under-researched, and this study serves to address this gap in the literature. The study, whose participants were mainly in long term relationships, showed that spending time in natural surroundings may have helped the veterans maintain these relationships, where in contrast it has been found in veterans with PTSD, relationship breakdown is common (Price & Stevens, 2009). Future research could further

investigate the role of nature and other factors that may facilitate more resilient relationships in this population.

3.5.7 Limitations

Although not limited to fishing, the present study was fishing focused, and this can be seen as a limitation. The veterans' interviews alluded to advantages to other green activities including dog walking, camping, and deer stalking. Thus, it is reasonable to surmise at least some of the findings would be transferable to other green activities. Equally, although the veterans' construction of themselves as belonging to a unique military group identity, similar social mechanisms have been evidenced in other emergency services. Transferability of findings to other such groups, as well as more broadly to anyone with a 'nature mindset' is highly plausible. Future research could investigate how transferable the findings are to other populations and in other contexts. The study was able to highlight how veterans' military identity played a role in their construction of nature as a place of restoration.

3.5.8 Clinical implications

Implications of the study include highlighting the value of proactively using nature to combat the effects of living with PTSD. This facilitates autonomy and, by focusing on the positive value of nature, a naturally strengths-based approach to managing PTSD is produced. Such insight could provide value in clinical settings. The study has clear clinical implications especially for clinicians with no military background. It provides detailed insight into how veterans with PTSD construct a view of civilian support as being inaccessible, and where support is accessible, veterans can position themselves as misunderstood and undervalued. Such knowledge can help clinicians understand their veteran patients and could help them comprehend the importance of education in military needs. Furthermore, the study adds to existing

understanding of the benefits of peer support in veterans and may help clinicians suggest veteran groups and interventions specifically for veterans with mental health issues.

3.6 Reflexive statement

As previously discussed, in social constructionist research, the influence of the researcher in the co-construction of interview data is viewed positively (Burr, 2006). To ensure I remained aware of my input in this regard, notes after each interview were taken and a diary of thoughts arising from the interviews were kept. As a female research student in her 50s, with no military background, the interviews would have reflected the interpersonal relationship between participants and researcher. All the participants were already known to me to some degree. All but one was known through attendance at the fishing interventions, and for some of the participants this included having provided informal mental health support at the interventions. In this way, I was largely viewed as someone who was there to help and support, and as they were aware of my research, they also saw me as someone who sought to understand them. This, I felt, led to interviews where the participants were keen to share their stories, but perhaps because they were eager to tell me about problems they had had, there may have been a bias towards telling me negative stories regarding the military and accessing support once they had left. Additionally, as they knew of my research, there may have been a greater likelihood of being more positive about being around nature. Thus, the findings may have been likely to show military experience and mental health support in a negative light, and nature in a positive one. In addition to nature, as I was mainly on the fishing interventions, I would most likely have been seen as representing iCARP, the organisation behind the interventions. Therefore, the participants may have been

more inclined to be positive about their experiences of the interventions. However, it is also the case that the participants were not positive about all aspects of their experiences, and they may also have viewed me as a listening ear for any complaints they had about the interventions. In addition to personal influences, there were also other factors, namely, the fact that I was female with a non-military background would have been influential. Aspects which may have been a factor include protecting me from harrowing details, being careful not to use 'military language' and seeing me as not being able to understand them, as a civilian. However, there were indications that because I was seen as someone wanting to understand in order to help, that they were more accepting of me. This is shown in the following interaction with Thomas:

T: Army blokes and civilians don't really work.

R: Sorry! (smiles)

T: Nah, that's different. You're here to help us! (laughs)

3.7 Conclusion

This study sought to explore how and why particular green activities such as fishing are beneficial to veterans with PTSD. Nature is constructed as a life-long nonthreatening and comforting environment, reinforced through military experiences. It has shown that spending time in nature provides positivity through reconnecting them to memories and associations of time spent outside in childhood and during military service. Green activities draw on skills developed in military training, and the green environment provides a nonthreatening place of safety in lives often fraught with discord. Individually, nature provides respite from PTSD symptoms, improves self-esteem, reduces anxiety, and enhances family relationships. When in a group of other veterans with PTSD, they are reconnected to a sense of belonging, and coping strategies perceived as unique to those with a military background, which facilitates feelings of no longer being seen as the weak link, and a realisation they are not alone in their battles with mental health.

Some elements of the findings resonate with existing literature. For example, nature as a place of safety (Poulsen & Stigsdottir, 2015), of restoration (Hawkins et al., 2016; Kaplan, 1995) and belonging (Kellert & Wilson, 1995). Where insight has been gained is in the level of importance that military identity has in the veterans' lives. Also, that the lack of support and stigma of mental health problems experienced through the military culture, for some remained an issue, irrespective of how long ago the veterans left the military. The veterans' military selves were seen as the 'real me' by many of the veterans, exacerbating a sense of disconnection in civilian life, and the veterans felt a need to reconnect to their military selves. This reconnection was provided by the natural environment, green activities, and by socially reconnecting in veteran groups.

Chapter 4 Mental health and green activities survey

4.1 Chapter summary

In this chapter, the relationship between veterans and nature was further explored using an online survey. Veterans and non-veterans were compared in terms of their nature connectedness, relationship between nature and mental health, and preferred green activities. Results showed veterans were not more connected to nature than non-veterans, but their relationship with nature was different to non-veterans in some important respects, especially when veterans suffer from mental health problems. Green activities proffer some element of restorativeness to mental health, perhaps through an adaptive form of avoidance that provides strength and an element of control in their environment.

4.2 Introduction

In chapters 2 and 3, results revealed the benefits of spending time in nature include relieving stress and PTSD symptoms, as well as enabling a reconnection to aspects of military life and a sense of self through connection with nature. In both studies, participants had reported an existing nature mindset that led them to spend time doing nature-based activities. The veterans were shown to have a particular draw to nature-based activities which allowed them to reconnect with elements of their military lives. Both studies were with small groups of veterans who had taken part in nature-based interventions targeted at veterans with PTSD, and results cannot be generalised to the veteran population as a whole. It is thus unknown whether military veterans have a different relationship with nature than people without military backgrounds, and it is this that the study in the present chapter seeks to address.

4.2.1 Differences between veterans and non-veterans

There are many differences between veterans and non-veterans, although relevant to the research in this thesis include those related to physical health, prosocial factors, and mental health. For instance, a recent study comparing almost three thousand UK veterans to the general public found veterans were more likely to report common mental health problems and alcohol abuse (Rhead et al., 2020). Another UK study found veterans were more prone to problem gambling than non-veterans (Dighton et al., 2018). Veterans have been found to be twice as likely to die from suicide as non-veterans in the USA (Kaplan et al., 2007), where they are also more prone to homelessness (Fargo et al., 2012). Research into mental health treatments have found evidence that PTSD treatment response is lower in veterans than non-veterans (Bisson et al., 2007; Murphy & Smith, 2018) and potential factors relating to this low response include a higher prevalence of anxiety and depression, childhood adversity, and direct combat experience (Murphy & Smith, 2018).

4.2.2 The role of nature in mental health

As reported in Chapters 1, 2 and 3, benefits from nature-based activities have been observed in prior research (e.g. Bragg & Atkins, 2016; Lackey et al., 2021) and there is growing evidence that military veterans benefit from nature-based interventions (Greer & Vin-Raviv, 2019). Although regularly surmised that veterans are particularly suited to nature-based interventions, it appears that research to date has not explored whether they respond any differently to non-veterans. Despite establishing that veterans with PTSD can benefit from nature-based interventions (Greer 2019), little is known about veterans' relationships with nature in their daily lives and in comparison, to people without military backgrounds.

4.2.3 Nature connectedness

A different aspect of how much nature-based activities affect mental health has been linked to the subjectively experienced extent to which people feel connected to nature (Cervinka et al., 2012). A meta-analysis using thirty studies found a small but significant association between nature connectedness and happiness, vitality and life satisfaction (Capaldi et al., 2014). The construct of 'nature connectedness', sometimes referred to as 'nature relatedness', has been viewed as a trait-like characteristic that has been found to be relatively stable over time in some studies (Capaldi et al., 2014; Nisbet et al., 2009), although there is contrasting evidence that sustained, positive connection with nature can increase nature connectedness over time (Richardson & McEwan, 2018). In adults, higher nature connectedness has been found to be correlated with more time spent around nature as a child and higher parental nature connectedness (Passmore et al., 2021; Rosa et al., 2018). A literature search revealed only one study that measured nature connectedness in military veterans, although the results were not reported in the paper as the project was still ongoing (Littman et al., 2021). In this thesis, the themes 'Engaging with the Environment' in Chapter 2 and 'Nature connectedness' in Chapter 3, indicated that some participants had a lifelong relationship with natural environments and a subjective view of themselves as being particularly connected with natural environments. However, there is no indication in research to date as to whether veterans are more connected to nature than the general public.

4.2.4 Access to green spaces

A further factor that has been found to link nature and mental health is the accessibility that people have to natural environments, sometimes referred to as 'green spaces'. Having access to green spaces has been found to be beneficial to

mental health (Kessel et al., 2009), and higher quality of green spaces has been linked to increased happiness (Carter & Horwitz, 2014). In Western Europe, rural living has been associated with increased wellbeing compared to urban living (Burger et al., 2020) and it has been found that people exposed to more green spaces have less health inequality, including stress-related illnesses such as circulatory disease (Mitchell & Popham, 2008). To date no such research into green space accessibility has reported veteran participants, thus it is currently unknown whether mental health in veterans and non-veterans are differently related to accessibility of nature.

4.2.5 Summary

Thus, research has shown various aspects of nature that are relevant to mental health, but as yet, differences between veterans and non-veterans have not been explored. To be aware of differences between veterans and non-veterans could help focus interventions and maximise positive outcomes. In mental health support arenas, such as crisis cafes and GP surgeries, clinicians and mental health professionals see a variety of service users, some of which may be veterans. Greater understanding of responses to 'green care' in veterans and non-veterans would be valuable to clinicians making recommendations to service users with mental health issues.

4.2.6 The present study

The purpose of this study was to investigate potential differences between veterans and non-veterans in their relationships with nature and associated connections with mental health, thus increasing our understanding of how veterans' mental health may be affected by green activities and nature-based interventions. This will facilitate the development of innovative and more effective interventions aimed at increasing mental health and wellbeing according to more individualised needs.

4.2.6.1 Research questions

The aim of this study was to investigate the role of green activities in the lives of military veterans. The primary research question was 'What is the relationship between nature and mental health in military veterans compared to non-veterans, and how is this linked to managing symptoms and general wellbeing?'

This broad question was then split into four specific research questions drawing from results found in prior chapters. Due to a lack of prior research specific to this area, the formation of hypotheses was not appropriate:

- Are military veterans more connected to nature than the non-veteran population?
- Do veterans have a different relationship between nature and their mental health compared to non-veterans?
- Do veterans attribute spending time in nature as more important than nonveterans in managing their mental health?
- Is there evidence of different green activity behaviour between veterans and non-veterans?

4.3 Method

4.3.1 Design

The questionnaire was an online, composite survey consisting of established questionnaires relating to mental health and nature, together with questions targeting activities and perception of their role in achieving and maintaining psychological wellbeing. Participants accessed the survey through a link to the software Qualtrics XM, which was distributed by email and online via Facebook.

4.3.2 Participants

Recruitment was via email invitation and social media posts and subsequently through snowballing. To initially target the military veteran population, the email was sent to veterans' charities and placed on veteran charity Facebook pages. To target the non-military population, the survey was distributed to contacts via email, a Facebook post was posted by the researcher on their personal Facebook page and Twitter feed and added to Facebook community groups. The survey was open to all adults over the age of 18 except for current military personnel. Demographics are shown in table 14

	All (n =502)		Veteran (n = 103)		Non-veteran (n = 399)	
	n	%	n	%	n	%
Gender						
Male	224	44.6	92	89.3	132	33.1
Female	271	54.0	11	10.7	260	65.2
Transgender male	2	0.4	0	0	2	0.5
Gender variant/non-conforming	3	0.6	0	0	3	0.8
Other	1	0.2	0	0	1	0.3
PNTS / missing	1	0.2	0	0	1	0.3
Age category						
18 - 24	49	9.8	1	1	48	12
25-39	136	27.1	16	15.5	120	30.1
40 - 54	196	39	57	55.3	139	34.8
55 - 69	100	19.9	26	25.2	74	18.5
70+	18	3.6	3	2.9	15	3.8
PNTS / missing	3	0.6	0	0	3	0.8
Religion						
Buddhist	7	1.4	0	0	7	1.8
Christian	195	38.8	54	52.4	141	35.3
Hindi	2	0.4	1	1	2	0.5
Jewish	8	1.6	1	1	7	1.8
Muslim	4	0.8	34	33	3	0.8
No religion	228	45.4	5	4.9	194	48.6
Other religion or belief	9	1.8	2	1.9	4	1
Spiritual	33	6.6	1	1	31	7.8
PNTS / missing data	16	3.2	5	4.8	10	2.4

Table 14 Participant demographics

Table 14 continued

	All (n =502)		Veteran (n = 103)		Non-veteran (n = 399)	
-	n	%	n	%	n	%
Ethnicity						
White	447	89	94	91.3	353	88.5
Black / Black british - Caribbean	5	1	1	1	4	1
Black / Black British - African	3	0.6	0	0	3	0.8
Other black background	1	0.2	0	0	1	0.3
Asian / Asian British - Indian	5	1	1	1	4	1
Chinese	6	1.2	0	0	6	1.5
Other Asian	7	1.4	0	0	7	1.8
Mixed - white / Black Caribbean	1	0.2	0	0	1	0.3
Mixed - white / Black African	1	0.2	0	0	1	0.3
Mixed - white and Asian	2	0.4	0	0	2	0.5
Other mixed background	9	1.8	0	0	6	1.5
Arab	2	0.4	3	2.9	2	0.5
Other ethnic background	5	1	2	1.9	3	0.8
PNTS / missing	8	1.6	2	1.9	6	1.2
Disability						
No disability	354	70.5	52	50.5	302	75.7
Two or more impairments / conditions	20	4	7	6.8	13	3.3
Learning difficulty	15	3	3	2.9	12	3
Social impairment e.g. autistic spectrum	5	1	0	0	5	1.3
Long standing condition e.g. cancer, HIV	20	4	5	4.9	15	3.8
Mental health condition	60	12	23	22.3	37	9.3
Mobility or physical impairment, eg, use of a v	3	0.6	1	1	2	0.5
Deaf / hearing impaired	1	0.2	1	1	0	0
Blind / visually impaired	2	0.4	1	1	1	0.3
Impairment/condition not listed	12	2.4	7	6.8	5	1.3
PNTS / missing	10	2	3	2.8	7	1.5
Education						
No formal qualifications	25	5	10	9.7	15	3.8
GCSE or equiv	64	12.7	16	15.5	48	12
A level or equiv	69	13.7	17	16.5	52	13
Higher Education	57	11.4	13	12.6	44	11
Degree or equiv	137	27.3	22	21.4	115	28.8
Masters, PhD or equiv	108	21.5	11	10.7	97	24.3
Other qualification	35	7	13	12.6	22	5.5
Don't know	4	0.8	1	1	3	0.8
PNTS / missing	3	0.6	0	0	3	0.8
Primary Employment						
Employed full or part time	341	67.9	76	73.8	265	66.4
Full time in education	57	11.4	1	1	56	14
Carer, e.g. for children or other relative	6	1.2	0	0	6	1.5
Not in employment	92	18.3	26	25.2	66	16.5
PNTS / missing	6	1.2	0	0	6	1.6

Note. PNTS / missing - Respondent selected 'Prefer not to say' option or did not select a response

4.3.2.1 Veteran split

According to the formal definition of military veterans in the UK, veterans were defined as having served for at least one day in Her Majesty's Armed forces, either regular or reserve (Burdett et al., 2013). Question 1.5 asked 'Have you ever served in the military?' There were 96 respondents who selected 'I am a military veteran' as their response. Seven respondents selected 'other' and stated they had been in the military reserves so were also categorised as military veterans. The total number of military veterans in the sample after this adjustment was 103 (20.5%) with 399 non-veterans (79.5%). Of the 103 veterans, 92 (89.3%) were male, and 11 (10.7%) were female, which reflected the current British Armed Forces gender statistics of 11% female (Ministry of Defence, 2021b) . No veterans selected any other gender category.

4.3.3 The survey

The survey took between 15 and 25 minutes for most respondents to complete. An additional, optional cognitive task accompanied the survey that relates to the study in Chapter 5, and this added a further 5 minutes for respondents who chose to do it. A complete copy of the survey can be found in appendix P.

4.3.4 Measures

4.3.4.1 Choice of measures

To address the research questions, a notable amount of data was required that explored nature connectedness, mental health and wellbeing, PTSD symptoms and green activity behaviour. To reduce the amount of time taken to complete the survey and encourage as many participants as possible to answer all questions, short form measures were chosen where possible. Thus the criteria for measures used were that they reflected the variables of interest, had good psychometric properties and had the lowest number of items possible. A summary of measures in the survey are as follows:

4.3.4.2 Nature connectedness

To explore whether military veterans would exhibit more connectedness to nature than the non-military population, the survey included the Nature Connectedness Index (Richardson et al., 2019). The 6 item questionnaire originates from the Monitor of Engagement with the Natural Environment (MENE) national survey, which is part of the UK's natural statistics (Hunt et al., 2017) and was found to have good psychometric properties as a stand-alone measure of nature connectedness (Richardson et al., 2019). Tests showed high internal consistency (α = .92) and good concurrent validity when compared to other nature connectedness measures e.g. the Nature relatedness scale (Nisbet & Zelenski, 2013) and the Nature in Self scale (Schultz, 2001), which showed correlations of $r_s = .67$ and $r_s = .53$ respectively. The questionnaire consists of six statements including 'Being in nature makes me very happy' and 'I feel part of nature'. Participants are asked to rate how much they agree with each statement on a 7-point scale ranging from 'completely disagree' to 'completely agree'. Scoring for each item in the measure was weighted in accordance with the research paper that developed the scale, with agreement to statements being scored proportionately higher (Richardson et al., 2019). An example is the statement 'I feel part of nature' was scored as 1 for disagree, 13 for agree and 23 for completely agree. Total scores range from 0 to 100.

In addition, the survey included a nature statement taken from the Relatedness to Nature scale (Nisbet & Zelenski, 2013), which states 'My ideal vacation spot would be a remote, wilderness area'. The reason for including this additional question was due to veterans expressing a liking for solitude when in nature in interviews
conducted in chapter 2 and 3 (e.g. 3.4.4.1). This aspect of nature connectedness not covered by items in the NCI.

4.3.4.3 Green Activities

To investigate the relationship between green activities and mental health, the survey asked participants to indicate which types of 'outdoor activities in green spaces (e.g., park, woodland, nature reserve, garden, riverside)' they took part in and how often. A list of fourteen suggested activities was provided which included dog walking, bird watching, running, wild swimming and fishing, plus a free text space for activities not on the list. Respondents were asked how often they participated in each activity in a 'typical' month - never, less than once a month, once a month, more than once a month, once per week, more than once a week, or daily.

4.3.4.3.1 Last green activity (LGA)

A separate question asked respondents when they last took part in a 'green activity' for at least ten minutes. The responses were I can't remember, more than a month ago, more than a week ago, in the last week, yesterday and today.

4.3.4.4 Mental Health

Several questions focused on mental health. Firstly, the Short Depression/Happiness scale (Joseph et al., 2004) was used as a measure of happiness. The scale has 6 items where the participants are asked to describe how much each statement relates to them over the prior 7 days, on a scale of: never, rarely, sometimes, and often. Statements include 'I felt happy', 'I felt cheerless' and 'I felt that life was enjoyable'. The checklist has been shown to have good psychometric properties including internal consistency Cronbach's alpha (α = .77 to .94) and test re-test reliability (r = .68; Joseph et al., 2004). Scores range from 0 to a maximum of 18 with higher scores indicating more happiness and less depression.

Stress was measured using the four item Perceived Stress Scale (Cohen et al.,

1983), This asks respondents about their thoughts and feelings over the last month and how frequently they felt or thought in certain ways according to four statements, for example 'Unable to control the important things in your life'. Responses were on a five-point Likert scale of never to very often. Internal consistency for the scale has been estimated using Cronbach's alpha ($\alpha = .68$) and test re-test reliability over two months was r = .55 (Cohen et al., 1983). Scoring ranges from 0 – 18.

PTSD Symptom severity was assessed using the self-report questionnaire PCL–5 PTSD Checklist (Blevins et al., 2015). Used frequently as a clinical tool, the questionnaire asks 'In the last month, how much have you been bothered by....' followed by twenty scenarios relating to the DSM-V criteria for post-traumatic stress disorder. Participants are asked to rate these scenarios on a 5-point scale ranging from 'not at all' to 'extremely' The scale includes four subscales relating to the DSM-V symptom clusters, namely *re-experiencing, avoidance, negative alterations in cognitions and mood*, and *hyper-arousal*. The PCL-5 has strong psychometric properties including internal consistency (α = .94) and test re-test reliability (r = .82; Blevins et al., 2015). There are several ways to use the scale, however, for the purposes of this study, PCL-5 total score was used for analysis. Total score ranges from 0 – 80.

Respondents were also asked whether they currently, previously or have never had mental health issues. Their answer determined subsequent questions, and to provide clarity in this report, the question is provided in detail, as follows: Here are some questions about your mental health. Please choose the statement which best describes you (please make sure you read all options first before choosing)

- 1. I am currently living with mental health issues
- I am currently living with mental health issues although I have overcome some aspects (e.g., you may have mild depression but have recovered from a bout of severe depression)
- 3. I am prone to mental health issues although I am ok at the moment
- 4. I have had mental health issues in the past and feel those days are behind me
- 5. I have not ever had issues with my mental health
- 6. I would prefer not to say

4.3.4.5 Management of symptoms, wellbeing, and influences in recovery

The survey included three questions to investigate the perceived roles of spending time in nature in the management of mental health issues and wellbeing:

Those who indicated current mental health problems (answer 1 or 2 to the mental health issue question detailed above) were asked to rate how helpful they found a list of factors in helping them manage their symptoms and their daily lives. Factors included medication, therapy, exercise, spending time around nature, support from close family, friends, and social media. There was a further text item for respondents to add other type of a support not on the list. For each factor, respondents chose between unhelpful/makes no difference/slightly helpful/very helpful/crucial or n/a.

Respondents who reported they had recovered from all (answers 3 and 4), or some mental health difficulties (answer 2) were asked to indicate how helpful they found the same list of support factors in their *recovery*. Available answers were the same as in the previous paragraph.

Respondents who reported they had never had mental health issues or preferred not to say (answers 5 and 6) were asked how helpful they found a list of support factors in contributing to general wellbeing and happiness. The list was similar to the above but did not include medication or therapy, and exercise was separated into indoor, outdoor, and 'Yoga, Pilates, Tai chi or similar'. Available answers were the same as for the above question on recovery factors.

4.3.4.6 Attention and other cognitive functions

Chapter 5 explores attention restoration theory through the survey data. The survey measured attention through a subjective questionnaire (the Attentional Function Index, AFI, Cimprich et al, 2011) and a cognitive task, both of which are described in detail in chapter 5.

4.3.4.7 Demographics

Demographics were collected including gender, age category, employment, education. In addition, participants were asked two nature related demographic questions: How close they lived to accessible 'green spaces' for example a park, nature reserve or woodland. Available responses were more than a mile/10 – 20 minutes' walk/ 5 – 10 minutes' walk/less than 5 minutes/I live surrounded by green space, and how they would describe where they lived. Available responses were Urban – city or large town/Urban small town/semi-rural and rural.

4.3.5 Ethical considerations

Ethical approval was obtained from the University of Essex (Appendix Q, Reference: ETH1819-0238) The main ethical considerations were in respect of the mental health of the participants, some of whom were expected to have mental health issues including a clinical level of PTSD symptoms. It was not anticipated that the nature of the survey would be detrimental to participants, however, links to the MIND website were included in the survey along with a reminder to visit the GP if participants had concerns about their mental health. Should participants wish to stop the survey, all they were required to do was close the browser window. Participants were advised that data from partial completion of the survey may still be used in the analysis. Details of how to request the removal of data were provided.

4.3.6 Planned analysis

4.3.6.1 Analysis comparing veterans and non-veterans

The small number of veteran women in the sample (n = 11) meant that analyses of responses from this group was likely to be too underpowered to find significant differences. Therefore, where analysis involved comparing veterans and non-veterans, it was decided not to compare veteran men, veteran women, non-veteran men, and non-veteran women in the first instance. Instead, the analysis plan was to first conduct Mann-Whitney U tests comparing all veterans and all non-veterans for each dependant variable. Then, because veterans were 89.3% men, a second Mann-Whitney U for each variable was carried out between all men and all women in the sample to assess whether results of the first Mann-Whitney test may have been reflecting a male/female split. When significant differences were found, a Kruskal Wallis test for dependent variable was carried out with the independent groups being

veteran men, veteran women, non-veteran men, and non-veteran women. This analysis plan was relevant to any analysis requiring Mann-Whitney U test.

4.3.6.2 Treatment of gender responses

Data from all genders was included when either the whole sample was used, or when non-gender-based groups (e.g., veterans) were being examined. When analyses were split according to gender, the onus was to explore whether differences between veterans and non-veterans were due to gender, then, because all veterans in the sample responded as 'male' or 'female', responses from other gender groups (transgender male, gender variant/non-conforming and 'other') were not included in those analyses.

4.3.6.3 Research question 1: Are veterans more connected to nature than nonveterans?

To investigate the first research question, analyses focused the nature connectedness index (NCI), and the single item taken from a different nature connectedness scale (Nisbet & Zelenski, 2013) of 'My ideal vacation spot would be in the wilderness' (the wilderness statement).

Total NCI scores and answers to the wilderness statement were analysed using a Spearman's' Rho to assess how correlated the two measures were. The smaller and weaker the correlation, the more this indicated the NCI scores, and the wilderness statement measure were measuring different elements of nature connectedness

Mann-Whitney U tests were carried out to explore differences between veteran and non-veteran groups for these two dependent variables.

4.3.6.4 Research question 2: Do veterans have a different relationship between nature and their mental health compared to non-veterans?

To explore this question, analyses focused on whether nature-related variables correlated with mental health-related variables in non-veterans compared to veterans. First, however, the mental health of the respondents was explored.

4.3.6.4.1 Mental health of respondents

A Mann Whitney U test was conducted, with stress, happiness, and PTSD symptoms ('mental health variables') as the dependant variables and veterans/non-veterans as the independent variables.

4.3.6.4.2 Correlational analysis

A Spearman's' Rho correlational analysis was conducted for 'nature-related variables' and 'mental health variables' of stress, happiness, and PTSD symptoms with data split between veterans and non-veterans.

The nature-related variables used for this analysis were:

- Nature connectedness (NCI)
- Proximity of accessible green spaces
- How rural/urban respondents lived
- Wilderness statement
- How much respondents agreed with the statement 'Spending time around nature feels like an escape from my problems' ('Escape statement')
- Last green activity (LGA)

All nature-related variables were assigned values in the same direction, so that the higher the value, the closer accessible green spaces, more rural, more likely to

agree with the wilderness statement and escape statement, and the more recent the last green activity.

The Spearman's' Rho was then repeated with data split between men and women to see if results could have reflected nearly all veterans being men and the majority of non-veterans being women.

4.3.6.4.3 Current mental health issues.

A new independent variable was created to distinguish between respondents who reported current mental health problems with those who had none (recovered or who had never had any issues). Data was split according to this variable and a Mann Whitney U test was conducted with the independent variables veterans and nonveterans and dependent variables of nature connectedness, the wilderness statement, escape statement and last green activity.

4.3.6.5 Research Question 3: Is there a difference in green activity behaviour between veterans and non-veterans?

To explore the third research question, Mann Whitney U tests were conducted with independent variables of veterans/non-veterans and dependant variables of the frequency of each green activity (presented as a list of fourteen suggested activities, including, for example, running, dog walking, fishing).

Due to most veteran respondents being men, and most non-veterans being women, the Mann Whitney U tests were repeated with independent variables of men/women.

4.3.6.5.1 Comparing last green activity (LGA) between veterans and nonveterans

A further Mann Whitney U test was carried out with independent variables veterans/non-veterans and dependant variable last green activity (LGA was also used in the correlational analysis exploring research question 2).

4.3.6.6 Research question 4: Do veterans attribute spending time in nature as more important than non-veterans in managing their mental health?

The survey presented three aspects of mental health management:

- Wellbeing factors (WBF) for respondents who reported no mental health issues or who preferred not to say,
- Recovery factors (RF) for respondents who had recovered or partially recovered mental health issues
- Managing symptoms factors (MSF) for respondents who reported current mental health issues.

N/A responses were converted to missing data.

To explore the research question, Mann Whitney U tests were conducted on each aspect of mental health management (WBF, RF and MSF). The independent variables were veterans and non-veterans, and dependant variables were the helpfulness attributed to factors under each heading.

4.4 Results

4.4.1 Description of the sample

There were 623 responses to the survey. 121 (19.4%) were discarded as they were less than 40% completed, leaving a total of 502 respondents who had completed

more than 40% of the survey. A 40% completion rate was chosen because it resulted in responses to at least question 4.1, therefore including demographics and nature connectedness data, and enabling the first hypothesis to be explored. The 502 responses consisted of 224 (44.6%) male, 271 (54%) female, two (0.4%) transgender male, and three (0.6%) people who identified as nonbinary.

4.4.1.1 Nature-related demographics

Of the total respondents, 319 (63.6%) lived in an urban environment, and 183 (36.4%) in a semi-rural or rural area. Only 21 (4.2%) respondents lived more than a mile away from accessible green spaces, with 299 (59.5%) living less than a 5 minutes' walk away from green spaces. Examples of green spaces given were a park, nature reserve, woodland, fields with public footpaths etc.



а

b



4.4.1.2 Veteran split

According to the formal definition of military veterans in the UK, veterans were defined as having served for at least one day in Her Majesty's Armed forces, either regular or reserve (Burdett et al., 2013). Question 1.5 asked 'Have you ever served in the military?' There were 96 respondents who selected 'I am a military veteran' as

their response. Seven respondents selected 'other' and stated they had been in the military reserves so were also categorised as military veterans. The total number of military veterans in the sample after this adjustment was 103 (20.5%) with 399 non-veterans (79.5%). Of the 103 veterans, 92 (89.3%) were male, and 11 (10.7%) were female, which reflected the current British Armed Forces gender statistics of 11% female (Ministry of Defence, 2021b). No veterans selected any other gender category.

4.4.2 Descriptive statistics

Descriptive statistics for the main dependent variables by veterans / non-veterans

and by gender are shown in table 15.

		Military background				Gender									
		Veteran	S	No	on-vetera	ins		Male			Female	9		Other	а
Variable	n	Median	IQR	n	Median	IQR	n	Median	IQR	n	Median	IQR	n	Median	IQR
Perceived stress score	98	7	6	381	7	5	215	7	5	258	7	4	6	11.5	5.25
Depressions/Happiness score	98	11	6	379	12	7	214	11	6.25	257	12	7	6	8.5	9.5
PCL-5 Score (PTSD symptoms)	91	32	37	352	17.5	28	200	20	34.75	238	18.5	28.25	5	42	22
Nature connectedness score	98	65	31	381	64	40	224	60.5	37	271	67	36	7	59	67
Green space proximity	98	4	2	381	4	1	224	4	1	271	4	1	7	3	1
Place of residence	98	3	1	381	2	2	224	2	2	271	2	2	7	1	1
ldeal vacation in wilderness	98	6	2	381	5	3	224	5	2	271	5	2	7	5	4
Nature as escape from problems	98	4	2	381	4	1	224	4	1	271	4	1	7	4	2
Last Green activity	91	4	2	343	4	2	196	4	2	233	4	2	5	4	3

Table 15 Medians and IQR for dependant variables

Note: ^a includes participants who selected transgender male, nonbinary or other

Table 16 below shows the reported mental health status of veterans and nonveterans. The median mental health status for veterans was 'I am currently living with mental health issues although I have overcome some aspects' and for nonveterans was 'I have had mental health issues in the past and feel those days are behind me'. Results showed 15.5% of veterans and 29.6% of non-veterans reported never having mental health issues.

	Military background			Gender						
	Veterans		Non-veterans		Male		Female		Other ^a	
Median	:	2	4		4		3		2	
IQR	3		3		3.75		3		2	
	n	%	n	%	n	%	n	%	n	%
1 Current mental health issues	21	20.4	56	14	40	17.9	35	12.9	2	28.6
2 Current mental health issues but improved	23	22.3	56	14	31	13.8	46	17.0	2	28.6
3 Recovered but prone to MH issues	6	5.8	57	14.3	23	10.3	38	14.0	2	28.6
4 Recovered from MH issues	26	25.2	68	17	46	20.5	48	17.7	0	0.0
5 Never had MH issues	16	15.5	118	29.6	58	25.9	76	28.0	0	0.0
6 Preferred not to say or missing	11	10.7	44	11	26	11.6	28	10.3	1	14.3
Total	103	100	399	100	224	100	271	100	7	100

Table 16 Mental health status of respondents

Note: ^a includes participants who selected transgender male, nonbinary or other

4.4.3 Test of normal distribution.

Data from scales used in the study (NCI, Depression/Happiness scale, PSS, and PCL-5) were tested for normal distribution using a Komogorov-Smirnov test. This revealed all tests to be highly significant (ps < .001), suggesting data was not normally distributed, although kurtosis and skewness were all between -1 and +1. Histograms showed data deviated from normal distribution, with the exception the PSS which was normally distributed. In particular, the NCI showed many respondents (13.5%) scoring a maximum of 100, and PCL-5 scores were positively skewed. The depression/happiness scale was negatively skewed. Samples of the

histograms and results of normality tests are shown in appendix R. Due to data not being normally distributed, non-parametric tests were used in the analysis.

4.4.4 Reliability of scales

The reliability of scales for the survey sample was calculated using Cronbach's alpha. All showed good reliability (table 17)

Scale	Items	Cronbach's alpha
Perceived stress scale	4	.819
Depressions/Happiness scale	6	.885
PCL-5 (PTSD symptoms)	20	.963
Nature connectedness index	6	.873

Table 17 Reliability of scales

4.4.5 Research question 1: Are veterans more connected to nature than non-veterans?

4.4.5.1 Nature connectedness index

A Mann-Whitney U test for NCI scores between veteran and non-veteran groups found no difference between veterans and non-veterans (p > .05). As per the planned analysis (section...) a further Mann Whitney U test with men/women as the independent group found women scored significantly higher on the NCI than men (U = 33,929, z = 2.261, p = .024, r = 0 .10).

To investigate this further, a Kruskal Wallis test was run with the independent groups being male veterans, female veterans, male non-veterans, female non-veterans. No significant differences between the four groups in NCI were found (ps > .05).

4.4.5.2 The wilderness statement

A Mann-Whitney U test comparing veteran and non-veteran scores on the wilderness statement found veterans were significantly more likely than non-veterans to agree their ideal vacation spot was in the wilderness, with a small to medium effect size (U = 27,211, z = 5.18, p = .000, $r_s = 0.23$).

A further Mann-Whitney U test revealed that men were significantly more likely to agree their ideal vacation would be in the wilderness than women with a small effect size (U = 27,016, z = -2.150, p = .032, $r_s = 0$.10). Therefore, the significant difference between veterans and non-veterans in the wilderness statement, may have reflected most veterans (89.3%) being men.

To investigate this further, a Kruskal Wallis test for the wilderness statement was carried out with the independent groups being male veterans, female veterans, male non-veterans, female non-veterans. There was a main effect of the wilderness statement showing a significant difference between the four groups (H (3) = 26.961, p < 0.001). Pairwise comparisons showed male veterans were significantly more likely to agree with the statement than male non-veterans and female non-veterans (table 18).

	n	Z	r
Veteran male to veteran female	103	-0.154	-0.015
Veteran male to non-veteran male	224	-4.289	-0.287 **
Veteran male to non-veteran female	352	-4.635	-0.247 **
Veteran female to non-veteran female	271	-1.985	-0.121
Veteran female to non-veteran male	143	-2.012	-0.168
Non-veteran male to non-veteran female	392	-0.19	-0.010

Table 18 Pairwise comparisons for the wilderness statement

4.4.5.3 Summary research question 1.

There was no difference between veterans and non-veterans in nature connectedness as measured with the NCI. Women were significantly more connected to nature than men with a small effect size, although when comparing the four groups (male veterans/female veterans/male non-veterans/female nonveterans), no significant differences were found between them. Overall, results suggest that veterans are not more connected to nature than non-veterans.

In relation to the wilderness statement, veterans were significantly more likely to say their ideal vacation would be in the wilderness than non-veterans. This was supported by pair wise comparisons that showed veteran men were significantly more likely to agree with the statement than non-veteran men and women. The small size of the veteran women group means that results for this group may be due to being underpowered. The largest effect size was for veterans/non-veteran comparisons.

4.4.6 Research question 2: Do veterans have a different relationship between nature and their mental health compared to non-veterans?

4.4.6.1 Mental health of the sample

A Mann Whitney U test revealed there was no significant differences between veterans and non-veterans in stress or happiness (ps > .05). Veterans did, however, have significantly higher PCL-5 scores than non-veterans (U = 20,087, z = 3.74, p < .001, r = 0.18).

As per planned analysis, a further Mann Whitney U test for mental health measures with the independent variables as men/women was conducted and showed no significant differences between men and women for stress, happiness or PTSD symptoms were found (ps > .05).

Of the 352 non-veteran respondents and 91 veterans who filled out the PCL5, 25.3% (n = 101) of non-veterans scored over the probable threshold for PTSD, compared to 42.7% (n = 44) of the veterans. The median (IQR) PCL-5 score for veterans was 32 (37), one mark off the threshold for probable PTSD, and for non-veterans was 17.5 (28).

4.4.6.2 Correlational analysis

A Spearman's' Rho correlational analysis was conducted for nature measures and mental health measures with data split between veterans and non-veterans (table 19).

	Variable	n	1.	2.	3.	4.	5.	6.	7.	8.	9.
Military veteran	1. Perceived stress score	98	-								
	2. Depression Happiness score	98	777**	-							
	3. PCL5 Score (PTSD symptoms)	91	.641**	633**	-						
	4. Nature connectedness score	98	-0.03	0.002	0.081	-					
	5. Green space proximity	98	-0.078	0.083	-0.041	.200*	-				
	6. Place of residence	98	-0.033	-0.016	-0.034	0.189	.582**	-			
	7. Ideal vacation in wilderness	98	0.032	-0.107	.218*	.471**	0.051	0.026	-		
	8. Nature as escape from problems	98	0.17	216*	.357**	.411**	0.068	0.084	.359**	-	
	9. Last Green activity	91	-0.095	.211*	-0.123	0.134	.377**	.347**	-0.08	0.07	-
Non military veteran	1. Perceived stress score	381	-								
	2. Depression Happiness score	379	735**	-							
	3. PCL5 Score (PTSD symptoms)	352	.690**	655**	-						
	4. Nature connectedness score	381	138**	.169**	-0.025	-					
	5. Green space proximity	381	136**	.180**	113*	.123*	-				
	6. Place of residence	381	-0.067	0.055	-0.026	0.072	.441**	-			
	7. Ideal vacation in wilderness	381	0.055	-0.033	.153**	.475**	0.08	0.015	-		
	8. Nature as escape from problems	381	0.073	-0.039	.115*	.337**	-0.01	0.051	.262**	-	
	9. Last Green activity	343	131*	.172**	145**	.182**	0.085	.127*	.149**	0.05	-

Table 19 Correlations for mental health scales and nature measures

Note. * p< 0.05 ** p< 0.01

4.4.6.2.1 Nature connectedness and mental health

In veterans, nature connectedness was not associated with either happiness, stress, or PTSD symptom severity (ps >.05). In non-veterans, nature connectedness was positively correlated with happiness (r_s (377) = .180, p = .001) and negatively correlated with perceived stress (r_s (379) = -.138, p = .007), suggesting those more connected to nature, were happier and less stressed. There was no association between nature connectedness and PTSD symptom severity (p > 0.05)

A subsequent Spearman's' Rho test that split whole sample data between male and female participants found no association between nature connectedness and happiness, stress, or PTSD symptoms severity in men (ps > .05). In women, higher nature connectedness was associated with more happiness (r_s (255) = .186, p = .003) and less stress (r_s (256) = -.155, p = .013) but not PTSD symptoms severity (p > 0.05).

4.4.6.2.2 Proximity to green spaces and mental health

For veterans, there was no association between living closer to green spaces and happiness, stress, or PTSD symptoms (ps > .05). In non-veterans, living closer to green spaces was positively associated with happiness (rs (377) = .180, p < .001) and negatively associated with stress (rs (379) = -.136, p = .008) and PTSD symptoms (r_s (350) = -.113, p = .34).

A subsequent Spearman's' Rho test that split data between men and women showed that there was no association in men between living closer to green spaces and happiness, stress, or PTSD symptoms (ps > .05). However, women who lived closer to green spaces were significantly happier (r_s (255) = .202, p = .001) and less stressed (r_s (256) = .178, p = .004) but there was no association with PTSD symptoms (p > .05).

4.4.6.2.3 Urban and rural living and mental health

There was no association between how rural or urban respondents' place of residence was and any mental health measure for either veterans or non-veterans. There was also no association between urban living and mental health when the sample was split between men and women.

4.4.6.2.4 Ideal vacation spot in the wilderness (wilderness statement) and mental health

There was no association between the wilderness statement and happiness or stress for veterans or non-veterans (ps > .05).People with higher PTSD symptom severity were more likely to agree that their ideal vacation spot would be in the wilderness in both veterans (r_s (89) = .218, p = .038) and non-veterans (r_s (350) = .153, p = .004) with a small effect size.

Subsequent Spearman's' Rho tests showed that PTSD symptom severity in both men and women was correlated with the wilderness statement (r_s (198) = .230 ,p = .001; r_s (236) = .189, p = .003) although the effect size was small.

4.4.6.2.5 Seeing nature as an escape from problems (Escape statement) and mental health

In veterans, there was a negative correlation between happiness and seeing time in nature as an escape (r_s (96) = -.216, p = .032). There was no such association in non-veterans (p > .05).

A subsequent Spearman's' Rho test that split data by men/women, showed a weak negative correlation between seeing nature as an escape and happiness in men (r_s (212) = -.154, p = .024) but not women p > .05). There was also a positive correlation between PTSD symptom severity and seeing nature as an escape from problems for both men (r_s (200) = .206, p = .003) and women (r_s (257) = .151, p = .020).

There was no association between seeing nature as an escape and stress for veterans or non-veterans.

In veterans there was a moderate association between PTSD symptoms and seeing spending time in nature as an escape (r_s (89) = .357, p = .001). In non-veterans, this association was significant but weaker (r_s (350)= .115, p = .031).

4.4.6.2.6 Last green activity (LGA) and mental health

Spearman's' Rho tests found both veterans and non-veterans were significantly happier the more recent their last green activity (r_s (89) = .211, p = .045; r_s (339) = .172, p = .001 respectively).

A subsequent test splitting data between men/women found that both men (r_s (193) = .174, p = .015) and women (r_s (230) = .185, p = .005) were happier the more recent their last green activity.

A Spearman's' Rho test, splitting data between veterans and non-veterans, showed non-veterans were less stressed the more recent their last green activity (r_s (341) = -.131, p = .015) but this result was not found in veterans (r_s (91) = .095, p > .05). When the data were split between men and women, men were significantly less stressed the more recent their last green activity (r_s (194) = -.147, p = .04), but there was no similar significant relationship for women.

These findings indicated a different pattern of relationship between last green activity and mental health for male veterans and non -veterans. To clarify this, a further Spearman's' Rho test splitting data four ways, between veteran men/veteran women/non-veteran men/non-veteran women was conducted. This confirmed that non-veteran men were less stressed the more recent their last green activity (r_s (124) = -.253, p = .005) but veteran men and both groups of women were not (ps > .05). For veteran women, these results could have been due to the small size of the group. A Spearman's' Rho test showed a significant negative correlation between last green activity and PTSD symptoms in non-veterans (r_s (324) = -.145, p = .009) but not veterans (r_s (91) = -.163, p > .05).

A follow-up Spearman's' Rho test, split between men and women, showed neither had significantly different PTSD symptoms associated with the recency of their last green activity (ps > .05).

To clarify the above finding, a further Spearman's' Rho further splitting data between veteran men/veteran women/non-veteran men/non-veteran women was conducted. This showed non-veteran men and non-veteran women had lower PTSD symptoms the more recent their last green activity (r (124) = -.252, p = .006; r (228) = -.151, p = .022 respectively). Men and women veterans showed no such association (ps > .05).

4.4.6.2.7 Current mental health issues.

A Mann Whitney U test was conducted with dependent variables of nature connectedness, the wilderness statement, escape statement and last green activity (nature variables). Independent variables were veterans and non-veterans. Data were split between those who reported current mental health problems and those who did not.

Results showed that in respondents with current mental health problems (n = 156), there was a significant difference between veterans and non-veterans, with veterans more likely to have done more recent green activities (U = 2,461.5, z = 2.150, p = .032, r = 0.18), see time spent in natural surroundings as being an escape from problems (U = 3,044.5, z = 2.397, p = .017, r = 0.19) and to agree their ideal vacation would be in the wilderness (U = 3,188.5, z = 2.922, p = .003, r = 0.24).

There was no difference in nature connectedness between veterans and nonveterans in those with current mental health problems.

For respondents with no reported mental health issues (n = 291), veterans were significantly more likely than non-veterans to agree their ideal vacation would be in the wilderness (U = 11,117.5, z = 3.866, p < .001, r = 0 .21 respectively), but there were no differences in the other nature variables between veterans and non-veterans.

The analysis was repeated with men/women as the independent variable. In respondents with mental health problems there was no significant differences between men and women in any of the nature variables (ps > .05). In respondents with no mental health issues the only difference was in nature connectedness, where women were significantly more connected to nature than men, although this had a small effect size. (U = 16,934, z = 2.632, p = .008, r = 0 .14).

4.4.6.3 Summary research question 2

Results suggest veterans' connectedness to nature was not linked to happiness, stress, or PTSD symptom severity, but this may have been related to the majority of veterans in the sample being men. Men's mental health was not associated with nature connectedness, but women's was.

Participants with higher PTSD symptoms were more likely to see spending holidays in the wilderness as more ideal than those with lower PTSD symptoms, irrespective of being a veteran, non-veteran, man, or woman.

People with higher PTSD symptoms were also more likely to see time spent in nature as an escape from problems. The strongest effect was in veterans. Veterans

were more likely to see nature as an escape from problems when they were less happy but in non-veterans, there was no association between happiness and seeing nature as an escape from problems.

Veterans were not happier or less stressed the closer they lived to green spaces, but non-veterans were. However, these findings may have reflected the split of men to women in the sample rather than being related to military background, as women were found to be happier and less stressed the closer, they lived to green spaces, but not men.

There was a significant, but weak correlation between last green activity and happiness for veterans, non-veterans, men, and women, suggesting people who report being happier had done more recent green activities.

Veterans showed no association between their last green activity and PTSD symptoms, but non-veterans (men and women) showed lower PTSD symptoms with more recent green activities. Lower stress was only associated with more green activities in non-veteran men. Veteran men and women (both veteran and non-veteran) showed no association between their last green activities and stress.

In respondents who declared current mental health issues, veterans were more likely than non-veterans to see nature as an escape from problems and have taken part in more recent green activities.

4.4.7 Research question 3: Is there a difference in green activity behaviour between veterans and non-veterans?

Results showed that veterans engaged significantly more frequently than nonveterans in the following green activities: walking (U = 23,258, z = 3.024, p = .002, r = 0 .137), dog walking (U = 22,727.50, z = 3.564, p < .001, r = 0 .162), fishing (U = 24,800, z = 8.228, p < .001, r = 0 .377), and 'other' green activities (U = 5,655, z = 2.036, p = .042, r = 0.130) (Figures 11 a – c). There were no activities non-veterans engaged in more frequently than veterans. Frequencies of all other listed green activities were not significantly different between veterans and non-veterans.





Due to most veteran respondents being men, and most non-veterans being women, further Mann Whitney U tests were conducted for the listed green activities with men/women between groups. Results showed that men across the whole sample reported statistically more frequent running (U = 23,673.50 z = -3.066, p = .002, r = 0 .141), cycling (U = 21,465 z = -4.458, p < 0.001, r = 0 .206), fishing (U = 21,187.50 z = -6.837, p < .001, r = 0 .315), sports such as football (U = 23,403.50 z = -4.281, p < .001, r = 0 .198) and golf (U = 23,633.00 z = -5.020, p < .001, r = 0 .231). All other activities were not significantly different between men and women (ps > .05). There was no significant difference between men and women participants for recency of last green activity

4.4.7.1 Last green activity (LGA) in veterans and non-veterans

A Mann Whitney U test revealed veterans reported significantly more recent green activity than non-veterans, with a very small effect size (U = 20,524.50, z = 2.021, p = .043, r = 0 .093).



Figure 12 Last green activities for veterans and non-veterans

4.4.7.1.1 Summary of research question 3

These results suggest that veterans reported statistically more frequent walking and dog walking than non-veterans and were more likely to have done more recent green activities. Although veterans also showed statistically more frequent fishing than non-

veterans, it is likely this difference was due to men being more likely to do more

frequent fishing than women.

4.4.8 Research question 4: Do veterans attribute spending time in nature as more important than non-veterans in managing their mental health?

A summary of significant differences between veterans and non-veterans is shown in table 20.

Items shown	Wellbeing factors	Recovery factors	Managing symptoms factors
Medication		\checkmark	\checkmark
Therapy		\checkmark	\checkmark *
Social support - family and/or partner	\checkmark	\checkmark	\checkmark
Social support - close friends	\checkmark	\checkmark	\checkmark
Spending time around nature (green activities)	\checkmark	√ **	✓ **
Support from peer group (e.g from a club or society you attend, or sports team you belong to)	√ *	\checkmark	\checkmark
Support through contact on social media (e.g., Facebook, Twitter etc)	\checkmark	√ *	\checkmark
Support from a charity		√ **	√ **
Meditation or deep breathing techniques (including through apps such as Calm and Headspace)	\checkmark	\checkmark	\checkmark
Exercise		\checkmark	\checkmark
Telephone helpline (e.g. Samaritans) or online help		\checkmark	\checkmark
Self help books, websites or YouTube videos	√ * a	\checkmark	\checkmark
Spending time with pets/animals	\checkmark	√ *	\checkmark
Yoga, Pilates, Tai chi or similar	√ * a		
Indoor exercise	\checkmark		
Outdoor exercise	\checkmark		
Other	\checkmark		

Table 20 Mental health management factors for veterans and non-veterans

Note. The table shows items shown to respondents, depending on reported mental heath status. * p < .05 ** p < .01

^a Non-veterans reported more helpful than veterans, All other significant results show factors found more helpful by veterans than non-veterans

4.4.8.1 Wellbeing factors

For wellbeing factors (WBF), Mann Whitney U test revealed veterans found 'support from peer groups' significantly more helpful than non-veterans (U = 3,558.50 z = 2.240, p = .025, r = 0 .161). There were two wellbeing factors that veterans found significantly less helpful than non-veterans: 'Self-help books, websites or YouTube videos' (U = 749.00 z = -2.625, p = .009, r = -0 .220) and 'Yoga, Pilates, Tai chi or similar' (U = 526.5 z = -4.464 p < .0001, r = -0 .377). There were no other differences in other wellbeing factors (ps > .05).

To investigate whether these differences may have reflected that veterans were almost all men, the Mann Whitney U tests were repeated with men/women as the independent group across the whole sample. Results showed two factors that women found more helpful than men: 'Social support from close friends' (U = 11,369.50 z = 2.485 p = .013, r = 0.148) and 'Yoga, Pilates, Tai Chi or similar' (U = 2,723.00, z = 2723.00, p = .05, r = .237). There were no other significant differences between men and women (ps > .05).





Slightly

helpful

Verv

helpful

■Non-Veterans n = 157

Crucial

No

difference

4.4.8.2 Recovery Factors

10 0

С

Unhelpful

Veterans n = 37

Mann Whitney U tests revealed that helpfulness of recovery factors significantly differed between veterans and non-veterans for four items. Veterans found 'time spent around nature' (U = 4,466, z = 2.587, p = .010, r = 0 .182), 'time spent with pets/animals' (U = 2,857.00, z = 2.261, p = .024, r = 0 .176), 'support through social media' (U = 1,977.50, z = 2.185, p = .029, r = 0 .195) and 'support through charities (U = 411.00, z = 2.257 p = .024, r = 0 .320) all more helpful than non-veterans did.

Mann Whitney tests with men/women as the between groups factor showed no significant difference in any of the recovery factors (all ps> .05) suggesting findings between veterans and non-veterans was not due to most veterans being men.





Figure 14 Recovery factors with significant differences between veterans and nonveterans

4.4.8.3 Managing symptoms factors

For managing symptoms factors, Mann Whitney U tests showed that spending time in nature was perceived as more helpful in veterans compared to non-veterans, with a medium effect size (U = 2,974, z = 4.727, p <0.00, r = .40), as was support from charities (U = 483.00, z = 2.761, p = 0.006, r = .383). Therapy was also seen as more helpful by veterans although the effect was smaller and only just reached significance (U = 1,285, z = 1.973, p = .049, r = .198). There were no differences between veterans and non-veterans for the other factors (all ps > .05) Across the sample, men were shown to be significantly more likely to find charities helpful than women (U = 210, z = -2.057, p = .040, r = -.288). These results suggest that the significant difference between veterans and non-veterans and non-veterans in finding charities helpful, may have been due to veterans being mainly men.





С

Figure 15 Recovery factors with significant differences between veterans and non-

veterans

4.4.8.4 Summary of research question 4

In respondents who were not currently suffering from mental health problems, veterans attributed more helpfulness to peer groups and charities in managing their general wellbeing than non-veterans, whereas non-veterans found 'Self-help books, websites or YouTube videos', and 'Yoga , Pilates, Tai chi and similar' significantly more helpful than veterans did.

In respondents who had fully or partly recovered from mental health problems veterans attributed more helpfulness in their recovery than non-veterans in time spent in nature, time spent with animals, support through social media and support from charities.

In respondents who were still suffering with mental health issues, veterans found time spent in nature, support from charities, and therapy more helpful than nonveterans in managing their symptoms.

4.5 Discussion

4.5.1 Summary of findings

The purpose of the study was to investigate how the relationship between nature and mental health may differ between military veterans and non-veterans. Findings suggest veterans have a different relationship with nature than non-veterans in some ways but not others. Veterans were not more connected with nature than non-veterans and showed no association between nature connectedness and happiness or stress. Veterans were, however, statistically more likely than non-veterans to agree their ideal vacation would be in the remote wilderness, a question taken from a different nature connectedness scale. There was also evidence that veterans had a different relationship with nature to non-veterans when they were struggling with

mental health issues, but not when they were healthy. They viewed time spent in nature as more important than non-veterans for managing their symptoms and in their recovery from prior mental health issues. Potential reasons for these differences between veterans and non-veterans are discussed in the following sections.

4.5.2 Nature connectedness

Subjective views of a strong connection with the natural environment expressed by veteran participants in earlier chapters did not translate into a greater connectedness to nature than in non-veterans, as measured by the NCI. Veterans' nature connectedness has not previously been researched, thus there is no direct comparison available in literature to date, although results can be compared to literature in other ways to assess whether findings seem realistic. For example, women scored higher on nature connectedness than men in this study, following prior research that has found the same (Richardson et al., 2019; Swami et al., 2016). Men were more likely to agree their ideal vacation would be in the wilderness in this study, which is in line with a study of people staying overnight in wilderness environments in the United States found they were significantly more likely to be men than women (Cole, 2008). Findings in this study mirroring prior findings in this way suggests the measures were working as intended (see below for further discussions of this point).

However, there are also indications that the measures for nature connectedness were not as informative as they could have been. The NCI had been chosen because it has just six items and good internal consistency and reliability (Richardson et al., 2019). Additionally, it contained no spiritual focused questions, such as 'My connection to nature and the environment is a part of my spirituality', found in an alternative scale of the same length (Nisbet & Zelenski, 2013), which it was thought may not have suited the potentially practical, secular nature of some of the veteran respondents (31.4% of servicing personnel report no religion in 2021; Ministry of Defence). However, results showed ceiling effects, with 13.5% of respondents achieving the top score of 100, meaning they had 'completely agreed' with every statement. This phenomenon was also found in the paper in which the measure was developed (Richardson et al., 2019), and was in part dismissed as being due to the measure being designed for both children and adults. However, it does appear the measure failed to capture a sufficient range of nature connectedness to produce normal distribution, with statements perhaps being too general.

The statement 'My ideal vacation spot would be a remote, wilderness area' (the wilderness statement) was a question from the NR-6 (Short form nature relatedness scale; (Nisbet & Zelenski, 2013) and used because interviews in chapter 3 revealed a desire in veteran participants for solitude. Veterans in this study were more likely to agree with the statement than non-veterans. Agreement with the statement was correlated with NCI score. Despite being taken from a scale measuring nature connectedness, as a single question, responses to this statement could represent something other than nature connectedness: for example, social anxiety or avoidant behaviour by seeking solitude to avoid anxiety triggers. Avoidance is a core element of PTSD, and PTSD symptoms were also correlated with the wilderness statement for both veterans and non-veterans. Furthermore, analysis found veterans in the sample were more likely to have PTSD, so there is a possibility the wilderness statement was reflecting avoidance related to PTSD rather than relatedness to

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nature. Further clarification of nature connectedness between veterans and nonveterans in this study therefore requires more research, in which it may be worth considering using different nature connectedness measures than the present study used.

4.5.2.1 Relationship between nature and mental health

Evidence of an association between nature connectedness and wellbeing was found, but for women only. Veterans, and men across the sample who were more connected to nature, were not happier or less stressed than those less connected. This contrasts with prior literature in this area, although this has mainly centred around nature connectedness and happiness. For example, in a meta-analysis that included twenty one studies and thirty non-overlapping data samples, a small significant effect was found between nature connectedness and happiness, with gender not being a moderating factor (Capaldi et al., 2014). Results in the present study, however, suggests no such association may be present for veterans.

Despite nature connectedness not being associated with happiness in men and veterans in the current study, there was a significant, but weak correlation between happiness and last green activity across the whole sample, suggesting green activities may have a short-term effect on happiness for both veterans and non-veterans, irrespective of their nature connectedness.

In relation to stress and nature connectedness in existing literature, there are very few prior studies that have measured both (Bakir-Demir et al., 2021). One found practising mindfulness was more successful in improving wellbeing including stress when conducted in simulated nature environments compared to non-nature environments. However, nature connectedness was not a moderator in this effect
and there were no differences between genders (Choe et al., 2020). In another study, a link was found between nature connectedness, emotional regulation and stress, however, men were excluded from the main analysis due to the small number who took part in the study (Bakir-Demir et al., 2021). This would, then potentially support findings in the present study where women showed an association between stress and nature connectedness, but in men and veterans, the picture is as yet unclear and requires more research.

There was also a difference between veterans and non-veterans between how close they lived to green spaces and mental health. Veterans showed no association between living near accessible green spaces and mental health, but non-veterans did: The closer non-veterans lived to green spaces, the happier, less stressed, and fewer symptoms of PTSD.

Conceptually, spending time in nature has been linked to happiness and wellbeing through theories such as Biophilia (Kellert & Wilson, 1995), and this has been reflected in previous literature that has found people are happier in natural surroundings (MacKerron & Mourato, 2013). Taking results in the present and prior literature, however, it seems such associations may be more prominent in women than in men, or veterans.

4.5.3 Differences in veterans with and without mental health problems

Perhaps the most significant finding in this study was that the relationship with nature for veterans was different depending on whether they were experiencing current mental health issues. Veterans were more likely to see green activities as important in recovering from mental health difficulties and managing symptoms of current mental health problems. This was supported by results showing veterans reporting current mental health problems were more likely to agree that time in nature was an escape from problems than non-veterans, but there was no difference between veterans and non-veterans where there were no current mental health issues reported. Furthermore, the correlation between PTSD symptoms and seeing nature as an escape from problems was stronger and more significant in veterans than non-veterans. Taken together, this suggests that for veterans, time spent around nature provides a positive and significant influence when struggling with mental health, but not when well.

In a prior study, Duvall and Kaplan (2014) used a sample of ninety-eight veterans, of which 46% did not report any mental or physical health problems. They found those who said they had 'infrequent' issues with their mental or physical health showed no significant improvements after a nature-based intervention in their psychological wellbeing, social functioning, or social outlook, whereas veterans with 'frequent' mental or physical health issues showed significant improvement in these measures. This suggests a positive effect of nature on wellbeing in those veterans with worse physical and mental health, providing some support for the subjective findings in the present study.

The mechanisms behind this phenomenon could be similar to the idea of providing respite from PTSD through activities such as surfing, which focuses the mind on the present and prevents traumatic thoughts from dominating (Caddick, Smith, et al., 2015b). Such respite from PTSD symptoms in veterans or indeed from other mental health problems can be achieved through green activities that take place in a non-threatening, natural environment in which veterans typically function well. Another way to look at this would be to view it as a type of avoidant coping through negative

reinforcement, in that seeking another environment away from daily triggers that cause anxiety and exacerbate psychological symptoms is avoidant behaviour, a key element of PTSD.

4.5.4 Green activities as adaptive avoidant coping

Coping is a complex concept (Hofmann & Hay, 2018), although established theories have split coping mechanisms into three types: problem focused, emotion focused, and avoidant focused (Carver et al., 1989; Folkman & Lazarus, 1980). Problem focused coping, in which a person faces problems and concentrates on finding ways to solve problematic issues is viewed as the most positive and adaptive method of coping. Emotional coping relates to efforts to reduce negative emotions such as stress and anxiety and can include positive actions such as meditation and grounding techniques which are largely seen as adaptive. Avoidant (or disengagement) coping involves attempts to escape from the threat and its associated negative emotions (Hofmann & Hay, 2018). It is usually considered a maladaptive coping method; in that it provides temporary positive feelings of relief but is difficult to maintain. For example, avoidance is a core element of PTSD, and involves avoiding external triggers of anxiety such as reminders of traumatic experiences, and internally, for instance, by trying to avoid intrusive thoughts. Although such avoidance can achieve immediate relief from anxiety, it can lead to PTSD sufferers avoiding social situations, becoming increasingly isolated and struggling to leave their homes. Internally, attempts to suppress intrusive thoughts can lead to drug and alcohol abuse (Taylor & Stanton, 2007).

However, it has also been recognised that avoidant coping can be adaptive in certain circumstances, such as during the bereavement process (Shear, 2010) and during

exposure therapy (Hofmann & Hay, 2018). Hofmann and Hay posit that some avoidant coping can be adaptive depending on its purpose. For example, it can assist people having exposure therapy for PTSD to feel more in control of the therapeutic process if they are able to take breaks from directly engaging with their trauma. Equally, avoidant coping can be temporarily adaptive through disengagement, or escape from a situation seen as impossible to control (Hofmann & Hay, 2018), which could be applied to seeking green activities when experiencing mental health problems, and is illustrated by veterans with mental health problems being more likely to agree with the escape statement in this study (Spending time around nature feels like an escape from my problems). Hofmann and Hay (2018) emphasise the importance of the purpose of avoidant behaviour being an indicator of whether it is adaptive and give importance to the role of control. This element of taking control has been found in relation to green activities: In chapter 3, in the theme 'Reconnection through the environment and green activities', as well as other studies (Caddick, Smith, et al., 2015a; Craig et al., 2020; Hyer et al., 1996), where green activities such as fly fishing, surfing and outward-bound activities created feelings of strength through an increased sense of control. It has been proposed that such proactive behaviour is particularly relevant to veterans because it employs a type of masculine stoicism related to military identity: This allows veterans to negotiate their mental health problems through a position of strength by proactively pursuing ways to control them (Caddick, Smith, et al., 2015a).

4.5.5 Overall strengths of the study

The study had several strengths. The method of using an online survey was suitable for collecting relevant data, enabling effective exploration of the research questions, even in a time of a world pandemic. Seemingly, this study is the first to investigate differences between veterans and non-veterans in their relationship between green activities and mental health, establishing base findings for building future research on. The finding that military veterans have a different relationship with nature than non-veterans adds to the literature and shows how veterans are particularly well suited to nature-based interventions for mental health when they are ill.

Another strength of the study was to reveal potential gender differences regarding mental health and nature that were not related to veterans. Interestingly, women's happiness, but not men's, was related to how close they lived to green spaces. Whereas men were significantly less stressed the more recent their last green activity had been, but this was not the case for women. Although not a main focus of this study, such findings pave the way for future research to further investigate gender differences in green exercise and the associated relationship between mental health and nature connectedness.

4.5.6 Limitations

Several limitations can be applied to the design of this study, which could be addressed in future research by using a similar survey with small adjustments. The study could have been improved with a greater sample size, and a shorter survey may have encouraged more participants. Unfortunately, veterans, in particular women veterans, were under-represented in the study. More veterans would have allowed for more analyses between veterans and non-veterans with and without PTSD, and thus would have fitted in better with the main purpose of this thesis. In addition, the small effect sizes of many findings mean results should be viewed with caution and would benefit from further research in this area. A further issue with reporting PTSD was that it was not possible to compare respondents with PTSD, prior PTSD, and no prior PTSD due to the survey design. The survey allowed for reporting current and recovered from PTSD, but not for never having had PTSD. Although a response of 'not applicable' was available, this was not the same as stating they had never had PTSD, and because none of the questions were compulsory, not answering the question could only be taken as missing data. An improvement in future research would be to ensure there was a direct question asking people to state previous and current PTSD status. A further tool to improve data relating to PTSD symptoms would have been the use of 'Criterion A', a supplement question to the PCL-5. 'Criterion A' asks respondents if they have suffered a traumatic experience, and this is a condition of any diagnosis of PTSD. It is possible that on its own, PCL-5 scores could have reflected anxiety or depression without trauma, thus 'Criterion A' would be a useful addition to any future research with similar aims to the present study.

One element of the study that could not have been controlled for was the Covid-19 pandemic. Some of the data were collected during the Covid-19 pandemic lockdown of March 2020. It is possible this may have affected the results in some ways. For example, responses to the effect of the proximity of green spaces may have been different, as one research study spanning nine countries showed access to green or blue spaces during lockdown was beneficial to mental health, compared to people without such access (Pouso et al., 2021).

4.5.7 Implications for future practice

Several aspects of the study findings inform future practice, particularly in terms of providing support to veterans. Data showed that veterans considered charity support

significantly more helpful than non-veterans did, in both recovering from mental health issues and managing symptoms. Finding charities helpful may reflect the volume of veteran charities and the reliance veterans may have on charitable support compared to non-veterans: In this study, 7.5% of non-veteran respondents reported charities as a recovery factor compared to 19.4% of veterans, suggesting charities may be seen as more helpful by veterans because they are used more by them. Veterans have been shown to feel better served by accessing specialist, military-friendly mental health support (Fraser, 2017). In chapter 3, the theme 'Disconnect from society' and subtheme 'Negative civilian identity' illustrated struggles to access adequate support were often underpinned by the veterans feeling they were not understood by non-military clinicians. Perhaps, then, they are more likely to utilise veteran charities than access general mental health support. Non-veterans, however, may be more inclined to seek support through the NHS, and are more likely to go through charities for mental health support for particular types of help, such as domestic abuse, or substance abuse. Furthermore, veterans may be attracted to using veteran charities because they provide access to other veterans. Veterans have been found to consider relationships with veteran peers better than non-military friends and family (Laffaye et al., 2008) and the benefits of peer support have been found in several papers exploring nature-based interventions for groups of veterans (Bennett et al., 2017; Hyer et al., 1996; Mowatt & Bennett, 2011; Poulsen & Stigsdottir, 2015; Rogers et al., 2016). Findings in the present study also support this, with veterans showing peer group support significantly more helpful than non-veterans. Therefore, this study has highlighted the importance of charitable and peer group support for veterans, showing the continuation of such support is crucial in supporting veterans' mental health.

The correlation between PTSD symptom severity and seeing the wilderness as an ideal vacation highlights that wilderness therapy could be beneficial for people with PTSD generally, and not just veterans. The finding also provides support for the growing number of nature-based interventions for veterans with mental health issues such as PTSD. The focus of the study is on the role of nature, but results also show veterans found social media, spending time with animals and charity support were all significantly more important to veterans than non-veterans in recovering from mental health problems. This provides validation for social media support, encouraged alongside some interventions for veterans (Wheeler et al., 2020).

4.5.8 Conclusion

In conclusion, seemingly investigated for the first time, the study provided significant insight into the relationship between nature and mental health in military veterans compared to non-veterans. Although veterans were not more 'nature connected' than non-veterans, results suggest that when they were struggling with their mental health, they saw nature as having an important role in their recovery, or, if still struggling, with helping them manage their symptoms. Additionally, they were more likely to have done more recent green activities, see nature as an escape from their problems and to see being in the wilderness as their ideal holiday. This points to veterans viewing and actively using nature as restorative to their mental health. Although this could be to use natural environments as an escape, suggesting avoidance, or negative reinforcement, together with results from chapters 2 and 3, it could be it is an adaptive form of avoidance that provides strength and an environment they can feel more connected to and in control of. Results also highlighted that veterans viewed charitable support and social media as more

important in helping with mental health than non-veterans and this provides useful practical insight for people supporting veterans with mental health conditions.

Chapter 5 Flanker task study

5.1 Chapter summary

The purpose of this study was to explore whether there was a relationship between attentional function and how recently participants had taken part in a nature-based activity. Data were from 104 survey respondents who chose to carry out an optional computerised task attached to the survey reported in chapter 4. Analyses compared how recently participants had taken part in nature-based activities with performance on the task, along with subjective and objective attentional function using a correlational analysis. No evidence of a correlation between recent nature-based activities and subjective attentional function was found overall. However, for male veterans, there was evidence of a relationship between more recent nature-based activities and quicker performance on the cognitive task.

5.2 Introduction

Attention Restoration Theory (ART) centres on the view that primarily, we have a cognitive response to being in natural environments, whereby they restore previously fatigued directed attention (Kaplan, 1995; Kaplan et al., 1988) and this subsequently improves stress. As discussed in previous chapters, there is a growing body of evidence that spending time in natural environments can indeed result in such benefits (Ohly et al., 2016; Stevenson et al., 2018)

5.2.1 Objective measurements of attention

To objectively measure the conceived benefits of nature proposed by ART, previous research has employed many different computerised cognitive tasks, and no task has yet emerged as the principle objective test for studies investigating attention restoration theory. However, as described in chapter 1, Flanker tasks are used to

test executive attentional function as part of the Attentional Network Test (Fan et al., 2002). Originating in 1974, flanker tasks (Eriksen & Eriksen, 1974) involve participants pressing a key to record the direction of a central target, which is 'flanked' by other distractor stimuli that either face the same (congruent) or different (incongruent) direction to the target. Attentional performance from being able to accurately carry out the task, and more specifically, the amount of distraction that results from the flankers, is assessed through percentage of errors and latency of responses and the difference between congruent and incongruent trials. As such, it can be said to measure the process of directed attention as described by ART (Sahni & Kumar, 2020). To date, flanker tasks have been used in at least two studies measuring the attentional effects of nature, one of which found no improvements in the task in school children after their school grounds were made more nature-orientated (Kelz et al., 2015), and the other found improvements in flanker task performance after participants were shown nature-based audio and video stimuli (Sahni & Kumar, 2020). No research to date has been done with flanker tasks assessing attentional effects of nature in veterans.

5.2.2 Subjective measurement of attention

Subjective measures of attention used in studies investigating attention restoration theory have included the Attentional Function Index (Cimprich et al., 2011). Originally designed to measure changes in cognitive function in cancer patients, the scale has also been used in several other similar research studies with different populations. For example, nature-based activities resulted in significant improvements in AFI scores in patients with clinical depression after horticultural therapy (Gonzalez et al., 2010), and after nature-based interventions in nursing students (Sanders et al., 2005), and military veterans with PTSD (Duvall & Kaplan, 2014). However, no differences in AFI scores were found between groups of students with varying levels of natural environment visible from their dormitory windows (Tennessen & Cimprich, 1995). In chapter three of this thesis, six out of eight (75%) veterans with PTSD showed reliable pre to post improvements in AFI score, and two out of four (50%) in pre-follow up after a seven-night fishing intervention. Thus, the AFI can be seen as an established measure of subjective attentional function suitable for assessing effects of nature-based activities.

5.2.3 The present study

The purpose of this study was to investigate whether there was evidence supporting Attention Restoration Theory at a single time point. This was done by asking respondents to report their recent green activity behaviour, data represented the natural lifestyle of the participants, rather than using controlled conditions. Attentional function was measured objectively through a computerised Flanker task, and subjectively using the AFI.

Due to the exploratory nature of the study, there is no prior research to base an hypothesis on, however, the principal research question was 'Would respondents to the survey who had carried out more recent nature-based activities perform better in the flanker task and score higher on the AFI than people who had done nature-based activities less recently?'. The study also explored whether there was a difference between veterans and non-veterans in any effect found.

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5.3 Method

5.3.1 Design

The study used a correlational design, using variables from the online survey detailed in chapter 4 that related to subjective attentional function and green activity behaviour and the accompanying online cognitive task.

5.3.2 Participants

Participants were respondents to the survey in Chapter 4. At the end of the survey, a link was provided to a title page for the cognitive task with instructions of how to proceed. Out of the 449 survey respondents who completed the survey and thus were shown the task link, 114 (25.06%) carried out the cognitive task.

When the survey and cognitive task were first published, there was an error in the task that meant the options for the task responses on some smartphones did not display correctly. This was reported by two participants and the task was duly corrected. To allow for when this error had created difficulty in completing the task, error rate on congruent trials were examined. Six participants' data were removed because they had error rates of more than 20%, whereas all other participant error rates were 8% or less. Additionally, one participant reported not understanding the task and asked for their task data to be removed. This left data for 107 participants in the task. Of these, three had missing data for the question 'When did you last spend time doing a 'green activity' for at least 10 minutes?', leaving one hundred and four for analysis in the present study.

Twenty participants (19.3%) were veterans and eighty-four (80.77%) were nonveterans. The sample was 46.2% men and 53.8% women, 92.3% were white, and the most common age group was 40-54yrs. Nature related demographic questions showed that 40.4% of participants lived less than five minutes-walk from accessible green spaces and only 1.9% of participants lived more than a mile away. On the day participants completed the study, 29.8% had taken part in a green activity of at least ten minutes. Details are shown in tables 21 and 22.

	,	All	Vete	erans	Non-veterans			
	(n =	104)	(n :	= 20)	(n = 84)			
	n	%	n	%	n	%		
Lives in urban or rural area								
Urban large town or city	37	35.6	6	30	31	36.9		
Urban small town	29	27.9	6	30	23	27.4		
Semi rural	25	24	6	30	19	22.6		
Rural	13	12.5	2	10	11	13.1		
Accessible green spaces								
> mile	2	1.9	2	10	0	0		
10-20mins	12	11.5	1	5	11	13.1		
5-10mins	21	20.2	4	20	17	20.2		
< 5mins	42	40.4	8	40	34	40.5		
Surrounded	27	26	5	25	22	26.2		
Last Green activity								
> month ago	9	8.7	0	0	9	10.7		
> week ago	7	6.7	1	5	6	7.1		
In the last week	35	33.7	8	40	27	32.1		
Yesterday	22	21.2	2	10	20	23.8		
Today	31	29.8	9	45	22	26.2		

Table 21 Nature related demographics

$\begin{array}{ c c c c c c c c c c c c c c c c c c c$			All	Vete	erans	Non-veterans			
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Disability 77 74 9 45 68 81 Two or more impairments / conditions 4 3.8 1 5 3 3.6 Learning difficulty 3 2.9 1 5 2 2.4 Long standing condition e.g. cancer, 4 3.8 1 5 3 3.6 Mental health condition 13 12.5 6 30 7 8.3 Mobility or physical impairment, e.g. wt 1 1 1 5 0 0 Impairment / condition not listed 2 1.9 1 5 1 1.2 Education 1 1 1 5 0 0 0 GCSEs or equivalent 8 7.7 3 15 5 6 A levels or equivalent 10 9.6 3 15 7 8.3 Degree or equivalent 30 28.8 2 10 28 33.3 Masters, PhD or equivalent <td>Prefer not to say</td> <td>1</td> <td>1</td> <td>0</td> <td>0</td> <td>1</td> <td>1.2</td>	Prefer not to say	1	1	0	0	1	1.2		
No disability 77 74 9 45 68 81 Two or more impairments / conditions 4 3.8 1 5 3 3.6 Learning difficulty 3 2.9 1 5 2 2.4 Long standing condition e.g. cancer, 4 3.8 1 5 3 3.6 Mental health condition 13 12.5 6 30 7 8.3 Mobility or physical impairment, e.g. w 1 1 1 5 0 0 Impairment / condition not listed 2 1.9 1 5 1 1.2 Education No formal qualifications 1 1 1 5 0 0 GCSEs or equivalent 8 7.7 3 15 5 6 A levels or equivalent 10 9.6 3 15 7 8.3 Degree or equivalent 30 28.8 2 10 31 36.9 Other	Disability								
Two or more impairments / conditions 4 3.8 1 5 3 3.6 Learning difficulty 3 2.9 1 5 2 2.4 Long standing condition e.g. cancer, 4 3.8 1 5 3 3.6 Mental health condition 13 12.5 6 30 7 8.3 Mobility or physical impairment, eg, w 1 1 1 5 0 0 Impairment / condition not listed 2 1.9 1 5 1 1.2 Education 1 1 1 5 0 0 GCSEs or equivalent 8 7.7 3 15 5 6 A levels or equivalent 17 16.3 5 25 12 14.3 Higher Education 10 9.6 3 15 7 8.3 Degree or equivalent 30 28.8 2 10 21 21.2 Primary employment 5 <td>No disability</td> <td>77</td> <td>74</td> <td>9</td> <td>45</td> <td>68</td> <td>81</td>	No disability	77	74	9	45	68	81		
Learning difficulty 3 2.9 1 5 2 2.4 Long standing condition e.g. cancer, 4 3.8 1 5 3 3.6 Mental health condition 13 12.5 6 30 7 8.3 Mobility or physical impairment, e.g. w 1 1 1 5 0 0 Impairment / condition not listed 2 1.9 1 5 1 1.2 Education 2 1.9 1 5 0 0 0 GCSEs or equivalent 8 7.7 3 15 5 6 A levels or equivalent 17 16.3 5 25 12 14.3 Higher Education 10 9.6 3 15 7 8.3 Degree or equivalent 30 28.8 2 10 28 33.3 Masters, PhD or equivalent 33 31.7 2 10 31 36.9 Other qualification	Two or more impairments / conditions	4	3.8	1	5	3	3.6		
Long standing condition e.g. cancer, 4 3.8 1 5 3 3.6 Mental health condition 13 12.5 6 30 7 8.3 Mobility or physical impairment, eg, w 1 1 1 5 0 0 Impairment / condition not listed 2 1.9 1 5 1 1.2 Education No formal qualifications 1 1 1 5 0 0 GCSEs or equivalent 8 7.7 3 15 5 6 A levels or equivalent 17 16.3 5 25 12 14.3 Higher Education 10 9.6 3 15 7 8.3 Degree or equivalent 30 28.8 2 10 28 33.3 Masters, PhD or equivalent 33 31.7 2 10 31 36.9 Other qualification 5 4.8 4 20 1 1.2 Pri	Learning difficulty	3	2.9	1	5	2	2.4		
Mental health condition 13 12.5 6 30 7 8.3 Mobility or physical impairment, eg, w 1 1 1 5 0 0 Impairment / condition not listed 2 1.9 1 5 1 1.2 Education 1 1 1 5 0 0 Mo formal qualifications 1 1 1 5 0 0 GCSEs or equivalent 8 7.7 3 15 5 6 A levels or equivalent 17 16.3 5 25 12 14.3 Higher Education 10 9.6 3 15 7 8.3 Degree or equivalent 30 28.8 2 10 28 33.3 Masters, PhD or equivalent 33 31.7 2 10 31 36.9 Other qualification 5 4.8 4 20 1 1.2 Primary employment 2 67.3 </td <td>Long standing condition e.g. cancer,</td> <td>4</td> <td>3.8</td> <td>1</td> <td>5</td> <td>3</td> <td>3.6</td>	Long standing condition e.g. cancer,	4	3.8	1	5	3	3.6		
Mobility or physical impairment, eg, w 1 1 1 1 5 0 0 Impairment / condition not listed 2 1.9 1 5 1 1.2 Education 1 1 1 1 5 0 0 GCSEs or equivalent 8 7.7 3 15 5 6 A levels or equivalent 10 9.6 3 15 7 8.3 Degree or equivalent 30 28.8 2 10 28 33.3 Masters, PhD or equivalent 33 31.7 2 10 31 36.9 Other qualification 5 4.8 4 20 1 1.2 Primary employment 2 67.3 12 60 58 69 Full time in education 14 13.5 0 0 14 16.7 Carer, e.g. for children or other relativ 3 2.9 0 0 3 3.6	Mental health condition	13	12.5	6	30	7	8.3		
Impairment / condition not listed 2 1.9 1 5 1 1.2 Education No formal qualifications 1 1 1 5 0 0 GCSEs or equivalent 8 7.7 3 15 5 6 A levels or equivalent 17 16.3 5 25 12 14.3 Higher Education 10 9.6 3 15 7 8.3 Degree or equivalent 30 28.8 2 10 28 33.3 Masters, PhD or equivalent 33 31.7 2 10 31 36.9 Other qualification 5 4.8 4 20 1 1.2 Primary employment Employed full or part time 70 67.3 12 60 58 69 Full time in education 14 13.5 0 0 14 16.7 Carer, e.g. for children or other relativ 3 2.9 0 0 3 3.6 <td>Mobility or physical impairment,eg, w</td> <td>1</td> <td>1</td> <td>1</td> <td>5</td> <td>0</td> <td>0</td>	Mobility or physical impairment,eg, w	1	1	1	5	0	0		
Education No formal qualifications 1 1 1 5 0 0 GCSEs or equivalent 8 7.7 3 15 5 6 A levels or equivalent 17 16.3 5 25 12 14.3 Higher Education 10 9.6 3 15 7 8.3 Degree or equivalent 30 28.8 2 10 28 33.3 Masters, PhD or equivalent 33 31.7 2 10 31 36.9 Other qualification 5 4.8 4 20 1 1.2 Primary employment T F F F F F F Employed full or part time 70 67.3 12 60 58 69 Full time in education 14 13.5 0 0 14 16.7 Carer, e.g. for children or other relativ 3 2.9 0 0 3 3.6	Impairment / condition not listed	2	1.9	1	5	1	1.2		
No formal qualifications 1 1 1 1 5 0 0 GCSEs or equivalent 8 7.7 3 15 5 6 A levels or equivalent 17 16.3 5 25 12 14.3 Higher Education 10 9.6 3 15 7 8.3 Degree or equivalent 30 28.8 2 10 28 33.3 Masters, PhD or equivalent 33 31.7 2 10 31 36.9 Other qualification 5 4.8 4 20 1 1.2 Primary employment 5 67.3 12 60 58 69 Full time in education 14 13.5 0 0 14 16.7 Carer, e.g. for children or other relativ 3 2.9 0 0 3 3.6	Education				-				
Bit CSEs or equivalent 8 7.7 3 15 5 6 A levels or equivalent 17 16.3 5 25 12 14.3 Higher Education 10 9.6 3 15 7 8.3 Degree or equivalent 30 28.8 2 10 28 33.3 Masters, PhD or equivalent 33 31.7 2 10 31 36.9 Other qualification 5 4.8 4 20 1 1.2 Primary employment 5 67.3 12 60 58 69 Full time in education 14 13.5 0 0 14 16.7 Carer, e.g. for children or other relativ 3 2.9 0 0 3 3.6	No formal qualifications	1	1	1	5	0	0		
A levels or equivalent 17 16.3 5 25 12 14.3 Higher Education 10 9.6 3 15 7 8.3 Degree or equivalent 30 28.8 2 10 28 33.3 Masters, PhD or equivalent 33 31.7 2 10 31 36.9 Other qualification 5 4.8 4 20 1 1.2 Primary employment 5 67.3 12 60 58 69 Full time in education 14 13.5 0 0 14 16.7 Carer, e.g. for children or other relativ 3 2.9 0 0 3 3.6	GCSEs or equivalent	8	7.7	3	15	5	6		
Higher Education 10 9.6 3 15 7 8.3 Degree or equivalent 30 28.8 2 10 28 33.3 Masters, PhD or equivalent 33 31.7 2 10 31 36.9 Other qualification 5 4.8 4 20 1 1.2 Primary employment 70 67.3 12 60 58 69 Full time in education 14 13.5 0 0 14 16.7 Carer, e.g. for children or other relativ 3 2.9 0 0 3 3.6	A levels or equivalent	17	16.3	5	25	12	14.3		
Degree or equivalent 30 28.8 2 10 28 33.3 Masters, PhD or equivalent 33 31.7 2 10 31 36.9 Other qualification 5 4.8 4 20 1 1.2 Primary employment 5 67.3 12 60 58 69 Full time in education 14 13.5 0 0 14 16.7 Carer, e.g. for children or other relativ 3 2.9 0 0 3 3.6	Higher Education	10	9.6	3	15	~	8.3		
Masters, PhD or equivalent 33 31.7 2 10 31 36.9 Other qualification 5 4.8 4 20 1 1.2 Primary employment Employed full or part time 70 67.3 12 60 58 69 Full time in education 14 13.5 0 0 14 16.7 Carer, e.g. for children or other relativ 3 2.9 0 0 3 3.6	Degree or equivalent	30	28.8	2	10	28	33.3		
Other qualification54.842011.2Primary employmentEmployed full or part time7067.312605869Full time in education1413.5001416.7Carer, e.g. for children or other relative32.90033.6	Masters, PhD or equivalent	33	31.7	2	10	31	36.9		
Employed full or part time7067.312605869Full time in education1413.5001416.7Carer, e.g. for children or other relative32.90033.6	Other qualification	5	4.8	4	20	1	1.2		
Employed full or part time7067.312605869Full time in education1413.5001416.7Carer, e.g. for children or other relative32.90033.6	Employed full or and time	70	67.0	10	60	50	60		
Full time in education 14 13.5 0 0 14 16.7 Carer, e.g. for children or other relativ 3 2.9 0 0 3 3.6	Employed full of part time	70	07.3	12	60	58	10 7		
Carer, e.g. for children or other relative 3 2.9 U U 3 3.6	Full time in education	14	13.5	0	0	14	16./		
Not in amployment 17 16.9 9 40 0 40.7	Varer, e.g. for children or other relativ	3	2.9	0	40	3	3.6		

Table 22 Participant demographics

Notes ^aOnly gender categories selected are shown

5.3.3 Measures

The following measures in the survey were relevant to the present chapter analysis:

5.3.3.1 Attentional Function Index

The AFI in this study was the original scale detailed in Cimprich et al. (2011) which consists of thirteen statements with three subscales of *effective action*, *attentional lapses*, and *interpersonal effectiveness*. Statements include 'Keeping your mind on what you are doing', 'Doing things that take time and effort' and 'Forgetting to do important things'. The scale asks participants to rate how well they feel they are functioning in various areas of attentional function on a sliding scale of 1 to 100, where 1 is not very well or not at all and 100 is extremely well or a great deal. A full copy of the scale is included within the copy of the survey in Appendix P (different to Appendix H which is the version of the scale used in Chapter 2). The measure has been found to have high internal consistency using Cronbach's alpha ($\alpha = .92$; Cimprich et al., 2011).

5.3.3.2 The Flanker task

To test participants' objective attentional functionality, a cognitive task was included in the survey. To access the task, the participants followed a link to Inquisit 6.2.2 software (copyright Millisecond Software).where the task was accessed. To bypass the task, respondents simply clicked on the next page of the survey.

Flanker tasks involve identifying whether a target character that appears in the centre of the screen is pointing either left or right, whilst ignoring flanker characters that appear alongside the target character which are either pointing the same (congruent) or the opposite (incongruent) way as the target. In the present study, target and flanker characters were pictures of a fish, and the version of the task has

been used in previous studies investigating attentional development in children (Rueda et al., 2004) and stress in older adults (Marshall et al., 2016).

The flanker task was accessed online through Inquisit software Player version 6.2.2 (Millisecond Software, Seattle WA) and lasted approximately 5 minutes. Upon clicking on a link at the end of the survey, participants were directed to a launch screen containing a link to download the Inguisit software. Once the software was downloaded, the participant was directed to press a 'Start' button on the launch screen. The task consisted of a series of trials where a stimulus consisting of a horizontal row of five fish appeared in the centre of the screen. Participants were instructed to focus on the central fish, and to record whether it was facing to the right or left, as guickly as possible. On a computer keyboard the M key was used for right and C for left: On a touchscreen, keys appeared on the bottom right or left of the screen. The two fish on either side of the central fish were either facing the same way as the central fish (congruent trial) or the opposite way (incongruent trial). Participants did two practice blocks before the main block. The practice blocks were six trials each. The first showed single fish at a time in the centre of the screen for a maximum of 3000ms: Three faced left and three faced right, presented randomly. The second practice block included six trials of a row of five fish, two each of congruent left, congruent right, incongruent left, incongruent right. The main experimental block consisted of 120 trials, with a 20 second break after 60 trials. The size of the fish images was 10% of screen size, and 10% of the distance in screen width between flankers. The screen was white during the task, the fish stimuli were yellow and black (Figure 16 a and b).

Fish stimuli for practice and main blocks remained on the screen for a maximum of 3000ms with 1500ms between each trial. If a participant had not responded by 3000ms, an error message stating 'Too slow' appeared on the screen. If a participant responded within 200ms of the stimulus appearing on the screen (an anticipatory error), a message 'Early response' was shown. If the response given was incorrect, 'Wrong response' appeared. All error messages were in arial font, in red on a white screen, 5% of the screen height, and appeared for 1000ms.

When each participant had finished the task, a thank you message was shown with a link to delete the software (Appendix S).



Figure 16a & 16b Screenshots of stimuli as they appeared on screen; a,

congruent trial, b, incongruent trial

Performance on the task was measured for accuracy (through error rate) and speed (through response time for correct responses) for the different conditions (congruent and incongruent). A measure of the distractor effect of the flankers was obtained by subtracting participants' mean response time on congruent tasks from the mean response time on incongruent tasks (Rueda et al., 2005).

5.3.3.3 Nature-based activities

To query how recently participants had spent time in a natural environment, the variable 'Last green activity' (LGA) detailed in Chapter 4 was used in the present study. The options for LGA were '> month ago', '> week ago', 'in the last week', 'yesterday' and 'today', with the values assigned 1 - 5, so that the higher the value, the more recent the green activity.

An additional variable 'Green activity today' (GAT) was created from LGA to distinguish between participants who had taken part in nature-based activities the same day as filling out the survey and those who had taken part in nature-based activities any time beforehand. Labels for this variable were 'Before today' (value 1) and 'Today' (value 2).

5.3.4 Planned analysis

To explore whether respondents to the survey who had carried out more recent nature-based activities had performed better in the flanker task and score higher on the AFI than people who had done nature-based activities less recently a correlational analysis was carried out using Spearman's Rho between participants' last green activity (LGA), 'green activity today' (GAT), their task performance (objective attentional measure) and AFI score (subjective attentional measure). To explore whether there was a difference between veterans and non-veterans, the Spearman's Rho was conducted across the whole sample, and then data were split between veterans and non-veterans and the analysis run again.

Because there was only one female veteran out of 20, a Spearman's rho test was also conducted with data split between men and women. Where significant correlations were found in men and not women, this could indicate any difference in correlational relationships between veterans and non-veterans could have reflected gender differences. To explore this further, and to see if there was a difference between veteran men and non-veteran men, data were split again between veteran men, non-veteran men and non-veteran women. There was only one veteran woman participant, so no analysis was possible.

Data were also examined to see if there were any relationships between living near green spaces and attentional function using a Spearman's Rho.

To explore subjectively measured attentional function in detail, AFI scores were additionally computed for the three subscales of 'Effective action', 'Attentional lapses' and 'Interpersonal effectiveness' in all analysis.

5.4 Results

5.4.1 Test of normal distribution.

To explore whether data were normally distributed, skewness and kurtosis were explored, and a Kolmogorov-Smirnov test was carried out with and without data split between veterans and non-veterans. Results were mixed, with AFI score normally distributed and errors in congruent and incongruent trials not normally distributed for either veterans or non-veterans or the whole sample. Tests of normality and sample histograms for whole sample are shown in appendix T. Due to mix of distribution, non-parametric tests were used for all analyses. Due to AFI scores being normally distributed parametric Pearson's' correlation coefficients were also conducted, but there were no noticeable differences in results. Therefore, for the sake of consistency only Spearman's Rho analyses are presented.

5.4.2 Descriptive statistics

Medians and interquartile ranges are shown in table 23. The median error rate across all trials was .83% in veterans and 1.25% in non-veterans. This was comparable to the percentage error rate for adults of 1.2% in the study that developed the fish flanker scale (Rueda et al., 2004).

		Military b	ackground						
	Vete	rans	Non-ve	eterans	Ma	ale	Fen	nale	
	n =	20	n =	84	n =	48	n = 56		
	Median	IQR	Median	IQR	Median	IQR	Median	IQR	
Last green activity	4.00	2.00	3.50	2.00	3.00	2.00	4.00	1.75	
Green activity today	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.75	
Flanker % errors congruent trials	0.00	0.00	0.00	1.67	0.00	1.25	0.00	1.67	
Flanker % errors incongruent trials	1.67	2.92	1.67	3.33	1.67	3.33	1.67	3.33	
Flanker mean RT congruent trials	542.23	118.25	547.22	227.12	535.24	136.50	580.37	260.16	
Flanker mean RT incongruent trials	574.74	101.38	598.41	268.32	574.74	147.57	616.17	295.05	
Flanker RT mean all trials	558.48	109.34	574.12	262.77	562.00	148.41	595.29	289.63	
Flanker mean error % all trials	0.83	1.67	1.25	3.33	0.83	1.67	1.67	3.33	
Flanker RT incongruent minus congruent trials	41.39	19.25	31.69	44.19	33.03	30.49	34.28	39.90	
AFI score overall	57.69	19.50	62.50	27.32	59.19	22.54	62.42	28.44	
AFI Effective action	65.00	29.68	58.07	31.71	60.71	29.82	59.93	34.68	
AFI Attentional lapses	59.33	45.50	67.33	31.00	67.00	29.17	67.00	37.75	
AFI Interpersonal effectiveness	50.83	31.50	65.33	25.75	61.00	29.58	66.50	29.00	

Table 23 Medians and interquartile ranges

5.4.3 Correlational analysis

A Spearman's Rho test across the whole sample identified no correlations between variables (ps > .05). When split between veterans (table 24) and non-veterans (table 25) the Spearman's Rho showed no correlations between LGA, GAT and other variables for non-veterans (ps > .05). However, in veterans, there was a moderate negative correlation between last green activity and mean RT in the task for congruent stimuli ($r_s = -.471$, p = .036, n = 20), incongruent stimuli ($r_s = -.557$, p = .011, n = 20), and mean congruent and incongruent trials combined ($r_s = -.505$, p = .023, n = 20). This effect was stronger with GAT, which was negatively correlated with mean RT in congruent trials ($r_s = -.601$, p = .005, n = 20), incongruent trials ($r_s = -.688$, p = .001, n = 20), and mean RT for congruent and incongruent trials combined ($r_s = -.636$, p = .003, n = 20). Therefore, the more recent the last green activity, the faster veterans carried out the task. Furthermore, results indicate this effect was stronger when doing the task on the same day as a green activity. However, it should be noted that the variables GAT and LGA were highly correlated as expected, but particularly so in veterans.

n = 20	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Last green activity	-												
2. Green activity today	.938**	-											
3. Flanker % errors congruent trials	0.346	0.208	-										
4. Flanker % errors incongruent trials	-0.271	-0.117	0.134	-									
5. Flanker mean RT congruent trials	471*	619**	-0.198	-0.02	-								
6. Flanker mean RT incongruent trials	557*	692**	-0.219	-0.046	.974**	-							
7. Flanker RT mean all trials	505*	648**	-0.198	-0.026	.989**	.991**	-						
8. Flanker mean error % all trials	-0.165	-0.077	.462*	.920**	-0.027	-0.07	-0.04	-					
9. Flanker RT incongruent minus congruent trials	-0.209	-0.138	0.219	-0.076	-0.111	0.037	-0.003	-0.042	-				
10. AFI score overall	0.096	0.182	0.282	0.286	-0.193	-0.203	-0.202	0.323	-0.137	-			
11. AFI Effective action	-0.052	0.087	0.178	0.298	-0.162	-0.181	-0.173	0.283	-0.086	.880**	-		
12. AFI Attentional lapses	0.167	0.255	0.178	0.083	-0.317	-0.289	-0.32	0.093	0.005	.595**	0.258	-	
13. AFI Interpersonal effectiveness	-0.055	-0.051	0.428*	0.043	-0.102	-0.056	-0.098	0.198	-0.018	.776**	.566**	.627**	-

Table 24 Correlational table showing results of Spearman's Rho test for veterans

Note: * p < .05 ** p < 0.01

n = 84	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Last green activity	-												
2. Green activity today	.788**	-											
3. Flanker % errors congruent trials	0.07	0.176	-										
4. Flanker % errors incongruent trials	0.047	0.137	.399**	-									
5. Flanker mean RT congruent trials	-0.034	-0.057	0.084	-0.112	-								
6. Flanker mean RT incongruent trials	-0.01	-0.044	0.092	-0.094	.977**	-							
7. Flanker RT mean all trials	-0.024	-0.046	0.097	-0.109	.994**	.992**	-						
8. Flanker mean error % all trials	0.078	0.166	.720**	.898**	-0.096	-0.075	-0.086	-					
9. Flanker RT incongruent minus congruent trials	0.099	0.047	-0.002	-0.045	0.132	.313**	.217*	-0.029	-				
10. AFI score overall	0.075	-0.077	-0.061	-0.132	-0.112	-0.095	-0.115	-0.094	0.045	-			
11. AFI Effective action	0.166	-0.021	-0.097	-0.114	-0.1	-0.087	-0.103	-0.099	0.036	.939**	-		
12. AFI Attentional lapses	0.014	-0.123	-0.01	-0.108	-0.142	-0.14	-0.151	-0.066	-0.054	.846**	.707**	-	
13. AFI Interpersonal effectiveness	-0.13	-0.139	0.058	-0.036	-0.112	-0.09	-0.106	0.017	0.071	.730**	.539**	.560**	+ -

Table 25 Correlational table showing results of Spearman's Rho test for non-veterans

Note: * p < .05 ** p < 0.01

A further Spearman's rho test with data split between men and women showed in women (n = 56) there was no association between the last green activity, performance on the task or AFI score. In men (n = 48) there was a significant and weak to moderate positive association between the variable 'green activity today' and percentage of errors on congruent trials ($r_s = .336$, p = .020, n = 48) and mean percentage errors for congruent and incongruent trials combined ($r_s = .315$, p = .029, n = 48). This suggests that men who had taken part in a green activity on the same day as the survey and task made a higher percentage of errors.

When data were split between veteran men (n = 19), non-veteran men (n = 29) and nonveteran women (n = 55) a Spearman's Rho showed there were no significant correlations between LGA or GAT and any attentional measure for non-veteran women (all ps > .05). In non-veteran men, no relationship between performance on the task or AFI and last green activity, but there was a positive correlation between the 'green activities today' variable and percentage of errors in congruent trials ($r_s = .379$, p = .042, n = 29) and incongruent trials ($r_s = .457$, p = .013, n = 29), suggesting they made more errors on the task when they had done green activities on the same day. In contrast, veteran men showed no significant correlations between GAT and errors on the task. Veteran men did, however, show a significant negative correlation between response time on incongruent trials and LGA ($r_s = -.510$, p = .026, n = 19). There was a stronger effect in the GAT variable, which showed a negative correlation between GAT and response time in congruent trials ($r_s = -.564$, p = .012, n = 19), incongruent trials ($r_s = -.662$, p = .002, n = .00219) and overall response time across all trials ($r_s = -.615$, p = .003, n = 19). This suggests veteran men were quicker at the task when they had done nature-based activities on the same day compared to previous days.

There were no significant correlations found between living near green spaces and attentional function for the whole sample or when split between veterans and non-veterans, or men and women (ps > .05).

5.5 Discussion

Contrary to the hypotheses, across the whole sample, results showed no correlation between more recent nature-based activities and increased attentional function, whether measured objectively or subjectively. However, when data were split, veterans were found to be quicker in the flanker task the more recently they had taken part in nature-based activities. This was not evident in non-veterans. Interestingly, results showed non-veteran men were less accurate on the task when they had engaged in green activities on the same day when compared to previous days.

5.5.1 Differences between veterans and non-veterans

Similar to the findings in Chapter 4, the results of this study suggest veterans may have a different response to nature-based activities than non-veterans. Where Chapter 4 found veterans had a different relationship with nature and their mental health than non-veterans, the current study suggests they may also have a different cognitive response to nature. This has not been explored in prior research, and veterans have largely been absent in previous studies investigating changes in attention after exposure to nature, as posited by ART. There are two exceptions to this, both of which explored psychological wellbeing and subjectively measured attention after nature-based interventions (Duvall & Kaplan, 2014; Vella et al., 2013). However, they did not include a non-veteran control group for comparison.

5.5.2 Objectively measured attentional restoration

The present study found mixed support for attention restoration after recent green activities when measured objectively through the flanker task. Whilst veteran men performed faster in the task when they had done nature-based activity on the same day, non-veteran men were less accurate, and there were no statistically significant findings in women. In some ways, these results reflect the current mixed results found in the literature: Although there is a growing number of studies showing improvements in attentional function after nature-based activities, there are also plenty that have found no such improvements. Two systematic reviews found mixed results from studies, and posited a reason for this could be the varied nature of the studies to date, which have used a broad spectrum of cognitive tasks, definitions of directed attention, type and duration of exposure to nature and statistical methods (Ohly et al., 2016; Stevenson et al., 2018).

Most studies in the reviews, however, adopted either a repeated measures design, comparing attention before and after nature-based activities or between group design, comparing a group doing a nature-based activity with a control group. Only a handful used existing, naturally occurring conditions like the present cross-sectional study and these all focused on how close participants lived to nature rather than on green activities. For example, Kuo and Sullivan explored aggression and attentional function in women who were inner city residents of Chicago (2001). They used the Digit Span Backwards (DSB) task to measure attention in 145 women who lived in architecturally identical apartment blocks, where some had areas of 'nature' in sight of the apartments, and some were in 'barren' locations. They also measured aggression through questionnaires and individual interviews. Women in the 'green condition' performed significantly better on the DSB task and reported less aggression than those in the 'barren' condition. This contrasts with the present study, where no relationship was found between how near participants lived to nature and objectively measured attention. This was the case for the whole sample as well when split between veterans and non-veterans, and women and men. There are several differences in the studies, for instance they used different tasks, and the sample characteristics were very different between the studies: Participants in Kuo and Sullivan

(2001) all lived in the inner city. They were predominantly poor African American women, mainly single mothers, who had finished their education with high school diplomas. In the present study, only 35.6% of participants lived in large towns or cities, and participants were predominantly white and educated to degree level. Only 1.9% of participants in the present study lived more than a mile away from green spaces. It could be that as a sample they were generally more nature orientated and thus differences were less evident, and maybe a larger, less skewed sample would have identified significant relationships. More research is required to establish how much these differences may have made to the results.

In another study that measured the effects of living near nature using objectively measured tasks, Taylor et al. (2002) found girls, but not boys, were more self-disciplined and had better concentration when they lived nearer nature. They used a battery of cognitive tasks, which they separated into domains of inhibitory control (four tasks including a Stroop task) and concentration (three tasks including Digit Span Backwards test) and compared data using the average z-scores across tasks in each domain. Girls scored significantly better on concentration and inhibitory control measures the nearer they lived to nature, but boys did not. Although the present study found no relationships between how far participants lived from nature and attention, we did find gender differences in respect of attention and last green activity. However, in this case, women showed no significant relationship between performance on the task and their last green activity, but men did, albeit differently depending on whether they were veterans or not. One reason given for the results in Taylor et al. (2002), was that boys may have played further away from homes than girls and thus were less affected by the amount of nature near where they lived. In the present study, because it measured last green activity as well as how closely people lived to nature, this eliminates this issue, and results showed it was the green activity, not the location of green spaces that was more relevant.

Tennessen and Cimprich (1995) investigated attentional function in a group of seventyfour undergraduates with different levels of 'naturalness' in the views from their dormitory windows. They used four objective measures of attention: The Digit Span Backwards, digit span forwards, Necker cube pattern control (NCPC) task and the symbol digit modalities test (SDMT). Unlike Kuo and Sullivan (2001), there was no significant relationship with between dormitory view and performance on the Digit Span Backwards, or forwards task, but those with more natural views performed significantly better than those with less natural views on the NCPC and SDMT, indicating better attentional focus on some measures. Results then, of these three prior cross-sectional studies and the present study, show mixed results and indicate more cross-sectional research is required to investigate correlations between nature and attentional function.

5.5.3 Subjective attentional measures

The lack of evidence for an association between nature-based activities and subjective attentional function using the AFI found in the present study, has been reported in prior literature. Although Tennessen and Cimprich (1995) found some evidence of a link between the naturalness of dormitory views and objectively measured attention (as detailed above), there was no such link with subjective measures, using the AFI. However, in a study with veterans that also used the AFI, Duvall and Kaplan (2014) found evidence of an improvement in subjective attention after the veterans had attended a variety of outdoor, nature-based interventions, compared to before. Similarly, in Chapter 2 of this thesis, reliable pre- to post-intervention improvements in AFI score following a 7-night fishing intervention were found in six out of seven participants (85.7%) who took part in post-intervention measures. It could be argued that the differences in findings are related to contrasting nature experiences and study design. Both studies finding subjective differences were pre-post studies where participants had taken part in a nature-based intervention that they knew they were evaluating through attentional measures. The post-intervention measures.

intervention measures were taken very much in context of experiencing the intervention. On the other hand, the studies where no changes in subjective attention were found, were natural experiments where there was no manipulation of nature-based experiences and subjective attention was measured at one time point. Thus, interventions may result in improvements in subjectively assessed attention. More generally, effects of living near green spaces or having done recent green activities may have smaller effects on subjective attention in people's daily lives, and this may require large sample sizes to produce enough power to establish significant effects.

The differences between subjectively and objectively measured attention have previously been discussed in chapter 2 of this thesis. In sum, the AFI provides a broader definition of 'attention' that covers a wide range of subjective aspects of attention in daily living, whereas objectively measured attention tends to focus narrowly on specific cognitive elements of attention in simple tasks. Measures such as the AFI involve subjectivity that could be more reflective of psychological distress than attentional function (Hutchinson et al., 2012). Indeed, Tennessen and Cimprich (1995) found a correlation between AFI scores and scores on the Profile of mood states (POMS), finding as negative mood states were higher, attention function on the AFI were lower. In this respect, where the AFI is used as a pre-post evaluation of an intervention, improvements in post scores may reflect improvements in mood as a response to the intervention, whereas in cross-sectional studies such as the present study and Tennessen and Cimprich (1995), results could reflect the general mood of participants. Disparity between objective and subjectively measured attention has been found in previous literature (Hutchinson et al., 2012; O'Neil et al., 2019) and this, together with findings in chapter 2 are discussed in more detail in chapter 6.

5.5.4 Strengths

A particular strength of the study was its high external validity because participants were not asked to change their behaviour prior to taking part in the study. Studies investigating ART have invariably used laboratory-based designs, or have controlled and manipulated nature-based activities for the purposes of the research (Ohly et al., 2016; Stevenson et al., 2018) with only a few studies using existing naturally occurring conditions (Kuo & Sullivan, 2001; Taylor et al., 2002; Tennessen & Cimprich, 1995). The advantage of the approach in this study is that it tells us more about the effects of spending time in nature in peoples' real lives, rather than in controlled conditions. Thus, the findings in the present study infer that there may be a connection in some populations (military veterans), but not others (women) between the focused attention on a computer task and recent naturebased activities. Furthermore, in some cases (non-veteran men) there may be some connection between recent nature-based activities and making more errors on a computer task. This paves the way for future research to investigate these findings further.

Our results suggest that veterans may respond to nature differently to other populations and as such are a useful population to study in future research into attention restoration through nature. This area of research is important as nature-based activities for good mental health are being increasingly promoted through research (e.g.Barton & Rogerson, 2017), through mental health charities such as Mind (2021) and the NHS through 'green social prescribing' (NHS England, 2020). Research that shows military veterans respond differently to nature than non-veterans provides important information for clinicians, charities and organisers of nature-based interventions, to help them target support in different populations.

5.5.5 Limitations

As the study was an adjunct to the survey used in Chapter 4, the design was more influenced by the research questions from that chapter. As such, particular factors

affecting the hypotheses of the current study may not have been addressed, for example, finding out more about the most recent nature-based activity participants had taken part in. Additionally, it was quite a long survey and thus the participants may have been tired or bored, and potentially less inclined to do the cognitive task, thus also affecting the sample size. This tiredness may also have influenced performance on the task, and may even have created directed attention fatigue, and this could have prejudiced results and negated effects of the nature-based activities previously done.

In the present study, the amount of time between the nature-based activity and filling out the survey and doing the task is not known, so a participant may, for example, have gone for a woodland walk in the morning and done the task in the evening after work. Kaplan (1995) suggests attentional fatigue especially occurs when carrying out tasks that are important, but not necessarily interesting, such as work-related tasks, with the suppression of distractions to carry out the tasks tiring attentional capacity. Thus, a participant may, for example, have 'restored' their attention in the morning, and then been at work all day carrying out tasks that fatigued their directed attention again, and this may have affected results.

The small sample size of 20 veterans who carried out the task meant there were insufficient numbers to split the results into those with and without mental health problems, or PTSD. Nevertheless, the sample size is still comparable with other studies in the area, such as Tennessen and Cimprich (1995), whose study of 72 undergraduate students split into four categories, with two categories of only 10 participants each. Thus, results of the present study should not be discounted, but interpreted in this context.

5.5.6 Future studies

As a correlational design, no causality was established and there may have been extraneous variables that influenced the results. However, the findings can be taken as a springboard for future research, which could address the lack of baseline data and controls with alternative experimental designs. Repeated measures would allow exploration of changes in attention before and after the nature-based activity, and a control group who did not do any nature-based activities would potentially help to identify the presence of extraneous variables.

Future studies could be better focused on the hypothesis in this study, rather than in combination to the study in chapter 4. This would allow for a shorter survey, more information about the activities participants had taken part in and reduce the potential for creating fatigue before carrying out the cognitive task.

Due to some of the limitations of the study detailed above, future studies could also ask participants to provide details of the duration and type of green activities, as well as the length of time since, and type of non-green activities (such as office work) between the last green activities and conducting the research. This would account for 're-fatiguing' of directed attention after green activities.

5.5.7 Conclusion

In conclusion, this study showed evidence of an association between increased objective attentional function and more recent nature-based activities in male veterans but not nonveteran men and women. These findings provide support for attention restoration theory in veteran men. Disparity between objective and subjective attention function were found and add to similar findings in other studies. The study provides a useful basis for future research to further investigate the influence of nature-based activities on attentional function in the veteran and non-veteran population.

Chapter 6 Discussion and conclusion

The main purpose of this PhD thesis was to increase understanding of how nature-based activities help veterans with PTSD. The research questions underpinning the studies in the thesis were i) How do veterans with PTSD use nature-based (green) activities to help them with their daily lives? ii) What mechanisms are involved in nature-based activities shown to be beneficial to veterans with PTSD? iii) How do group nature-based interventions contribute to the wellbeing of veterans with PTSD? and iv) Can attention restoration theory be applied to veterans with PTSD, which posits that time spent in nature can improve attention (Kaplan, 1995)? Due to minimal literature in areas explored in this thesis, much of the research presented was exploratory in nature. This chapter firstly summaries the studies, before synthesizing the findings and discussing them in relation to the research questions. Implications for theory, and for practice are discussed, limitations reflected on, and ideas for future research presented.

6.1 Summary of studies and main results

Chapter 2 presented a mixed methods case series study, which evaluated a 7-night angling intervention for a group of veterans with PTSD. The purpose was to gain in-depth insight into how the veterans responded to participating in the intervention, adding to the literature, and explore whether the veterans experienced the intervention as proposed by ART. The study used questionnaires and cognitive tasks to assess the trajectory of psychological, social and attentional effects across five time points: before, during (x3) and one month after the intervention. Additionally, interviews provided qualitative data that detailed participants' subjective experiences, especially in relation to social effects and experiential elements relating to ART. Analyses revealed pre- to post-intervention improvements in PTSD symptoms, stress, anxiety, depression and negative affect, predominantly experienced in the latter half of the intervention. No improvement in social

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connectedness was found using the Social Connectedness Scale, although veterans expressed social benefits in their interviews. The Attentional Function Index showed improvements in subjective attention, but the cognitive tasks showed mixed results. The study revealed that seven out of eight participants were already keen anglers and alluded to using fishing as a coping mechanism for PTSD. This led into the second study in Chapter 3.

Chapter 3 presented a qualitative study. Using a social constructionist approach and thematic analysis, interview data from thirteen veterans were analysed to gain understanding of how the veterans constructed nature as restorative and how they used nature-based activities to help them cope with their PTSD. Analysis produced five themes: 'Disconnect from the military', 'Disconnect from society', 'Negative identity constructs', 'Nature connectedness', and 'Reconnection through the environment and green activities'. These illustrated how the veterans used nature-based activities to reconnect to their military identities and regain a sense of control, and this provided respite from PTSD symptoms and the sense of disconnection felt in their daily lives. The veterans' construction of nature was highly related to their military identity, and this was accompanied by a negative construct of civilians. This showed the veterans' constructed identities viewed themselves as different to non-veteran population and this led into the study in Chapter 4.

The study presented in Chapter 4 used an online survey to investigate potential differences between veterans and non-veterans in their relationships between nature and mental health. Results showed veterans were not more connected to nature than non-veterans using the nature connectedness index. However, veterans appeared to view nature as restorative when they were suffering with their mental health, but not when they were healthy, and this was not the case in non-veterans.
The final study presented in chapter 5 returned to attention restoration theory and examined whether there was an association between attentional function (measured objectively through a computer task and subjectively through a self-report questionnaire) and how recently participants had taken part in green activities. Results showed veterans were quicker at the task when they had taken part in a green activity for at least 10 minutes on the same day, but non-veterans were not. This suggests veterans may respond cognitively to nature in a different way to non-veterans. There was no correlation between self-reported attentional function and recent green activities.

6.2 Discussion of main findings in relation to research questions

6.2.1 How veterans with PTSD utilise nature-based activities

A main aim of thesis was to increase understanding of how veterans with PTSD use nature-based activities to help them. The studies presented in this thesis backed up prior literature showing nature-based interventions to be beneficial to veterans with PTSD (e.g. (Greer & Vin-Raviv, 2019) and also examined how veterans proactively used nature to counteract their PTSD in their daily lives, an element lacking in literature to date. Studies in chapters 3 and 4 were most insightful in this respect.

Analysis in Chapter 3 suggested social factors such as lack of support while in the armed forces and difficulties accessing treatment were pivotal in the development and maintenance of their PTSD and perpetuated feelings of disconnection. This mirrored views that PTSD is not just a reaction to a single traumatic event but a process involving significant social factors before and after the event which contribute to its' development and continuation (Nijdam & Wittmann, 2015). Insufficient social support has been sited previously in literature as a major factor in PTSD development (Brewin et al., 2000; Iversen et al., 2008). Chapter 3 showed how veterans employed a positive construction of

nature when taking part in nature-based activities that counteracted feelings of disconnection from the military and civilian society.

Normal civilian life for veterans can be difficult, especially for those with poor mental health (Dighton et al., 2018; Hatch et al., 2013; Rhead et al., 2020). Getting away to a natural environment removes daily stressors, and thus is avoidant behaviour, one of the key symptoms of PTSD according to the DSM V classification (American Psychiatric Association, 2013). Avoidant behaviour is most often considered a maladaptive coping strategy that exacerbates PTSD symptoms (Hofmann & Hay, 2018; Keane et al., 1985). However, the advantages of taking part in nature-based interventions or independent green activities provide more than the absence of stressors. Veterans are equipped to thrive in natural environments due to military training and service, where survival skills are pivotal (Hawkins et al., 2016). In contrast to their usual lives, in natural surroundings, the veterans felt able to connect with their environment, and the activities busied their minds and blocked thoughts related to their PTSD, which they normally spent much of their time struggling to supress. Doing activities they perform well, such as fishing, camping or surviving in the wild provides a sense of achievement and control, again found in chapter 3 and prior studies (Bennett et al., 2014; Mowatt & Bennett, 2011), which contrasts with the struggles in their normal life. It has been suggested this way of addressing PTSD head-on through proactive means resonates with the stoicism of the military culture (Caddick, Smith, et al., 2015a). Although there is a stigma in mental health that has been shown to be inherent in the military culture, Caddick and colleagues proposed that one way of negotiating round stigma is by facing up to applying a 'getting on with it' approach to fighting symptoms.

An example of this was in the way the participants used their hypervigilance as a watchful aid in such activities as fishing and deer stalking. This went further than providing respite

from usual stressful lives by using elements of their PTSD to help them in their endeavours. Vigilance in the military is not only part of training but is constantly reinforced as a positive attribute, especially in combat situations (Kimble et al., 2013). Indeed, it has been suggested that many 'symptoms' of PTSD are essential survival skills when deployed in a war zone (Hoge, 2010). However, in PTSD in veterans, the essential vigilance, or hypervigilance in its extreme form, becomes almost impossible to dial down when no longer required and thus becomes a problem (Hoge, 2010). The study revealed for some of the veterans, when fishing or deer stalking, their hypervigilance became useful again, and, due to the lack of threat in the natural environment, in the words of one of the veterans, 'It turns apprehension into anticipation' (Greg, 3.4.6.1). The veterans were shown to use time in nature to reconnect to their military identities, which were strong in the veterans despite being accompanied by a sense of loss and resentment towards their treatment in the Armed Forces.

The idea of using nature proactively as adaptive avoidance is supported by results in chapter 4, which suggested that the draw to nature expressed by veterans in chapters 2 and 3, rather than particularly reflecting nature connectedness, was more indicative of a practical inclination to spend time in nature for its restorative properties. Findings showed that when well, veterans did not report nature-based activities as more helpful than non-veterans. However when struggling with mental health spending time in nature was seen as more helpful to their mental health either in managing their symptoms or in their recovery, compared to non-veterans. This perhaps reflects that when feeling vulnerable due to poor mental health and their daily lives become difficult, veterans look to natural environments and green activities to meet their mental health problems head-on. In this way, although avoidant, it could be argued that it is not maladaptive avoidance because it produces other benefits above removing some of the triggers, instead utilising autonomy, and a strengths-based problem-solving approach (Hawkins et al., 2016). It has been

suggested that avoidance is adaptive when it serves a positive purpose (Hofmann & Hay, 2018), and meeting symptoms head-on in this way is a good example of a distinct purpose. This has been discussed in more detail in Chapter 4.

6.2.1.1 Group nature-based interventions

Furthermore, in group-based interventions, the social element of being with other veterans with PTSD further utilises the adoption of military identity to combat their problems. Military identities are created in a collectivist culture and thus are socially constructed. Being with other veterans resurrects the camaraderie readily available during military service and thus assists in creating a collective stoicism aimed at combatting mental health problems, further mirroring military culture (Caddick et al., 2015).

6.2.1.2 Linking adaptive avoidance to models of PTSD

The idea of adaptive avoidance to help veterans with PTSD can be explained through the emotional process theory (Foa & Rothbaum, 1998) and cognitive models of PTSD (Ehlers & Clark, 2000). Foa and Rothbaum suggest two core dysfunctional cognitions are at the heart of PTSD; one of the external world 'The world is dangerous' and one internal 'I am incompetent'. Most usual practices of maladaptive avoidance perpetuate these cognitions. For example, avoiding going out so as not to be triggered by reminders of the trauma may reduce the intrusive thoughts but perpetuates the idea that the world is dangerous and that the person cannot cope with things normal people do, so they must be incompetent. It could be argued that adaptive avoidance through nature-based activities can improve these cognitions: Veterans spending time doing nature-based activities are able to use the environment to counteract their PTSD by receiving a sense of achievement, tap into their military identity, where adversity is met with stoicism. Where this is difficult in their normal lives which are often full of anxiety triggers, away from such daily stressors they are able to engage in an environment they can cope with and feel control in and is therefore not seen as dangerous. Further, because they function well in the environment, they receive

feedback that they are not incompetent, thus cognitions may become more positive, and veterans may be able to counteract their core beliefs underpinning their PTSD to some extent. It may even make them more likely to commit to therapy as they are more likely to think they have agency in the process (Hofmann & Hay, 2018), rather than believing nothing can change.

6.2.2 Theoretical implications: Attention restoration theory

A main research question in this thesis asked if attention restoration theory can be applied to veterans with PTSD. Chapters 2 and 5 both investigated this, and both juxtaposed subjective and objective measurements of attention. Participants in the Chapter 2 study showed attentional deficits in line with attentional fatigue as described in the ART literature (e.g. Kaplan,1995). Compared to norms they showed deficits in visual attention (TMT A and B), task switching (TMT B), sustained attention and inhibitory control (SART), although not working memory (DSB). This is in largely in line with literature that has found cognitive deficits in people with PTSD (Qureshi et al., 2011; Vasterling et al., 2002; Woon et al., 2017).

The qualitative data in the study in Chapter 2 illustrated the veterans' subjective experience of the fishing trip resonated with the restorative experience of nature as described in attention restoration theory (Kaplan, 1995): The fishing intervention took the veterans away from daily stressors, they found the environment fascinating and absorbing and the experience of fishing engaged their minds and alleviated their PTSD symptoms. Results of measuring the veterans' changes in attentional function during and postintervention, however, were inconclusive.

6.2.2.1 Evidence for attentional change through objective measurement

Results showed improvements in visual attention and task switching through the TMT A and B occurred for most participants over the course of the intervention. In contrast, there were no improvements in the DSB which measures working memory, even though the task has been shown to be one of the most reliable tasks to show changes after nature-based activities (Ohly et al., 2016). This may have been due to the participants' working memory appearing equivalent to normative values. There were no changes in the SART task suggesting sustained attention and inhibitory control did not improve.

The mixed results are in line with prior research. For example, a meta-analysis of thirty one studies exploring ART found some tasks producing improvements after nature-based interventions and some not (Ohly et al., 2016). It has been argued that the mixed findings reflects the lack of clarity in the cognitive mechanisms involved in 'directed attention' (Neilson et al., 2019) and the vast array of cognitive tasks used to measure it (Ohly et al., 2016) , which was discussed in more detail in Chapter 1 (section 1.2.2.1.2.2).

As discussed in Chapter 1 and 2, prior literature has not measured changes in attentional function objectively after time spent in nature, and only minimal studies have explored changes cognitive function in PTSD patients, including attention, following therapy (Nijdam et al., 2018; Walter et al., 2010). However, results in Chapter 2 indicate changes may occur after nature-based interventions in some aspects of attention, although as a small-scale observational study, results cannot be generalised.

The cross-sectional study in Chapter 5 indicated that for veterans only, recent green activities and quicker performance on a flanker task were associated. There were insufficient participants to differentiate between veterans who had PTSD and those who did not. However, similar to Chapter 2 results, the results in Chapter 5 suggest an association between green activities and better attention in veterans. As exploratory studies, however, findings should not be taken as conclusive, however, they do provide a basis from which to continue researching attention restoration theory for veterans with PTSD.

6.2.2.2 Evidence for attentional change through subjective measurement

Results in Chapter 2 showed pre to post improvement in self-reported attentional function approaching significance, and six out of seven participants showed reliable pre-to post improvements. These improvements mirror findings in two previous papers measured subjective attention through self-report questionnaires found pre- to post-improvements in veterans after nature-based interventions (Duvall and Kaplan, 2013; Vella et al., 2013). In contrast, in Chapter 5 there was no link between self-reported attentional function and how recently participants had carried out green activities, but there was a relationship between last green activities and objective measurement of attention, as discussed above. Reasons for differences in results between the two studies have been discussed in detail in Chapter 5, and may, for example, be linked to different study designs.

Although studies in Chapters 2 and 5 have different results, they both showed a disparity between subjective and objective attention, mirroring previous studies that have measured attention both subjectively and objectively (Hutchinson et al., 2012; O'Neil et al., 2019). In particular, O'Neil and colleagues found that where 80% of veteran participants with PTSD declared cognitive problems through self-report, only 47% showed objectively measured deficits in at least one domain. As previously discussed in Chapters 2 and 5, subjective and objective measurements treat attention differently: Whereas the AFI broadens 'attention' to incorporate a range of aspects of attention in daily living, attentional tasks do the opposite by attempting to isolate specific elements of cognitive functionality. There is thus, for example, a vast difference between the Digit Span Backwards task that measures working memory and asking someone how well they can stay on daily tasks.

The disparity between objective attention and perceived attention may be explained through the relationship between perceived attention and wellbeing, for example subjectively measured attention has been linked to distress (Hutchinson et al., 2012) and negative mood (Tennessen and Cimprich, 1995). In another study, 'functional outcome' was mediated by the perception of cognitive deficits including questions relating to concentration, forgetfulness and decision making (Samuelson et al., 2017), but not by objectively measured attention including the TMT and digit span tests. In Chapter 2, psychological measures of PTSD, stress and mood followed a similar pattern of changes as AFI, although as a case series design, results would need to be replicated in an experimental study to further investigate this pattern, and to see if changes in subjective attentional function are related to psychological wellbeing.

In sum, although the results were mixed, enough evidence has been presented in the current thesis to warrant future research with veterans with PTSD underpinned by attention restoration theory. When measuring attentional changes as a consequence of nature-based activities, however, future research should consider that objective measures have not produced consistent results, and subjective measures may reflect psychological wellbeing.

6.2.2.3 Other theories relating to nature-based restoration

Although ART was the primary nature restoration theory addressed by the research questions, other theories are relevant to the findings. In Chapter 2 there was evidence of a reliable reduction in pre to post intervention stress in seven out of eight participants, as measured by the DASS-21 questionnaire, and a significant main effect of time on stress reduction. This provided support for stress reduction theory (SRT; Ulrich et al., 1991) which proposes nature is restorative predominantly by reducing stress. Previous studies measuring stress in veterans with PTSD attending nature-based interventions have also found similar benefits (Bennett et al., 2017; Townsend et al., 2018; Vella et al., 2013; Wheeler et al., 2020). However, in the online survey in Chapter 4, stress in veteran respondents was not associated with any nature measures (nature connectedness, how

recently participants had taken part in green activities or how close they lived to green spaces). Support for SRT is therefore mixed across these two studies, although both measured stress by questionnaires rather than objective measures such as heart rate variability and skin conductance, which could be a useful approach in future studies investigating stress reduction through green activities.

Findings also echo social explanations of how nature can be restorative. For example, Mayer et al. (2009) proposed that nature-based activities promote positive well-being through several factors including social interactions and personal achievements. Both are elements of nature-based interventions that have been shown to be beneficial in the studies in Chapters 2 and 3, by mixing with other veterans and by carrying out activities such as fishing. For veteran participants in Chapters 2 and 3, time in nature evoked happy childhood memories of going fishing and leisure time in nature, similar to influences proposed in other research with veterans on nature-based interventions (van den Berg et al., 2007). Additionally, participants associated nature with time in the military, which gave them feelings of control and competence. Applying conditioned restoration theory (CRT; Egner et al., 2020), this can be described as restorative conditioning, where associations developed through positive experiences in natural environments are broadened out to be activated by being in other natural environments. This generalization could account for how veterans associated the environment of a carp fishing lake with time in the military spent in very different, albeit nature-based environments when deployed and in training.

6.2.3 Strengths

Strengths of individual studies in the thesis have been discussed in each chapter. Considering the research as a whole, one strength is that prior literature investigating the benefits of nature-based activities for veterans with PTSD have tended to explore effects of group nature-based interventions (Greer & Vin-Raviv, 2019). This thesis sought to expand on prior literature by widening the research to investigate the relationship between veterans with PTSD and nature outside of organised interventions, putting the veterans at the centre of the research, rather than intervention efficacy. The use of mixed methods allowed for this to be achieved through studies in Chapters 3 and 4 and 5 and the research has provided insight into how veterans use nature-based activities in their own lives, and further, how group interventions provide additional benefits.

Research in this thesis appears to be the first to explore differences between veterans and non-veterans in their relationships with nature and mental health. Chapters 2 and 3 illustrated how veterans perceived themselves as being different to 'civilians', and Chapters 4 and 5 were able to evidence that military veterans may have a different relationship with nature than non-veterans: Chapter 4 showed veterans did more frequent walking and dog walking than non-veterans, had done more recent green activities (particularly when reporting current mental health problems), and found nature more helpful that non-veterans in managing symptoms and aiding recovery from mental health problems. Chapter 5 showed that veterans may respond cognitively to time spent in nature in a different way to non-veterans. As exploratory studies, more research is needed to investigate this further, but indications are for building future research on. Establishing differences between veterans and non-veterans in how nature helps their mental health is important because it helps social prescribers and clinicians understand veteran needs (Garside et al., 2020)

6.2.4 Limitations

There were various issues with the studies in the thesis that have been discussed in individual chapters. There were several areas in the research where results were affected by lower number of participants than desirable. For example, there was a very small take up in providing follow up data in Chapter 2. Additionally the online survey in Chapter 4

would have been better with more participants, especially veterans and veteran women. Although the percentage of female veterans was in line with current percentage of women in the Armed Forces (Ministry of Defence, 2021b), there needed to be more veterans as a whole for data from female veterans to have statistical power. It would have been useful to have been able to distinguish between respondents who had PTSD and other mental health issues both in the past and present, as well as veterans and non-veteran. This was not possible due to the number of participants and survey questions. The study in Chapter 5 was also underpowered and would have benefitted from a greater number of participants. A particular reason this is important is that chapters 4 and 5 were not able to differentiate between veterans who had PTSD and other veterans. The focus of the thesis was on veterans with PTSD, but some findings can only be related to veterans with and without current mental health problems (Chapter 4) or to veterans as a whole (Chapter 5). Further research is thus required to investigate whether findings in the current thesis relate specifically to veterans with PTSD.

6.2.5 Clinical implications

There are numerous clinical implications from the research in this thesis which have previously been discussed. These include three important areas:

Firstly, findings contribute to the recommendation in a government report that increased understanding of who benefits and how from nature-based social prescribing is required (Garside et al., 2020). Evidence showed that veterans may view nature-based activities as particularly useful when suffering from mental illness, and this information is valuable for clinicians and social prescribers. The studies were also able to show *how* veterans used green activities, for example, by reconnecting to their military identities, to doing activities that provide a sense of control, and by proactively using elements of their PTSD such as hypervigilance in a positive way. All of this helps social prescribers and clinicians to understand that veterans with PTSD may be particularly suited to nature-based activities.

In addition, the first study in chapter 2 contributed to the discussion on the optimum dose of nature required to produce beneficial results, and provides useful insight for organisers of nature-based interventions. Findings indicate that optimum dose, relevant to all nature-based activities (although particularly in the case of group interventions), may be dependent on the amount of disruption and effort involved in initially starting the activity and accessibility of the environment. This may be particularly in the case of people who have anxiety based mental health issues such as PTSD. By understanding initial responses to interventions and potential negative consequences that could delay benefits, interventions can be designed more effectively. For example, more adventurous interventions with increased potential for initial stressors such as long journeys and unfamiliar routines, could include familiarising participants with each other online ahead of the intervention, and a detailed itinerary provided in advance. Equally, shorter, more accessible interventions could be chosen that may be cheaper and just as beneficial.

Finally, the research in this thesis highlighted experiences of veterans with PTSD that could enhance understanding of veterans' needs. For example, in Chapter 3 veterans cited difficulties connecting with civilian support networks and feelings of being ignored and undervalued. This contributed to the construction of a negative view of civilians and available mental health support and a possibly exacerbated social isolation. This is crucial information for clinicians in helping them understand veterans' needs and links in with the values promoted in the Armed Forces Covenant.

6.2.6 Future research

Much of the research in this thesis is exploratory due to minimal prior literature, and as such, is well placed to inform future work. Opportunities for future research have already

been highlighted throughout the thesis. One of these relates to continuing the exploration of changes in attentional function as proposed by ART (Kaplan, 1995), in veterans with PTSD who attend nature-based interventions. Such research would need to consider cognitive tasks used, for example, the veterans seemed to struggle with the SART used in Chapter 2 and thus it may not be appropriate for future studies. In addition, further exploration of social effects of such interventions using a scale other than the Social Connectedness Scale used in Chapter 2 would be worth exploring. An RCT could use a wait list control protocol such as that used in a prior study (Wheeler et al., 2020).

Linked to this, the study in Chapter 5 is seemingly the first study to examine the relationship of recency of nature-based activities with attentional function, with the two prior cross-sectional studies discussed in Chapter 5 examining proximity of green spaces (Kuo & Sullivan, 2001; Taylor et al., 2002). Although studies have found proximity of green spaces is linked to mental health benefits, (Kessel et al., 2009), further research detailing benefits of *using* the green spaces would be worthwhile.

As previously discussed, it may also be worthwhile to further explore the differences between veterans and non-veterans in their relationships with nature and mental health. Chapter 4 suggests that there are indeed differences, but future work would benefit from enhanced experimental design and larger sample sizes. This would allow for issues found in this thesis, such as a low numbers of veterans, especially veteran women, to be rectified and different types of mental health issues including PTSD to be compared.

Given the study in Chapter 3 found that time spent in nature allowed the veterans to connect to their military identity and this seemed important constituent in their restoration, it may be useful for future research to explore this in more detail using studies in this thesis as a starting point. For example, all participants in Chapter 3 had PTSD, so perhaps future work could explore if veterans are more likely to need to connect to their military

identity when they struggle with mental health problems. It could be that veterans who have integrated well into civilian society and have no mental health issues, have a military identity that is more dormant because it is not emotionally linked with feelings of resentment, rejection, and loss. Future research could explore military identity in veterans with and without mental health difficulties to explore this further.

6.2.7 Critical reflections

Several pivotal decisions made in relation to the research in this thesis were made within the context of opportunities and restrictions that presented themselves. For example, the case series design in Chapter 2 emerged from an invitation to attend and evaluate a weeklong intervention, and this provided a detailed observational study that informed the direction of subsequent studies in the thesis. Additionally, an early intention of following up the case series with a random controlled trial was not realised because of unforeseen practical difficulties of achieving this before a standard programme of interventions had been established for evaluation. However, if such a study had been included, it may be that there would not have been the time or resources to carry out the other studies featured in the thesis, which produced, in the author's view, valuable and insightful findings. A lesson learnt from this is the value of flexibility when conducting research, being open to opportunities when they arise and being flexible and open minded when plans do not come to fruition. Some decisions in the studies in the thesis were perhaps a result of over ambition. An example of this is using variables in the online survey that were not used in the analysis, and were not detailed in this thesis, but which made the survey longer. They were perhaps included due to interest in the subject and an attempt to cover too many angles. Although good practice of keeping surveys short is well documented, it is perhaps only by experiencing the stark reality of needing to find people who are willing to give up half an hour of their time that the full appreciation of just how important short surveys are can be reached.

6.2.8 Conclusion

In conclusion, the studies in this thesis have increased understanding of how veterans with PTSD use nature to support their mental health, both through nature-based interventions and independent green activities. The research suggests that some veterans with PTSD seem to proactively use time spent in nature to distance themselves from daily stressors, provide respite from PTSD symptoms and reconnect to their sense of self and military identity through the environment and green activities. This can be further advanced through group interventions. I have suggested this could be viewed as adaptive avoidance. Additionally, the research in the thesis has found some evidence that nature-based activities can improve attentional function, although results were mixed. Findings suggests veterans may have a different relationship with nature than non-veterans in relation to their mental health. Within the veteran population, those with current mental health problems were found to view nature-based activities more helpful than non-veterans in aiding recovery and managing current symptoms. Such increased understanding is useful to clinicians and social prescribers working with veterans and provides a springboard for future research.

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Appendix A C2 Ethical approval

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the l rece fluid crim Fact whe obta App Res by the doct A fu	Jniversity. 'Human participants' are defined ently died (cadavers, human remains and bo s, and human data and records (such as, b inal or administrative records and test resul mence until written approval has been rece ulty Ethics Sub-Committee (ESC) or the Uni en setting a start date for the project. Ethica ain ethical approval prior to data collection w lications must be made on this form, and su earch/Ethics Officer. A signed copy of the f he Director of Research/Ethics Officer in the University's Ethics Committee. A copy of yo umentation (e.g. consent form, recruiting ma ill copy of the signed application will be retain appletion of the project. The signed application	d as including living human period parts, human beings who have ody parts), embryos and foetuses, human tissue and bodily ut not restricted to medical, genetic, financial, personnel, its including scholastic achievements). Research must not ived (from departmental Director of Research/Ethics Officer, iversity's Ethics Committee). This should be borne in mind I approval cannot be granted retrospectively and failure to vill mean that these data cannot be used. ubmitted electronically, to your departmental Director of form should also be submitted. Applications will be assessed a first instance, and may then passed to the ESC, and then to our research proposal and any necessary supporting aterials, etc) should also be attached to this form. ined by the department/school for 6 years following on form cover sheet (two pages) will be sent to the Research
Gov	vernance and Planning Manager in the REO	
as S	Secretary of the University's Ethics Committee	ee.
1	Title of project: Examining the effects of	a 7 night group angling trip on executive function,
	mood state and symptomology in milita case series study.	ary veterans with post-traumatic stress disorder. A
2. 3. 4.	The title of your project will be published object, then a reference number will be u Do you object to the title of your project b This Project is: Staff Research Principal Investigator(s) (students should	in the minutes of the University Ethics Committee. If you sed in place of the title. Heing published? Yes // No // Project Student Project also include the name of their supervisor):
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External ethics approval obtained (attach over the process of the proces of the process of the process of the process of the	
Declaration of Principal Investigator: The information contained in this application, including any accompanying information, is, to the best of m throwledge, complete and correct. <i>Uwe have read the University's Statement on Safeguarding Good</i> this application in accordance with the guidelines, the University's Statement on Safeguarding Good this application in accordance with the guidelines, the University's Statement on Safeguarding Good this application in accordance with the guidelines, the University's Statement on Safeguarding Good there conditions laid down by the University's Ethics Committee. <i>Uwe have attempted to identify all risks</i> related to the research that may arise in conducting this research and acknowledge my/our obligations and the rights of the participants. Signature(s): Made. Name(s) in block capitals: Rachel Marrow Date: .02/09/18	
Date:	ıy. ut in
Supervisor's recommendation (Student Projects only): I have read and approved the quality of both the research proposal and this application. Supervisor's signature:	<u>1, 6</u>
I have read and approved the quality of both the research proposal and this application. Supervisor's signature: Image: Image	
Supervisor's signature: A manual Outcome: The departmental Director of Research (DoR) / Ethics Officer (EO) has reviewed this project and consider the methodological/technical aspects of the proposal to be appropriate to the tasks proposed. The DoR reviewed the investigator(s) has/have the necessary qualifications, experience and facilities to condit the research set out in this application, and to deal with any emergencies and contingencies that may arrive the research set out in this application, and to deal with any emergencies and contingencies that may arrive this application falls under Annex B and is approved on behalf of the ESC This application is referred to the ESC because it does not fall under Annex B This application is referred to the ESC because it requires independent scrutiny Signature(s): Mame(s) in block capitals: Department: Stisc Department: Stisc Date: Signature(s): The application has not been approved by the ESC The application is referred to the University Ethics Committee Signature(s): Name(s) in block capitals:	
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iculty:	

06 September 2018

MRS RACHEL MARROW 58 EAST STREET COGGESHALL ESSEX CO6 1SJ

Dear Rachel,

Re: Ethical Approval Application (Ref 17055)

Further to your application for ethical approval, please find enclosed a copy of your application which has now been approved by the School Ethics Representative on behalf of the Faculty Ethics Committee.

Yours sincerely,

Melle

Lisa McKee Ethics Administrator School of Health and Social Care

cc. Research Governance and Planning Manager, REO Supervisor

Colchester Campus Wivenhoe Park Colchester CO4 3SQ Jnited Kingdom

School of Health and Social Care T 01206 872854 E hsc@essex.ac.uk www.essex.ac.uk

🕥 @Uni_of_Essex

Appendix B C2 Participant information sheet consent form and debrief

Participant Information Sheet Fishing Trip study 27th October to 3rd November 2018

My name is Rachel Marrow, and I am a PhD student at the University of Essex, studying the effects of group outdoor activities on military veterans with PTSD. The activity involved in this study is a 7-night fishing trip you are already enrolled on. You have been selected as a suitable participant because you are a military veteran with a PTSD diagnosis which you consider to be relevant to you at the current time. There will be other veterans with similar backgrounds also doing fishing and you can choose to spend time with them or on your own.

What will I need to do?

The first stage is for you to read this information and then, if you agree to continue with the study, to fill out the attached consent form and return it to me via email.

I will then need to arrange a telephone call with you about 2 weeks before the fishing. This call will take up to 15 minutes and will entail taking some brief details from you and asking you some questions about how you are feeling and your PTSD symptoms. You will also then be sent a link to some computer tasks, which I will ask you to complete. For this you will need access to a computer or laptop with a keyboard and a mouse. The tasks are not difficult, but they are a vital part of this study. I will then call you again to make sure the tasks went ok, and to take you through two final short questionnaires.

What happens at the fishing?

When you first arrive at the fishing lake, before you start fishing you will be asked to spend about 15 minutes doing some more research. This will involve filling out the same questionnaires and doing the same tasks on the computer. We may also measure some physiological measures such as heart rate or blood pressure. After this you will have plenty of time to fish and relax.

You will be asked to complete the questionnaires and do the tasks two more times during the week, and you may be asked to have your blood pressure or heart rate taken each day. On the last day, I will also ask you to take part in a short interview to ask some additional questions about your experiences during the week and how they have made you feel. This interview will be recorded so I can transcribe it later and I may use some of your answers in my write up.

About 4 weeks after the fishing you will be asked one more time to complete the questionnaires and do the tasks

Will my involvement in the research be filmed?

As you are aware, the fishing trip is being filmed by a University of Essex documentary filmmaking team. Consequently your involvement in the study will not be anonymous. You
may be filmed whilst you carry out the computer tasks, however, your data responses to the tasks and your individual answers to questionnaires will not be filmed and will be stored separately to your name. You may withdraw from the research at any time during the study and your data will be removed from research records. Withdrawal from the research, however, would not mean withdrawal from the filming. Everyone featured in the documentary will be subject to separate consent and Essex university ethics approval to be submitted by the documentary filmmakers.

What is the purpose of this study?

The purpose is to see what effects taking part in a week long residential fishing activity on your PTSD symptoms, as well as your mood and your performance in the computer tasks. **What are the risks?**

There are no risks anticipated, although the tasks you will be given require concentration. However, should any of the tasks or questions distress you in any way, please do contact me so I can direct you to sources of support.

If I say yes, can I change my mind later?

Taking part in this is completely voluntary and you can withdraw at any time until all the data is collected. If you decide during the fishing that you wish your data not to be used, that will be fine, and you can continue to fish anyway. As previously mentioned, however, this would not mean you would be withdrawing from the filming.

What will happen to my results?

All your data will be kept under your individual participant number (not your name) and stored safely and securely by the University of Essex. Although it is possible the results will appear in future publications, no data will be included which will allow you to be identified. What if I have some questions or worries?

If you would like to ask any questions before agreeing to take part, or at any time in regard to your participation please contact me using the details below. If you have any concerns about the study, please contact one of my supervisors using the details below.

Thank you again and with kind regards

Rachel

Contact details:

Rachel Marrow, PhD researcher, School of Health and Social Care The University of Essex Wivenhoe Park, Colchester, Essex CO4 3SQ Email Rachel.marrow@essex.ac.uk

Supervisor details:

Dr Leanne Andrews, Senior Lecturer School of Health and Social Care The University of Essex Wivenhoe Park, Colchester, Essex CO4 3SQ Email landre@essex.ac.uk

Dr Nicholas Cooper, Senior Lecturer Department of Psychology The University of Essex Wivenhoe Park, Colchester, Essex CO4 3SQ Email: ncooper@essex.ac.uk

Consent Form

Thank you for your help with this research. Please consider the following questions and click the relevant box to give your consent to take part in the study.

- Have you been given a description of the general purpose of the research? Yes //
 No //
- 2. Have you been given the opportunity to discuss any questions with the researcher?

Yes		/	No	
-----	--	---	----	--

- 3. Have you received enough information to decide whether or not you wish to take part in the study? Yes // No
- Do you understand that you have the right to decide to leave the study at any time?
 Yes // No //
- 5. Do you consent to your interview with me on the last day being recorded? Yes //
- 6. Do you understand that your data will be kept confidential at all times? Yes // No
- 7. Do you consider your PTSD diagnosis to still be applicable? Yes // No
- 8. Do you agree to take part in the study? Yes // No

Please type your name and today's date below if you give your consent to continue. Your personal details will **not** be stored with your responses to the tasks.

Name:

Date:

Debrief Information

Thank you for taking part in this study, which is researching the effects of time spent fishing with a group of people with similar experiences. Previous research has shown that such an activity can improve PTSD symptoms and mood. This is what the questions were designed to measure. The computer tasks are designed to test your brain function and to see if the tasks become easier as you relax during the week.

The task where you are asked to repeat some numbers is called the digit span test (backwards), and it is a test of your working memory, the ability to hold and manipulate information for a very short space of time. Another test is a test of attention, measuring how much you are able to keep on the task and resist pressing the space bar when the 3 comes up. Finally, the joining the dots task is measuring your visual attention and ability to switch between numbers and letters. If you'd like any more information on these or on anything else in the study, please contact me.

We hope you enjoyed the fishing and the tasks we asked you to do. If you found anything upsetting, or if you would like to discuss this with one of the research team, please contact me or one of my supervisors using the contact details below. Here is also a list of support groups you may find useful.

Walnut Tree

Recovery activities, crisis support, coaching and mentoring to emergency service personnel and serving members of the armed forces, military veterans and others

Walnut Tree Health and Wellbeing C.I.C Wymondham, Norfolk NR18 9RS https://www.walnuttreehealthandwellbeing.co.uk t: 01603 516580

Combat Stress

Support, help and information regarding mental health for veterans :

Helpline: 0800 138 1619 Email: helpline@combatstress.org.uk Text: 07537 404 719 https://www.combatstress.org.uk

<u>Mind</u>

Information on mental health including PTSD -

Helpline: 0300 123 3393 Email: info@mind.org.uk Text: 86463 Website: https://www.mind.org.uk/information-support/types-of-mental-health-problems/post-traumatic-stress-disorder-ptsd/

<u>NHS</u>

Details of help provided by the NHS for veterans: https://www.nhs.uk/NHSEngland/Militaryhealthcare/veterans-familiesreservists/Pages/veterans-mental-health.aspx

Thank you again and with kind regards

Rachel

Contact details:

Rachel Marrow, PhD researcher School of Health and Social Care The University of Essex Wivenhoe Park, Colchester, Essex CO4 3SQ Email Rachel.marrow@essex.ac.uk

Supervisor details:

Dr Leanne Andrews, Chartered Health Psychologist School of Health and Social Care The University of Essex Wivenhoe Park, Colchester, Essex CO4 3SQ Email landre@essex.ac.uk

Dr Nicholas Cooper, Senior Lecturer Department of Psychology The University of Essex Wivenhoe Park, Colchester, Essex CO4 3SQ Email: ncooper@essex.ac.uk

Appendix C C2 Risk assessment

Ş	University of Essex	k assessment					
Title	PhD projects involving re fishing events. Thesis we veterans with post-trauma exercise, and what effects symptomology and cogni	search with veterans attending rking title - How do military tit stress disorder use green does this have on their tive functioning?	Location	Lieu dit Le France Fishing lak	Queroy, Abzac, 16500, es in UK	Risk assessment No	
Mana	ger responsible	Dr Leanne Andrews, Academic Su and Social Care, and Dr Nicholas (Supervisor Psychology Dept	pervisor, Sch Cooper, Acad	iool of Health Iemic	Signature & date	L. Redrew	> 26/10/19
Asse	ssed by (name & role)				Signature, assessment date & time		
I Revie	w (date & reason)						

	Review (date & reas	son)					
+							
	hazard	Who	Current controls	Current risk	Additional	Residual	Date
	hazardous event	might be		LxC=R	controls	risk	achieved
	consequence	harmed				<mark>L୪C</mark> =R	
	Hazard: Uneven or slippery ground, holes or debris. Hazardous event: Slips, trips & falls	Researcher	Pre-event walk round Initial safety talk observation Sensible footwear and clothing appropriate for the conditions.	Major x Very Unlikely = Low			
	major injury.						
	Hazard: Working alone with a participant.	Researcher	Researcher monitors behaviour of participant and stops work if they feel vulnerable.	Major x Unlikely = Medium			
	Hazardous event:		Other people will be in vicinity at all times.				
	Unpredictable behaviour from the participant, aggression and/or		Researcher has mobile phone with emergency number.				
	violence.		Doors kept unlocked so access / exit can be gained quickly				
	Consequence: Physical Injury or mental trauma.		Trauma therapist with group readily available on mobile phone or walkie talkie				

Risk-estimation-guide_V0116

University of Essex						
hazard hazardous event consequence	Who might be harmed	Current controls	Current risk LXC=R	Additional controls	Residual risk L୪၄=R	Date achieved
Hazard: Stress/Anxiety/ re-experiencing of traumatic events Hazardous event: Anxiety/re-experiencing of traumatic events brought about by external environmental factors such as loud and/or unexpected noises or reminders of traumatic events related to participant's PTSD Consequence: Mental trauma / PTSD symptomology	Participant	Agreement has been obtained by the property owners with the local mayor that no shooting events licences will be granted for the duration of the trip Trauma therapist/clinician with group available on mobile phone or walkie talkie	Moderate x unlikely = low			
Hazard: Fire and emergency, including first aid. Hazardous event: Failure to evacuate safely in event of fire. Smoke inhalation or burns. Potential for fatality. Failure to summon or apply first aid. Harm escalates due to delay in summoning first aid or lack of availability of first aid provisions.	Researcher/ Participant	Awareness of local fire evacuation procedure and how to report an emergency. Mobile phone with emergency number. Trained first aiders on site at all times. First aid kits readily accessible French phrase book on site Owners live on site and have access to and knowledge about local emergency and medical support	Catastrophic x Very Unlikely = Medium			
Hazard: Water Hazardous event: Person immersed in the water.	Researcher	Litesaving aids. Trained first aiders on site at all times. Angling taking part in designated areas only. Emergency procedures in place. Mobile phones / walkie takie carried at all times. Experienced fishing coaches with group.	Catastrophic x Very Unlikely = Medium			

Risk-estimation-guide_V0116

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hazard hazardous event consequence	Who might be harmed	Current controls	Current risk Լ <u>Հ</u> Ը=R	Additional controls	Residual risk LxC=R	Date achieved
Consequence: Drowning		Fishing activity will be covered by lake owner's risk assessment and safety procedures and under supervision				
Hazard: Water borne diseases/infection/ticks/l eeches/insect bites Hazardous event: Bites stings or injury Consequence: minor discomfort, irritation is most likely outcome (in rare cases <u>Ukanes</u> , disease or similar major condition)	Participants & researcher	Pre-event safety talk, Advice on eating, hand cleaning etc Advice relevant to local area will be obtained from property owners Long trousers and sleeves where relevant First aid equipment and insect repellent will be readily available	Minor x likely = medium			
Hazard: Extreme or difficult weather conditions Event: heavy rain, heavy wind, flooding, thunder and lighthing leading to person being hit by debris, lighthing strike or rising flood water.	Participants & researcher	Check and Monitor Weather. Research to be carried out indoors if weather unsuitable	Catastrophic x Very unlikely = Medium			

University of Essex

hazard	Who	Current controls	Current risk	Additional	Residual	Date
hazardous event consequence	might be harmed		<mark>L</mark> ★C=R	controls	risk L୪C=R	achieved
Hazard: Stress/anxiety Hazardous event: Participant feels anxious taking part in questionnaires, cognitive tests or interview questions Consequence: Temporary physical and mental health effects.	Participant	Trauma therapist/clinician with group available on mobile phone or walks talkie Researcher assesses participant before starting tests and stops tests or interview if the participant becomes anxious.	Moderate x Unlikely = Low			
Hazard: Stress/anxiety Hazardous event: Participant feels anxious being away from home and usual support networks Consequence: Temporary mental health effects.	Participant	Trauma therapist/clinician with group available on mobile phone or walkie talkie Trip organisers will have details of next of kin	Moderate x unlikely = low			

Appendix D PCL-5

Instructions: Below is a list of problems that people sometimes have in response to a very stressful experience. Please read each problem carefully and then circle one of the numbers to the right to indicate how much you have been bothered by that problem in the past month.

In the past month, how much were					
you bothered by:	Not at all	A little bit	Moderately	Quite a bit	Extremely
1. Repeated, disturbing, and unwanted memories of the stressful experience?	0	1	2	3	4
2. Repeated, disturbing dreams of the stressful experience?	0	1	2	3	4
3. Suddenly feeling or acting as if the stressful experience were actually happening again (as if you were actually back there reliving it)?	0	1	2	3	4
4. Feeling very upset when something reminded you of the stressful experience?	0	1	2	3	4
5. Having strong physical reactions when something reminded you of the stressful experience (for example, heart pounding, trouble breathing, sweating)?	0	1	2	3	4

 Avoiding memories, thoughts, or feelings related to the stressful 	0	1	2	3	4
experience?					
7. Avoiding external reminders of the					
stressful experience (for example,	0	1	2	3	4
people, places, conversations, activities,			-		·
objects, or situations)?					
8. Trouble remembering important parts	0	1	2	3	4
of the stressful experience?			L		-
9. Having strong negative beliefs about					
yourself, other people, or the world (for					
example, having thoughts such as: I am					
bad, there is something seriously wrong	0	1	2	3	4
with me,					
no one can be trusted, the world is					
completely dangerous)?					
10. Blaming yourself or someone else for					
the stressful experience or what	0	1	2	3	4
happened after it?					
11. Having strong negative feelings such	0	1	2	3	4
as fear, horror, anger, guilt, or shame?			-		
12. Loss of interest in activities that you	0	1	2	3	4
used to enjoy?			_		

13. Feeling distant or cut off from other people?	0	1	2	3	4
14. Trouble experiencing positive feelings (for example, being unable to feel happiness or have loving feelings for people close to you)?	0	1	2	3	4
15. Irritable behaviour, angry outbursts, or acting aggressively?	0	1	2	3	4
16. Taking too many risks or doing things that could cause you harm?	0	1	2	3	4
17. Being "superalert" or watchful or on guard?	0	1	2	3	4
18. Feeling jumpy or easily startled?	0	1	2	3	4
19. Having difficulty concentrating?	0	1	2	3	4
20. Trouble falling or staying asleep?	0	1	2	3	4

PCL-5 (14 August 2013) National Center for PTSD Page 1 of 1

Appendix E Positive and Negative Affect Scale (PANAS)

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way generally, that is, how you feel most of the time:

1.	2.	3.	4.	5.
Very slightly or Not at All	A little	Moderately	Quite a bit	Extremely

	_interested		irritable
<u> </u>	distressed		alert
	excited	<u> </u>	ashamed
<u> </u>	upset		inspired
	strong		nervous
	_guilty		determined
	scared		attentive
	hostile		jittery
<u> </u>	_enthusiastic		active
<u> </u>	_ proud		afraid

(Watson et al., 1988)

Appendix F Depression Anxiety and Stress Scale (DASS-21)

DASS2	Date:									
Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied										
to you a	to you over the past week. There are no right or wrong answers. Do not spend too much time on any									
stateme	nt.									
The rati	ng scale is as follows:									
0 Did n	ot apply to me at all									
1 Applie	ed to me to some degree, or some of the time									
2 Appli	ed to me to a considerable degree, or a good part of time									
3 Applie	ed to me very much, or most of the time									
1	I found it hard to wind down	0	1	2	3					
2	I was aware of dryness of my mouth	0	1	2	3					
3	I couldn't seem to experience any positive feeling at all	0	1	2	3					
4	I experienced breathing difficulty (e.g., excessively rapid breathing,	0	1	2	3					
	breathlessness in the absence of physical exertion)									
5	I found it difficult to work up the initiative to do things	0	1	2	3					
6	I tended to over-react to situations	0	1	2	3					
7	I experienced trembling (e.g., in the hands)	0	1	2	3					
8	I felt that I was using a lot of nervous energy	0	1	2	3					
9	I was worried about situations in which I might panic and make	0	1	2	3					
	a fool of myself									

10	I felt that I had nothing to look forward to	0	1	2	3
11	I found myself getting agitated	0	1	2	3
12	I found it difficult to relax	0	1	2	3
13	I felt down-hearted and blue	0	1	2	3
14	I was intolerant of anything that kept me from getting on with	0	1	2	3
	what I was doing				
15	I felt I was close to panic	0	1	2	3
16	I was unable to become enthusiastic about anything	0	1	2	3
17	I felt I wasn't worth much as a person	0	1	2	3
18	I felt that I was rather touchy	0	1	2	3
19	I was aware of the action of my heart in the absence of physical	0	1	2	3
	exertion (e.g., sense of heart rate increase, heart missing a beat)				
20	I felt scared without any good reason	0	1	2	3
21	I felt that life was meaningless	0	1	2	3

Social Connectedness Scale (SCS)

Social Connectedness Scale – Revised

Directions: Following are a number of statements that reflect various ways in which we view ourselves. Rate the degree to which you agree or disagree with each statement using the following scale (1 =Strongly Disagree and 6 =Strongly Agree). There is no right or wrong answer. Do not spend too much time with any one statement and do not leave any unanswered.

	Strongly		Mildly	Mildly				St	rongl	у	
	Disagree	Disagree	Disagree	Agree		Agre	e	A	Agree	;	
	1	2	3	4		5			6		
					Strong	ly			S	trongl	y
					Disagre	ee				Agree	
1.	I feel comforta	able in the prese	ence of strangers	3	1	2	3	4	5	6	
2.	I am in tune w	vith the world			1	2	3	4	5	6	
3.	* Even among	my friends, the	ere is no sense o	f							
	brother/sisterh	100d			1	2	3	4	5	6	
4.	I fit in well in	new situations.			1	2	3	4	5	6	
5.	I feel close to	people			1	2	3	4	5	6	
6.	I feel disconne	ected from the v	world around me		1	2	3	4	5	6	
7.	Even around p	eople I know, I	don't feel that I	really							
	belong.	•			1	2	3	4	5	6	
8.	I see people as	s friendly and a	pproachable		1	2	3	4	5	6	
9.	I feel like an o	utsider			1	2	3	4	5	6	
10.	I feel understo	od by the peop	le I know		1	2	3	4	5	6	
11.	I feel distant f	rom people			1	2	3	4	5	6	
12	I am able to re	elate to my peer	s		1	2	3	4	5	6	
13.	I have little se	nse of together	ness with my people	ers	1	2	3	4	5	6	
14	I find myself a	actively involve	d in people's liv	es	1	2	3	4	5	6	
15	I catch myself	losing a sense	of connectednes	S			_				
	with society.			-	1	2	3	4	5	6	
16	I am able to co	onnect with oth	er neonle		1	2	3	4	5	6	
17	I see myself as	s a loner	er peopre		1	2	3	4	5	6	
18	I don't feel rel	ated to most pe	onle		1	2	3	4	5	6	
19	My friends fee	el like family	-r		1	2	3	4	5	6	
$\overline{20}$	I don't feel I n	articipate with	anyone or any g	 	1	$\frac{1}{2}$	3	4	5	6	
			, sine of any gi	P	-	-	5	•	c	č	

1

Appendix H Attentional Function Index (AFI)

Attentional Function Index Date :									
Part 1									
At this time, how well do you feel you are functioning in each of the areas below?									
The rating scale is as follows:									
1 Not at all 2 To some degree 3 To a moderate extent 4 Quite well	5 Extre	mely	well						
1 Getting started on activities (tasks, jobs) you intend to do	1	2	3	4	5				
2 Following through on your plans	1	2	3	4	5				
3 Doing things that take time and effort	1	2	3	4	5				
4 Making your mind up about things	1	2	3	4	5				
5 Keeping your mind on what you are doing	1	2	3	4	5				
6 Remembering to do all the things you started out to do	1	2	3	4	5				
7 Keeping your mind on what people are saying	1	2	3	4	5				
8 Keeping yourself from saying or doing things you did not what to say or do	1	2	3	4	5				
9 Being patient with others	1	2	3	4	5				
Part 2									

At this time, how would you rate yourself on:

The rating scale is as follows:

10	How hard you find it to concentrate on details	1	2	3	4
		5			
11	How often you make mistakes on what you are doing	1	2	3	4
		5			
12	Forgetting to do important things	1	2	3	4
		5			
13	Getting easily annoyed or irritated	1	2	3	4
		5			
	Copyright © 2010 John Wiley & Sons, Ltd				

1 Not at all 2 A little bit 3 Moderately 4 Quite a bit 5 A great deal

	2 weeks before, on telephone	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	4 -6 weeks after return, on telephone
Day	Pre	1 Arrive	2	3	4	5	6	7	8 Leave	Follow up
SART	Х	Х			Х			Х		X
Digit span b	Х	Х			Х			Х		Х
TMT	Х	Х			Х			Х		Х
PCL-5	Х	Х			Х			Х		Х
DASS 21	Х	Х			Х			Х		Х
PANAS 20	Х	Х			Х			Х		Х
Social Connectedness scale	Х				Х			Х		Х
Attentional Function Index	Х				Х			Х		Х
Interview							Х			
Participant demographics	Х									

Appendix I C2 Schedule of measures and interview schedule

C2 Interview Schedule

Interviews were semi structured. These were the key questions/topics:

- How has your week been?
- How has being here affected your PTSD?
- What have been the benefits of being with other veterans? Have you talked much about your PTSD with the others?
- How much experience do you have of fishing? Do you often do you go fishing when you are at home?
- How has the filming affected you this week?
- Is there anything else you would like to tell me about?

Appendix J C2 Coding example

Excerpt from Interview 1

sofling P1 Bob WE How's your week been? My week's been amazing. Yep. Definitely. The travelling down was quite long. Had a few stops on the way, everyone was really tired and that sort of thing. Saturday, Sunday everyone was a bit sort of getting tuned into the week, sort of not quite sure what to expect. Yeah it's been nice. Nature been's good, weather's been terrible. It's been a bit bad. But we're not too worried, got plenty of clothes and waterproofs and things like that. Food's been good. the owner's been nice to us, caught 2 nice big fish, really chuffed with that. Spoke to the misses a couple of times. its almost like going fishing in the UK for 2 or 3 nights, always texting and phoning, that's normal and such. But, being away, all this way, it can pull on your heart strings a bit and then some of the time you just get on with it really Away April usus You mean all this far away? Yeah, Cos've I've done from X, to X, X down to Dover, then Dover to Calais, if you look at the map, if we go straight north now, I'd be home in 4 hours. That's funny. How has it helped your PTSD, being here fishing? as rediction It almost melts away. It's a funny thing, it's like fishing is a drug that, I can't quite explain it really. I think it's like being in your tent it's like being in your hide in the army or if you're bivvied up behind a tank when I was in warrior batallion, your poncho's out, you're sleeping underneath, you've got your binos looking out across on exercise. It's sort of flashbacks to that, but nice flashbacks. Which is nice, you don't usually get nice ones. Looking out across the lake, and the forest and stuff, it just feels like you're back in the army but you're fishing. And you're wearing army type clothing and camo stuff. How much fishing do you do, normally? I would say 2 to 3 nights a month on a good month. Sometimes I haven't gone for 2 or 3 months because of the depression just really kicks in. So how has this been different to other fishing trips? Other fishing trips with civilian friends, and it's not the same banter, it's not the same sort of experience you have. With the guys you'll all take the micky out of each other, have a laugh at dinner times, and it's, you sort of feel a hell of a lot safer on a lake with squaddies than you do with civry mates. - Other velocins - social effects. You feel safer? Yeah, even though you know nothings going to happen. And no terrorists are going to turn up. Even in the lakes in the UK, it's just some your civvy mates just haven't got a clue about your banter. They look at you and they're like you ain't going with him again, he's just nuts. But its just me having a laugh, having a giggle, mucking about and they don't get it, and then you feel detached from them, and I'll go on my own fishing now. Cos they don't get it. I don't think they'll ever get it really. Even if you give them a book about PTSD they'd read it and would go at least you can still do this and that. But the underlying stuff in the black is the

Appendix K C3 Participants information sheet consent form and debrief

University of Essex

Participant information Sheet

My name is Rachel Marrow, and I am a PhD student at the University of Essex, studying the effects of group outdoor activities on military veterans with PTSD. The activity involved in this study is a 3 day fishing trip you have already enrolled on. You are suitable for this study as a previous participant, and I am interested in how you feel about the fishing you have done before.

What will I need to do?

At some point during the fishing trip you will be invited to be interviewed about your experiences. It will be done in private, and be very informal, although it will be recorded. I will ask you about your PTSD, your treatment, and history of fishing trips you have been on. In particular I am interested in any effects that the fishing has had, both in terms of your PTSD and in any other aspect of your life. For example, you may have become keen on fishing as a regular pastime, or made new friends. The interview will last up to an hour, although it may be shorter or longer, depending on how much you want to say.

What is the purpose of this study?

Results of research so far have shown that fishing or with a group of people with similar experiences can help reduce PTSD symptoms. The purpose of this study is to find out more about how you have felt about the fishing, your individual experience, and any longer-term benefits. This is so we can understand what makes such activities effective from your point of view, and help us make future interventions as beneficial as possible.

What are the risks?

There are no risks anticipated, although you may wish to tell me about events which could be distressing to recall. If you have any concerns, please do contact me or the university using the contact details below.

If I say yes, can I change my mind later?

Taking part in this is completely voluntary and you can withdraw at any time. If you decide during the fishing that you wish your data not to be used, that will be fine, and you can continue to fish anyway.

What will happen to my results?

The interview will be recorded and transcribed. I will be doing several interviews and they will be analysed together to find common themes. All your data will be kept under your individual participant number (not your name) and stored safely and securely by the University of Essex. Although it is possible the results will appear in future publications, no data will be included which will allow you to be identified, and even though you may tell me personal details, the final report will be written in a way that protects your identity.

What if I have some questions or worries?

If you would like to ask any questions before agreeing to take part, or at any time in regard to your participation please contact me using the details below. If you have any concerns about the study, please contact one of my supervisors using the details below.

Thank you again and with kind regards

Rachel

Contact details:

Rachel Marrow, PhD researcher, School of Health and Social Care The University of Essex Wivenhoe Park, Colchester, Essex CO4 3SQ Email Rachel.marrow@essex.ac.uk **Supervisor details:** Dr Leanne Andrews, Chartered Health Psychologist School of Health and Social Care The University of Essex Wivenhoe Park, Colchester, Essex CO4 3SQ Email landre@essex.ac.uk

Dr Nicholas Cooper, Senior Lecturer Department of Psychology The University of Essex Wivenhoe Park, Colchester, Essex CO4 3SQ Email: ncooper@essex.ac.uk

Consent Form

Thank you for your help with this research. Please consider the following questions and click the relevant box to give your consent to take part in the study.

Have you been given a description of the general purpose of the research? Yes \square No \square Have you been given the opportunity to discuss any questions with the researcher? Yes \square No \square Have you received enough information to decide whether or not you wish to take part in the study? Yes \square No \square Do you understand that your interview will be recorded and are you happy for this to happen? Yes \square No \square Do you understand that you have the right to decide to leave the study at any time? Yes \square No \square Do you understand that your data will be kept confidential at all times? Yes \square No \square Do you agree to take part in the study? Yes \square No \square Please type your name and today's date below if you give your consent to continue. Your personal details will **not** be stored with your responses in this study.

Name:

Date:



Debrief Information

Thank you for taking part in this study, which is researching the effects of time spent fishing with a group of people with similar experiences.

We hope you enjoyed the trip. If you would like to discuss anything with one of the research team, please contact me or one of my supervisors using the contact details overleaf. Here is also a list of support groups you may find useful.

Walnut Tree

Recovery activities, crisis support, coaching and mentoring to emergency service personnel and serving members of the armed forces, military veterans and others

Walnut Tree Health and Wellbeing C.I.C Wymondham, Norfolk NR18 9RS https://www.walnuttreehealthandwellbeing.co.uk t: 01603 516580

Combat Stress

Support, help and information regarding mental health for veterans :

Helpline: 0800 138 1619 Email: helpline@combatstress.org.uk Text: 07537 404 719 https://www.combatstress.org.uk

<u>Mind</u>

Information on mental health including PTSD –

Helpline: 0300 123 3393 Email: info@mind.org.uk Text: 86463 Website: https://www.mind.org.uk/information-support/types-of-mental-healthproblems/post-traumatic-stress-disorder-ptsd/

<u>NHS</u>

Details of help provided by the NHS for veterans: https://www.nhs.uk/NHSEngland/Militaryhealthcare/veterans-familiesreservists/Pages/veterans-mental-health.aspx Thank you again and with kind regards

Rachel

Contact details: Rachel Marrow, PhD researcher School of Health and Social Care The University of Essex Wivenhoe Park, Colchester, Essex, CO4 3SQ Email Rachel.marrow@essex.ac.uk

Supervisor details:

Dr Leanne Andrews, Chartered Health Psychologist School of Health and Social Care The University of Essex Wivenhoe Park, Colchester, Essex CO4 3SQ Email landre@essex.ac.uk

Dr Nicholas Cooper, Senior Lecturer Department of Psychology The University of Essex Wivenhoe Park, Colchester, Essex CO4 3SQ Email: ncooper@essex.ac.uk

Appendix L C3 Ethical approval

University o	fEssex		
14 June 20	018		
MRS RAC 58 EAST S COGGESH ESSEX CO4 5EW	HEL MARROW STREET HALL		
Dear Rach	nel,		
Re: Ethica	al Approval Application (Ref 1704	14)	
Further to application Exercise S	your application for ethical approva n which has now been approved by Science Ethics Representative on b	II, please find enclosed a the School of Sport, Rel ehalf of the Faculty Ethic	copy of your nabilitation and s Committee.
Yours sinc	erely,		
Lisa McKe Ethics Adn School of I cc. Re Sup	e ninistrator Health and Social Care search Governance and Planning I pervisor	Manager, REO	
Colchester Campus Wwenhoe Park Colchester CO4 3SQ United Kingdom	School of Health and Social Care T 01206 872854 E hsc@essex.ac.uk	WWW.e	SSEX.ac.uk

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Iniv	ersi	EV		L33	GV
JI	0.0.	-2			

3.

Application for Ethical Approval of Research Involving Human Participants

This application form must be completed for any research involving human participants conducted in or by the University. 'Human participants' are defined as including living human beings, human beings who have recently died (cadavers, human remains and body parts), embryos and foetuses, human tissue and bodily fluids, and human data and records (such as, but not restricted to medical, genetic, financial, personnel, criminal or administrative records and test results including scholastic achievements). Research must not commence until written approval has been received (from departmental Director of Research/Ethics Officer, Faculty Ethics Sub-Committee (ESC) or the University's Ethics Committee). This should be borne in mind when setting a start date for the project. Ethical approval cannot be granted retrospectively and failure to obtain ethical approval prior to data collection will mean that these data cannot be used.

Applications must be made on this form, and submitted electronically, to your departmental Director of Research/Ethics Officer. A signed copy of the form should also be submitted. Applications will be assessed by the Director of Research/Ethics Officer in the first instance, and may then passed to the ESC, and then to the University's Ethics Committee. A copy of your research proposal and any necessary supporting documentation (e.g. consent form, recruiting materials, etc) should also be attached to this form. A full copy of the signed application will be retained by the department/school for 6 years following

completion of the project. The signed application form cover sheet (two pages) will be sent to the Research Governance and Planning Manager in the REO

as Secretary of the University's Ethics Committee.

- 1. Title of project: Examining the long term effects of peer group angling activities on military veterans with post-traumatic stress disorder a qualitative study
- The title of your project will be published in the minutes of the University Ethics Committee. If you object, then a reference number will be used in place of the title. Do you object to the title of your project being published? Yes □ / No ⊠
 - This Project is: 🗌 Staff Research Project 🛛 Student Project
- 4. Principal Investigator(s) (students should also include the name of their supervisor):

Name:	Department:
Rachel Marrow	Health and social care
Dr Leanne Andrews (supervisor)	Health and social care
Dr Nick Cooper (supervisor)	Psychology
Proposed start date: September 2018	
Probable duration: up to 3 years	
Will this project be externally funded?	Yes 🗌 / No [
If Yes,	
What is the source of the funding?	

9. If external approval for this research has been given, then only this cover sheet nee External ethics approval obtained (attach evidence of approval) Y	eds to be submitted 'es]/ No]
Declaration of Principal Investigator:	
The information contained in this application, including any accompanying information, is, knowledge, complete and correct. I/we have read the University's Guidelines for Ethical . Research Involving Human Participants and accept responsibility for the conduct of the p this application in accordance with the guidelines, the University's Statement on Safegua Scientific Practice and any other conditions laid down by the University's Ethics Committe attempted to identify all risks related to the research that may arise in conducting this res acknowledge my/our obligations and the rights of the participants.	to the best of my Approval of rocedures set out in rding Good ee. I/we have earch and
RACHG MARROW	
Name(s) in block capitals:	
Date: 46118	
Supervisor's recommendation (Student Projects only):	
I have read and approved the quality of both the research proposal and this application.	
Supervisor's signature: F. A. dreus	
Outcome:	viect and considers
Outcome: The departmental Director of Research (DoR) / Ethics Officer (EO) has reviewed this pro- the methodological/technical aspects of the proposal to be appropriate to the tasks propo- considers that the investigator(s) has/have the necessary qualifications, experience and the research set out in this application, and to deal with any emergencies and contingen-	ject and considers osed. The DoR / E facilities to conduct cies that may arise.
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All participants will be interviewed in public whilst either taking part in organised events such as fishing or hiking events or at a suitable public meeting place linked to their activity Reason for amendment 2018 trip which was to be researched was postponed (For office use only) The amendment has been approved The amendment has not been approved Resubmission required Signature: Jud. Name (in block capitals): F.BLUMENFELD Department: SHSC Date: 26.4-19

Appendix M C3 Interview schedule

Interviews were semi structured. Below are the key areas that were covered

PTSD

- First question Would you feel comfortable telling me the story of how you got PTSD? Please only tell me as much as you are comfortable with.
- PTSD story (as offered, without prompting for trauma details)
- PTSD treatment, diagnosis
- How PTSD affects your daily life, home life
- Things that help your PTSD

Nature

- How spending time in nature helps you. How it relates to your PTSD
- Types of nature-based activities. Why do you they help. How long you have been doing them, how often.
- Relationship with spending time in nature. What it means.

Nature-based interventions

- Benefits of taking part in interventions for veterans with PTSD, e.g. fishing trips
- How that differs from other nature-based activities you do

Other

• Anything else that seems relevant

Appendix N C3 Excerpt from interview no. 4

R: Would you feel comfortable telling me the story of how you got PTSD? It's entirely up to you how much you tell me, please only tell me things you're comfortable saying.

C: I joined the army at 16. Had a year's training. Joined the battalion in Germany in August and in December we flew out to the Gulf and done various stuff out there. Come back, and it was literally like we'd been on exercise. There was no debriefing, there was nothing. So we had a couple of days – and their words were 'go and get pissed'.

R: This is after something had happened when you were out there? I don't need details.

C: Yeah. This is when we got back to Germany. I mean when we saw stuff out there, it was just brushed aside. I mean just carry on. Being new to the battalion I didn't really question it. I was only 17/18 so. And I really didn't come from round there, I was really quiet. I didn't have the confidence; I was very quiet. I wouldn't speak up at all and when I came back from leave and that I found I was the complete opposite. I found I was getting into people's faces; I would argue about stuff. And it all got brushed aside. No-one spoke about it in the battalion. No-one. And you could see there was breaking points for everyone. But they didn't take any notice. Then, when we got to London we were going to a party. My son was about to be born and I broke my ankle. So we were fighting over tv channels and then my wife come back, and things weren't going right. And I recognised it in my head, and thought I can't bring my son up in this environment. I thought if I get out, things will be better. I got out, but things got worse. I beat all my mates up.

R: How old were you at this time?

C: 21. Beat all my mates up when I came out, because I was still in army mode, I don't know why. I didn't know how to function outside of the army. Things just happened. I only really found out when I had my mum and my dad by the throat, both of them, one in each arm and I thought this isn't right. Something is wrong. So I went to a doctor and he was like you might have PTSD, I don't know. Then I found out about [charity] and I saw Dr XX. I didn't really talk to him, I kept everything to myself and he just said to me you've got PTSD. And I said why, what are you talking about? And then I was talking to people who were already there and things started to make sense. How I was acting, they were doing the same things. People were all working, doing the same things. And then sort of the penny sort of dropped. Something's definitely wrong, I need to get help about this. And that was in 1998 when I got diagnosed with acute PTSD they called it in those days, now they say complex or multiple PTSD

R: So it was a combination of several things?

C: Yes. And to start off with, the staff there, who had been there for years and then the staff started changing, and the atmosphere in the place started changing.

R: Where was this?

C: At [charity]. So, they were getting rid of the old staff and bringing new staff in. They had all the qualifications, but they didn't know how to talk to people. So it was, there started to be more friction there and people started losing it a bit more. I was seeing doctors on the outside as well, while I wasn't at [charity] but I was going 3 times a year. So I could keep myself at some, I wouldn't say workable, but a reasonable level, I suppose shall we say. But I knew I would be going back in and I would go down and my mood would get worse, the depression would get worse, hypervigilance would be getting worse. And the anxiety would go through the roof, panic attacks, everything. It was just nonstop. When I went in, it was like a weight lifted off my shoulders coz it was my safe place. And then things started changing there, so I had nowhere that was my safe place, at all.

R: When you say you went 3 times a year, was that for one session with a psychiatrist?

C: 2 weeks. Then it would be you'd see a psychiatrist while you were there, we'd also have one to ones, and also group work as well. But it changed for the worse. And I couldn't get help on the outside because they wouldn't do multiple traumas. Luckily [trauma therapist] took me on.

R: They refused to help because your trauma's too complex?

C: Well you can only work on one trauma at a time, so multiple traumas shouldn't matter. But they won't do anything. I mean when I worked with [trauma therapist], I went back to the same place after [trauma therapist] had gone, they wouldn't take me. Even though I'd been there for like 2 years.

R: So what happened after that?

C: Yeah, it ruined my marriage. I mean I ruined it as well really coz I was really losing the plot and I was drinking far too much, doing too many drugs. Just to try and 1. stop thinking about stuff, and 2. was pain coz I've got a lot of physical injuries as well. So I had both of them and it was sort of not knowing where to go, until I got chucked out. Then I got my own place and started to sort myself out really. I mean I got referred to the [mental health unit]. I was going to start some work there, but the bloke left, so I got pushed back again. Asked around again if anyone could give me any sort of treatment. And then [charity] said sorry you can't come anymore Even though I'd been to their psychiatric nurse, and she said no, you need 2 weeks stay now, I'll get you in. But the letter I got back was basically said we can't see how you'd benefit from coming here. Which I don't understand.

Appendix O C3 Phase 1 notes

Struggles in the military and afterwards seem pivotal to their relationship with nature. Experiences of PTSD are integral to how they have constructed nature, as they are so much in contrast.

When they talk of being around nature, they sound relieved, calm, so different from the angst, the struggles they usually have. Like releasing a valve, one of them said. An overwhelming sense of injustice seems to come over in many of the participants. There are many negative views expressed of how they felt mistreated by the military, and how they no longer felt they were good enough because of their trauma which was not supposed to happen

A surprising element of participants' identities is the need and wish to help other people. They appear to almost disregard their own feelings or maybe get self-worth through helping others. Military collectivism.

Time and time again there are stories of being ignored, not listened to, not valued, being knocked back, rejected, let down and abandoned.

They have not let go of their military identities at all, almost like their military identities are sort of homeless. Is this the same for all veterans or just those with PTSD?

Isolation through PTSD – even those who have jobs and it's more hidden still said they avoid people, affects when they do shopping.

They just seem to keep going until a crisis hits

Military peers, so important, the banter, not being judged, the real me.

Civilians don't understand. They so wanted me to understand them.

Does fishing and deer stalking use hypervigilance? Apprehension into anticipation.... PTSD symptoms include many things, more than the formal symptoms.

Fishing is just like being in the army. Several expressed links between fishing, or nature-based activities and time when they served.

The word disconnection keeps coming into my head when reading the interviews. Disconnected from the military, from society.

Appendix P C3 Phase 2 raw codes

Code header		Code header	
Military self	Military identity Construction of a soldier Military pride Caring soldier Helping people Miss it every day Military culture, belonging	Military resentment, loss, disconnection	Military culture, weak link Anger Isolation Devalued, undervalued Ignored No deconstruction of a soldier PTSD emergent PTSD confusing/misinformed Rejection Disconnection Misunderstood Army didn't care Broken loyalty Let down by people who should care Symptoms ignored Weak link
Negotiating support	Care cul-de-sac Crisis before asking for help Dismissed by medical staff Denied help Ineffectual treatment Supportive family Group therapy no thank you Multiple failures to diagnose Getting there, finally on track Treatment interrupted, incomplete Peer support Charities	Transition to civilian life	Vulnerability in civvie street Can't connect Selfish civvies Civilians don't care UK public think we are trouble Loss, not human, had nothing Craving military days Lack of structure, purpose
PTSD me	Busy brain Avoidance, can't go out Memory, attention problems Can't time manage Shame, guilt Abandoned Retrospective regret, remorse, shame Trust issues Restaurants and supermarkets	Nature connection	Nature connected Fishing for purpose Escape Nature/military connection Happy place Contemplation in nature Fishing is like being in the army Fishing to manage irritability

	Feel less of a soldier Anger Aggression Sleep issues Suicidal Betrayed Depression PTSD for life Trauma value		Anticipation Sensory experience Calming Respite from symptoms, worry, triggers Helps relationships Controls hypervigilance Uses hypervigilance Focus Comfort Always Destress
Identity	PTSD has changed me Still a soldier The real me Selfless, others first Disconnected Constructed in the army Needs control	Peers (formal interventions)	Peer support Looked after Banter Reconnection Be the real me Not judged Understood Expertise Achievement Family Think the same Basic training Negatives to positives

Appendix Q C4 Ethical approval

Friday, May 6, 2022 at 15:58:54 British Summer Time

 Subject: Decision - Ethics ETH1819-0238: Mrs Rachel Marrow

 Date:
 Thursday, 22 August 2019 at 11:19:53 British Summer Time

 From:
 ERAMS

 To:
 Marrow, Rachel K

University of Essex ERAMS

22/08/2019

Mrs Rachel Marrow

Health and Social Care

University of Essex

Dear Rachel,

Ethics Committee Decision

I am writing to advise you that your research proposal entitled "Green exercise behaviour related to mental health management in military veterans " has been reviewed by COMMITTEE.

The Committee is content to give a favourable ethical opinion of the research. I am pleased, therefore, to tell you that your application has been granted ethical approval by the Committee.

Please do not hesitate to contact me if you require any further information or have any queries.

Yours sincerely,

Frances Blumenfeld

Ethics ETH1819-0238: Mrs Rachel Marrow

This email was sent by the University of Essex Ethics Review Application and Management System (ERAMS).





Appendix S C4 Online survey

This appendix contains all parts of the survey relevant to the analysis in Chapters 4 and 5 of this thesis

Green Exercise and Wellbeing Survey

What is the purpose of this survey?

The data from this survey will contribute to a PhD research thesis which is examining the effects of taking part in activities in different environments on people's mental health and wellbeing. The survey will ask you questions about your physical and mental health and activities you take part in. There is also a short, optional computer task towards the end of the survey. As a thank you for your participation we are running a prize draw to win a £50 Amazon voucher. At the end of the survey you will be given the opportunity to send us your email address in order to enter. *Who is responsible for this survey*?

My name is Rachel Marrow and I'm studying for a research PhD at the University of Essex. I will be running the survey, managed by my supervisors. If you would like to contact me about anything, or contact my supervisors with any concerns please <u>click</u> <u>here</u> for <u>https://essex.eu.qualtrics.com/CP/File.php?F=F_3aAKYBj7KZSnWol</u>contact <u>https://essex.eu.qualtrics.com/CP/File.php?F=F_3aAKYBj7KZSnWol</u>contact

How will my data be protected?

Participation in this survey **guarantees confidentiality**. We will only store the data downloaded from the survey on our own network and computers. Survey data is collected using secure remote servers by Qualtrics. Your data is always stored securely. You will not be asked to provide your name and your data will be stored by participant number. Any email address you provide to enter the prize draw will not be stored with your data.

Who is eligible to take part in this survey?

The survey is open to all adults over the age of 18. The only exception is people who are *currently* serving in the military, due to permission restrictions. Participation from military veterans is encouraged, as well as anyone who is not from a military background.

How to complete the survey

The survey will take 15 - 20 minutes (depending on the answers you give). There is also a 5-minute, optional computer task which accompanies the survey and that I would be really pleased if you would complete. You can skip any questions you'd prefer not to answer, and if you wish to leave and return to finish the survey, as long as you are on the same computer, your answers will be saved. Your data may still be used even if you do not complete the survey. However, you can ask for your data to be removed by contacting me by email and quoting your participant ID number (for contact details click here). Participant ID numbers will be generated on the first page of the survey.

Consent

By moving on to the next page (arrow bottom right) you indicate that you agree to take part in a survey about green exercise and mental health, and that you understand the purpose and nature of the survey. If you do not want to take part, please close your browser window and this will exit the survey for you. Your participation is entirely voluntary, and you are free to exit the study at any time. You can exit the survey, even after you have started, by closing the browser window.

(Ethics ref. ETH1819-0238)

Q1.2 To enable your data to be stored you will need a participant ID number. To generate this, the simplest way is to use your initials followed by the month you were born (for example, RG04). **Please enter your ID number here**

Q1.3 The first section covers general demographics. Please answer the following questions.

If you don't want to answer any of the questions, you can select 'Prefer not to say'

Q1.4 What is your primary employment status?

- o I am in full time or part time employment
- o I am in full time education
- I am a full time carer (for e.g., for a child/children or elderly relative
- I am not in employment (e.g., retired, unemployed, retired for health reasons, homemaker)
- o I prefer not to say

Q1.5 Have you ever served in the military?

- I have never served in the military
- I am currently serving in the military. Please note, selecting this answer will take you to the end of the survey.
- I am a military veteran. What was your role and when did you leave? _____
- I have never served in the military but my partner or close family member is a military veteran. Please describe how you are related _____
- I have never served in the military but my partner or close family member currently does serve in the military. Please describe how you are related
- Other (e.g., in the reserves). Please describe
- Prefer not to say

Q1.6 What is your ethnic origin?

- White
- Black or Black British Caribbean
- Black or Black British African
- Other Black background
- o Asian or Asian British Indian
- Asian or Asian British Pakistani
- o Asian or Asian British Bangladeshi
- Chinese
- Other Asian background
- Mixed White and Black Caribbean
- Mixed White and Black African
- Mixed White and Asian

- Other Mixed background
- o Arab
- Other Ethnic background
- Prefer not to say

Q1.7 What is your age category?

18 to 24 / 25 to 39 / 40 to 54 / 55 to 69 / 70+ / Prefer not to say

Q1.8 To which gender do you most identity?

Male / Female / Transgender male / Transgender female / Gender variant\non-conforming / Other / Prefer not to say

Q1.9 What is your disability status?

- o No Disability
- Two or more impairments and/or disabling medical conditions
- A specific learning difficulty such as dyslexia, dyspraxia or AD(H)D
- A social/communication impairment such as Asperger's syndrome/other autistic spectrum disorder
- A long standing illness or health condition such as cancer, HIV, diabetes, chronic heart disease, or epilepsy
- A mental health condition, such as depression, schizophrenia, or anxiety disorder
- A physical impairment or mobility issues, such as difficulty using arms or using a wheelchair or crutches
- Deaf or a serious hearing impairment
- o Blind or a serious visual impairment uncorrected by glasses
- A disability, impairment or medical condition that is not listed above
- I'd prefer not to say

Q1.10 What is your religious belief?

- \circ Buddhist
- Christian
- o Hindi
- o Jewish
- o Muslim
- No religion
- o Any other religion or belief
- o Spiritual
- o Sikh
- o Prefer not to say

Q1.11 What educational qualifications do you have?
- No formal qualifications
- GCSEs grades A*- C or equivalent
- A Level or equivalent
- Higher education
- Degree or equivalent
- Masters, PhD or equivalent
- o Other qualifications
- o Don't know
- Prefer not to say

Q2.1 How would you describe where you live?

- Urban city or large town
- o Urban small town
- o Semi-rural
- o Rural

Q2.2 How close do you live to accessible green spaces (e.g. a park, nature reserve, woodland, fields with public footpaths etc)

- More than a mile to a green space (at least 20 minute walk)
- o Between a 10 and 20 minute walk
- o Between a 5 and 10 minute walk
- Less than 5 minutes
- o I live surrounded by green space

Q3.1 Connectedness to nature

Please read the statements below and indicate how much you agree or disagree:

	Completely disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Completely agree
l always find beauty in nature	0	0	\bigcirc	0	\bigcirc	0	0
l always treat nature with respect	0	\bigcirc	0	\bigcirc	\bigcirc	0	0
Being in nature makes me very happy	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	0
Spending time in nature is very important to me	0	0	0	0	0	0	0
l find being in nature really amazing	0	0	0	\bigcirc	0	\bigcirc	0
l feel part of nature	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc

Q3.2 How much do you agree with the following statement?

My ideal vacation spot would be a remote, wilderness area

Strongly agree / Agree / Somewhat agree / Neither agree nor disagree / Somewhat disagree / Disagree / Strongly disagree

Q4.1 How would you describe your general physical health?

Excellent / Good / OK / Poor / Very Poor

${\rm Q4.2}$ Please briefly describe any significant issues you have with your physical health

Q5.1

This question is about time spent doing outdoor activities in green spaces (e.g., park, woodland, nature reserve, garden, riverside). In a typical month, how often do you engage in the following activities? For seasonal activities, please just

	Never (1)	Less than once a month (2)	Once a month (3)	More than once a month (4)	Once per week (5)	More than once a week (6)	Daily (7)
Walking for leisure in green spaces (Q5.1_1)	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
Dog walking (Q5.1_2)	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
Running (Q5.1_3)	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
Cycling (Q5.1_4)	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
Fishing (Q5.1_5)	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
Wild swimming (Q5.1_6)	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
Climbing/abseiling (Q5.1_7)	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc

estimate across the year

Conservation (e.g. woodland work party) (Q5.1_8)	\bigcirc						
Bird watching (Q5.1_9)	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	0
Gardening (Q5.1_10)	\bigcirc	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
Gym/Exercise class in park or natural environment (Q5.1_11)	0	0	0	0	0	0	0
Canal boating or sailing (Q5.1_12)	\bigcirc	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
Sport such as football played on grass in a park or other largely natural environment (Q5.1_13)	0	0	0	0	\bigcirc	0	0
Golf (Q5.1_14)	\bigcirc						
Other (please specify) (Q5.1_15)	\bigcirc						

Q6.1 Depression/Happiness

A number of statements that people have made to describe how they feel are given below. Please read each one and tick the box which best describes how frequently you felt that way in the past seven days, including today. Some statements describe positive feelings and some describe negative feelings. You may have experienced both positive and negative feelings at different times during the past seven days.

	Never	Rarely	Sometimes	Often
I felt dissatisfied with my life	0	0	0	0
l felt happy	0	0	0	\bigcirc
I felt cheerless	0	0	0	0
I felt pleased with the way I am	0	0	0	0
l felt that life was enjoyable	0	0	0	0
I felt that life was meaningless	0	0	0	0

Copyright: Stephen Joseph 2000

Q6.2 Perceived Stress scale

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

	Never	Almost never	Sometimes	Fairly often	Very often
In the last month, how often have you felt that you were unable to control the important things in your life?	0	0	0	0	0
In the last month, how often have you felt confident about your ability to handle your personal problems?	0	0	0	0	0
In the last month, how often have you felt that things were going your way?	0	\bigcirc	0	\bigcirc	\bigcirc
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc

Q7.1

Green activities (sometimes known as green exercise) can be defined as any physical activity which takes place in a natural environment. This could be activities linked to being around nature, such as gardening, fishing or wildlife conservation, or activities taking place in a natural environment which could also be done in an urban or indoor setting (e.g., walking, running, playing sports)

When did you last spend time doing a 'green activity' for at least 10 minutes

- Today
- Yesterday
- o In the last week
- More than a week ago
- More than a month ago
- o I can't remember

Q7.2 was not used in the analysis.

Q7.3 was not used in the analysis

Q7.4 How much do you agree with the following statement?

Spending time around nature feels like an escape from my problems

Strongly agree / Agree / neither agree or disagree / Disagree / Strongly disagree Q8.1 Here are some questions about your mental health

Please choose the statement which best describes you (please make sure you read all options first before choosing)

- I am currently living with mental health issues
- I am currently living with mental health issues although I have

overcome some aspects (e.g., you may have mild depression but have recovered from a bout of severe depression)

I am prone to mental health issues although I am ok at the moment

 I have had mental health issues in the past and feel those days are behind me

- I have not ever had issues with my mental health
- I would prefer not to say
- \bigcirc

Q8.2 Before you move to the next page, please check you are happy with your answer as the following section has no 'back' button

If you are concerned about your mental health please consider visiting your GP, other health provider or take a look at the MIND website by clicking <u>here</u> Q9.1

You have indicated that you are not currently living with any mental health issues, or you

would prefer not to say. This question is about factors which may contribute to your general wellbeing and happiness in your life currently

Please indicate how helpful you find the following factors in managing your day-today wellbeing

	Unhelpful (1)	Makes no difference (2)	slightly helpful (3)	Very helpful (4)	Crucial (5)	N/A (6)
Social support - close friends (Q9.1_1)	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	0
Social support - family and/or partner (Q9.1_2)	0	0	\bigcirc			\bigcirc
Support from peer group (e.g. from a club or society you attend, or sports team you belong to) (Q9.1_3)	0	0	\bigcirc	0	0	0
Support through contact on social media (e.g., Facebook, Twitter etc.) (Q9.1_4)	0	0	0	0	0	0
Spending time around nature (green activities) Please briefly describe (Q9.1_5)	0	0	\bigcirc	0	0	0

Meditation or deep breathing techniques (including through apps such as Calm and Headspace) (Q9.1_6)	\bigcirc	\bigcirc	0	0	\bigcirc	0
Self help books, websites or YouTube videos (Q9.1_7)	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	0
Spending time with pets/animals (Q9.1_8)	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	0
Yoga, Pilates, Tai chi or similar (Q9.1_9)	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	0
Indoor exercise (please specify) (Q9.1_10)	\bigcirc	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc
Outdoor exercise (please specify) (Q9.1_11)	\bigcirc	0	\bigcirc	0	\bigcirc	\bigcirc
Other hobbies or interests (please specify) (Q9.1_12)	\bigcirc	0	\bigcirc	\bigcirc	\bigcirc	0

Q10.1 was a list of mental health issues and was not used in the analysis

Q10.2 /Q11.3 Influences in recovery

This question is about the past influences which may have been significant in your recovery from any of the above mental health issues. Please fill in this question if you feel you have **recovered** or **largely recovered** from any of the above mental health issues

Please indicate how helpful the following factors were in your recovery

	Unhelpful (1)	No difference (2)	Slightly helpful (3)	Very helpful (4)	Crucial (5)	N/A (6)	
Medication (Q10.2_1)	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	
Therapy (please specify if you know the sort of therapy you had) (Q10.2_2)	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	0	
Support from family and/or partner (Q10.2_3)	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	
Support from close friends (Q10.2_4)	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	
Spending time around nature (green activities) Please briefly describe (Q10.2_5)	0	\bigcirc	\bigcirc	\bigcirc	0	0	
Support from peer group (e.g. from a club or society you attend, or sports team you belong to) (Q10.2_6)	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	

Support through contact on social media (e.g., Facebook, Twitter etc.) (Q10.2_7)	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	0
Support from a charity (please specify) (Q10.2_8)	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
Meditation or deep breathing techniques (including through apps such as Calm and Headspace) (Q10.2_9)	\bigcirc	0	0	0	0	0
Exercise (pls specify) (Q10.2_10)	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
Telephone helpline (e.g. Samaritans) or online help (Q10.2_11)	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
Self help book(s), information on websites or YouTube videos (Q10.2_12)	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
Spending time with pets/animals (Q10.2_13)	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
Other (please specify) (Q10.2_14)	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc

Q11.1 was a list of mental health issues and was not used in the analysis.

Q11.2 Current mental health difficulties

This question is about current mental health issues you are living with and the sort of influences that may help you. Please fill in this question if you *currently* suffer from any of the above mental health issues

Please indicate how helpful the following factors are in assisting your daily life and managing your symptoms

	Unhelpful	No difference	Slightly helpful	Very helpful	Crucial	N/A
Medication	0	\bigcirc	0	0	0	С
Therapy (please specify if you know the sort of therapy you had)	0	0	0	0	0	С
Support from family and/or partner	0	0	0	0	\bigcirc	С
Support from close friends	0	0	0	0	0	С
Spending time around nature (green activities) Please briefly describe	0	0	0	0	0	С
Support from peer group (e.g. from a club or society you attend, or sports team you belong to)	0	0	0	0	0	С
Support through contact on social media (e.g., Facebook, Twitter etc.)	0	0	0	0	0	С
Support from a charity (please specify)	0	0	0	0	\bigcirc	С
Meditation or deep breathing techniques (including through apps such as Calm and Headspace)	0	0	0	0	0	С
Exercise (pls specify)	0	0	0	0	0	С

	Unhelpful	No Slightly difference helpful		Very helpful	Crucial	N/A	
Telephone helpline (e.g. Samaritans) or online help	0	0	0	0	0	С	
Self help book(s), information on websites or YouTube videos	0	0	0	0	0	C	
Spending time with pets/animals	0	0	0	0	0	С	
Other (please specify)	0	\bigcirc	0	0	\bigcirc	С	

Q12.1 At this time, how well do you feel you are functioning in each of the areas below?

Please rate by using the slider to indicate your answer from 'not at all' to 'extremely well'

(Please note you can tap to move the slider to where you want it, or slide it with your finger or mouse)

Not at all

	0	10	20	30	40	50	60	70	80	90	100
Getting started on activities (tasks, jobs) you intend to do ()						J					
Following through on your plans ()											
Doing things that take time and effort ()					_						
Making your mind up about things ()											
Keeping your mind on what you are doing ()				_	_	J	_	_	_		
Remembering to do all the things you started out to do ()						J					
Keeping your mind on what people are saying ()						J					
Keeping yourself from saying or doing things you did not want to say or do ()						J					
Being patient with others ()											

Please note the next few items are the other way round to the ones above. In the above questions, the more to the right you answered the better, and in these ones, which are **problem statements**, the more to the right you answer, the more of a problem you are having.

At this time, how would you rate yourself on:

Not at all A great deal

0 10 20 30 40 50 60 70 80 90 100

Extremely well



Q13.1 Below is a list of problems that people sometimes have in response to a very stressful experience. Please read each problem carefully and then select one of the responses by clicking into it, to indicate how much you have been bothered by the problem.

	Not at all	A little bit	Moderately	Quite a bit	Extremely
Repeated, disturbing and unwanted memories of the stressful experience?	0	0	0	0	0
Repeated, disturbing dreams of the stressful experience?	0	0	0	0	0
Suddenly feeling or acting as if the stressful experience were actually happening again (as if you were actually back there reliving it)?	0	0	0	0	0
Feeling very upset when something reminded of the stressful experience?	0	0	0	0	0
Having strong physical reactions when something reminded of the stressful experience (for example heart pounding, trouble breathing, sweating)?	0	0	0	0	0
Avoiding memories, thoughts or feelings related to the stressful experience?	0	0	0	0	0
Avoiding external reminders of the stressful experience (for example, people, places, conversations,	0	0	0	0	0

In the past month, how much were you bothered by:

	Not at all	A little bit	Moderately	Voderately Quite a bit	
activities, objects or situations)					
Trouble remembering important parts of the stressful experience?	0	0	0	0	0
Having strong negative beliefs about yourself, other people, or the world (for example, having thoughts such as: I am bad, there is something seriously wrong with me, no one can be trusted the world is completely dangerous)?	0	0	0	0	0
Blaming yourself or someone else for the stressful experience or what happened after it?	0	0	0	0	0
Having strong negative feelings such as fear, horror anger guilt or shame?	0	0	0	0	0
Loss of interest in activities that you used to enjoy?	0	0	0	0	0
Feeling distant or cut off from other people?	0	0	0	0	0
Trouble experiencing positive feelings (for example, being unable to feel happiness or have loving feelings for people close to you)?	0	0	0	0	0
Irritable behaviour, angry outbursts or acting aggressively?	0	0	0	0	0

	Not at all	A little bit	Moderately	Quite a bit	Extremely
Taking too many risks or doing things that could cause you harm?	0	0	0	0	0
Being "super alert" or watchful or on guard?	0	0	0	0	\bigcirc
Feeling jumpy or easily startled?	0	0	0	0	\bigcirc
Having difficulty concentrating?	0	0	0	0	0
Trouble falling or staying asleep?	0	0	0	0	0

Q14.1 And finally! This is an optional add on. We would like you to complete a short computer task. It will take about 5 minutes, and will involve temporarily downloading some simple software - it won't take long, and the task is not hard. Although it does require concentration!

I suggest turning down the volume on your computer/device before starting, as there may be an occasional beep which is a little loud at full volume!

To carry out the task you will need your participant ID. Your ID number is (X)

Alternatively, to bypass the task, just continue on to the next page to take you to the end of the survey

For SurveyCircle users (www.surveycircle.com): The Survey Code is W1JF-SXDR-FR4K-UY6K

Q14.2

Please click here to start the task

End of Block: Cognitive task

Start of Block: Research request

Q15.1 A further request!

I am recruiting participants for a follow up online research project about green exercise. Taking part will qualify you for entering a prize draw to win a **£75 Amazon voucher**. If you think you would be willing to take part and would like to find out more, please either <u>click here</u> and message me to register your interest via my

Facebook page or enter your email address below.

Note: Any contact details provided below will only be used to contact you about my follow up research. Once your email is no longer required (e.g., when the research is complete or you decide not to proceed), your email address will be securely destroyed.

Q15.2 Prize draw

If you wish to be entered in the prize draw to win £50 in Amazon vouchers, please provide us with your email address in the box below.

Note: Your email address will only be stored up until the prize draw and you will only be contacted if you have been successful in winning. After this time your email address will be securely destroyed.

End of Block: Research request

C5 Flanker Thank you message

Thank you!

You have now completed the task and survey, and your data were successfully uploaded.

To enter the draw to win a £50 Amazon voucher, or register to be involved in future research, please <u>click here</u>. You can also register your interest in my research by sending me a message through my research page in Facebook (<u>Click here</u>)

The questions in the survey are designed to see how people view the green activities they do relate to their mental health. I am particularly interested in the factors which help people's recovery, and those which people view as important in maintaining psychological wellbeing.

The computer task measures attention and the ability to stay focused on a task

If you are concerned about your mental health please do visit your GP, other healthcare provider, or visit the MIND website (<u>click here</u>)

For SurveyCircle users (www.surveycircle.com): The Survey Code is: W1JF-SXDR-FR4K-UY6K

If you have any queries or concerns about this survey, you can contact one of my supervisors at the University of Essex by viewing their contact details by <u>clicking</u> <u>here</u>

Thanks again!

Uninstall Inquisit Web



Appendix U C5 Histograms and table showing distribution of data



Tests of normality for scales and task data, showing skewness, kurtosis and Kolmogorov-Smirnov test

	Ν	Mean	SD	Median	IQR	Skewness	Kurtosis	Kolmogorov-	р
								Smirnov	
Perceived stress score	104	6.73	3.20	7.00	4 00	-0.078	-0.558	0.082	0.085
AFL overall score	10.	0170	0.20	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		01070	0.000	0.002	0.005
	104	59.30	18.56	59.77	25.73	-0.382	-0.576	0.075	0.178
Flanker % errors congruent trials									
	104	1.07	1.81	0.00	1.67	-0.382	-0.576	0.358	0
Flanker % errors incongruent trials									
	104	2.36	2.97	1.67	3.33	2.091	4.556	0.265	0
Flanker mean RT congruent trials					407.00				
	104	589.01	1/1./5	545.42	187.66	1.445	2.682	0.121	0.001
Flanker mean RT incongruent trials	104	627.09	170 /1	E01 9E	217 40	1 212	2 2 2 2	0 124	0
	104	027.98	179.41	591.65	217.40	1.515	2.322	0.124	0
Flanker mean error % all thats	104	1 71	2.05	0.83	2 50	1 872	4 326	0 221	0
							0		
Flanker incongruent minus congruen	104	38.98	35.79	33.41	35.11	0.756	2.15	0.092	0.029
Flanker mean RT all trials									
	104	608.50	174.71	571.62	199.04	1.373	2.473	0.129	0